5G-IANA WEBINAR

The 5G-IANA experimentation infrastructure: 5G testbeds and other assets at the disposal of third parties

Wednesday 17 May 2023, 15:00 – 16:00 CET

5G-IANA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101016427.

SPEAKERS

Ross Staton (NOKIA)

Dejan Šošter (TS)

Sevi Christoforou (ICCS)

Jose Isola (Bylogix)

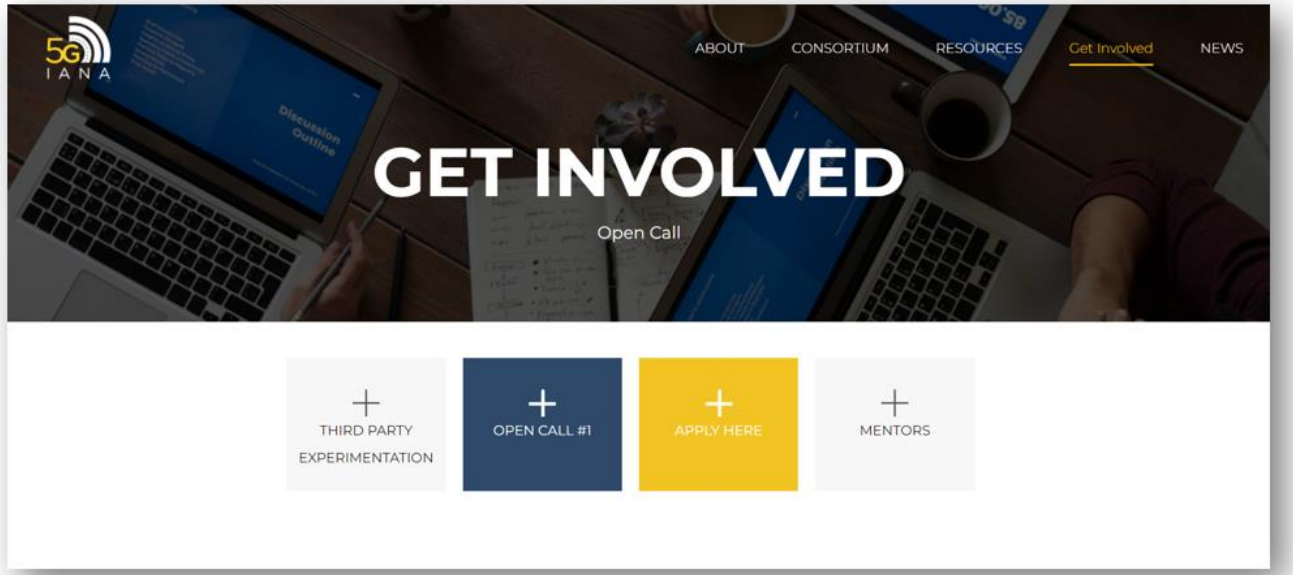
Edoardo Bonetto (LINKS)

AGENDA

- **Welcoming**
  Sevi Christoforou (ICCS)
- **NOKIA's 5G-IANA testbed in Germany**
  Ross Staton, Nokia
- **The 5G-IANA experimentation infrastructure: 5G testbed in Slovenia**
  Dejan Šošter, Telekom Slovenije
- **Drivable, autonomous twins: things of CARLA and hands on VeGA in the 5G-IANA playground**
  Jose Isola, Bylogix
- **Flexible OBUs and RSUs for the 5G-IANA project**
  Edoardo Bonetto, LINKS foundation
- **Questions & Answers**

Open Call – applications deadline 22/05

The intended audience is any legal entity in the form of a Small and Medium-sized Enterprise (SME / start-up), which is working with the concept of Network Applications (nApps) in the automotive vertical, and which is already developing or is willing to develop a product or service or functionality that leverages 5G capabilities through the 5G-IANA platform.



https://www.5g-iana.eu/get-involved/open-call/

open-call@5g-iana.eu

www.5g-iana.eu

Thank you for your attention!

Any questions?

Twitter: IANA_5G
LinkedIn: 5g-iana
Contact us: info@5G-iana.eu

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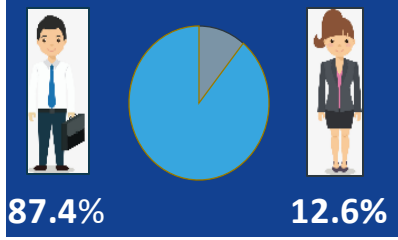
5G-IANA Nokia Testbed

NOKIA @ Ulm

Number of Employees



725

Focus Areas

R&D for LTE and 5G

Technology Expertise

- Base station and network system competence
- End-to-end Network verification and optimization
- 5G, 4G/LTE, Cloud, IoT, Virtual Reality, Autonomous Driving, Industry 4.0, Digitalization, Digital City

Site founded in

1998

Organization footprint

96% MN Products

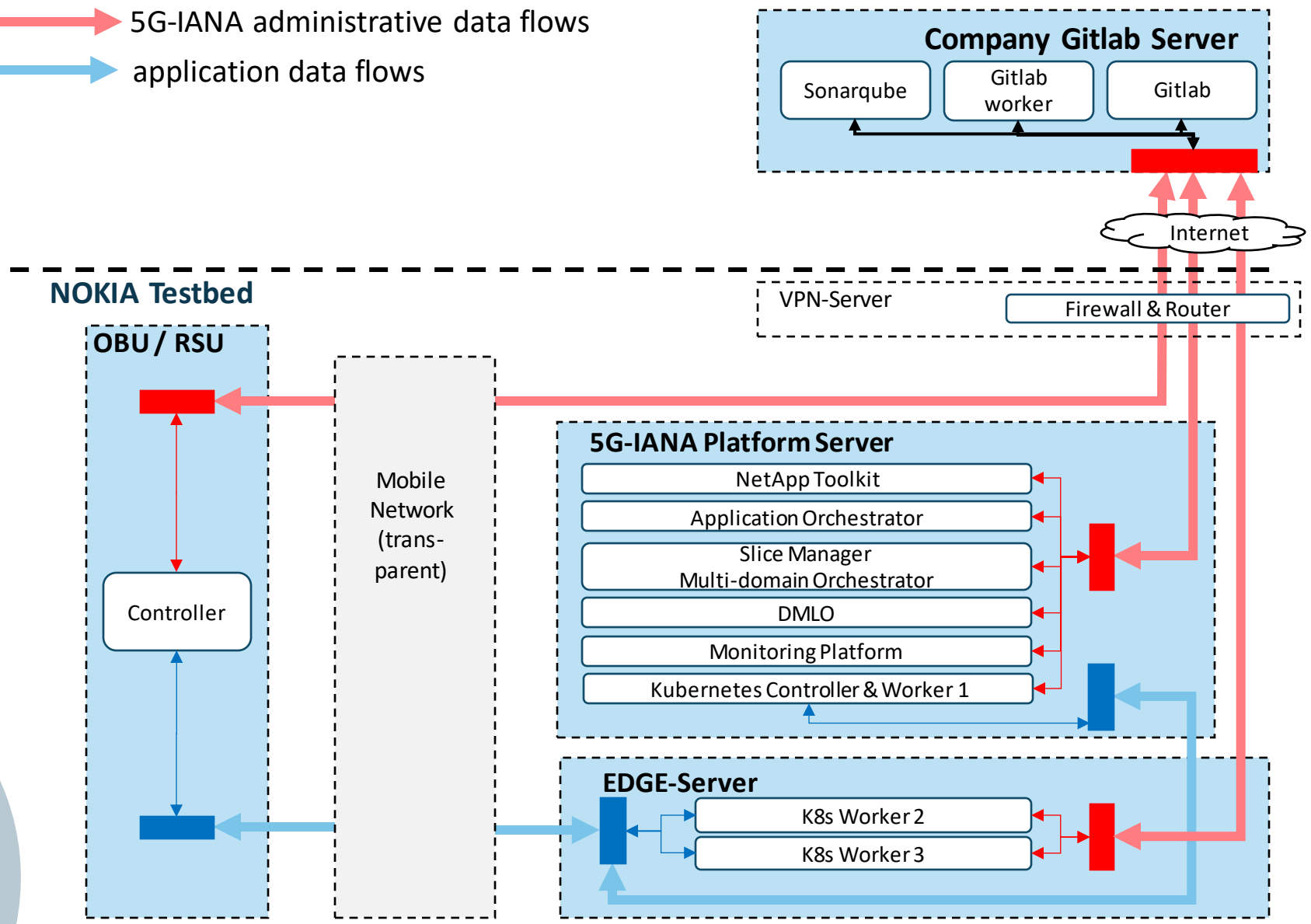
Nationalities

43 (25%)

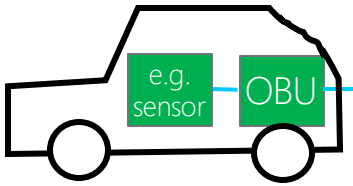
Local Ecosystem

- Universities
- Automotive Industry
- Defence Industry/Airbus
- SMEs

5G-IANA Platforms @ Nokia Ulm



5G SA Network Topology @ Nokia Ulm



= FAR EDGE Server

antenna site DRK
scheduled for use in 5G-IANA

antenna site SWU Lager

antenna site SWU K1
(currently deactivated)

antenna site NOKIA LM7/1
(3 sector cells/experimental)

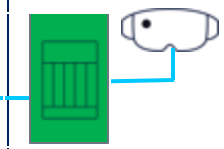
optical fibre

gNB — UPF — EDGE Server

hosts DNs

Nokia lab
(routers/firewalls in lab not shown)

Internet
(VPN)

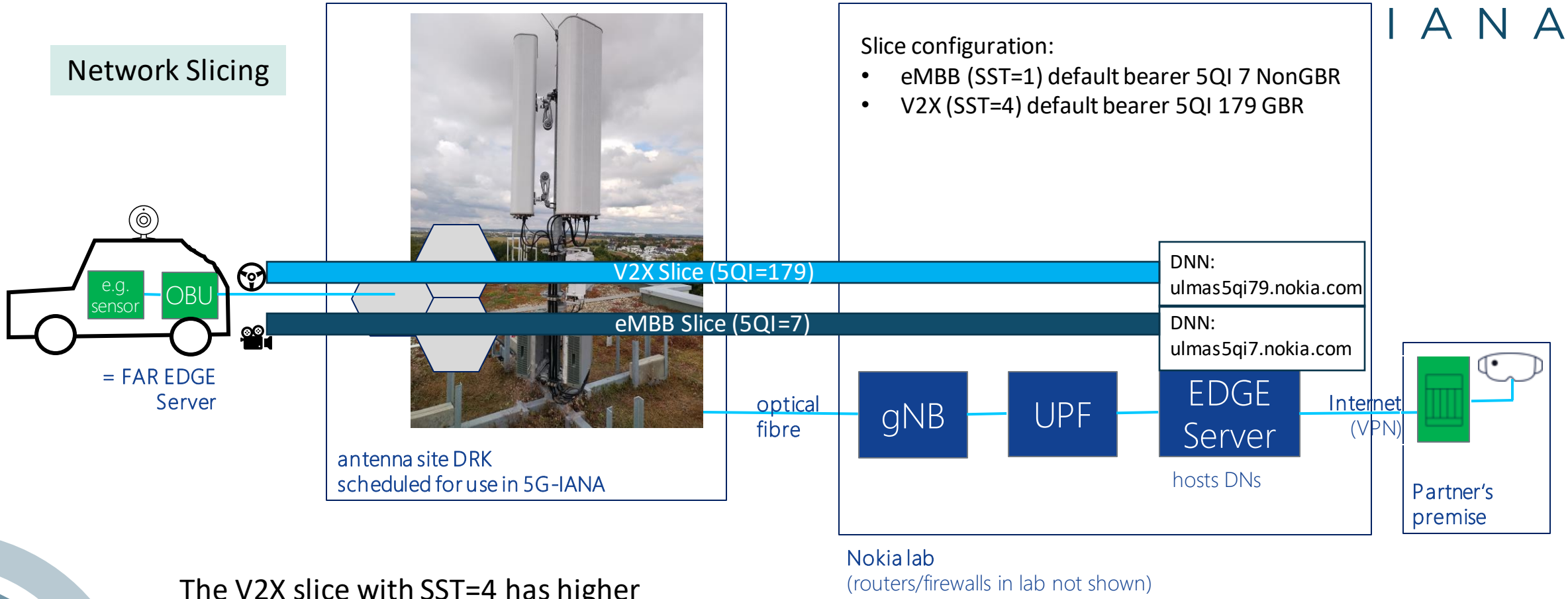


Partner's premise

Simplified Network Topology – user plane
Control plane network elements in Finland

5G SA Network Topology @ Nokia Ulm

Network Slicing

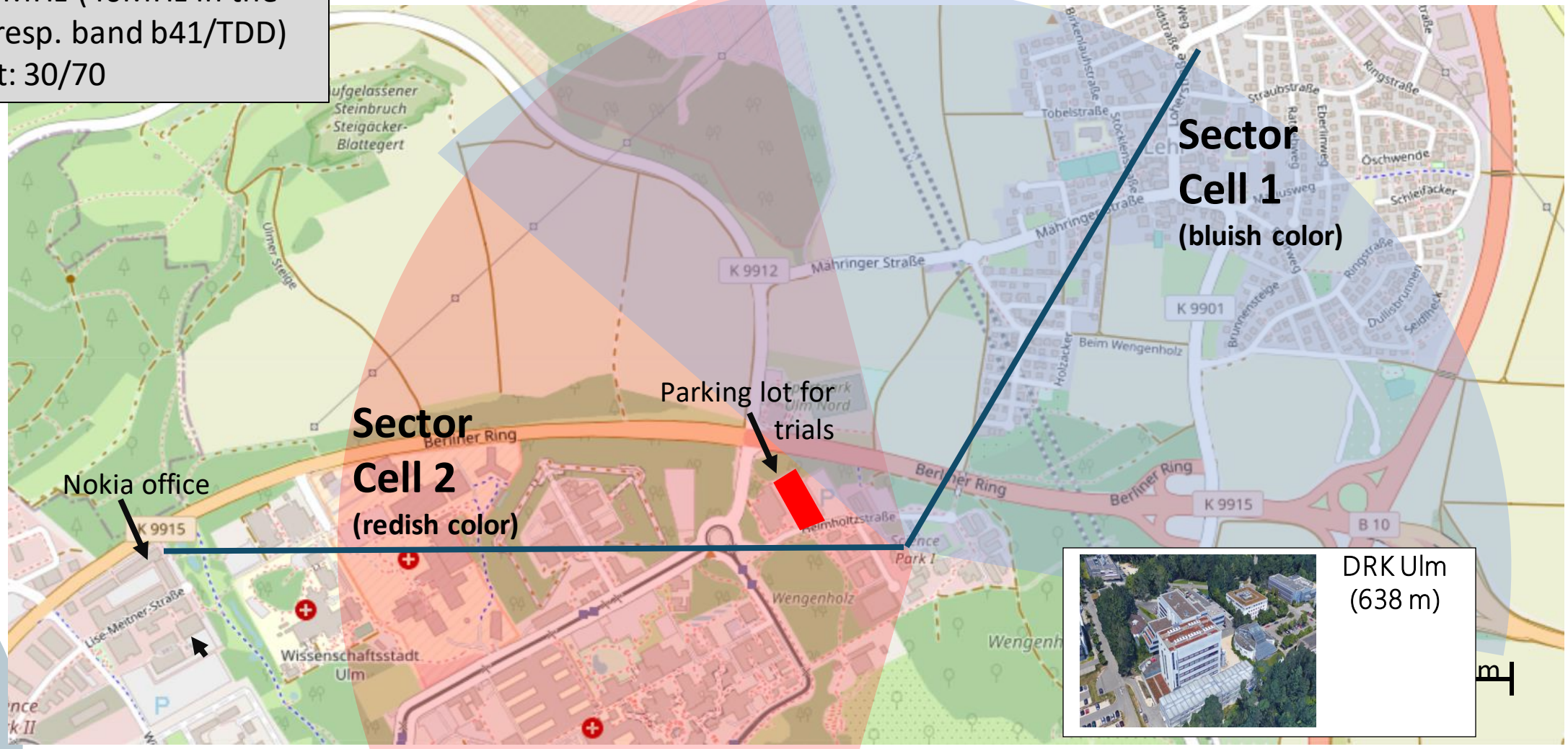


The V2X slice with SST=4 has higher priority and stricter latency requirements compared to the eMBB slice with SST=1

Simplified Network Topology – user plane
Control plane network elements in Finland

Site DRK for Trials and Demonstrations

2575-2615MHz (40MHz in the band b38 resp. band b41/TDD)
UL/DL split: 30/70



Cell DL Throughput @ DRK Ulm

Cell UL Throughput @ DRK Ulm

Questions?

5G-IANA: 5G Intelligent Automotive Network Applications

The 5G-IANA experimentation infrastructure: 5G testbed in Slovenia

Dejan Šošter
Telekom Slovenije

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Telekom Slovenije testbed (Ljubljana, Slovenia)

Dedicated 5G infrastructure is located at Telekom premises in Ljubljana (research Laboratory).

The infrastructure consists of:

- Cloud and virtualisation environment
- Centralized Edge
- Network connectivity
- 5G radio access network (3.5GHz)
- 5G SA Core
- Optional 4G – LTE radio access network (Nb-IoT, VoLTE, LTE-M)

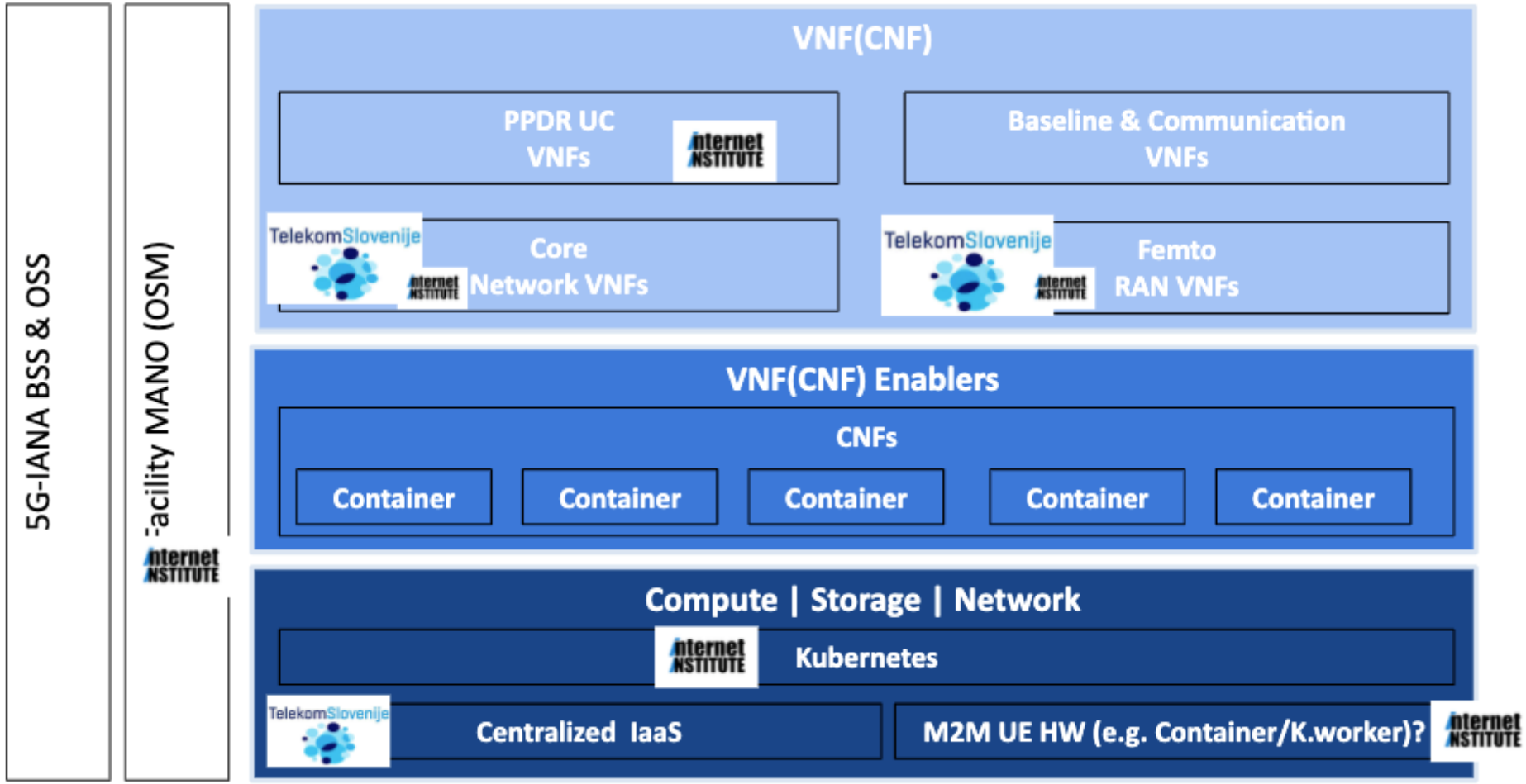
Cloud and virtualisation infrastructure

This is main compute, storage and network power of the facility.

It serves as a:

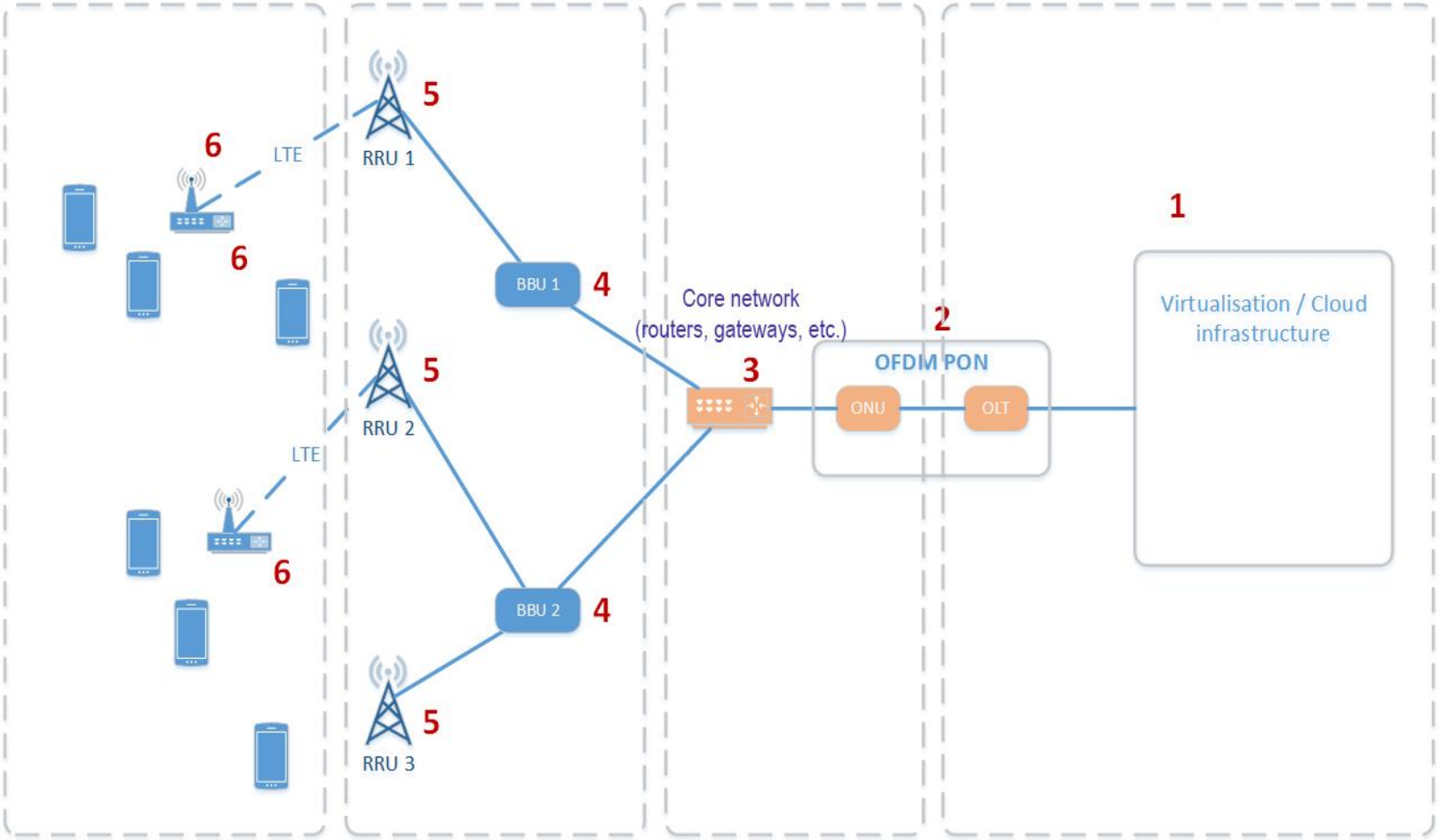
- container for deployment of virtual network functions (VNFs)
- for the control, management and orchestration component (CMO) with Kubernetes and MANO support.
- If needed: 5G-IANA NetApp Toolkit

Components of 5G-IANA testbed

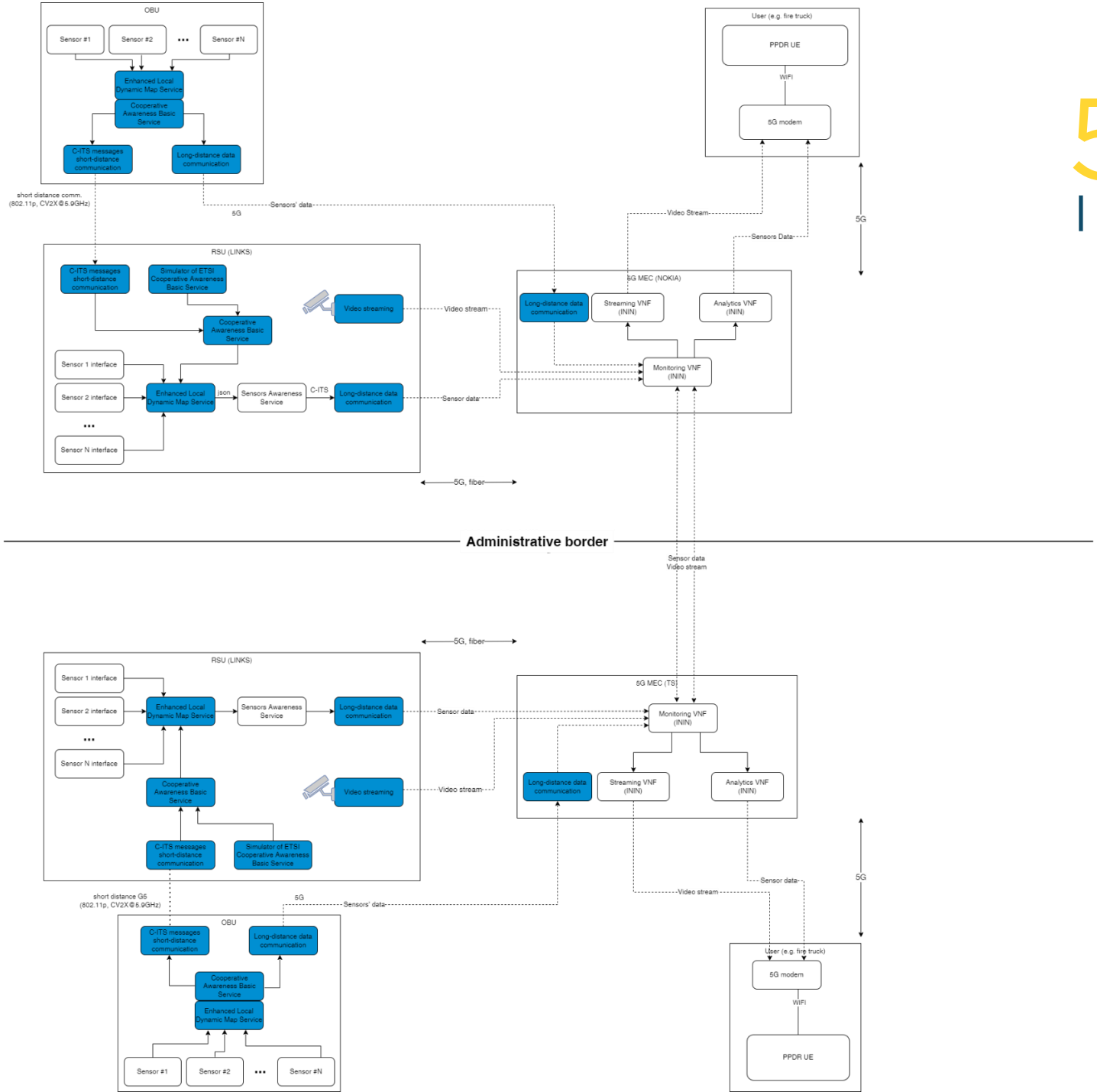


Physical-level architecture of the Telekom Slovenije facility

- Cloud virtualisation platform (1)
- Radio access network (4, 5) and extension via WiFi CPE (6)
- Network connectivity –(3)



Connection with Nokia testbed: VPN over Internet



Potential outdoor testbed location @Telekom Slovenije, Vojkova 78, Ljubljana

Thank you!

The 5G-IANA experimentation infrastructure: 5G testbeds and other assets at the disposal of third parties

Drivable, autonomous twins: things of CARLA and hands on VeGA in the 5G-IANA playground

José Isola (Bylogix)

17/05/2023

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Today's Topics

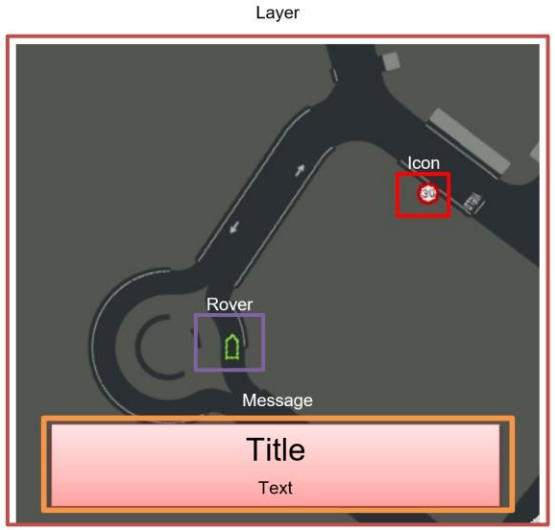
- The hands-on twin: VeGA
- The virtual twin in CARLA
- The complete 5G-IANA playground

The Hands-on Twin: VeGA (Veicolo a Guida Autonoma)

- SAE L4 autonomous vehicle, based on the Citroen E-Mehari
- Sensing: LiDAR, stereo vision, GNSS, IMU
- Actuation: Drive-by-wire, steer-by-wire, brake-by-wire

Connected VeGA

- VeGA will connect to the 5G-IANA platform by means of the LINKS OBU
- C-ITS manoeuvre coordination messages can be exchanged
- The vehicle can communicate its understanding of the world to the platform
- The platform will allow a nApp to drive the vehicle and display information on the HMI screens



The Virtual Twin: CARLA (CAR Learning to Act)

- Open source simulator for AD, based on Unreal Engine
- Latest release: v0.9.14 (Dec/2022)
- High scalability thanks to its client-server architecture
- Supports main AD-related packages/suites

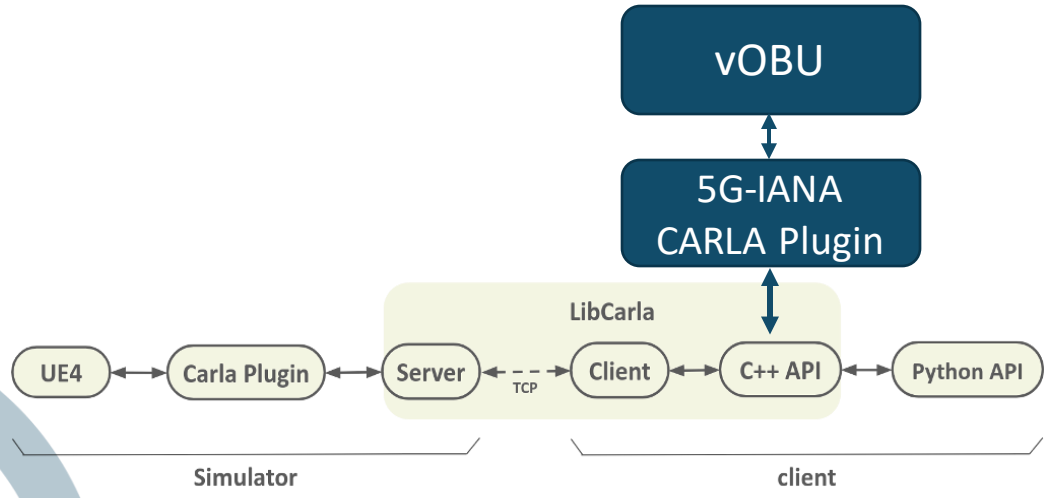
Virtual VeGA

- A virtual instance of VeGA will be available for use in CARLA
- Same vehicle, same sensing, same controls
- Same interface as the real vehicle thanks to the CARLA 5G-IANA plugin and the vOBU combination

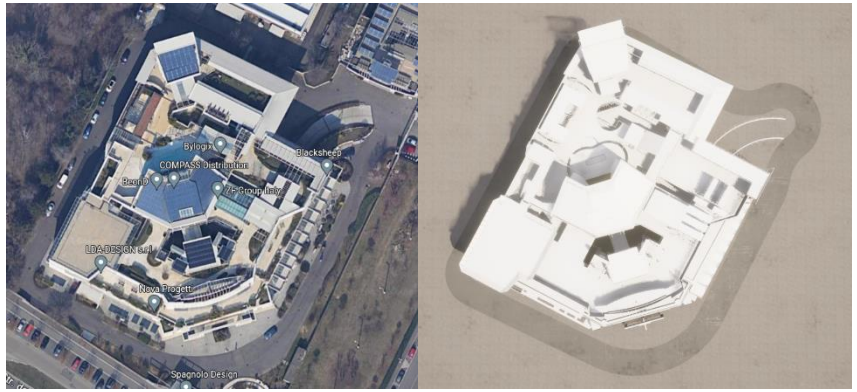
WIP VeGA 3D Model

The Virtual Testbed

- A CARLA server creates a digital twin of the NOKIA testbed, complete with geospatial and road network information (OpenDRIVE)
- The custom made 5G-IANA/CARLA plugin will handle the creation of vehicles and their respective connection to vOBUs



Digital Twin of the Bylogix Offices (NOT THE TESTBED)



The Complete 5G-IANA Playground

- At the testbed site, VeGA's OBU will be available through the 5G-IANA platform, allowing for the exchange of information
- Third parties may add virtual vehicles to the virtual testbed
- What do third parties see? **A single testbed consisting of both real and virtual vehicles**
- **Are virtual vehicles any different from a platform user perspective? No!**

www.5g-iana.eu

Thank you for your attention!

Any questions?

José Isola (jose.isola@bylogix.it)

Claudio Russo (claudio.russo@bylogix.it)

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Flexible OBUs and RSUs for the 5G-IANA project

Edoardo Bonetto
LINKS Foundation

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Far-edge devices from LINKS

- Research-driven Proof of Concept
  - **COTS hardware integrated by LINKS**
  - **Available C-ITS communication stack developed from LINKS**

- Conceived for experimenting with CCAM-related use cases
  - **available to third parties through open interfaces**

- Embedded devices based on NVIDIA® Jetson Xavier™ NX board
  - **ARM64 architecture**
  - **384-core NVIDIA Volta™ GPU reaching 21 TOPS performance**
  - **6-core NVIDIA Carmel ARM®v8.2 64-bit CPU**
  - **16 GB 128-bit of memory**

On Board Unit (OBU)

- 5G connectivity ensured by the 5G Telit FN980 modem
  - **tested with 5G NSA and SA**
- OBU includes the Ublox F9P GNSS receiver
  - **RTK capable**
- Ethernet interface available
  - **connecting to the vehicle network or to external sensors**
- WiFi hotspot
  - **for interaction with smartphones or wireless sensors**

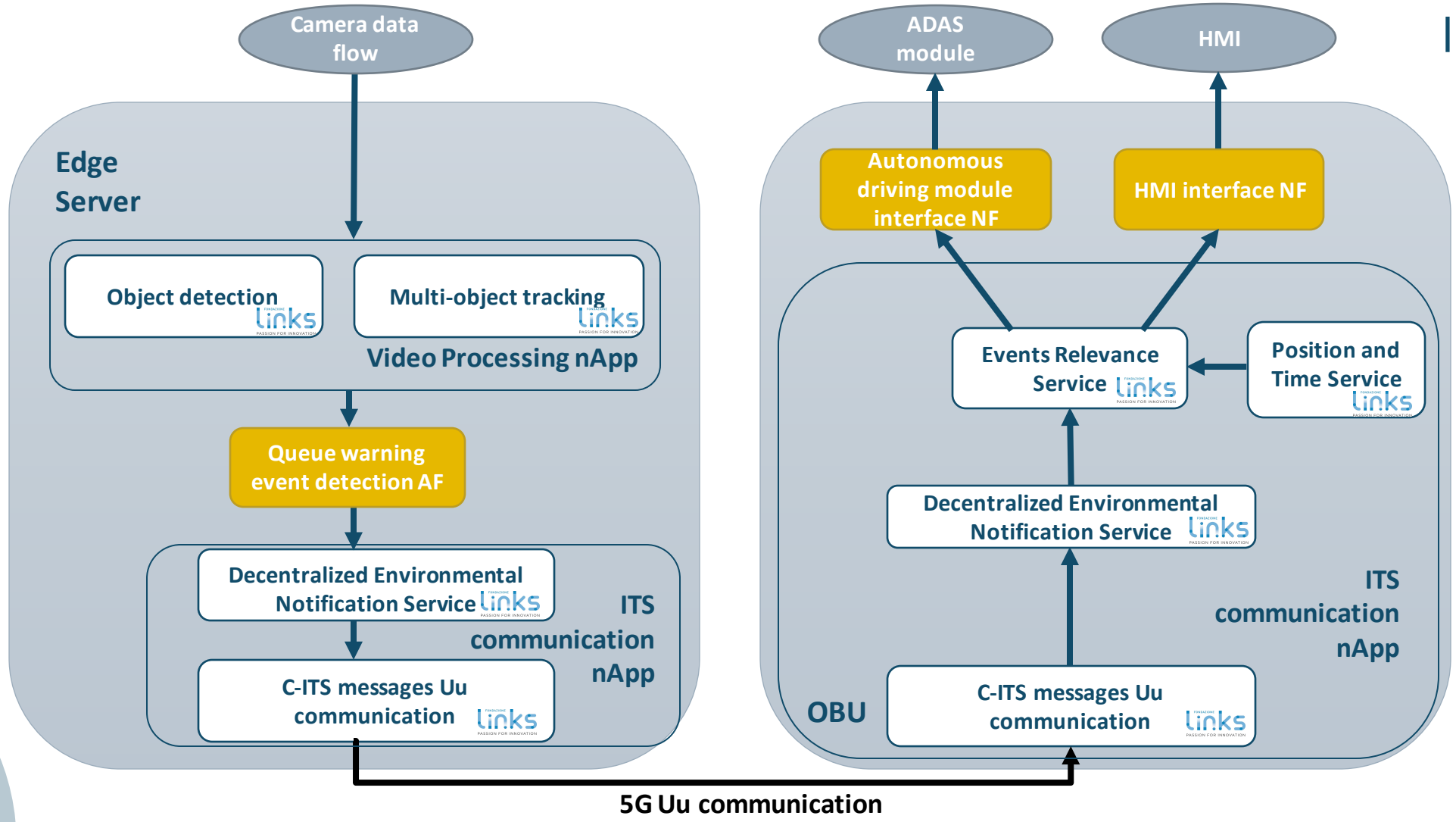
Road Side Unit (RSU)

- 5G connectivity as in the OBU
- RSU is provided with
  - **a camera**
  - **a solid-state LiDAR**
- Ethernet and USB interfaces available for external sensors
- WiFi hotspot also available

NFs/AFs from LINKS

- C-ITS communication NFs
  - **5G Uu C-ITS messages communication NF**
  - **C-ITS Messages Basic Services NFs**
  - **Position and Time Service NF**
  - **Events Relevance Service NF**
- Video processing AFs
  - **Object detection AF**
  - **Multi-object tracking AF**

Queue warning nApp example



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FONDAZIONE links PASSION FOR INNOVATION

5G IANA

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