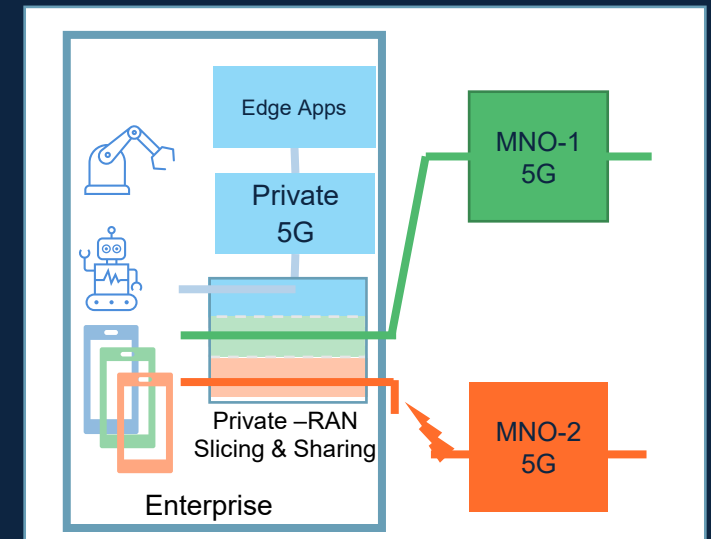


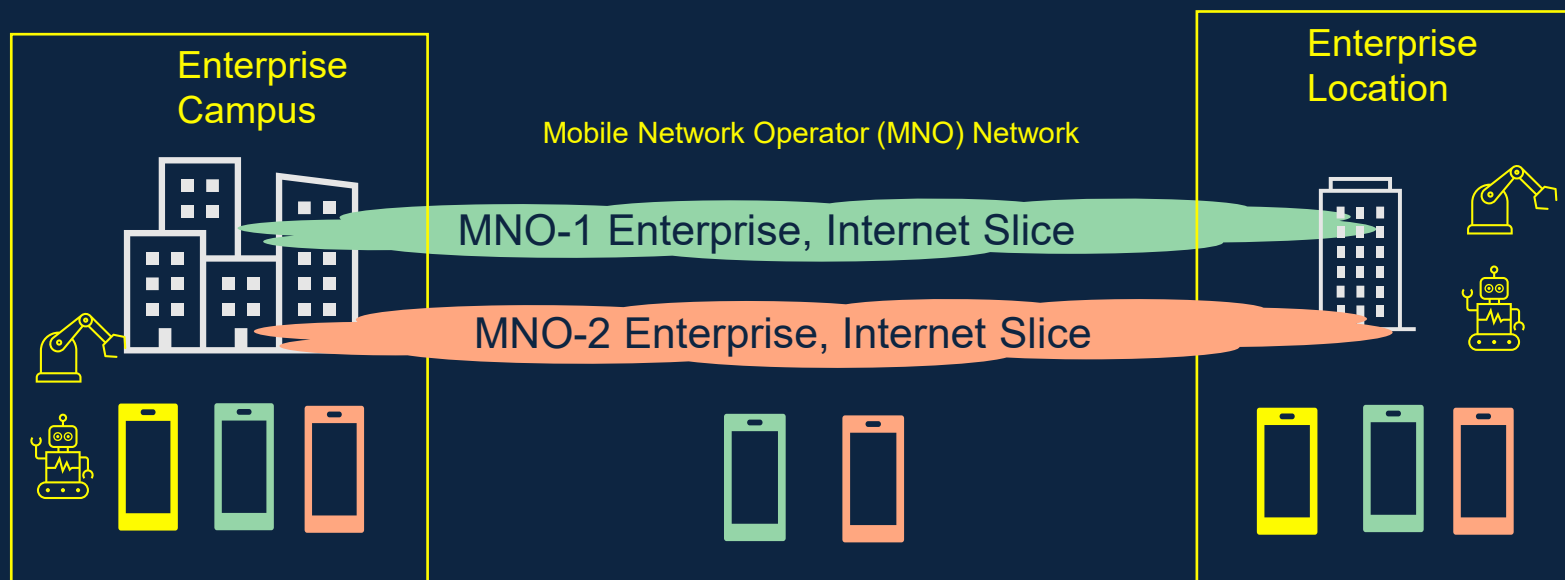
Private NextG RAN-sharing via Midhaul

Praveen Gupta, MITRE

Approved for Public Release; Distribution
Unlimited. Public Release Case Number
22-1712

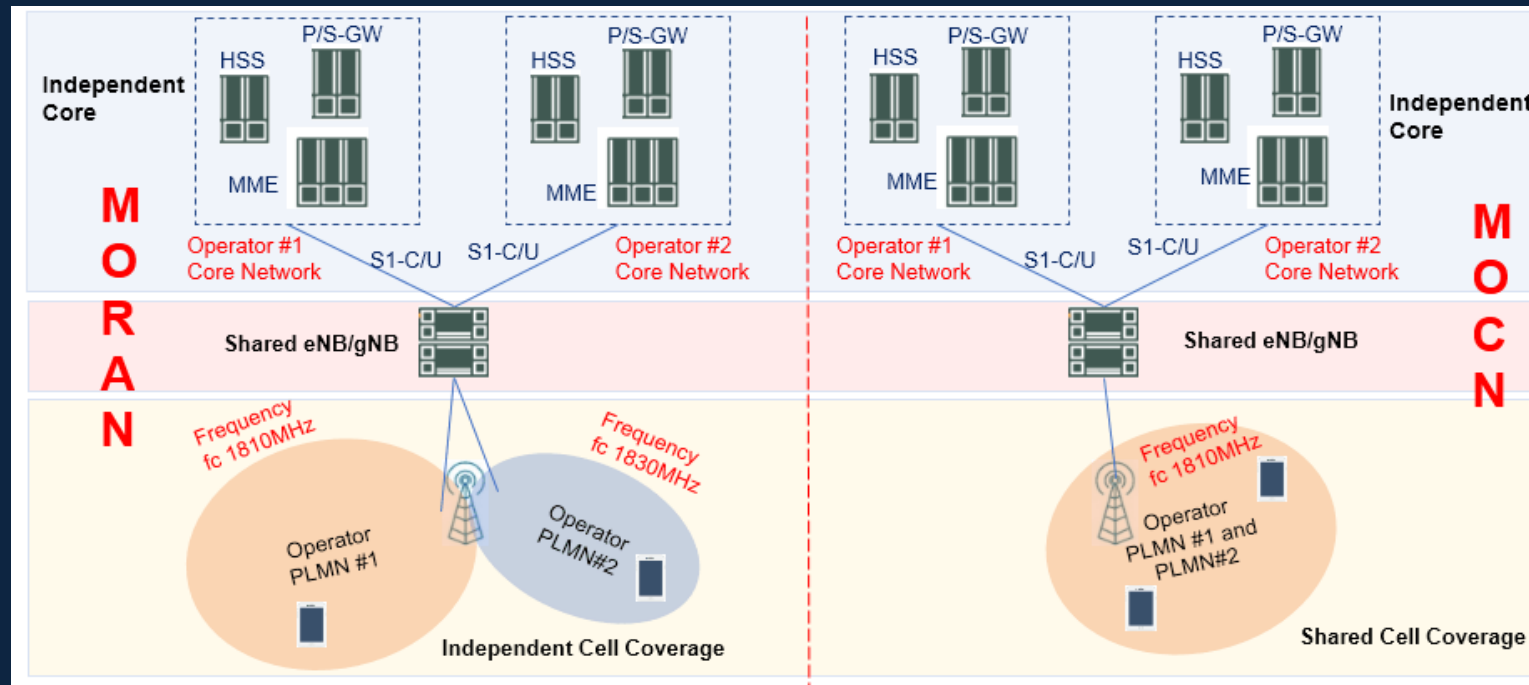


Enterprise NextG Needs



gNB/eNB RAN sharing problem

Small-cell (as gNB) mobility & integration with Macro-cell via backhaul & X1-interface is not scalable



Source – Tech Playon

References:

- GSMA 5G-Guideline
- 3GPP TS 32.130 Network sharing; Concepts and requirements
- 3GPP TS 23.251 Network sharing; Architecture and functional description
- 3GPP TS 23.501 - System architecture for the 5G System (5GS); Stage 2

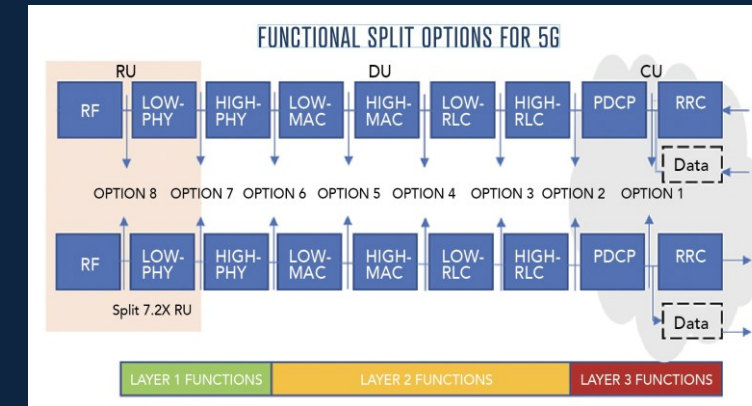
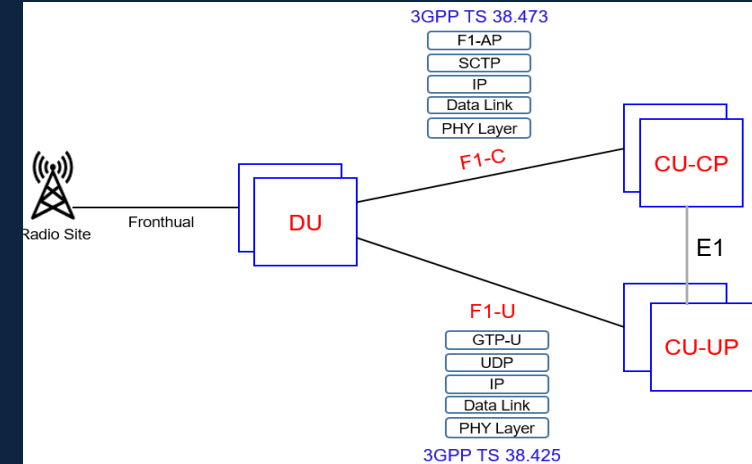
3GPP Open RAN architecture

5G gNB = 5G-RRU + 5G-DU + 5G-CU

F1 is a 3GPP-defined IP-based protocol with multi-vendor interoperability

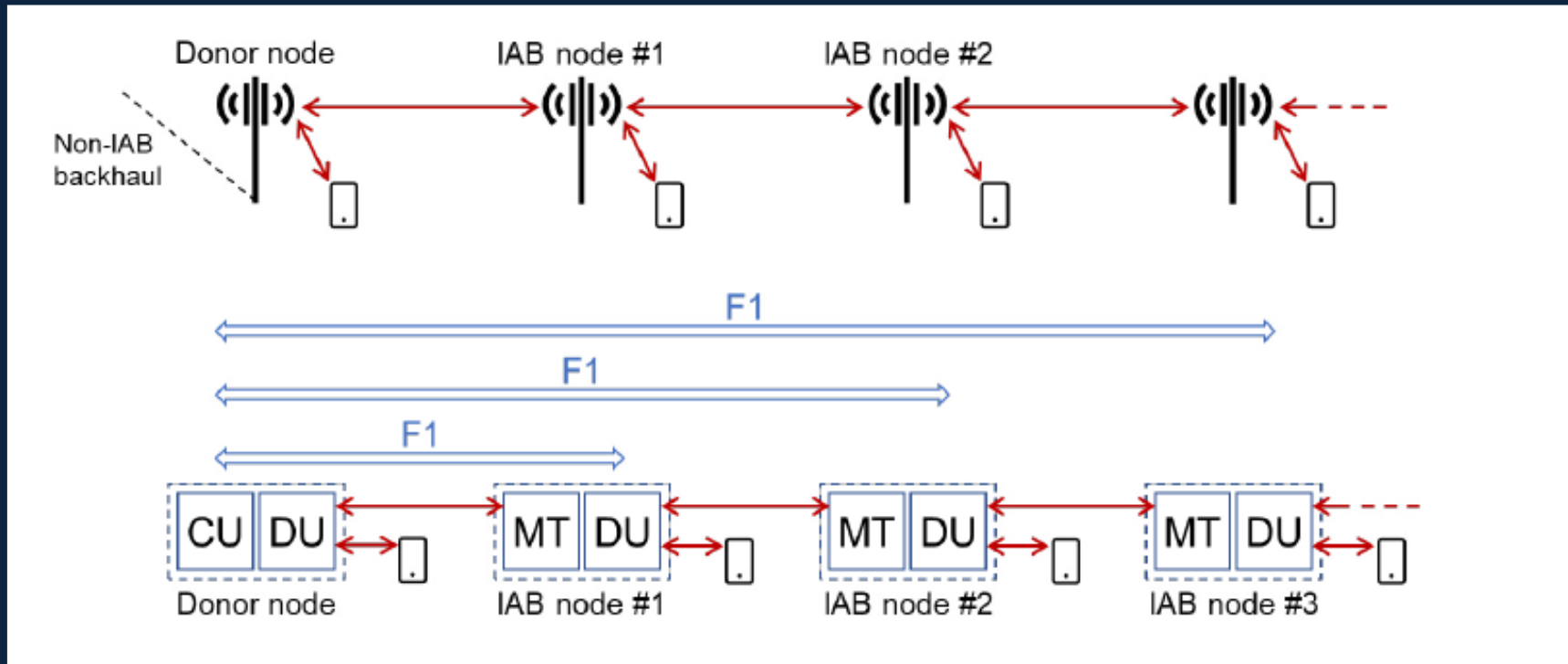
F1 is a good option for Enterprise-Network connection to Public-Networks:

- Unified L-3 features - Radio resource management (RRM) with public Macro-cell – important for seamless mobility
- Transport – F1 enables wired or wireless IP-connection which can be secured via IPsec
- Zero touch Integration – enables automated management of remote DUs



3GPP IAB Technology

IAB is – 3GPP defined xG F1 interface



Hierarchical Cell Structure using F1 / IAB

5gNB without densification



Hierarchical Cell Structure (HCS) is a nextG technology that is useful in extending coverage using small cells.

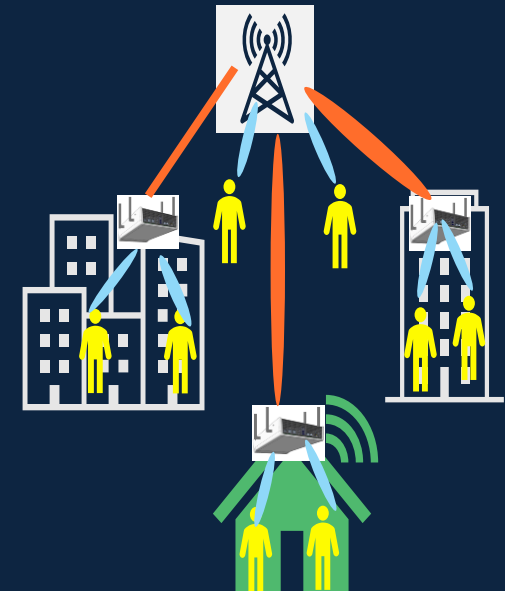
HCS solves small cell integration with Macro-cell problem to enable densification via small-cells

F1 & Integrated Access Backhaul (IAB) interfaces are example of HCS added in 3GPP Release-15 & 16 to:

- Support Higher Resiliency
- Achieve More Bandwidth
- Essential for mmWave deployment

What is MNO strategy for NextG densification at lower cost?

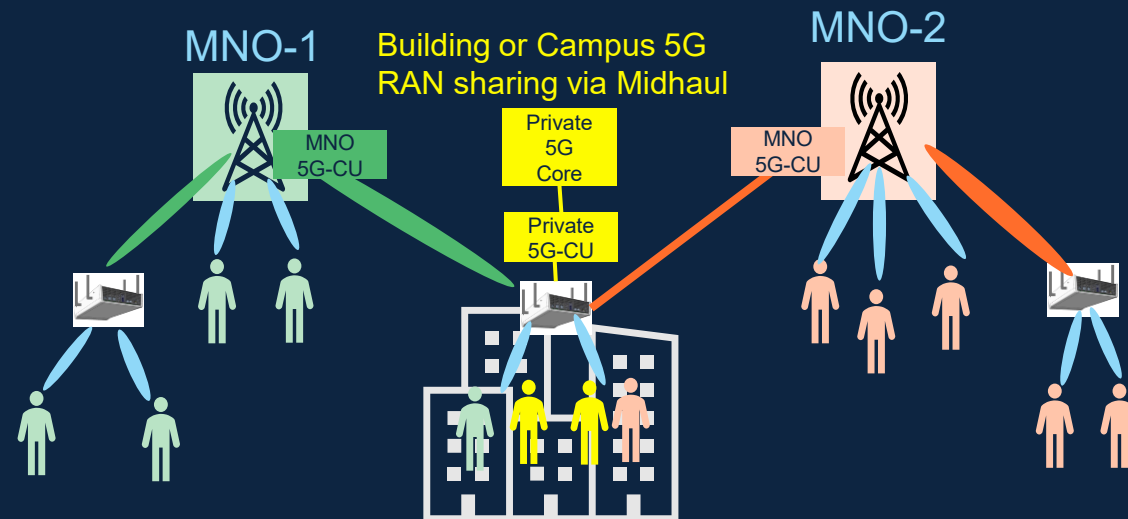
5gNB densification Idea



Midhaul & IAB reduces traffic congestion and improves channel utilization

Proposed Solution – 6G Heterogenous ownership

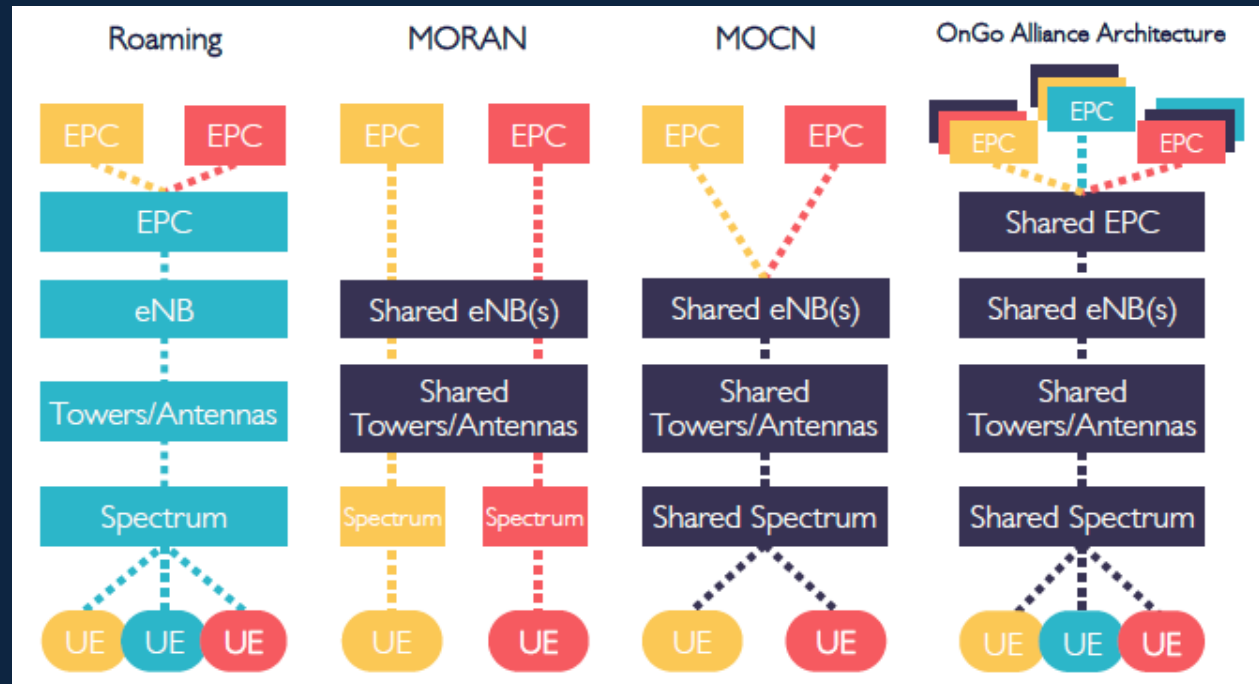
Idea – Develop RAN-Sharing NextG-network capable of integrating with multiple MNO's NextG Macro-cells and densify MNO coverage



In 6G, heterogenous ownership for HCS shall be added

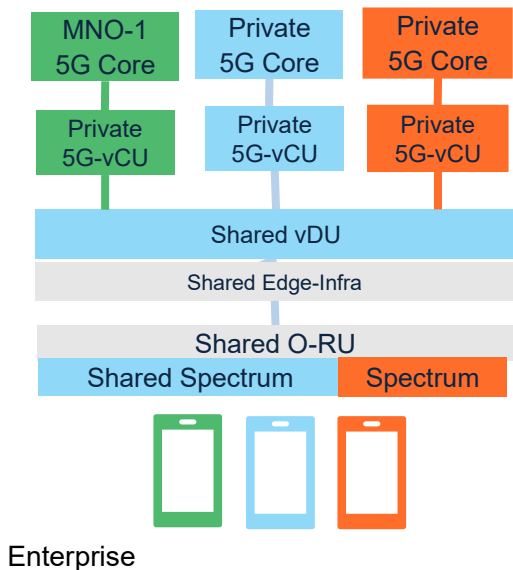
What is new in this Research

MITRE is proposing a new patent-pending Midhaul interface for RAN-sharing



MITRE Innovation

Neutral Host 5G-RAN with IAB-GW



Spectrum choice for Enterprise- NextG

New

Call for Action - Donate Spectrum to get coverage

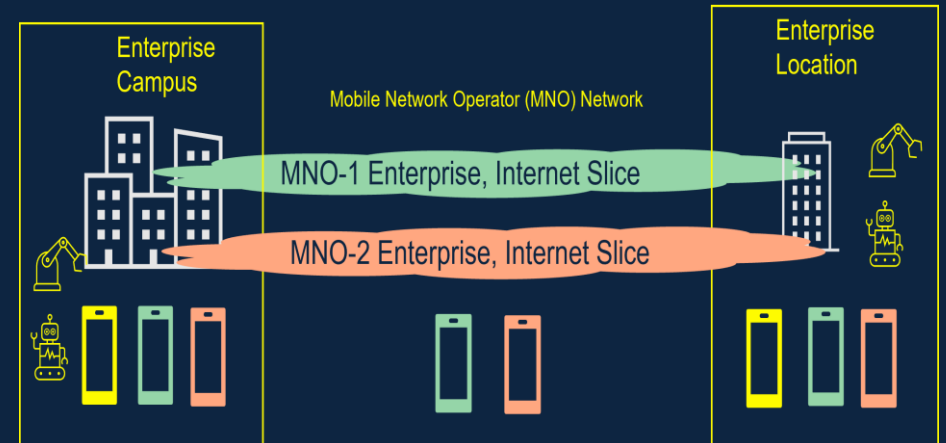
- Common Spectrum-bands across Enterprise-Sites
- Spectrum Sharing / licensing model

1. Spectrum for Private NextG

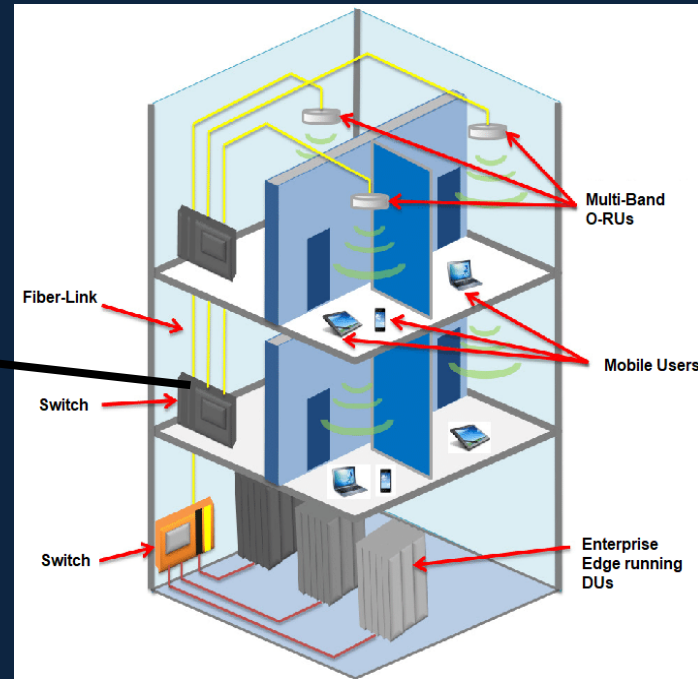
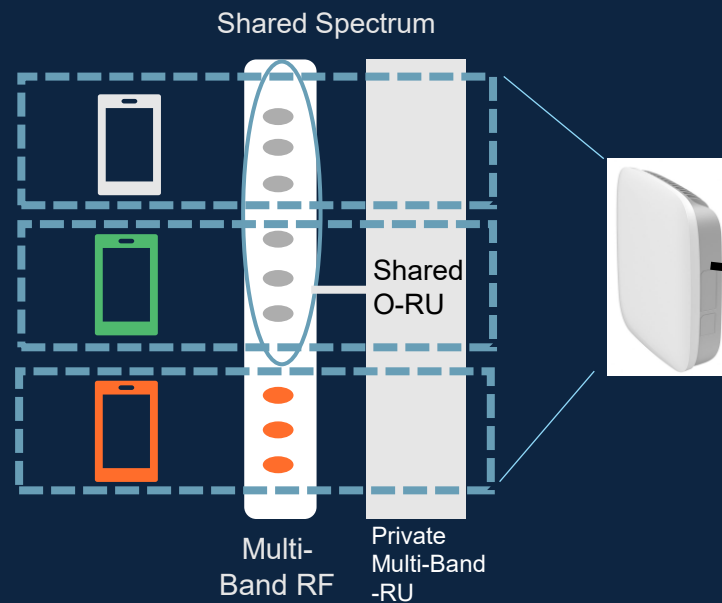
New

Idea to solves In-building Public Safety access issue– Offer Spectrum-license to Enterprise (Band14 or CBRS?) for Private 5G-deployment with Public Safety Priority access as part of licensing terms

2. Spectrum for DoD NextG
3. Spectrum for State Department NextG
4. Spectrum for Federal NextG
5. Spectrum for State, County and City NextG

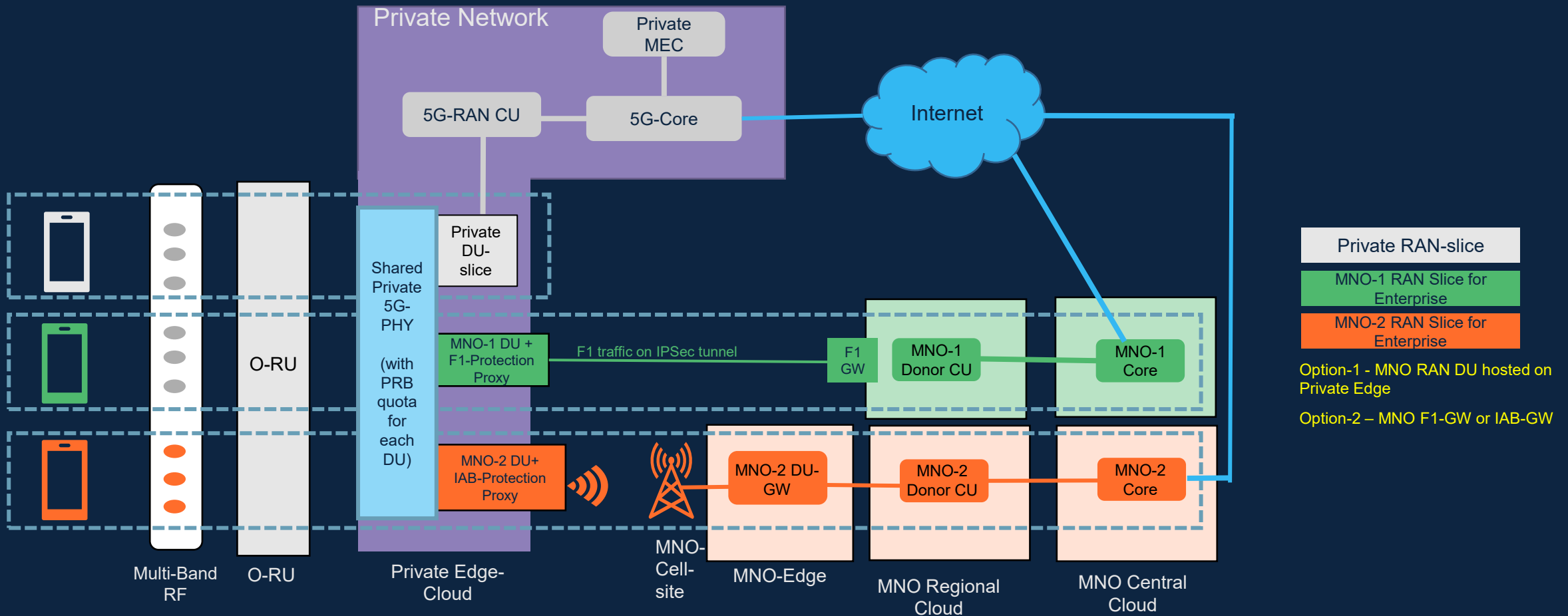


Spectrum & O-RU Sharing

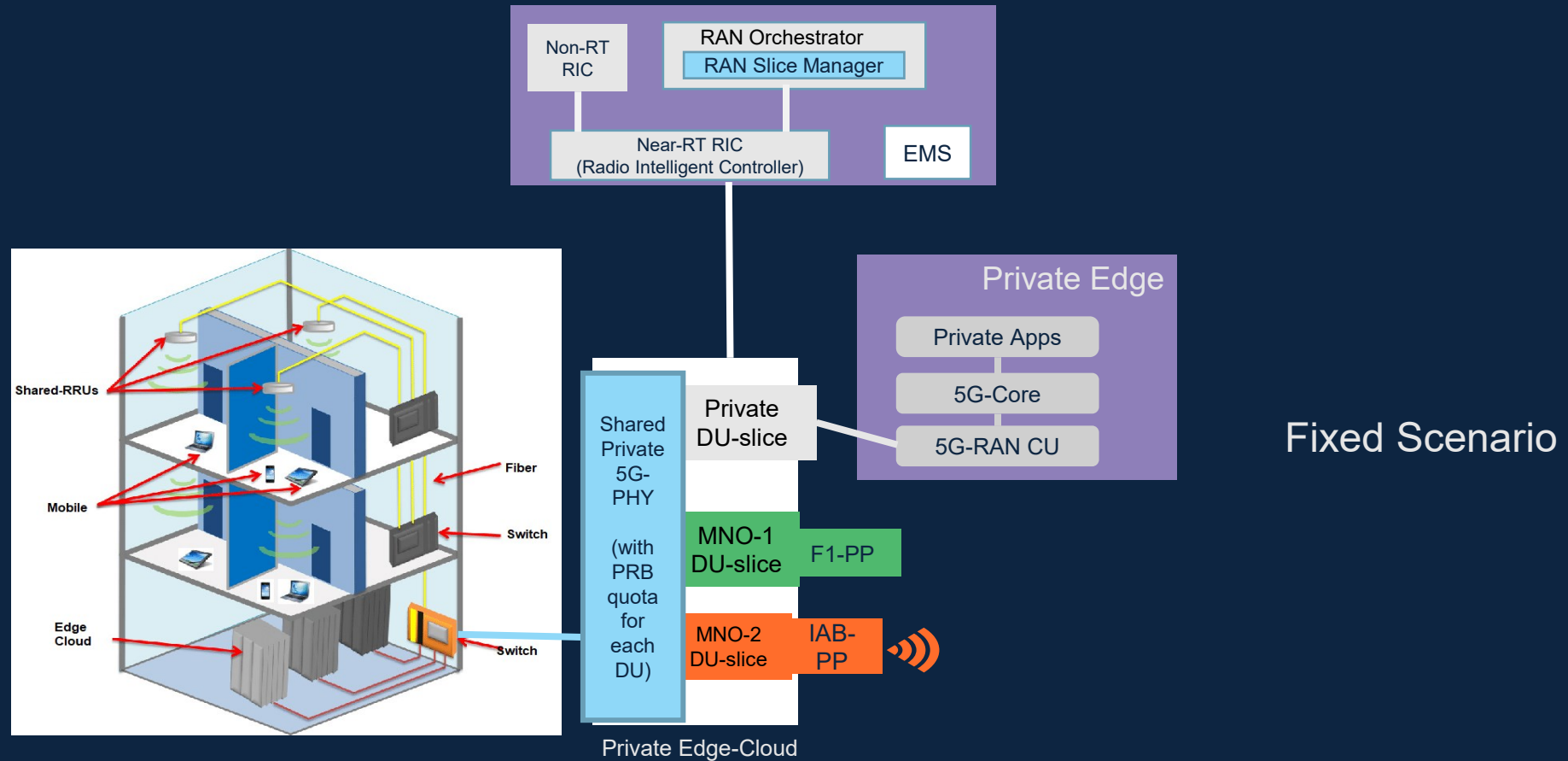


Spectrum Sharing
Enterprise Device Selection
Shared Remote Radio Unit (RRU)
Network

Private RAN-sharing



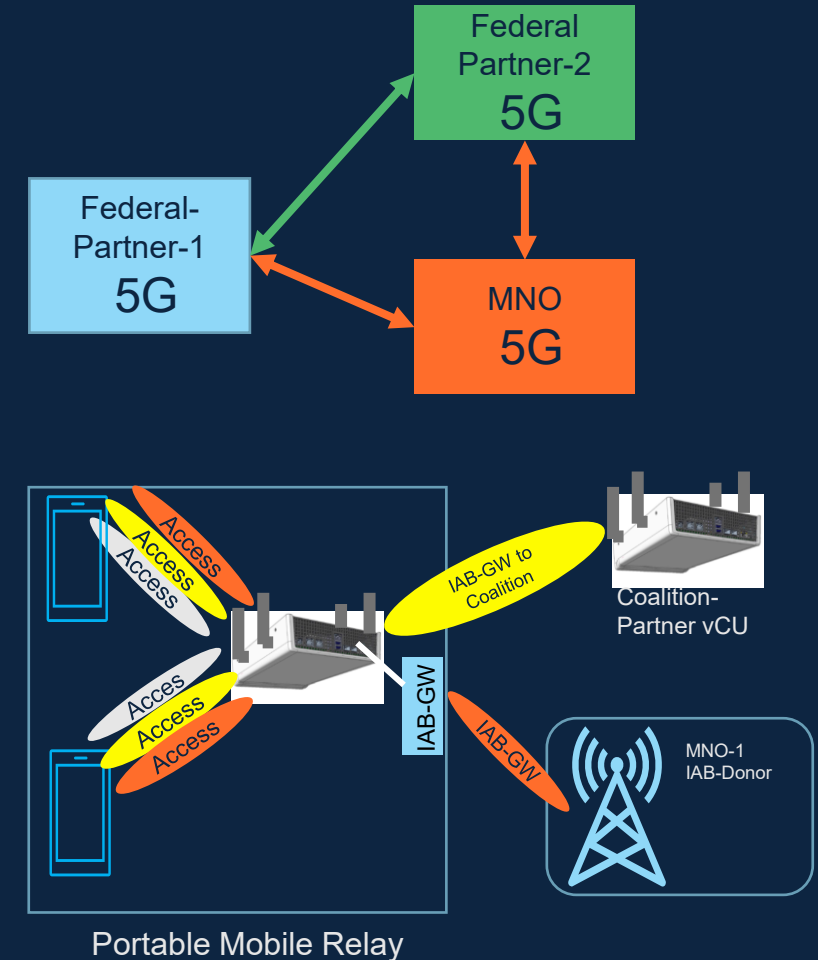
Private RAN-sharing with MNOs for Buildings



Private–Private Partnership for NextG-Network

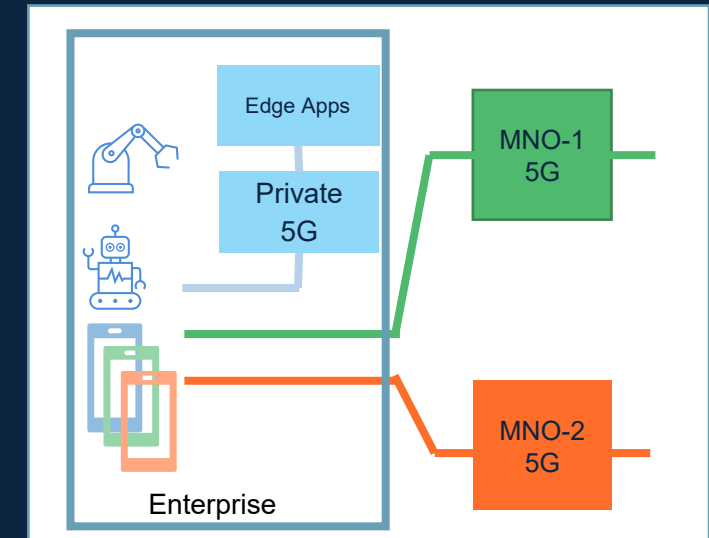
On Demand inter-agency NextG Network Collaboration

- Enables networking with partner networks or multiple MNOs
- Coalition Networking
 - NextG-IAB can be used as an inter-working option to connect different NextG networks



Desired Goals for Collaboration

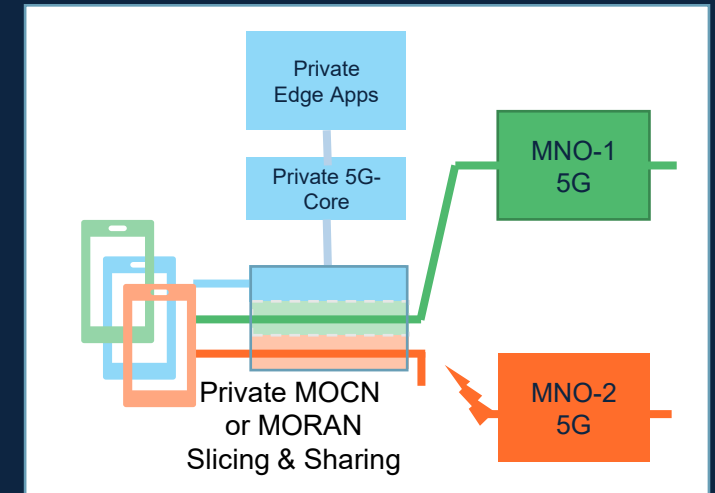
1. Develop Spectrum licensing options for Enterprise
 - Spectrum options for Shared-RAN
 - Commercial Device availability for Shared-RAN Spectrum options
2. Create open source NextG Coverage & IAB link analysis tool
 - Publish 5G-lab link analysis tool for MITRE
 - Research Publication
3. Experiment with Hybrid NextG Solution PoC Demo
 - How Private NextG-RAN/DU hosted MNO-slice connects to Public NextG-CU?
 - MNO Provisioning & integration steps for adding Private NextG-DU
 - Develop Security, RAN-slicing and Spectrum-Sharing model
 - Test Seamless mobility between Private-RAN and MNO-RAN
4. Create MNO Partnership Model Template
 - Enterprise NextG Deployment Plan
 - Provisioning of Public/MNO NextG-RAN slice on Private 5G Network
 - Connect MNO/Public slice with MNO's CU via IP-Sec tunnel or IAB-interface and test for mobility
5. Contribute to Standards development
 - Contribute Private-RAN sharing via IAB-GW research into standards for broader adoption



Develop Enterprise Hybrid-5G Deployment Plan

Four Steps template for Private-Network deployment

1. Spectrum licensing, sharing, RRU & Device Strategy
 - Private (example DoD, DHS) NextG-spectrum sharing with MNO
 - Open MNO-spectrum licensing – Big Idea
 - CBRS shared spectrum concepts
2. Private MEC Deployment (Buy HW + XaaS for Edge-Platform SW)
 - Reference Specification of Edge-HW and Multi-Band RRUs (Spectrum sharing capable)
 - Reference Edge-SW Platform & Orchestration SW
3. Private RAN Deployment (via RAN-SW via XaaS)
 - Enable Spectrum-solution with RAN-Slicing
 - Test end-to-end Private NextG Network
4. Install IAB-GW or F1-GW to connect Private RAN-slice to MNO vCU
 - Enable MNO-traffic for multiple MNOs based on Enterprise-MNO partnership agreement



Call for Action

NextG MNO & NextG Community – Let us collaborate to solve Federal & Enterprise Problems

- Industry Collaboration
 1. MNO-discussion, Industry, Academia & Vertical Industry – for funding & collaboration
 2. Industry participation in developing this use-case together (for Spec creation and contribution to Standards)
 3. Explore options of adding this use-case to CBRS and Multifire
- Federal First Mover options
 1. Create experiments & funding for Federal Enterprise NextG experiments

Thank you

Praveen Gupta
pgupta@mitre.org



@pgupta408



Linkedin.com/in/pgupta408