Challenges for Network Slicing in O-RAN

Based on work done in 5G-DRIVE

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5G-DRIVE in a nutshell

- 5G DRIVE aims to bridge current 5G developments in Europe and China through joint trials and research activities in order to facilitate technology convergence, spectrum harmonisation and business.

- 30-month (September 2018 – February 2021) Research and Innovation Action project, funded under the Horizon 2020 Framework programme.

- 17 partners from 10 European countries (Germany, Finland, Belgium, Italy, Switzerland, Poland, Greece, Portugal, United Kingdom and Luxembourg).

Status at 3GPP concerning RAN slicing
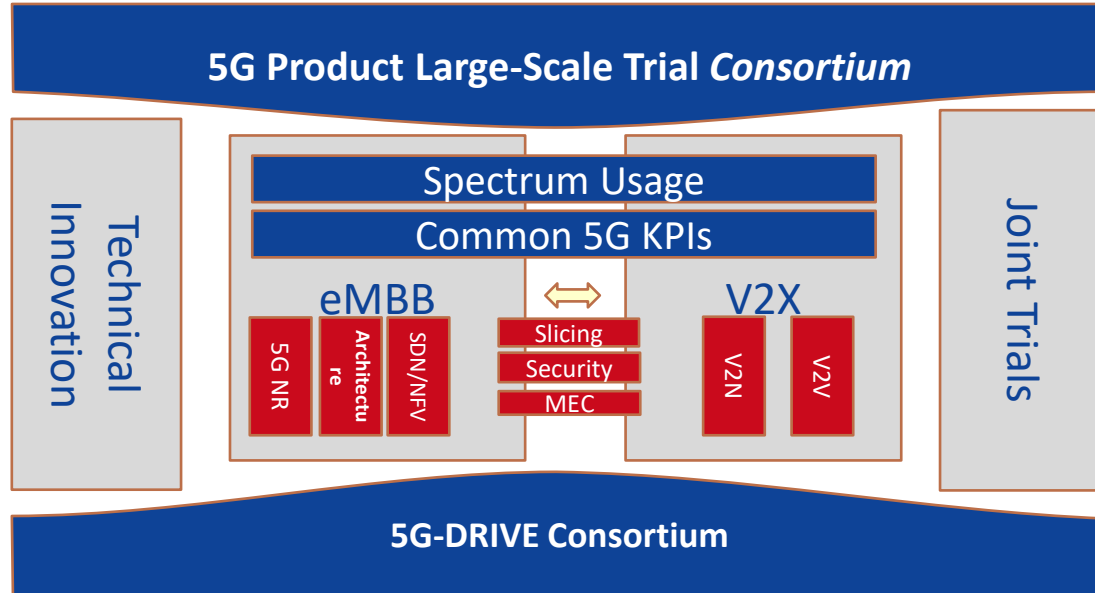
- ▸ 3GPP 5G SA allows for dynamic creation of separate logical networks, known as network slices

- ▸ 3 basic network slice classes have been defined: URLCC, eMBB, mMTC

| Slice Type	Bandwidth	Latency	Reliability	Connection density
eMBB	20 Gbps (DL) 10 Gbps (UL)	10 ms	-	-
URLLC	-	< 1 ms	99.9999%	-
mMTC	-	< 10 s	-	1 M/km^2

- ▸ Affects both 5GC and RAN

- ▸ Basic principles concerning RAN slicing are established in 3GPP, but no plans for defining how to implement RAN slicing

Status of RAN slicing at O-RAN Alliance

▸ O-RAN Alliance approach of „openness", disaggregating eNB/gNB into multiple modules with defined standard interfaces appears very attractive

  ➔ Enabling multi-vendor, best of breed flexibility

  ➔ Move away from proprietary hardware to off-the -shelf general purpose platforms

  ➔ Allows leveraging the Open Source community

  ➔ Greater agility, enables faster innovation

  ➔ Reduces complexity

  ➔ lowers CAPEX/OPEX

▸ But

  ➔ Only few documents on slicing released by O-RAN Alliance so far

5G-DRIVE Cooperation with Chinese twin project

▸ Several O-RAN related topics have been chosen for cooperation, including work on RAN slicing and the feedback-loop based control over E2 interface.

▸ First concepts for slicing extensions to O-RAN have been proposed by 5G-DRIVE and shared with the Chinese twin project

▸ NB: Significant (overall) research on RAN slicing already done in the community, with various concepts proposed.
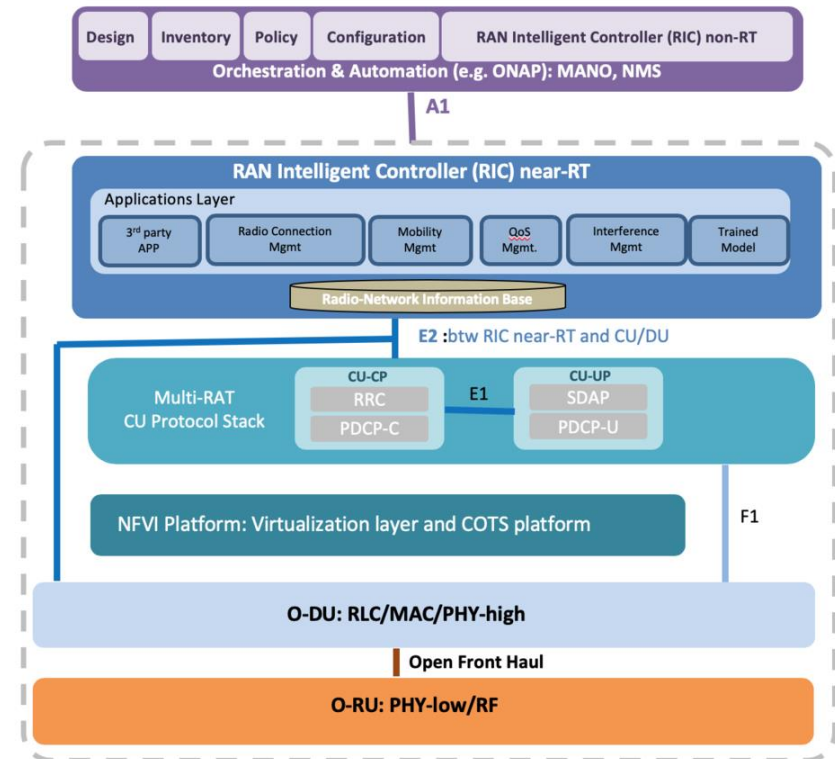
Challenges for O-RAN Slicing

▶ Even though RAN slicing not implemented in O-RAN currently, the platform seems a very promising solution

▶ Little „guidance" from 3GPP and O-RAN Alliance on RAN slicing implementation

▶ Difficult to involve verticals (due to complexity) to capture requirements

▶ Significant changes to the current O-RAN architecture required

➜ modification of MAC to support scheduling of different traffic types (eMBB, URLLC, etc.)

➜ A different split for different slice types

➜ customization of the RRM to obtain per slice behaviour as complementary mechanism to scheduler (packet scheduling, admission control)

➜ proactive provisioning of appropriate radio coverage and radio link quality on a per slice type level by using R-NIB and slice information.

➜ partitioning of the Application Layer of the near-RT RIC to separate slice operation spaces and their privileges and restrictions

➜ Support for multiple verticals at the Application Layer of the near-RT RIC
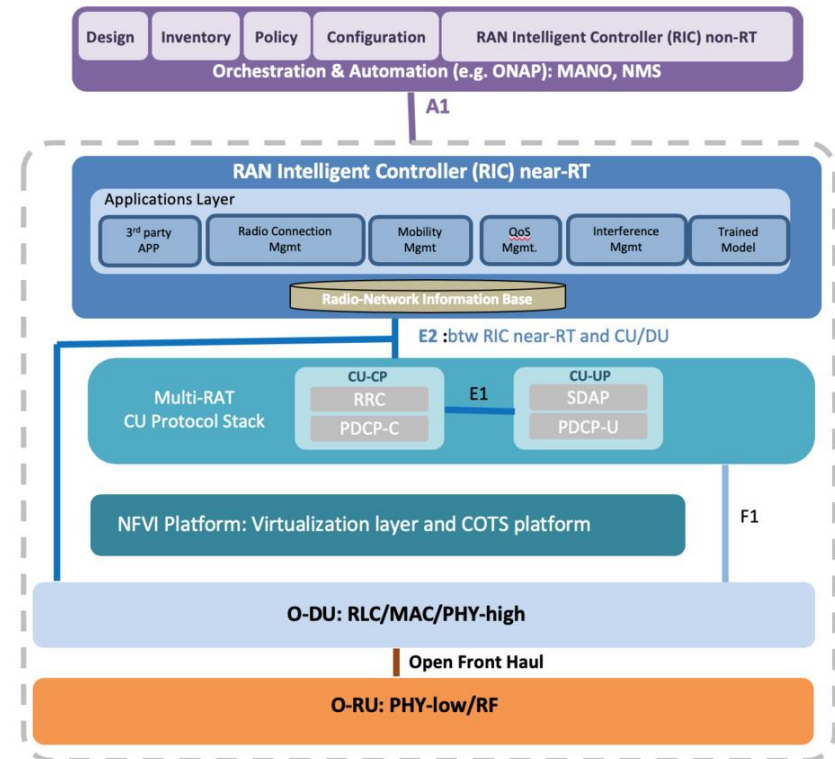
NS Enabled O-RAN - concept principles

- **Near-RT RIC functions are sliced** in the way in which all its functional elements (e.g. QoS Management, Radio Connection Management) are partitioned and each slice has **full constellation** of these partitions composing the *„virtual RIC"* dedicated to the slice and connected with the *„master RIC"*.

- The components are **piggy-backed** to the main component that realizes the function, for example Main Mobility Management Application

- The **Coordinator** (AI-driven) is trying to increase the orthogonalization' of APP requests

- Each slice has isolated R-NIB partition relevant only to this slice (i.e. about UEs that are attached only to this slice)

- Easy integration with updated MEC is possible

- Several joint whitepapers planned by 5G-DRIVE and Chinese twin project
    - RAN slicing survey
    - RAN slicing enabled near real-time RIC
    - O-RAN near real-time RIC functions coordination

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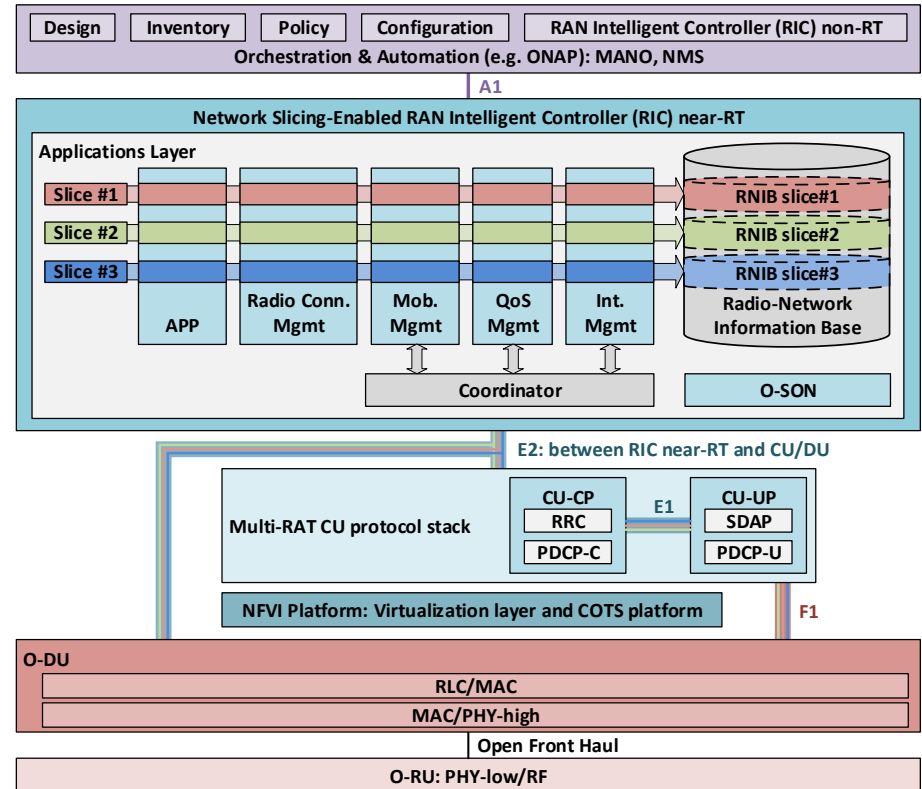
Thank you for your attention!

Find us at www.5g-drive.eu

Twitter: 5gDrive