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

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

Source – Tech Playon
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

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?

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

© 2022 THE MITRE CORPORATION. ALL RIGHTS RESERVED.
**Call for Action - Donate Spectrum to get coverage**

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

1. **Spectrum for Private NextG**
   - 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 with MNOs for Buildings

Fixed Scenario

© 2022 THE MITRE CORPORATION. ALL RIGHTS RESERVED.

MITRE Patent Pending
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-IAB 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