

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda Item: 4.2

RWS-210030

Qualcomm

On CPE Upper Layer Enhancements for Rel-18

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5G CPE/Fixed Wireless Access

Building on SA1 study and requirements

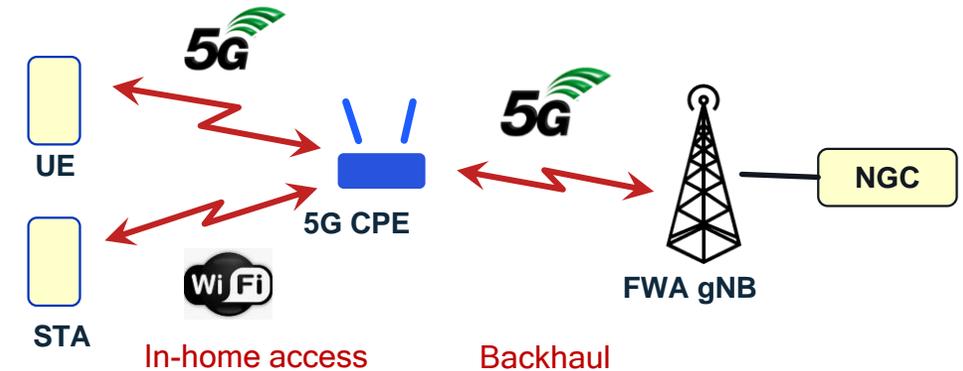
- CPE & Fixed Wireless Access

Motivation:

- SA1 has developed requirements on 5G access in home and 5G backhauling (FWA)
- 3GPP has previously developed various technologies that can support 5G access and backhauling, but their suitability to the scenarios requires study (including gap analysis)

- Technical challenges include:

- Architecture aspects: Layer 2 and layer 3 relay-like approaches are possible (including IAB)
 - Impact and suitability analysis of different options
- Support for flexible end-to-end QoS management (including local RAN, backhaul, relay function)
- Transport and signaling aspects including backhaul aggregation
- Multi-PLMN support
- Mobility aspects
- Interworking with non-3GPP access
- Interference / radio resource management



Aspects from SA1 Study: Enhancements for Residential 5G

- Some requirements from SA1 Study have critical impact on architecture selection
- End-to-end QoS for local and macro traffic
 - [PR 5.10.6-002] The 5G system shall support real time E2E QoS monitoring and control for any data traffic path (i.e. from/to a UE to/from the 5GC and to/from another UE) via a PRAS and an eRG when there is connectivity to the 5G system.
- Routing efficiency for local traffic
 - [PR. 5.4.6-001] The 5G system shall support routing efficiency for data traffic between a UE and a non-3GPP device through an Evolved Residential Gateway.
- Service disruption due to non-local connectivity control
 - [PR. 5.12.6-003] The 5G system shall minimize service disruption when a CPN communication path changes between two PRASes.
- Scalability to large number of 5G-LAN-VNs
 - [PR. 5.8.6-001] The 5G system shall be able to support large amounts of small 5G LAN-VNs targeting residential deployments.
- RAN sharing
 - [PR. 5.14.6-001] The 5G system shall be able to support PRAS sharing between multiple PLMNs.

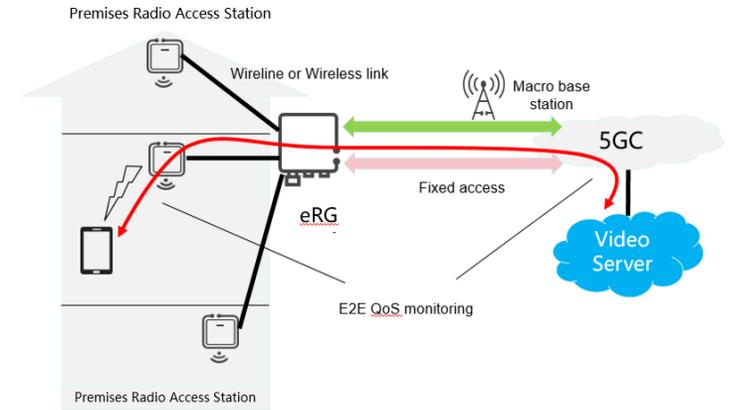


Figure 5.6.1-1. E2E QoS monitoring

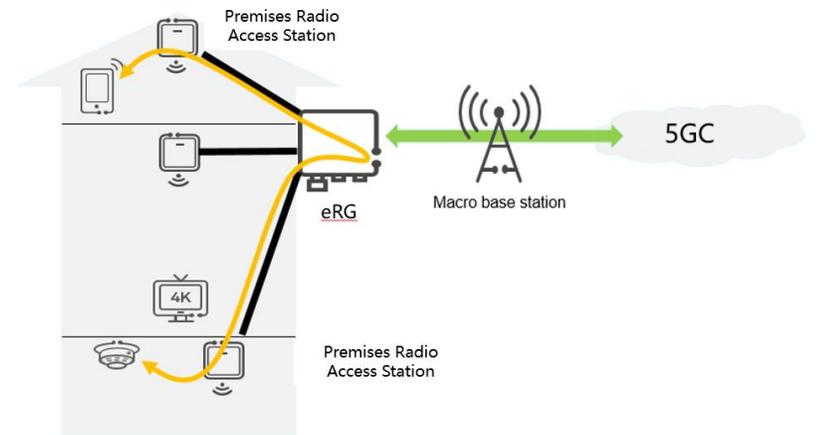
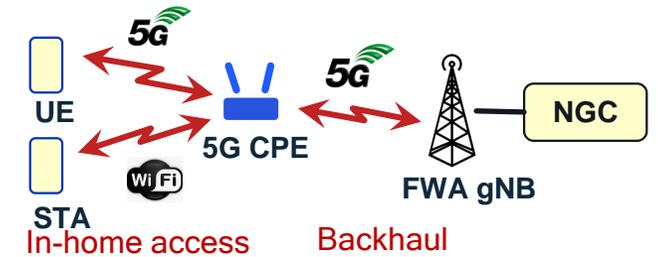


Figure 5.5.1-1: efficient routing for UE-to-UE communications via residential gateway

5G CPE/Fixed Wireless Access

Possible study approach

- Define baseline architectures, e.g.
 - UE/gNB back-to-back for CPE
 - Native IAB
 - Hybrid architectures could also be considered (e.g. leveraging IAB functionality that can be applied outside of IAB)
- Define characteristics / evaluation factors such as:
 - End -to-end QoS management including both access and backhaul
 - Required Level of coordination between the macro gNB and the CPE's gNB/DU
 - Need for BH PLMN to be the same as the access PLMN
 - Management and transport of local traffic
 - Support for interference management between BH and access links
- Identify strengths / weaknesses of each architecture
- Identify functionality gaps and make normative recommendations as needed

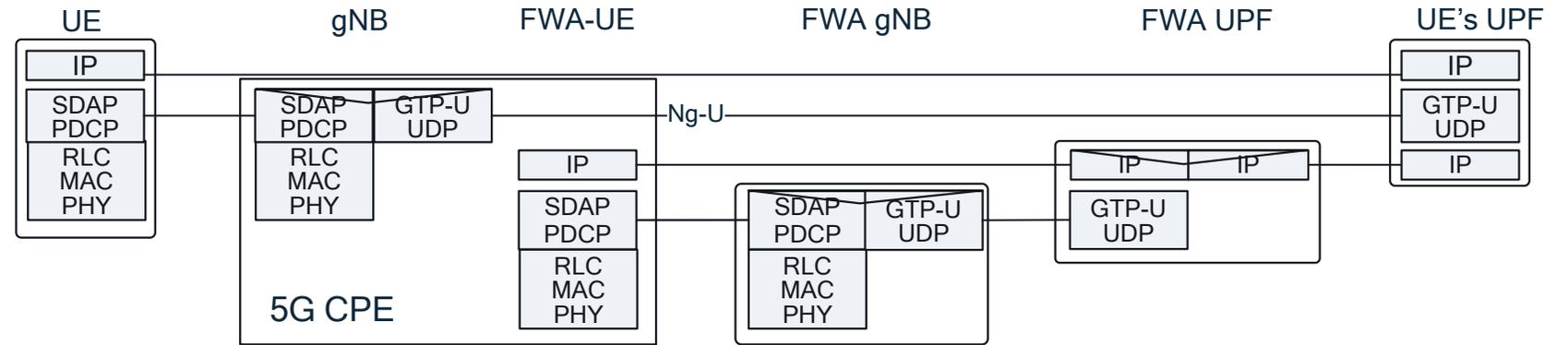


Baseline Architectures

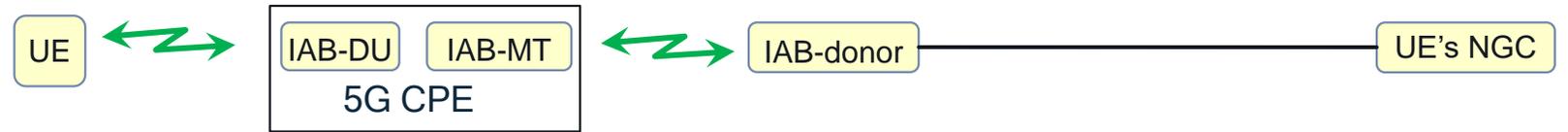
gNB/UE back-to-back



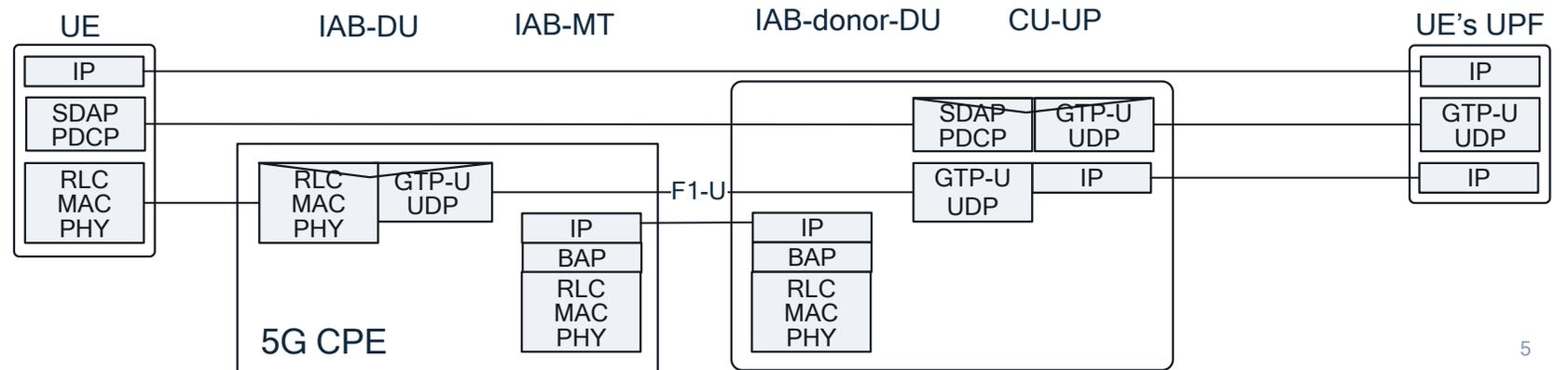
U-plane protocol stack



Native IAB



U-plane protocol stack

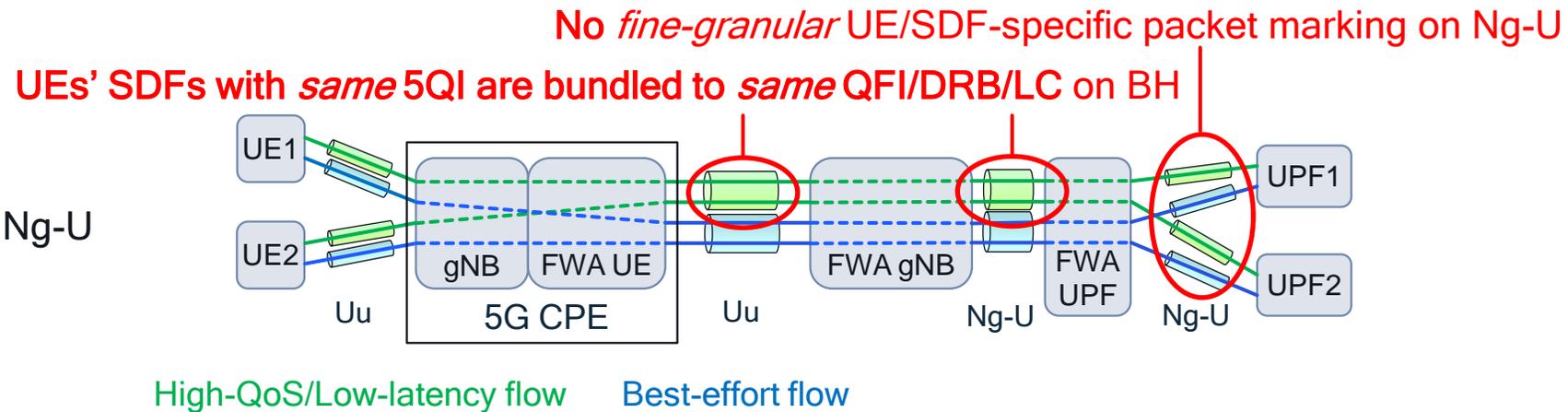


End-to-end QoS for Macro Traffic

- Requires UE/SDF-specific logical channel on the BH so that scheduler can differentiate SDFs of different UEs with same 5QI. This applies to 5G and non-3GPP access in home.
- Requires fine granular packet marking on UE's UPF to indicate high-QoS/low-latency flow to FWA RAN.

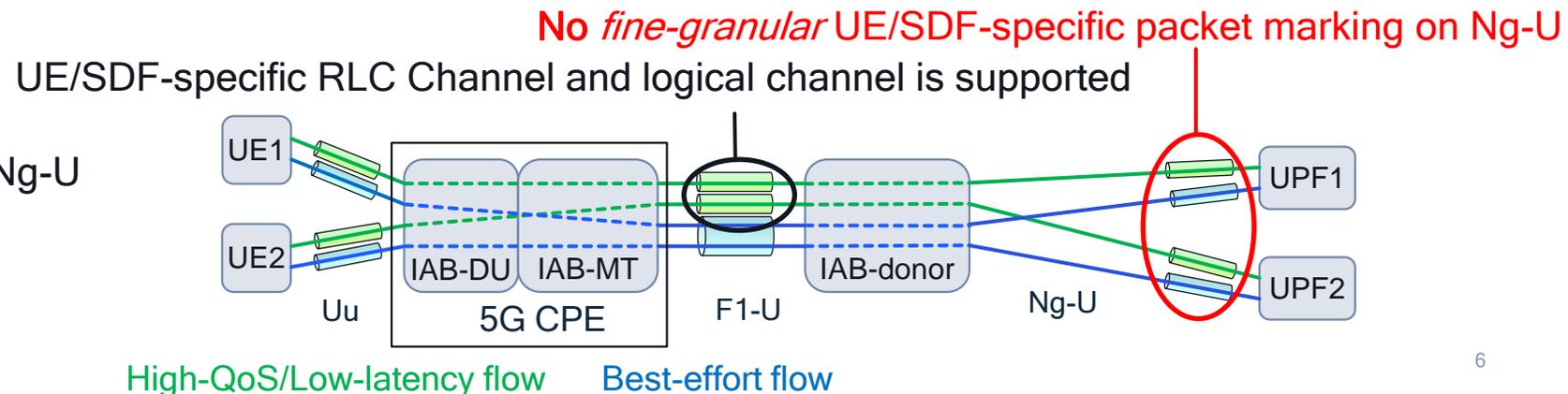
gNB/UE back-to-back

- Necessary extensions:
 - UE/flow-specific QoS on BH link
 - Fine-granular flow differentiation on Ng-U (e.g., using IPv6 Flow Label)
 - Support of E2E QoS monitoring



Native IAB

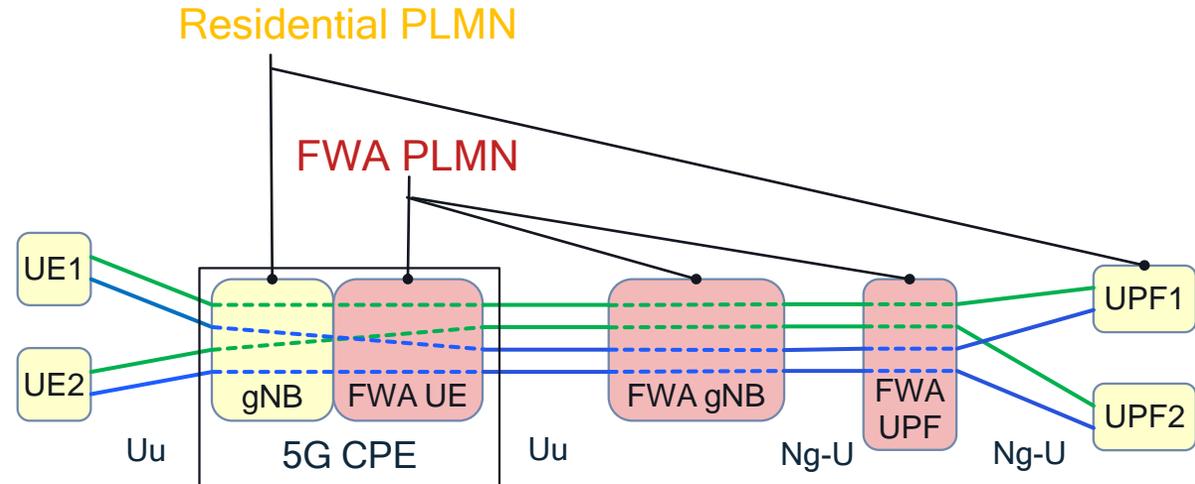
- Necessary extensions:
 - Fine-granular flow differentiation on Ng-U (e.g., using IPv6 Flow Label)
 - Support of E2E QoS monitoring



Coordination between Residential and FWA PLMNs

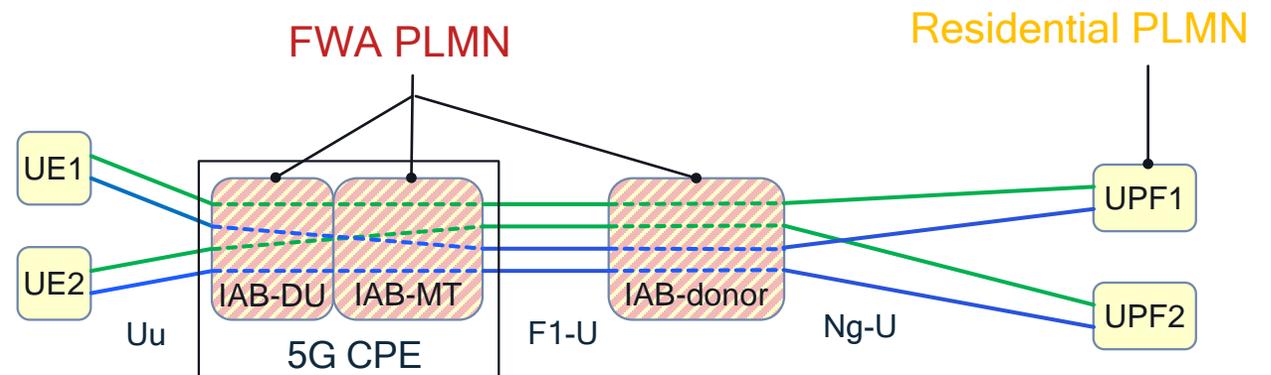
gNB/UE back-to-back

- Residential and FWA RANs may remain completely independent.
 - No mutual agreements necessary if operated by different PLMNs
 - It needs to be discussed how coordination is achieved for E2E QoS and radio resource management (see later slide) between residential and FWA RANs.



Native IAB

- RAN-sharing or roaming agreements necessary between PLMNs
 - No obvious way to separate management of IAB-DU and IAB-MT between different PLMNs.

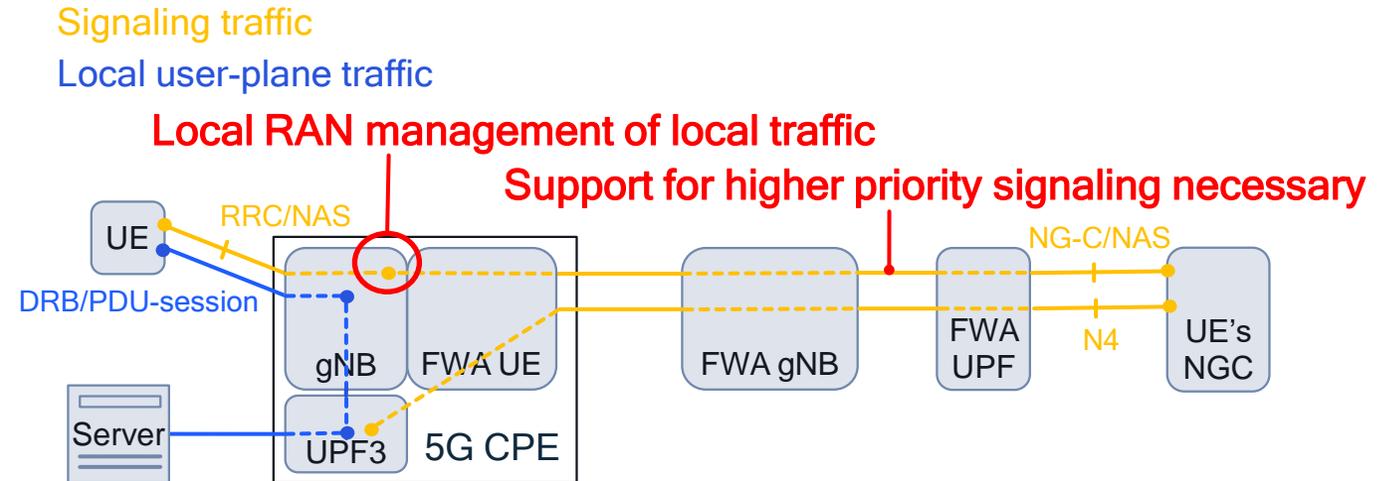


Management and Transport of Local Traffic

- Local traffic should be efficiently routed, i.e., remain within home network.
- Signaling should have high priority and remain local for better scalability and reduced service interruption.

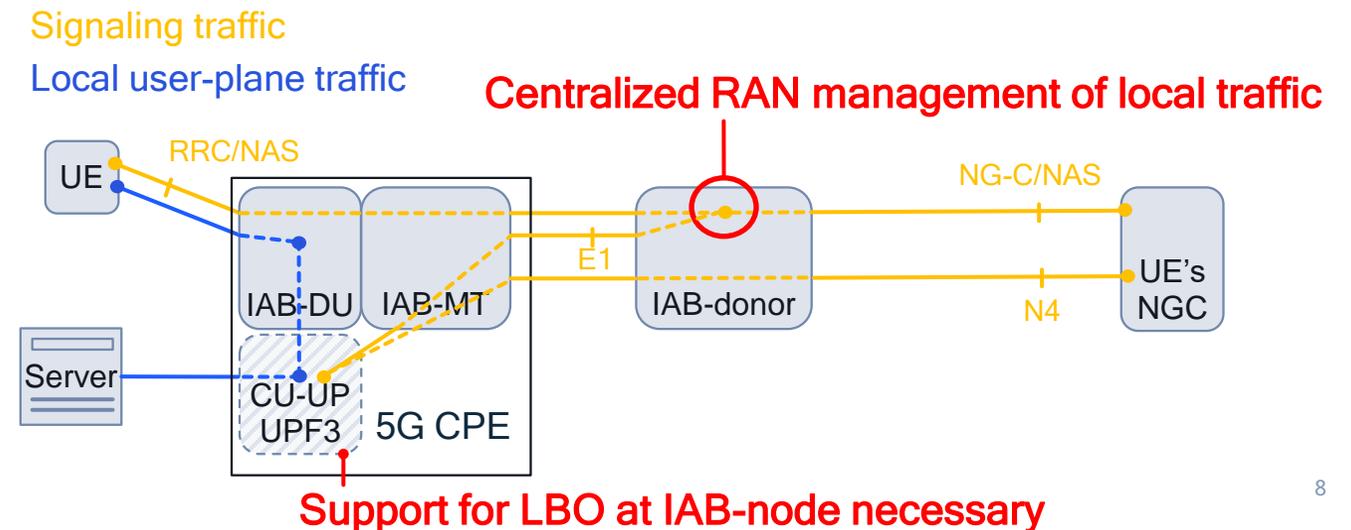
gNB/UE back-to-back

- Necessary extensions:
 - Support of higher priority for signaling traffic over data traffic on FWA BH
- Local RAN management of local traffic.



Native IAB

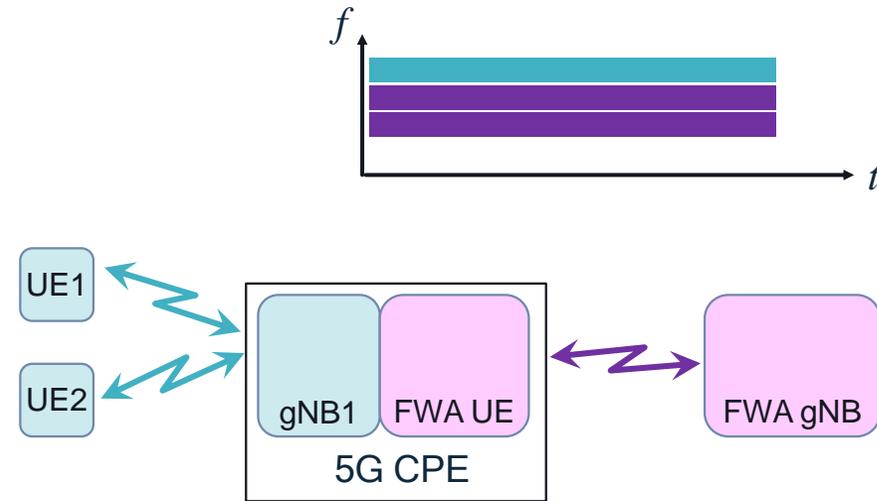
- Necessary extensions:
 - LBO with local CU-UP and UPF on IAB-node
- Centralized RAN management of local traffic



Multiplexing of Radio Resources for In-band Operation

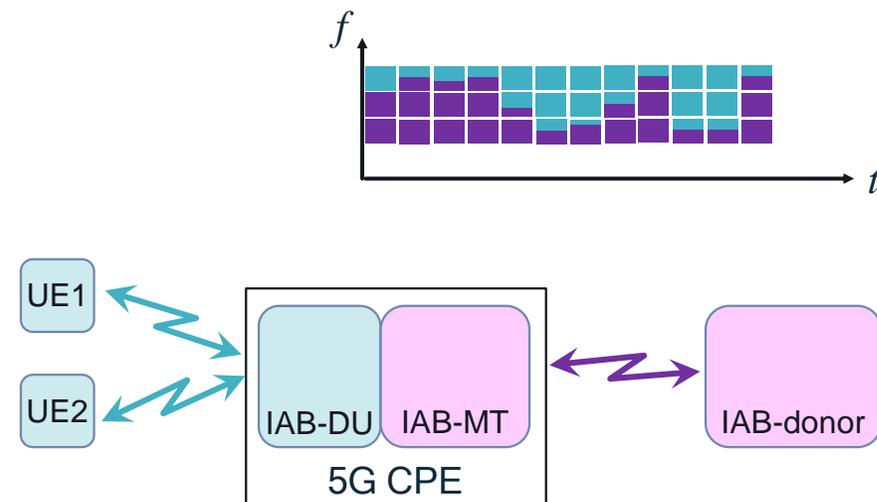
gNB/UE back-to-back

- Presently, supports only coarse radio-resource multiplexing between access and backhaul with granularity of bands or, potentially, CCs.



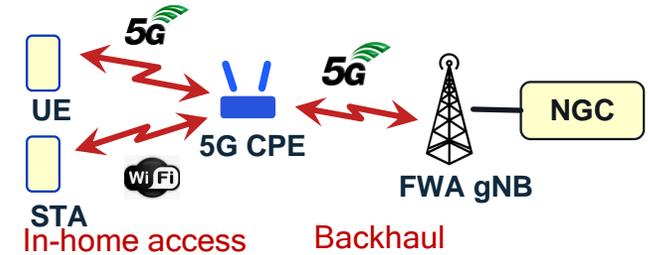
Native IAB

- Can leverage IAB's fine-granular TDM/FDM radio-resource multiplexing with symbol/RB granularity.



5G CPE/Fixed Wireless Access

Summary



- From the analysis of the baseline architectures:
 - Both exhibit functionality gaps
 - Each of them may be suitable to particular scenarios
- Study can consider additional architectures using above as reference points
 - Using the requirements and scenarios from SA1 for evaluation
- Overall, the topic seems well suited for a RAN3 led study
 - Interaction with SA2 likely to be needed mainly in the QoS area
 - **Goal: identify and evaluate BH options, and identify normative work to address the functional gaps**



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