2$^{\text{nd}}$ 6G-XR Open Call Information Webinar

6GSNS

www.6g-xr.eu

AGENDA

12:30 – 12:35 | **Agenda & Introduction to project**

12:35 – 12:45 | **2nd Open Call process**

12:45 – 13:05 | **Research infrastructures**

13:05 – 13:40 | **Topics presentation**

13:40 – 14:00 | **Q&A**

- Please keep your microphone and camera off
- For questions, please raise your hand or use the chat
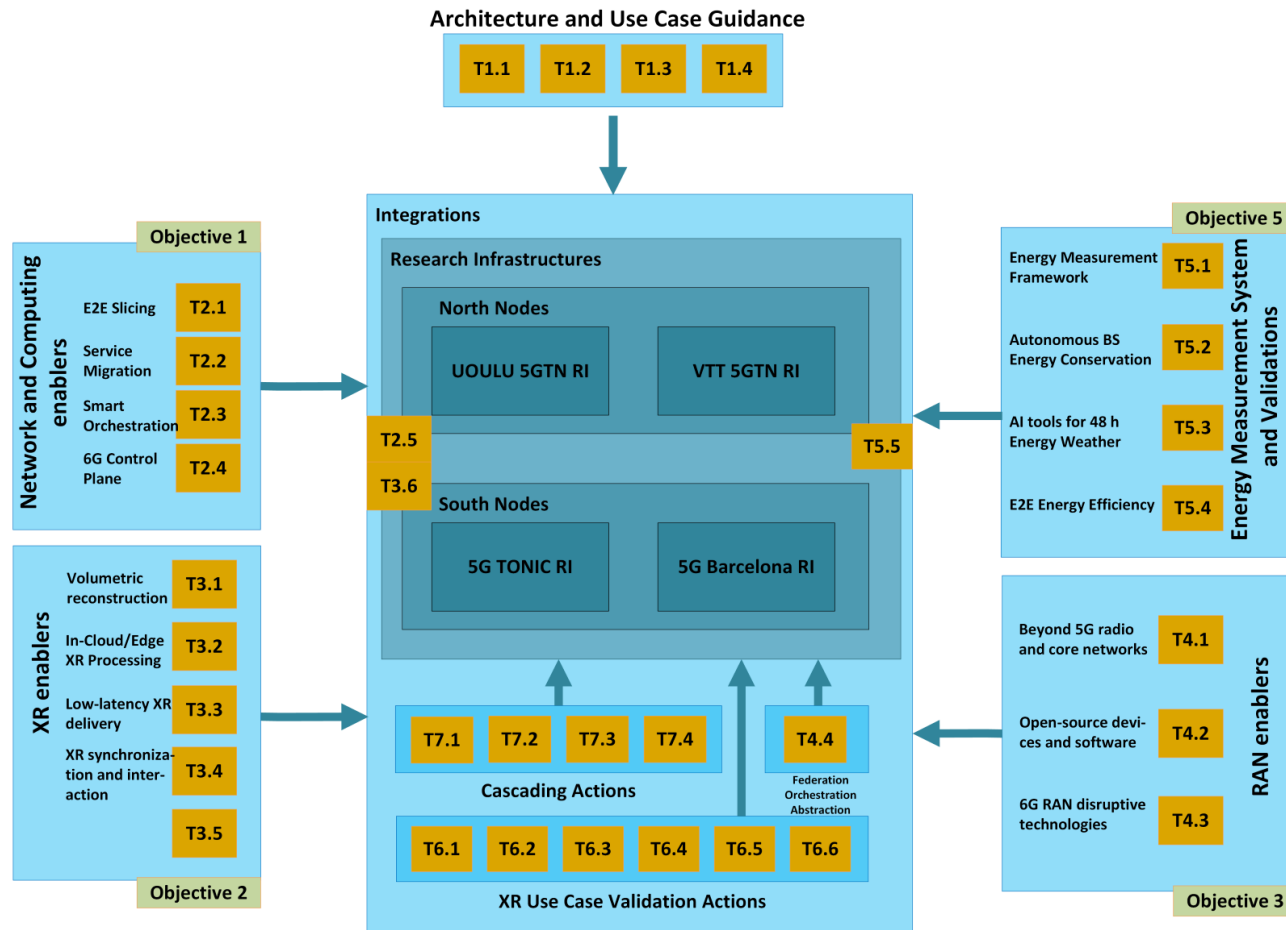- The session is recorded and will be available on www.6g-xr.eu/

6G XR

**Introduction to project &
Open call objectives**

**Jussi-Pekka Haapola,
University of Oulu**

6G-XR objectives & Open Call 2 objectives

Architecture and Use Case Guidance
T1.1 T1.2 T1.3 T1.4

Integrations

Research Infrastructures

North Nodes
UOULU 5GTN RI | VTT 5GTN RI

South Nodes
5G TONIC RI | 5G Barcelona RI

T2.5 / T3.6 | T5.5

Objective 1 — Network and Computing enablers
- E2E Slicing — T2.1
- Service Migration — T2.2
- Smart Orchestration — T2.3
- 6G Control Plane — T2.4

Objective 2 — XR enablers
- Volumetric reconstruction — T3.1
- In-Cloud/Edge XR Processing — T3.2
- Low-latency XR delivery — T3.3
- XR synchronization and inter-action — T3.4
- T3.5

Cascading Actions
T7.1 T7.2 T7.3 T7.4

Federation Orchestration Abstraction
T4.4

XR Use Case Validation Actions
T6.1 T6.2 T6.3 T6.4 T6.5 T6.6

Objective 5 — Energy Measurement System and Validations
- Energy Measurement Framework — T5.1
- Autonomous BS Energy Conservation — T5.2
- AI tools for 48 h Energy Weather — T5.3
- E2E Energy Efficiency — T5.4

Objective 3 — RAN enablers
- Beyond 5G radio and core networks — T4.1
- Open-source devices and software — T4.2
- 6G RAN disruptive technologies — T4.3

OC2 Objective:

Validate, test, and/or incorporate enablers coming out of Horizon Europe SNS JU Stream B thematizes:

- **Reflective intelligent surfaces**
- **Deterministic communications**
- **Energy measurement**
- **AI/ML for slicing**
- **Load balancing**
- **Security and trust mechanisms**
- **Increased capacity**
- **Other Stream B thematises**

6G XR

1. Open Call presentation

**Lamprini Kolovou,
Martel Innovate**

KEY DATES

ACTION	DEADLINE
Submission deadline of draft proposal for the Feasibility check	22 April 2024, @17:00 CET
Submission deadline	22 May 2024, @17:00 CET
Notification of the result	30 June 2024
Start of the Experiment	2 September 2024
End of the Experiment	2 March 2025

Open Call Targeted Participants

- SME
- Industry
- Research/scientific organisation
- Academia

All organisations eligible for participation in HE programme can participate

- Legal entity established in EU Member State* or Associated Country**
- Single party
- Absence of conflict of interest 6G-XR
- Type of activity (personnel, travel, indirect (25%) costs)
- Proposals need to come from the SNS JU Stream B thematises. Proposals are required to justify their linkage to Stream B thematises, and proposals coming directly from Stream B projects are required to ensure the proposed work is not already covered by the existing Stream B project, but it is in fact novel.
- If the proposal is based on Stream B action, there needs to be a clear justification
- English language
- Submission through project website tool
- Deadline
- GDPR compliant

Eligibility criteria

- All approved projects performed during this Open Call must be made available to other experimenters during the rest of the 6G-XR project duration
- A maximum of three proposals will be funded under any given (sub)topic
- All proposals passing the feasibility checks of Open Call 2 will be sent for evaluation by 6G-XR project external experts and will receive an independent scoring
- All proposals are then ranked based on the points they receive out of that evaluation. However, only the top three projects of any given (sub)topic will be considered for funding.

General terms

Project budget & payments

Open Call	Project duration	Max funding per project	No of projects	Total funding
6G-XR-OC2	6 months	60 000 EUR	10	600 000 EUR

- 1 payment of the awarded amount at the end of the project.
- Final report (financial & technical) within 15 days after completion (template).
- Assessment and approval by consortium.

Submission process

- Online form, Proposal template & Declaration of honour, Draft Third Party Agreement (pdf)

- Apply only through: https://www.6g-xr.eu/open-calls/oc2/#OC2form

- 2 options: **Feasibility Check** & **Final submission**

- Frequently Asked Questions

- If more questions: **opencalls@6g-xr.eu**

Evaluation criteria & process

- Clarity and methodology: Soundness of the approach and credibility of the proposed methodology.

- Ambition: The proposal is required to justify and position itself with relation to a SNS JU Stream B thematises.

- Impact: Technology and domain fit to 6G-XR scope and objectives.

- Replicability

- Contribution to standardisation on

- Team capacity

- Value for money

- SME participation is encouraged

- Gender dimension awareness

- Maturity/trajectory of the proposing organization/proposed development in the specific field of their proposal.

Evaluation process

- 1 awarded project per organisation
- External experts (2 per proposal)
- Consensus meeting
- Final ranking & approval by Open Call Steering Committee

After evaluation:
- Legal & financial check
- Signature of Third Party Agreement
- Implementation with guidance by Mentors

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2. Research Infrastructures

Antti Pauanne, UOULU

Jarno Pinola, VTT

Aurora Ramos, CGE

Amr Adbelnabi, i2CAT

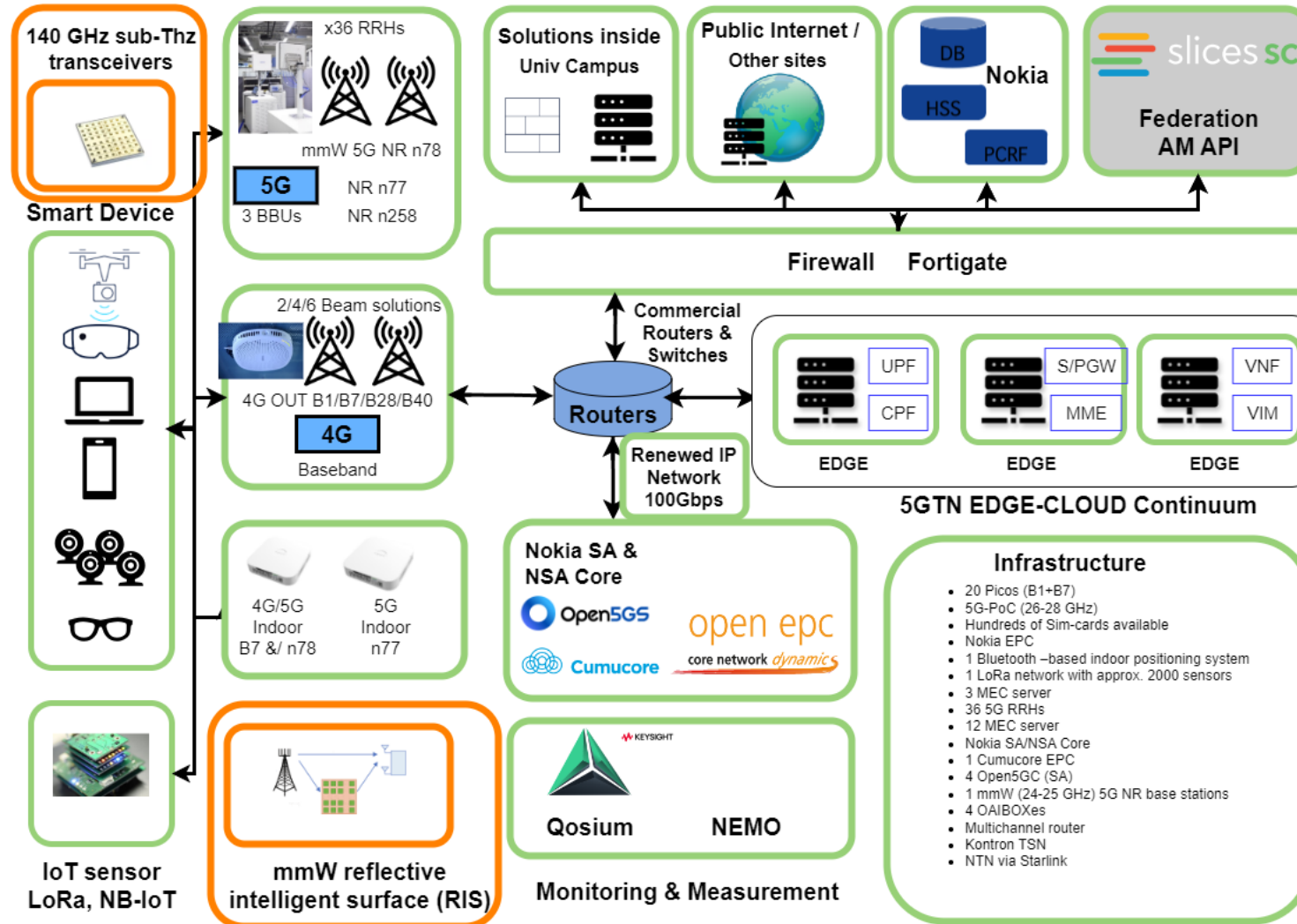## University of Oulu 5G Test Network (UOULU 5GTN) 1/3

- Located at the University of Oulu, Finland

- Micro Operator

- 5G Non-Standalone (NSA) and Standalone (SA) available

- 2/4/6 Beam solutions tested

- 4G and 5G with various frequencies

- Cellular IOT

- 400+ sensors at campus

- Energy consumption / production measurement environment

- Integrations to different verticals

- Roadmap evolution towards 6GTN
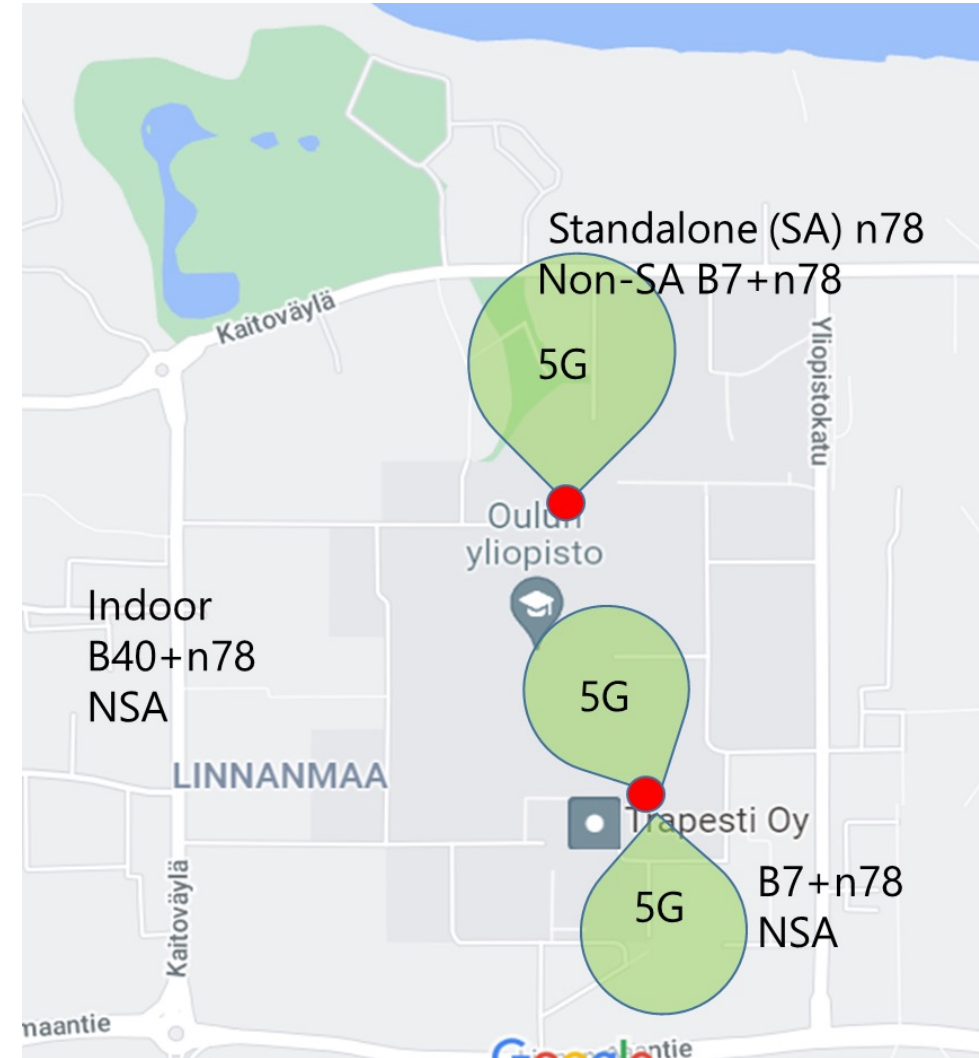
University of Oulu 5G Test Network (UOULU 5GTN) 3/3

Technology

- 1 webportal
- Frequency licences (in collaboration VTT - UOULU):
  - 700MHz (B28) BW=10MHz, VTT radio permit
  - 2100MHz (B1) BW=10MHz, TTO-license
  - 2300MHz (B40) BW=20MHz, Private LTE
  - 2600MHz (B7) BW=20MHz, TTO-license
  - 2600MHz (B7) BW=10MHz, Loan from Elisa
  - 3.5GHz (n78) BW=60MHz, TTO-license
  - 4.0GHz (n77) BW=200MHz, 5G license
  - 25GHz (n258) BW=850MHz, 5G license
- 2 Macros (B28) with NB-IoT and Cat-M
- 2 Macro (B7)
- 1 Macro (B40), LTE-TDD
- 20 Picos (B1+B7) on air (10+ picos available/in use for different tests)

- 3 pcs 5G NR (NSA + SA)
- 3 pcs 5G NR remote radio heads operating in NSA mode
- Hundreds of Sim-cards available
- 1 EPC (5G NSA), 1 OpenEPC, 1 Cumucore,3 Open5GC (SA) and one commercial SA/NSA 5G core
- 1 Bluetooth –based indoor positioning system, (700 beacons)
- 1 LoRa network with approx. 2000 sensors (partially NB-IoT enabled)
- 12 Edge servers
- 9 OpenEDGE servers
- 4 OAIBOXes
- 36 5GNR remote radio heads (RRHs) and 3 baseband units (BBUs)
- 1 mmW 5G NR base stations
- Several tens of different UE's: phones, modems, 5G routers, etc.
- 3D scanner and powerful GPUs available
- Test car with 5G and Starlink capabilities
- Test SW and HW like: Kaitotek Qosium, Keysight Nemo

VTT 5G Test Network (VTT 5GTN) 1/2

- Managed and operated by VTT

- 5G (NSA and SA), 4G, WiFi-6 connectivity

- Satellite links (including Starlink)

- Multiple frequency bands ranging from 450 MHz to 26 GHz

- Indoor and outdoor coverage

- Carrier grade and open source core network options

- Commercial and emulated UEs

- Edge cloud and MEC processing

- Server and storage capacity at the site

- Connected to GÉANT

- Local renewable energy sources and accurate power consumption monitoring framework

- Accurate time synchronization also for client devices
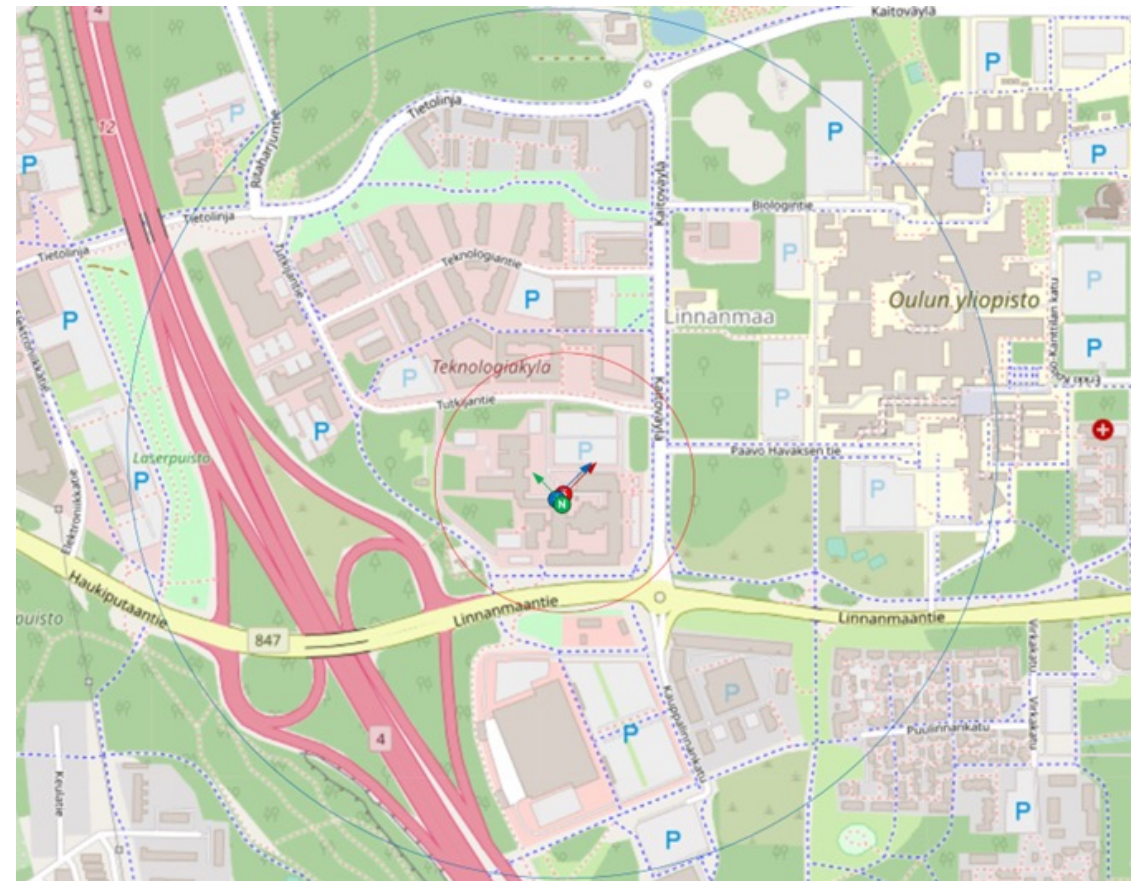
VTT 5G Test Network (VTT 5GTN) 2/2

- Frequency bands

  - LTE/NB-IoT: 450 Mhz (BW: 5 MHz), 700 MHz (BW: 3 Mhz), 1.8 Ghz (BW: 5 MHz), 2.1 GHz and 2.6 GHz (BW: 10 MHz),

  - 5GNR: 3.5 GHz (BW: 60 MHz), 3.9 GHz (BW: 100 Mhz), 26 GHz (BW: 800 Mhz)

- Core network options

  - Proprietary: Carrier grade telco cloud

  - Open source: Open5GS

- User equipment

  - Commercial: Smart phones and CPEs (~10 simultaneous users)

  - Emulated: SDR-based UE emulator (up to 1000 simultaneous users)

- Edge processing and local storage

  - Several edge platform implementations, inluding Nvidia H100 GPUs for AI processing

  - Server and storage space can be tailored for experimentation needs

South Node – highlevel and partners
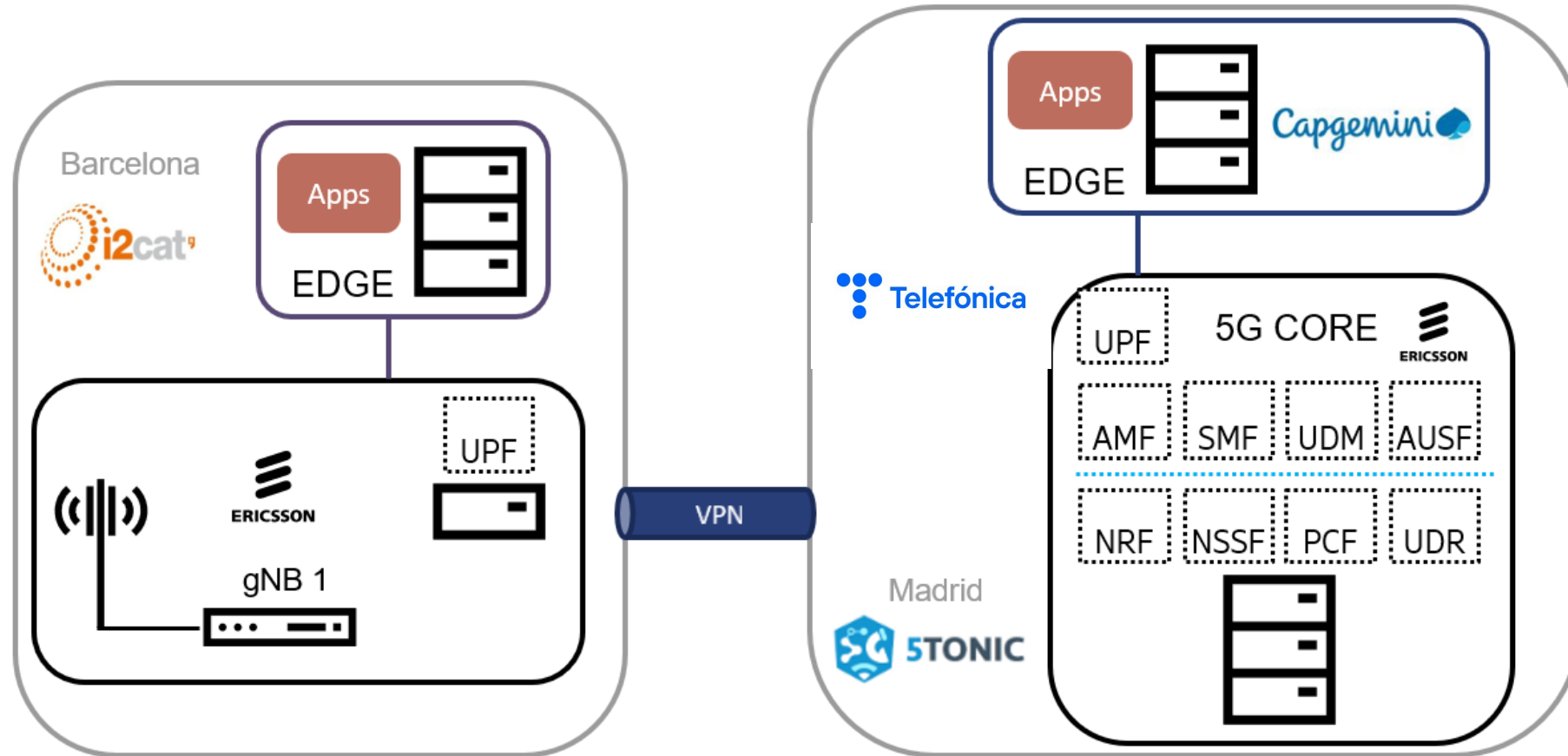
5GBARCELONA & 5TONIC

5GBARCELONA & 5TONIC
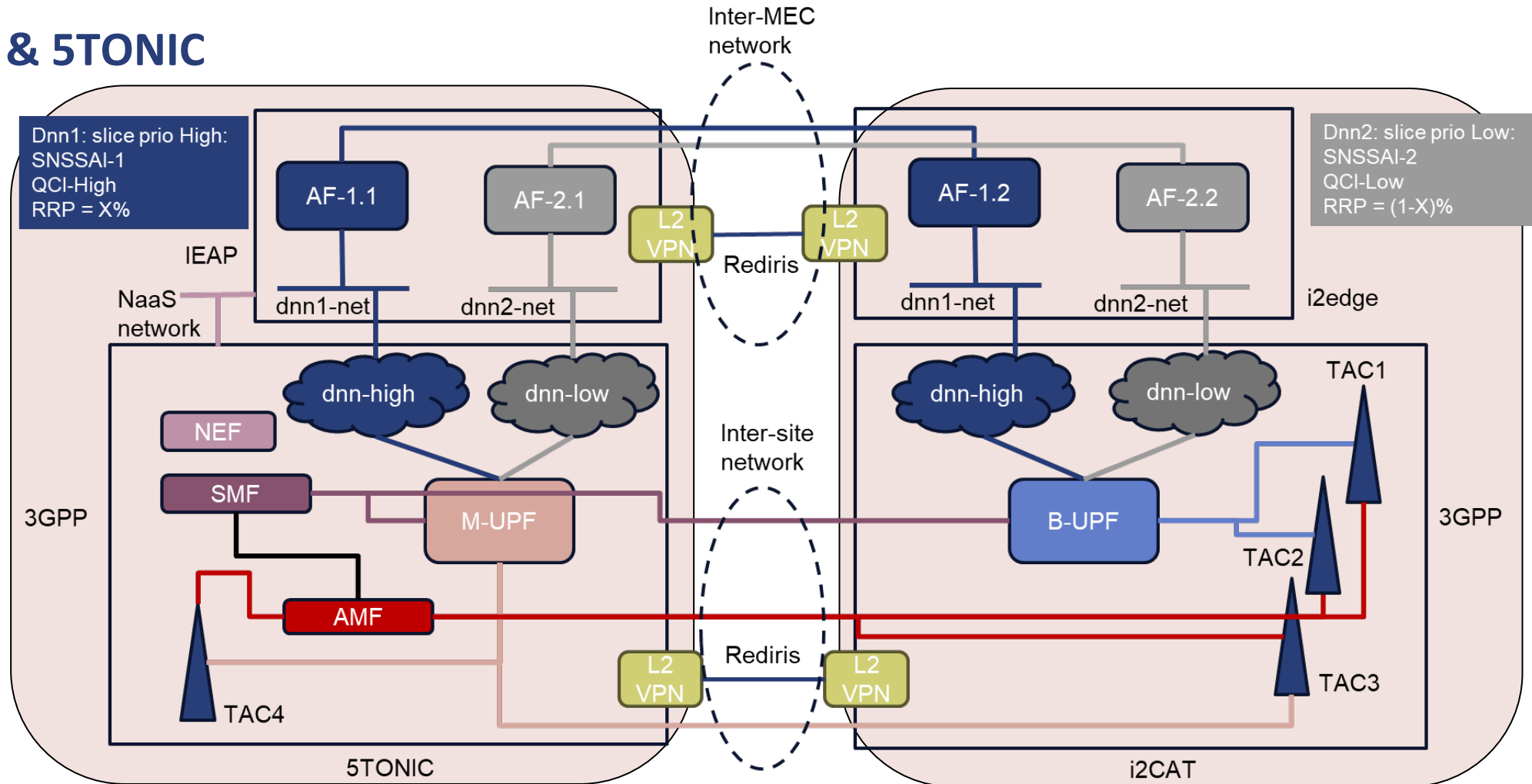
- Two edge locations
- Multiple pre-configured Slices & DNN
- NaaS Exposure
- RAN at both nodes
- Core at 5TONIC

South-node: Edge Orchestration APIs
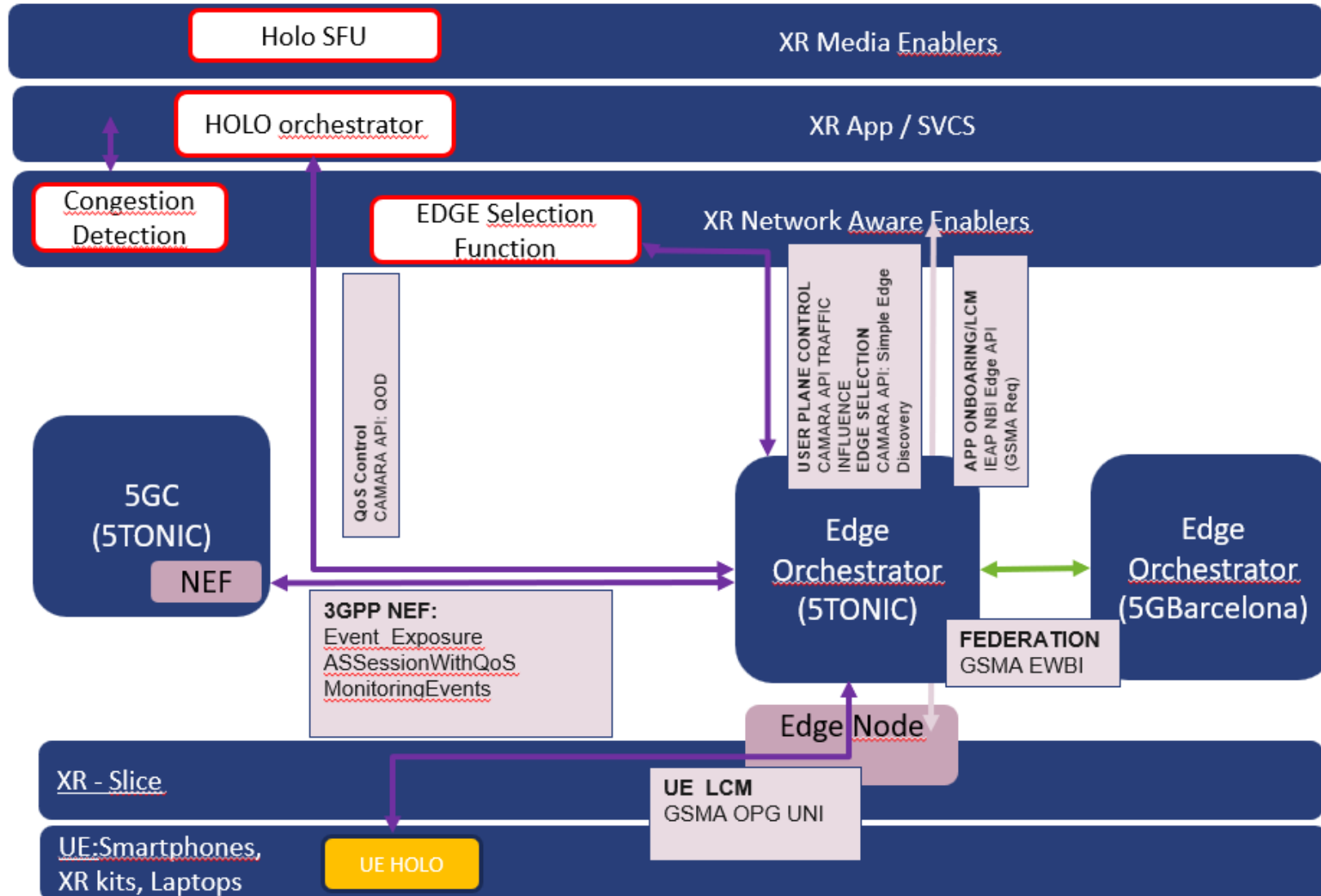
3. Topics presentation

- TOP1, **Marko E. Leinonen**
- TOP2.1, **UOULU, Kenichi Komatsu**
- TOP2.2, **i2CAT, Mario Montagud, UOULU, Kenichi Komatsu**
- TOP3.1, **UOULU, Hamid Malik, VTT, Jarno Pinola**
- TOP3.2, **VICOM, Roberto Viola, VTT, Jarno Pinola**
- TOP4, **UOULU, Jussi Haapola**
- TOP5.1, **VICOM, Roberto Viola**
- TOP5.2, **I2CAT, Amr AbdelNabi**
- TOP6.1, **CGE, Aurora Ramos**
- TOP6.2, **VTT, Jarno Pinola**
- TOP7, **i2CAT, Mario Montagud**
- TOP8, **UOULU, Jussi-Pekka Haapola**

Context

- North node has worked on the implementation and verification for wireless deterministic communication on 3D digital twin use case in 6G-XR. One of the 6G technology enablers for high data rate networks is higher operational frequency compared to current 5G networks.

- UOULU and IMEC are working and developing high data rate 6G radios for 300 GHz and 150 GHz frequency ranges.

Gaps & Goals

- The expected outcome of the proposed project named: 150 GHz Refective Intelligent Surface (RIS) project is to have a prototype that can be used in a laboratory environment in over-the-air (OTA) measurements. The reflection control should be done electronically, if possible. At least one RIS prototype should be delivered to the 6GXR project for demonstration purposes. 6G XR project will provide the experimental infrastructure of a 150 GHz OTA radio link and RF laboratory environment for validation:

- UOULU provides the following topic-specific enablers and preparations:

  - Automated RIS test system for RF laboratory validations

  - 150 GHz radio transmitter and receive will be provided by 6GXR project for OTA validation with a real communication signal

- The RIS demonstration aims to evaluate the feasibility of the RIS with a 150 GHz radio link that enables future 6G extreme data rate network deployments.

Context

- North node has worked on the implement and verification for wireless deterministic communication on 3D digital twin use case in 6G-XR.

- Verification of IEEE standards of Time Sensitive Networks (TSN) deterministic communication performance in the contents under 3GPP standard of 5G mobile private network at UOULU campus.

Gaps & Goals

- In the cyber physical world of Metaverse world, need to verify the collaboration task between the real physical status (motion, location etc) and the digital contents of virtual reality 3D models status (motions, location with other digital traffic).

- Wireless Deterministic communication capabilities (minimum jitter, traffic shaping) are required in 3D digital twin applications, mission critical XR interactions and machine motion control signals are prioritized traffic than other traffics e.g. massive video streaming.

- UOULU 5GTN provides the following topic specific enablers and preparations:

  - 5G Private local network with TSN equipment (Kontron industrial TSN switch)

  - XR devices (Oculus Quest Pro, Apple Vision Pro) with mobile edge computing for controlling and surveillance for the Industrial class arm robot of Universal Robots UR3.

TOP2.2 Deterministic Networking

Context

- Deterministic communication standards in wired network domains have already emerged, including Time Sensitive Networking (TSN) and Deterministic Networking (DetNet)

- Recent advances in the 5G domain have started to addressed the interworking with those standards

Gaps & Goals

- **Gap**: the full potential of 5G-advanced scenarios with TSN and DetNet is far from being fully exploited

- **Objectives**:

(i) 6G features for deterministic and predictable wireless transmission and wireless-friendly enhancements for TSN and DetNet, ensuring minimum latency and optimum communication paths;

(ii) 6G time synchronization solutions to ensure global time awareness over distributed cloud continuum ecosystems integrated with 6G environments;

(ii) hybrid wired+wireless enablers to guarantee deterministic networking over heterogeneous environments

TOP3.1 Sustainability enablers for energy measurement and optimisation solutions [North Node: UOULU]

Context

- Methods to explore energy saving potential using dynamic adjustment to OAI RAN configuration and paramters without requiring the base station to restart.

- The experiment will involve external meters (e.g., power analysers) with real-time energy monitoring, an MQTT broker running on the server for a common interface within the North Node, and experimentation with energy forecasting APIs and energy consumption data can be used as reference.

Gaps & Goals

- The proposed methods should provide near-real time adjustment to network parameter optimisation in a dynamic manner for more energy efficient end-to-end RAN configuration control.

- Utilizing AI/ML algorithms for energy-saving measures and network management involves dynamic RAN configuration changes to conserve energy. These changes are then assessed for their feasibility as potential energy optimization methods

- UOULU 5GTN provides the following topic specific enablers:

  - Evaluation of various configurations on OAI RAN and Open 5GS CN components measured with external power meters for baseline/comparison energy consumption data to assess energy consumption and potential savings.

  - OAI RAN components that can dynamically adjust RAN configurations such as bandwidth, TDD slots, modulation coding scheme, and MIMO mode selection based on energy weather forecast, energy pricing and linked CO_2 from grid intake and real-time energy energy consumption.

Context

- Methods to estimate and forecast the energy consumption of the North Node network components based on measurement of network KPIs and temporal changes in network utilization.

- The energy consumption measurement data collected from the North Node network components with external power meters can be used as reference data for the developed solutions.

Gaps & Goals

- The proposed estimation methods should provide high-enough time granularity to enable network parameter optimisation for more energy efficient end-to-end resource usage.

- Network management approaches (e.g., in the form of suitable AI/ML algorithms) should also be proposed that can use the generated energy consumption estimates for end-to-end network resource optimization.

- VTT 5GTN provides the following topic specific enablers:

  - 5G RAN and CN components measured with external power meters for baseline/comparison energy consumption data.

  - 5G RAN components that can be powered directly from local solar panels, batteries, or power grid to optimize utilization of renewable energy, price of the consumed energy, cell site resiliency, etc.

Context

- Methods to estimate and forecast the energy consumption of the North Node multimedia processing and streaming VNFs.

- The energy consumption measurement data collected from the North Node network components with external power meters can be used as reference data for the developed solutions.

Gaps & Goals

- The proposed estimation methods should provide information that is accurate enough to be used for the dynamic optimisation of multimedia encoding and transcoding functions aiming for more energy efficient streaming applications.

- Methods for detailed energy consumption estimation/measurement in user devices (preferably smartphone) or inside application functionalities are seen beneficial to further optimize the streaming parameters for end-to-end energy efficiency.

- VTT 5GTN provides the following topic specific enablers:

  - Server capacity at the network edge/local cloud for virtualised multimedia functions.

  - HW server infrastructure measured with external power meters for baseline/comparison energy consumption data and possibility to host test video content.

Context

- South Node has video encoding and streaming capabilities based on WebRTC and DASH

- Adaptive rate control for video streaming is based on network status (network-assisted rate control)

- Energy monitoring can provide further information for video rate adaptation

Gaps & Goals

- South Node lacks a framework to monitor the energy consumption of video streaming

- Proposals should provide a solution for measuring energy consumption in real time

  - Monitoring of Multimedia Functions, including GPU encoding process and/or streaming

  - Visualization of energy-related metrics in real time

  - Optimization strategies that allow to expand the rate control considering energy aspects

- South Node / 5GBarcelona provides the following topic specific enablers:

  - Server capacity at the network edge/local cloud for virtualised multimedia functions

  - GPU-enabled Remote Renderer VNF and Web players enabled with WebRTC and DASH streaming capabilities

TOP4 AI/ML for Slicing

Context

- 5G Slicing is an integral part of the system developed in/for 6G-XR.

- This topic looks for solutions to use AI/ML algorithms to control the usage of resources in a sliced 5G network in efficient and dynamic way.

- Supervised as well as distributed deep reinforcement algorithms can be concidered.

- Primary 5G Core in use is Cumucore but Open5GS core is also available.

- Commercial base stations are used with Cumucore. With Open5GS also USRP can be used.

Gaps & Goals

- Area of development is RAN resource control part of the sliced 5G SA network.

- Project to propose what parameters of the network are to be adjusted.

- Project is also to define what kind of measurement data it needs for the AI/ML from the 5G network.

- Target is to have fully integrated and tested AI/ML implmentation in the 5GTN, that operates within parameters agreed in the project.

Context

- South Node has two Edge nodes to deploy distributed applications

- Media Functions related to media processing such as Point Cloud rendering, video encoding and streaming (WebRTC and DASH)

Gaps & Goals

- This topic aims for new solutions for enabling flexible service deployment and management between distributed nodes (Device/Edge/Cloud)

    - Intra-domain or inter-domain load balancing and service migration

    - Task offloading from UE to the network

- South Node (5GBarcelona or 5TONIC) provides the following topic specific enablers:

    - Server capacity at the network edge/local cloud for virtualised multimedia functions

    - GPU-enabled Remote Renderer VNF and Web players enabled with WebRTC and DASH streaming capabilities
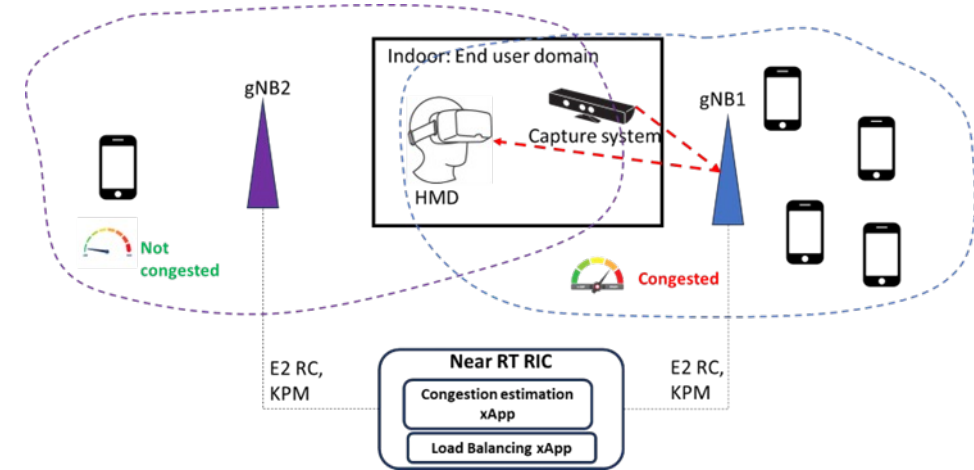
Context

XR user is connected to gNB 1 where other users connected to same gNB are connected performing Internet traffic while gNB 2 is not congested. Those users are causing interference to the XR user and pushes the cell to be congested. Upon congestion, the XR service is degraded significantly.

Gaps & Goals

Offload the congested cell by steering the users to less congested cell.

1. Develop Congestion aware mobile load balancing procedure to maintain XR performance.

2. Utilize the E2 KPM and E2 RAN models to detect congestion and track utilization of radio resources.

3. Build ORAN compliant testbed to test the new procedure.

TOP6.1 Multi-stakeholder trust mechanisms for Edge NBI

Context

- South Node provides enhanced APIs at edge Infrastructure NBI for the MEC orchestration

- The NBI APIs aim to ease access of network capabilities by vertical (XR) application providers/developers, regarding QoS control and best suitable edge resources allocation, among others features.

- Those NBI APIs are aligned with CAMARA LF project

Gaps & Goals

This topic looks for technologies and mechanisms to increase security, privacy and/or trustworthiness for vertical (XR) applications life cycle management on to the (telco) edge infrastructure.

- Trust mechanisms to incorporate on top of NBI APIs between vertical and telco operator

- Privacy and security management solutions

Context

- Energy efficient and adaptive confidential computing and security solutions for the network edge and cloud.

- Assessment of the energy consumption for different security levels and configurations in the proposed computing environment.

Gaps & Goals

- The proposed confidential computing or security enabler should be deployable on top of the 6G-XR test facility.

- A set of test cases should be defined to assess the energy efficiency of the provided solution with varying security levels and usage scenarios, including an analysis of the security overhead in relation to energy consumption.

- VTT 5GTN provides the following topic specific enablers:

  - Server capacity at the network edge/local cloud for the deployment of confidential computing and other security enablers.

  - HW server infrastructure measured with external power meters for the collection of accurate energy consumption reference data.

Context

- Next-generation wireless networks are envisioned to provide performance levels close to those provided by wired networks, in terms of data rates, ultra-low latency, and reliability, while providing other key features like mobility (i.e. wired free connections) and sensing (accurate localization of targets)

Gaps & Goals

- Accommodating novel and standards-compliant 6G enablers that contribute to this mission, including but not limited to:

(i) strategic aggregation of parallel transmission channels;

(ii) radio channels using spectrally efficient and robust bands;

(iii) intelligent mesh networking protocols for private networks;

(iv) accurate Integrated Sensing and Communication (ISAC) capabilities; etc

TOP8: Other Stream B thematises

- An open topic for proposals not specifically fitting any of the other topics described.

- The Node, Research Infrastructure, and Mentor can only be identified after initial consultation. Please use opencalls@6g-xr.eu for consultation.
  - Early interaction is especially important.
  - Feasibility check is mandatory with deadline April 22nd, 2024.

- A maximum of three (3) proposals will be funded on this topic.

- Proposals are required to justify their linkage to Stream B thematises, and proposals coming directly from Stream B projects are required to ensure the proposed work is not already covered by the existing Stream B project, but it is in fact novel.

- If the proposal is based on Stream B action, there needs to be a clear justification how the proposal goes beyond the project's description of action, or what is the difference between the respective description of action and this proposal.
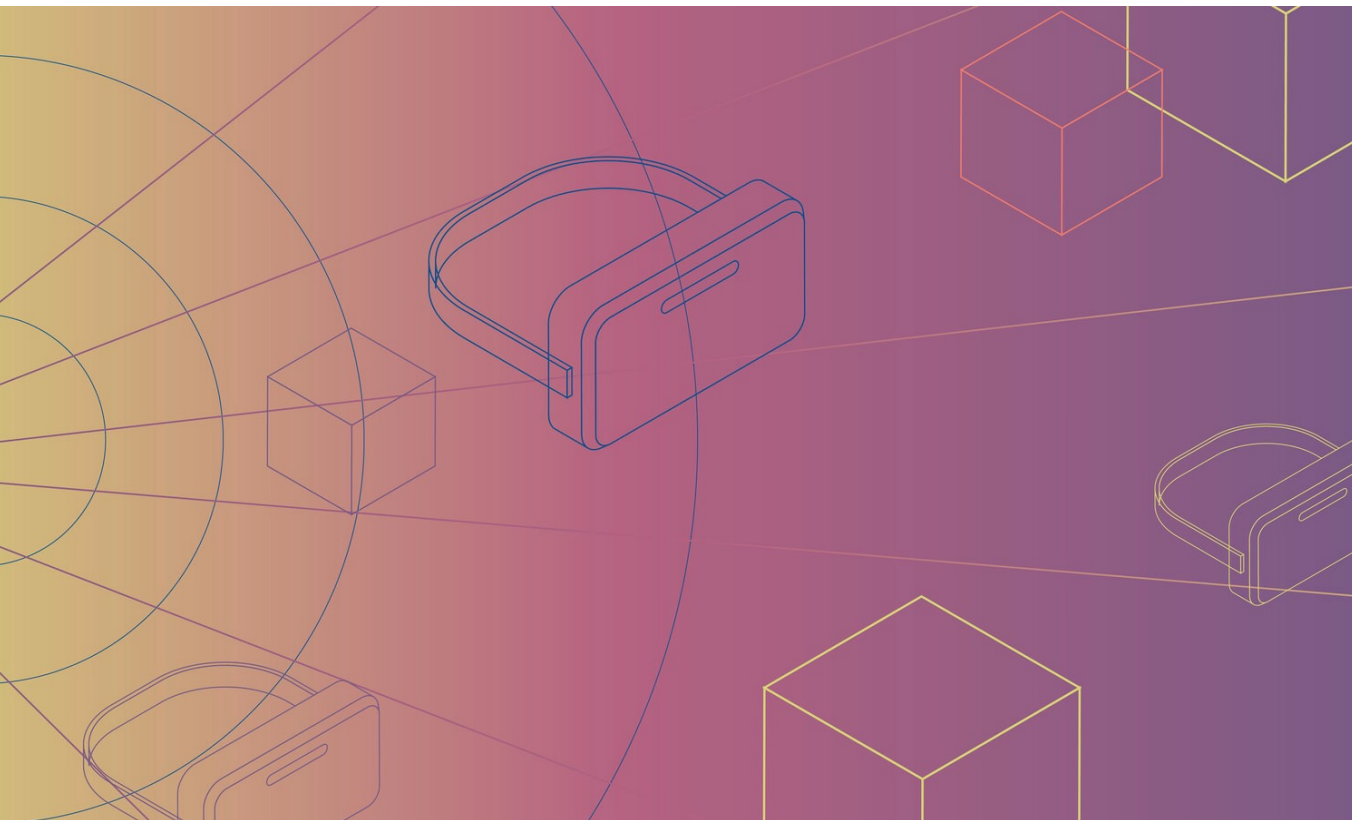
Questions & Answers

For more questions: **opencalls@6g-xr.eu**

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Thanks