1st 6G-XR Open Call Information Webinar

Co-funded by the European Union

6GSNS

www.6g-xr.eu

AGENDA

11:00 – 11:05 | **Agenda & Introduction to project**

11:05 – 11:15 | **Call presentation**

11:15 – 11:30 | **Research infrastructures**

11:30 – 12:30 | **Topics presentation**

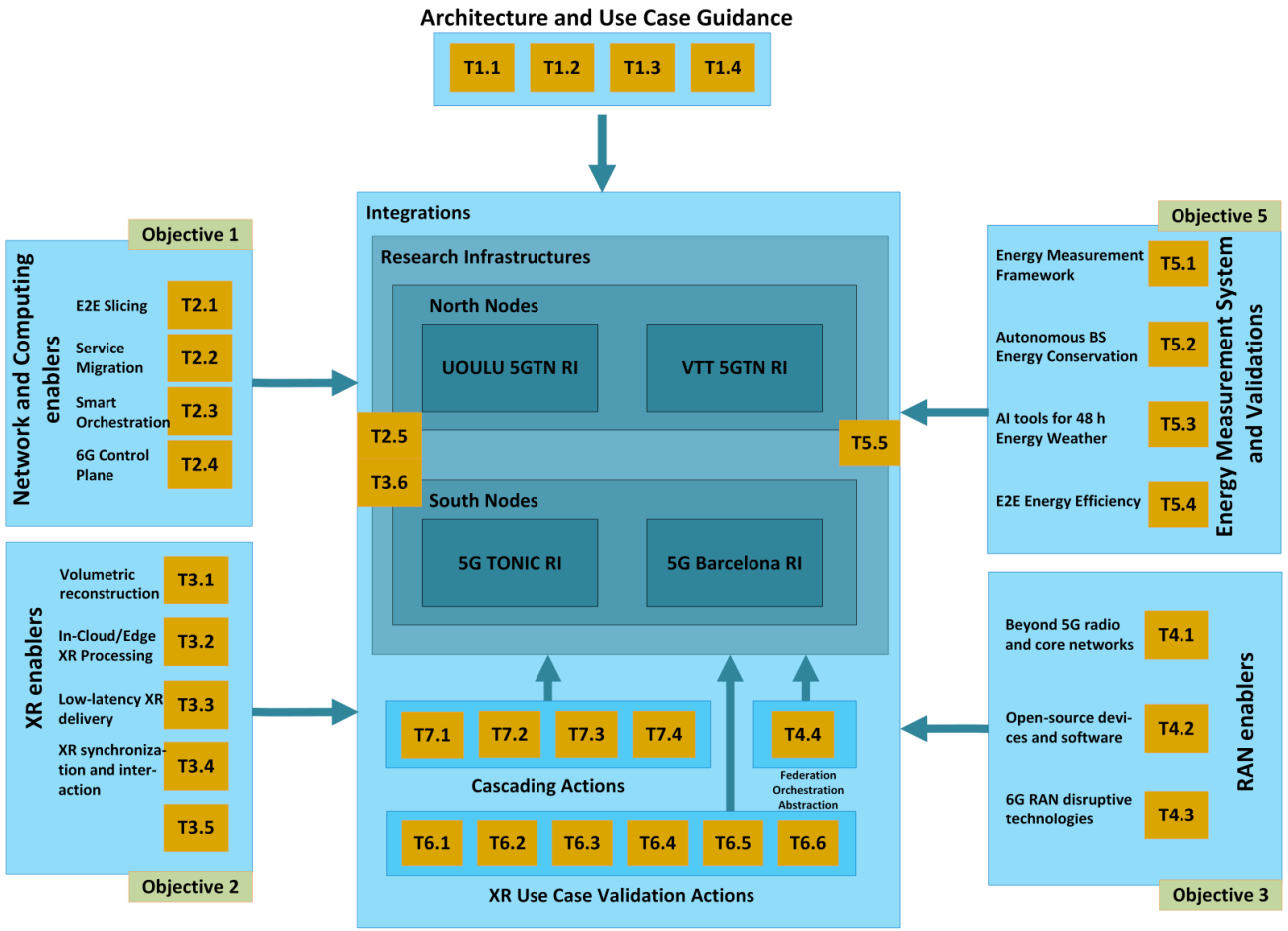
12:30 – 13:00 | **Q&A**

- 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/

Introduction to project & Open call objectives

Jussi-Pekka Haapola,
University of Oulu

6G-XR objectives & Open Call 1 objectives



OC1 Objectives:

1) Networking, Computing enablers
2) XR enablers
3) RAN enablers
4) Sustainability enablers for local green energy, controlling energy sources and charging/discharging, energy measurement and optimization solutions

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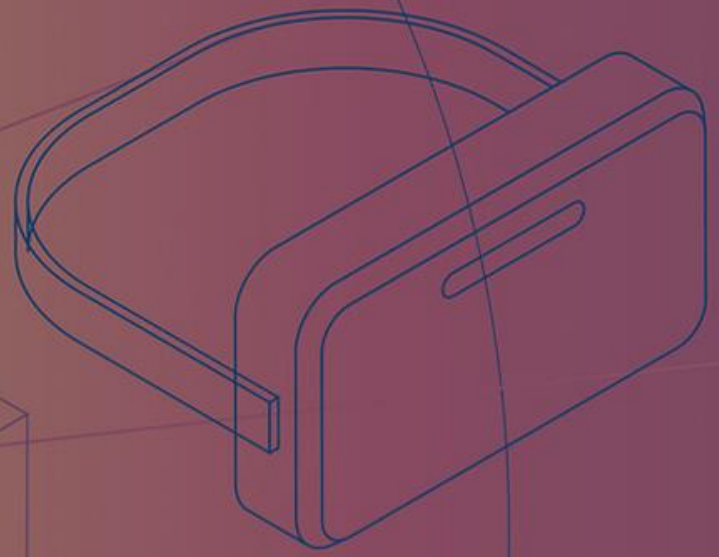


1. Open Call presentation

Eleni Pechlivanidou,
Martel Innovate

KEY DATES

ACTION	DEADLINE
Submission deadline of draft proposal for the Feasibility check	31 October 2023, @17:00 CET
Submission deadline	27 November 2023, @17:00 CET
Notification of the result	December 2023
Start of the Experiment	January 2024
End of the Experiment	June 2024

Open Call Targeted Participants

- SME
- Industry
- Research/scientific organisation
- Academia

All organisations eligible for participation in HE programme can participate

Eligibility criteria

- 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)
- English language
- Submission through project website tool
- Deadline
- GDPR compliant

**Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden*

***Access list here*

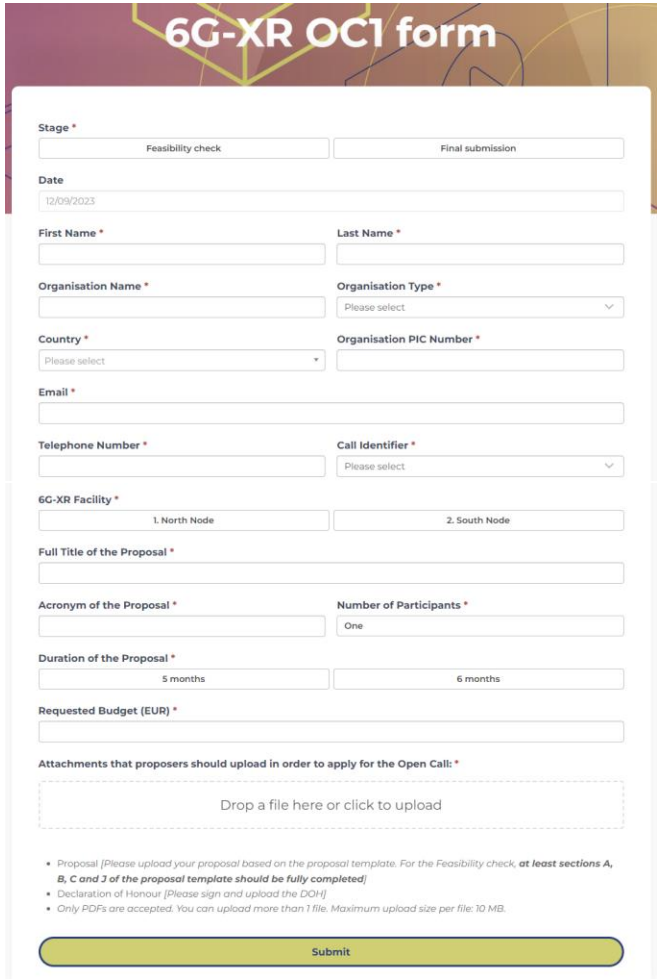
Project budget & payments

Open Call	Project duration	Max funding per project	No of projects	Total funding
6G-XR-OC1	5-6 months	60 000 EUR	8	480 000 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
- Apply only through: www.6g-xr.eu/open-calls/oc1
- 2 options: **Feasibility Check** & **Final submission**
- Frequently Asked Questions (updated)
- If more questions: **opencalls@6g-xr.eu**



Evaluation criteria & process

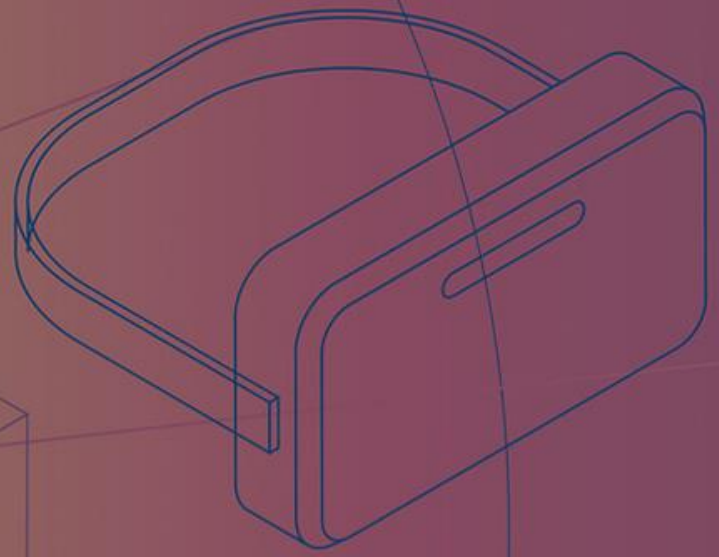
- Clarity and methodology
- Ambition
- Impact technology and domain fit to 6G-XR scope and objectives
- Replicability
- Contribution to standardization
- Team capacity, knowledge, expertise, commitment, research domain & track record
- Value for money
- SME participation (50%)
- Gender dimension awareness
- Maturity, trajectory of organisation/development

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 (template)
- Implementation with guidance by Mentors



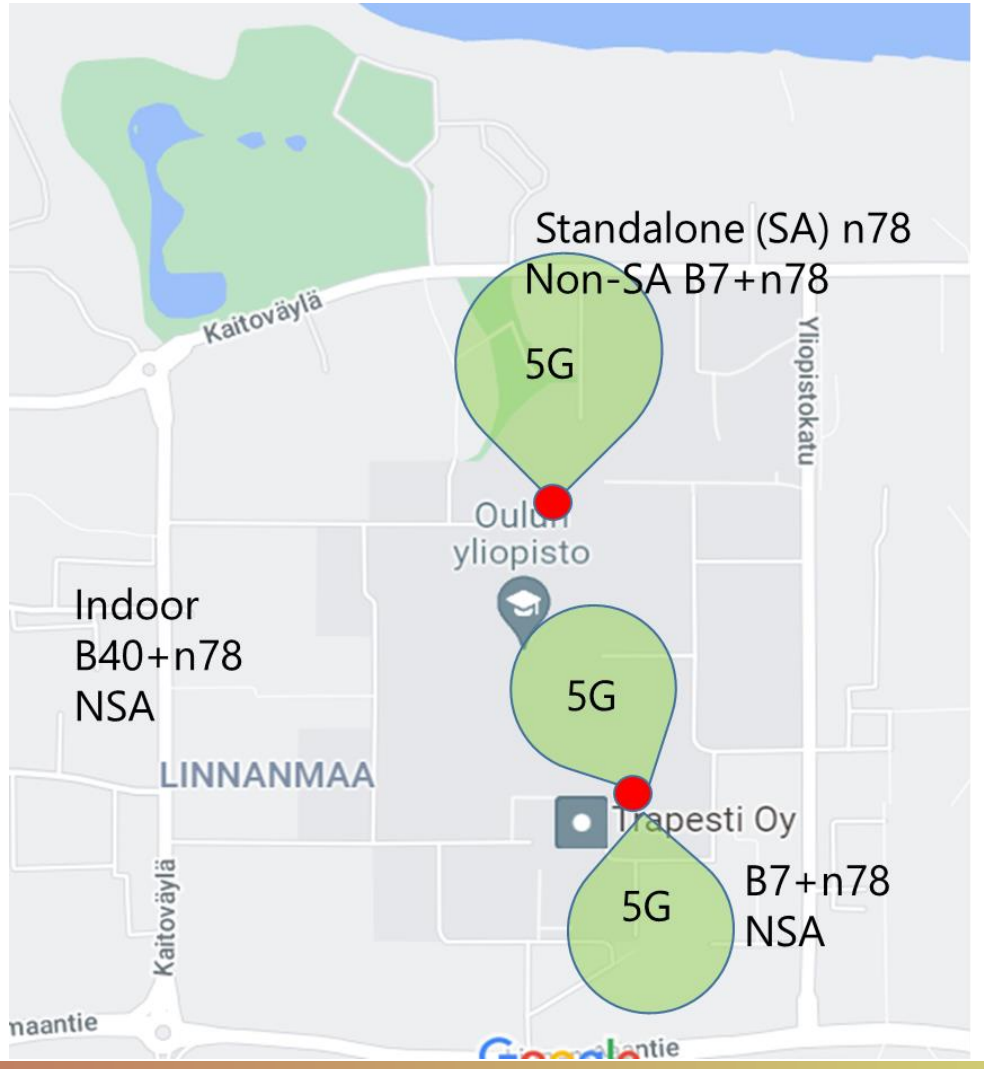
2. Research Infrastructures

Antti Pauanne, UOULU
Jarno Pinola, VTT
Jose Soriano, CGE

North Node

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 with various frequencies
- Cellular IOT
- 400+ sensors at campus
- Energy consumption / production measurement environment
- Integrations to different verticals
- Roadmap evolution towards 6GTN



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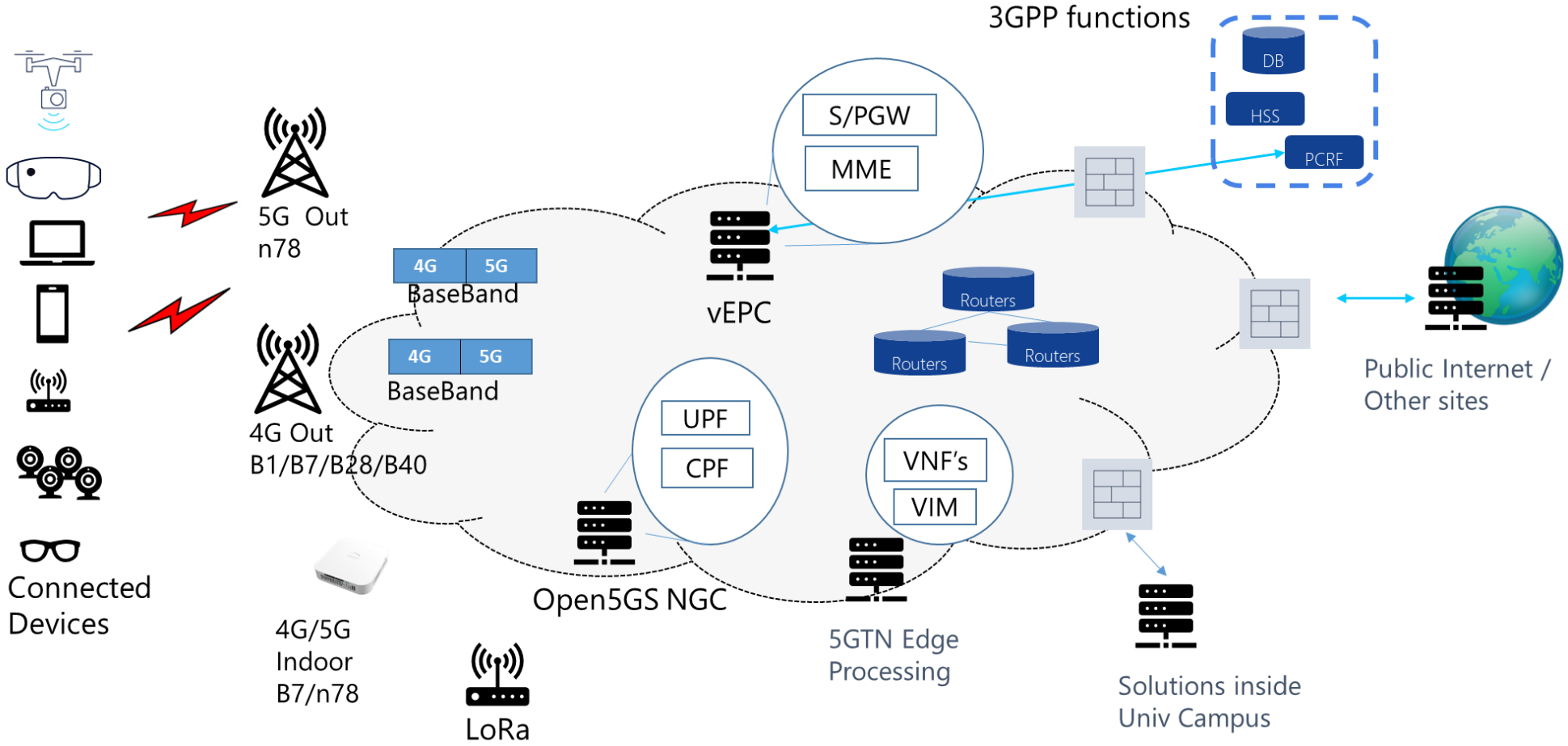
North Node

University of Oulu 5G Test Network (UOULU 5GTN) 2/3



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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
  - 24 GHz Sharing based radio permit
- 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)
- 2 pcs 5G NR (NSA + SA)
- 3 pcs 5G NR remote radio heads operating in NSA mode
- Hundreds of Sim-cards available
- 1 EPC (4G/5G NSA), 1 OpenEPC, 1 Cumucore EPC, Open5GC (SA)
- 1 Bluetooth –based indoor positioning system, (700 beacons)
- 1 LoRa network with approx. 2000 sensors (partially NB-IoT enabled)
- Several Edge servers
- 36 5GNR remote radio heads (RRHs) and 3 baseband units (BBUs)
- 1 mmW (24-25 GHz) 5G NR base stations
- Several tens of different UE's: phones, modems, 5G routers, etc.
- Test SW and HW like: Kaitotek Qosium, Keysight Nemo

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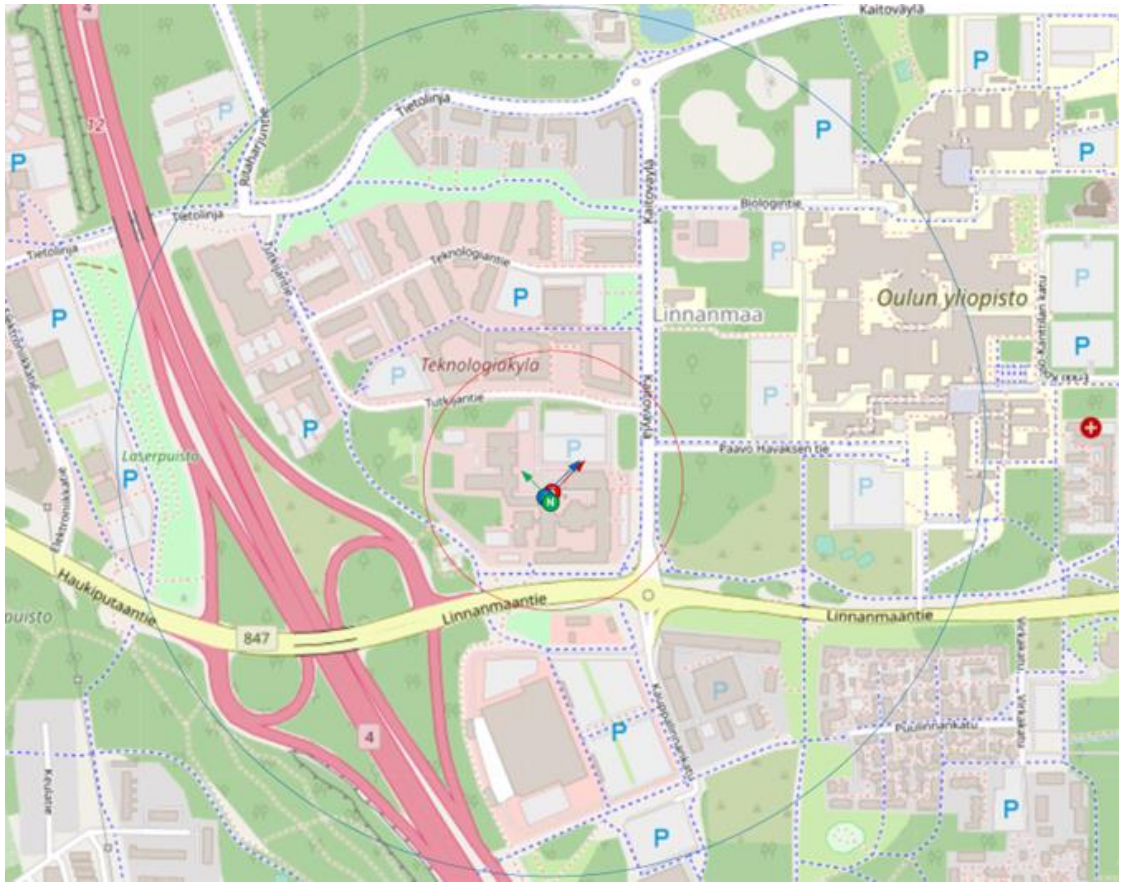
North Node

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

- Managed and operated by VTT
- 5G (NSA and SA), 4G, WiFi-6 connectivity
- Satellite links including Iridium Certus and 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



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North Node

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

- Frequency bands
  - LTE/NB-IoT: 450 Mhz, 700 MHz (BW: 10Mhz), 1800 Mhz, 2100 MHz (BW: 10 MHz), 2600 MHz (BW: 10 MHz)
  - 5G NR: 3500 MHz (BW: 60 MHz), 3900 MHz (BW: 100 Mhz), 26 GHz (BW: 850 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 a Nvidia TESLA cluster for AI and big data processing
  - Server and storage space can be tailored for project needs

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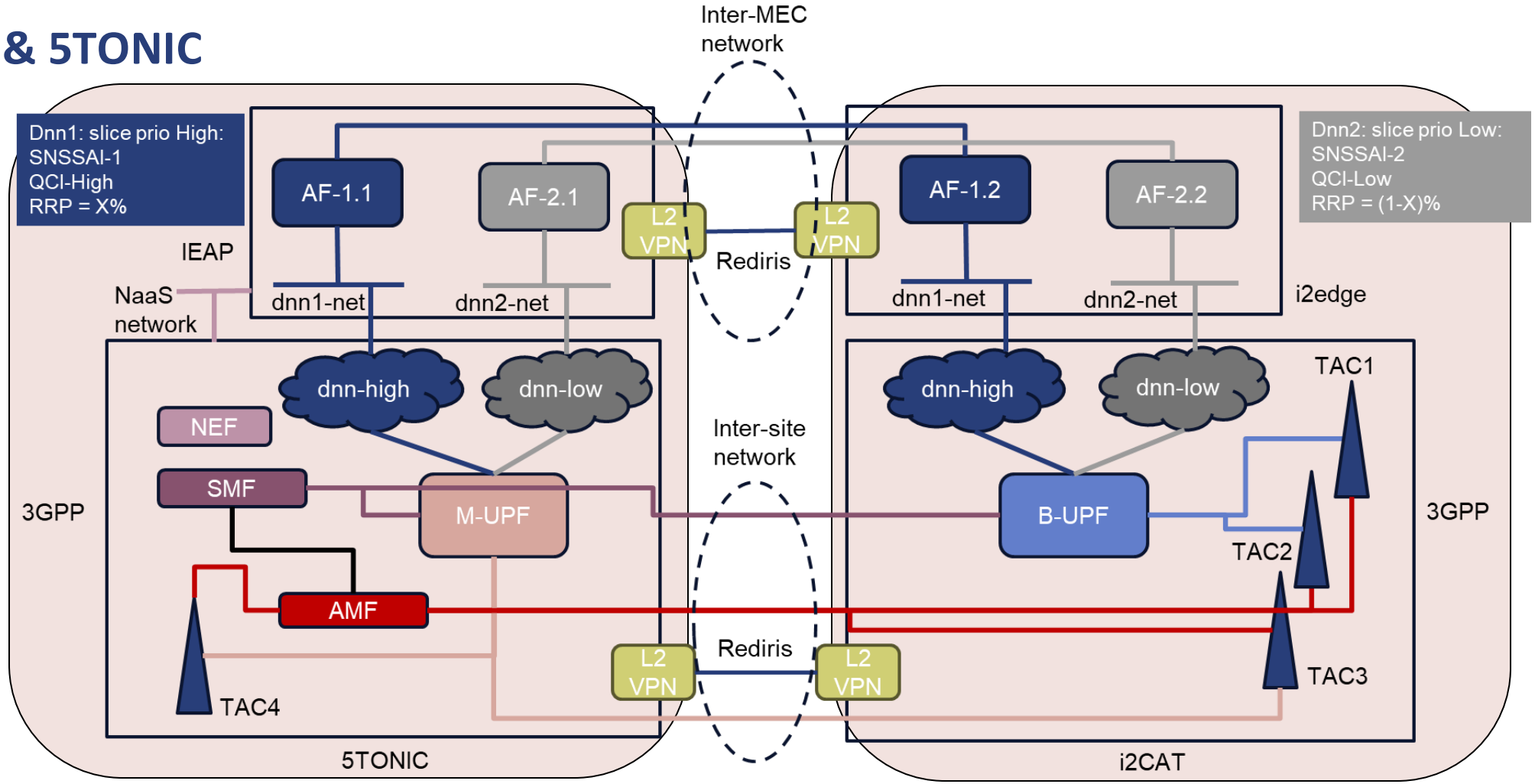
South Node

5GBARCELONA & 5TONIC

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



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3. Topics presentation

TOP1, 5, 14: Antti Pauanne, UOULU
TOP2: Cristina Santana, TID
TOP3: Matus Kirchmayer, MATSUKO
TOP4: Amr AbdelNabi, i2CAT
TOP6, 9, 10, 11: Roberto Viola, VICOM
TOP7, 8, 12, 13: Mario Montagud, i2CAT
TOP15: Jussi-Pekka Haapola, UOULU

TOP1. Automated IP network measurement system

Context

- Testing is a crucial part of any test platform as it is also in the 5GTN of the University of Oulu and VTT
  - Nearly daily operation for the organization
- As test cases vary a lot between different tests a lot of manual work is required when defining, building and operating test systems
  - Resources and time are tied to these activities that repeat the same procedures

Gaps & Goals

- University of Oulu has, in a previous project, developed an automated IP network test system based on Kaitotek Qosium QoS SW
- Although operational the system is not complete
- This Open Call item targets enhancing the existing automated test system to professional level
  - Automation extended to cover all the network functions and nodes including energy measurement system that is under development in 6G-XR
    - Includes test system initiation, running the tests, storing the data and ending the test case
    - Defined, documented, integrated and verified
  - Instructions/User Manual to be included. Used by both internal staff and remote & visiting researches outside the organization
- License and possible HW costs handled by University of Oulu and/or VTT

TOP5. Fab Lab digital twin environment 1/2

Context

- In 3D Digital Twin Use Case a digital twin of the University of Oulu FabLab is needed
- Two persons (Remote Instructor & Remote User) wearing VR Glasses will then connect wirelessly to this environment
- 3D object presented by RU is reviewed for 3D printing. After acceptanc the object is printed in a real 3D printer

Gaps & Goals

- A digital twin of the Universtity of Oulu FabLab is to be created
  - FabLab and relevant object are to be 3D scanned and a digital twin environment to be created
  - Digital twin to run on a game engine like Unity, located on a 5G network Edge server
  - There needs to be a connection to several real world devices
    - 5GTN, 3D printer, WiFi, etc,
- Environment is to be fully integrated and ready for use

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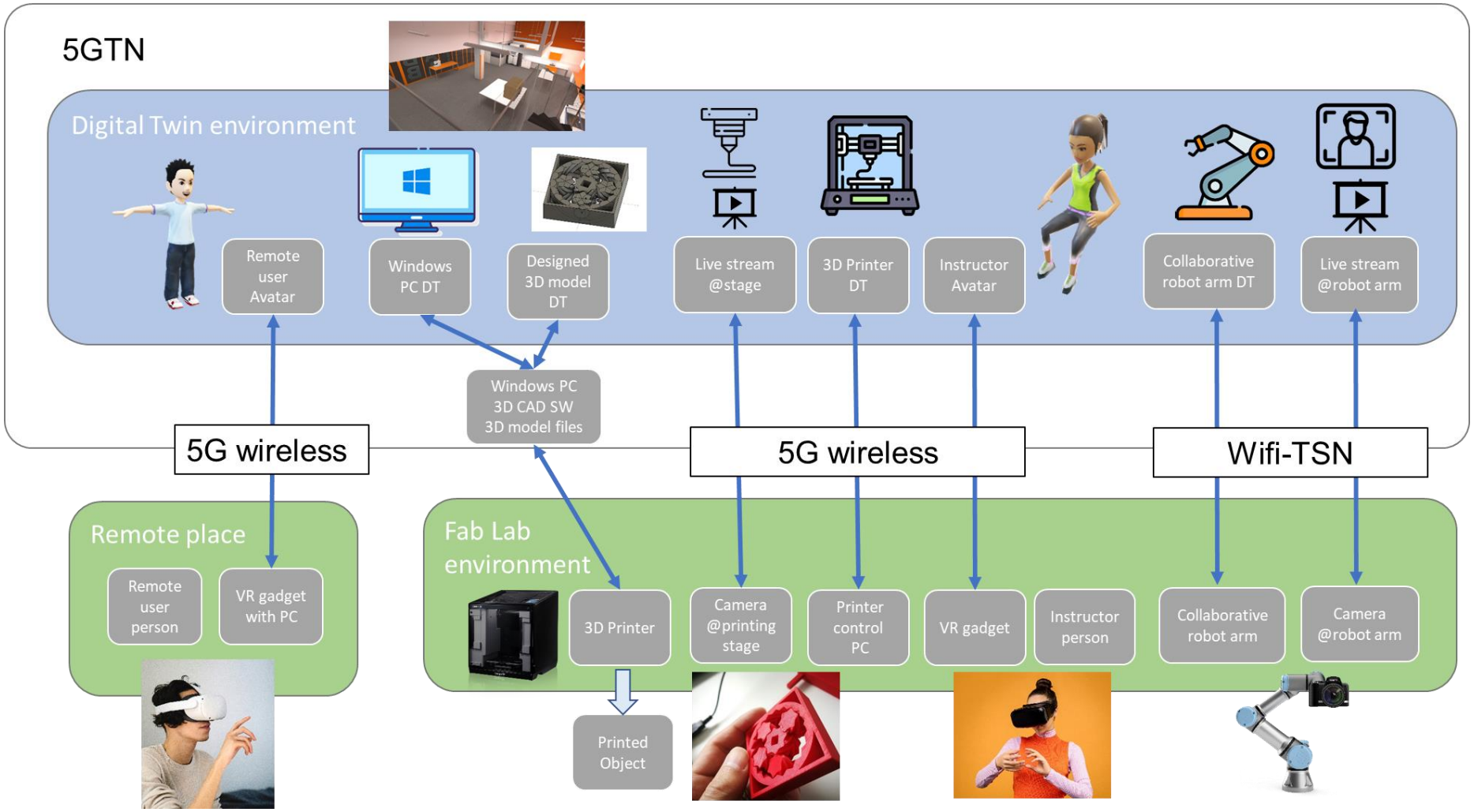
TOP5. Fab Lab digital twin environment 2/2



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TOP14. End-to-end slicing with RAN resource sharing

Context

- 5G Slicing is an integral part of the system developed in/for 6G-XR
- Need to create customizable and isolated virtual network segments, Slices, within a single physical network
- E-2-E slices covering the whole system
- Includes also RAN, not just the 5G Core

Gaps & Goals

- Area of development is RAN resource sharing part of the E-2-E Slicing.
- Resources should be able to allocate in an efficient and dynamic way.
- Two system environments currently seen possible in North Node:
  - Open5GS core + OAI RAN SW + USRP n310 radio
  - Open5GS core + SRS-RAN SW + USRP n310 radio

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TOP2. Edge discovery API

Context:

Currently, the Edge Platform to be deployed in the 6G-XR sites does not have an Open-Source Edge Discovery API implementation to provide to upper layers the list of available edges considering the topological situation, this Edge Platform provides an API and SDK for the user client that considers the UE location.

Gaps & Goals:

- **GAP:** Edge Discovery API that considers the topological situation of the user in the network , to detect in which UPF the user is connected to. This solution must be developed according to OpenSource principles.
- **Faciity:** 5Tonic
- **Goal:** Create a development of opensource code implementation of the CAMARA Edge Discovery API that can connect to NEF APIs from the network to provide the edge best selections based on the network information that can be colected to NEF APIs. (https://github.com/camaraproject/EdgeCloud)
- **Expected Feedback:** Defined, documented, and developed open source code based on CAMARA Edge Discovery API that can be even contributed to the community and can exposed northbound the API and connect with NEF southbound. Documentation and guides to code and integration guide.

TOP3. Holographics API

Context

- A hologram can be used in many use cases and can be embedded as a standalone component in other domains.
- Similarly to a 2D video (of a person) being embedded in a web page or an application, hologram can be embedded in other platforms or applications. It can be spawned by a script or activated via UI, for example as a smart link (ex: YouTube URL link).

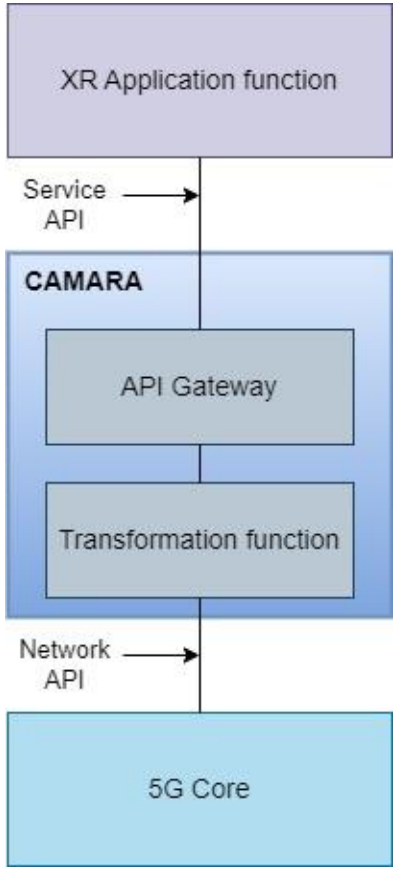
Gaps & Goals

- This topic aims to enrich XR enablers from 6G-XR with third-party (ideally open-source, and extensible) interface as software libraries, SDKs, and APIs to provide the possibility to easily embed a hologram in other XR experiences.
- Examples include: speaker as a hologram in a specific environment, presenter as a hologram showcasing custom 3D content, integration of a hologram to an existing XR platform.

TOP4. CAMARA QoD implementation over Open5GS

Context

- XR applications demand stable latency (reduced jitter) or prioritized throughput from the network.
- High uplink resource utilization that can lead to congestion.
- 5G network (NaaS) allows operators to expose network capabilities through APIs.
- CAMARA developed service API named "Quality on Demand (QoD) API" to set certain QoS parameters for the session between XR AF and media server.



Goal

The topic aims at solving congestion by tuning the QoS parameters for the XR session based on QoD profiles.

The proposals can encompass for QoD service API considering:

- API gateway and transformation function are to be fully integrated and tested between QoD API and 5G core.
- License for above functions and gateway to be valid till the end of the project

For more info: https://camaraproject.org/quality-on-demand/

TOP6. Advancing Heterogeneous XR Capture Systems

Context

- Holographic communications require specialized and expensive hardware to capture volumetric video
- Calibration process of the capture system can be complex and time-consuming

Gaps & Goals

- This topic aims at lowering the entry barrier of holographic communications by exploring innovating and cost-effective volumetric capture
- Proposals can encompass XR Enabler solutions for volumetric capture that consider:
  - Affordable (and wireless-enabled) devices and sensors to enable a wider range of users
  - Multi-sensor Free Viewpoint Video (FVV) capture setup in case of professional applications
  - User-friendly calibration methods

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TOP9. Encoding solutions optimized for Point Cloud/Volumetric Video compression

Context

- Volumetric data requires high network bandwidth resources to be transmitted
- Methods for Point Cloud/Volumetric Video compression are still limited
  - Lack of implementation of reference or standardised encoder/decoders (e.g., MPEG-PCC)
  - Pre-processing helps to reduce the amount of data to compress (e.g., tile- or ROI-based coding)

Gaps & Goals

- This topic aims for new approaches to reduce the required resource to transmit volumetric video
- Proposals can address different aspects of volumetric video compression:
  - New encoders tailored or natively designed for Volumetric Video. They can consider motion/time-aware/differential reconstruction to improve the compression.
  - Scalable methods for encoding, including pre-processing or super-sampling methods
  - Edge and GPU-acceleration

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TOP10. Low-latency or scalable streaming protocols and methods for XR

Context

- Current streaming protocols are designed to transmit legacy 2D video
- Limited ad-hoc implementation/adaptation of streaming solutions for volumetric video
- Applications or use cases may requires heterogeneous requirements in terms of latency and scalability

Gaps & Goals

- This topic aims for new solutions for media server and player that are capable to stream the volumetric video
- Proposals can address low-latency or high scalability scenarios (or both)
- Different and complementary aspects can be considered streaming protocols:
  - Novel protocols such as HTTP/3 and QUIC (e.g., DASH over HTTP/3 and WebRTC over QUIC)
  - Adaptive streaming strategies and tiled streaming. They can exploit characteristics of volumetric video to reduce the bandwidth utilization (e.g., viewpoints, distances and non-visible areas)

TOP11. QoE assessment models and methods for XR experiences

Context

- 6G-XR KPI and QoS telemetry system can be supplemented by QoE assessment to enable a complete multilayer monitoring
- Common QoE models and evaluation methods are designed for legacy 2D video (with limited interaction)

Gaps & Goals

- This topics aims at improving 6G-XR platform by enabling analytical models or methods to estimate the QoE of users participating in XR experiences
- Solutions for assessing the QoE can consider various objective factors:
  - Multimedia and interaction (e.g., video/audio quality, interactive and motion capabilities, synchronization and consistency)
  - Application or use case-specific factors

TOP7. XR fusion

Context

- 6G-XR aims to provide higher quality, affordable and interoperable holographic comms services
- Multi-sensor capture sub-systems based on: Light field sensors, RGB-D cams (e.g., K4A), iPhones
- Other capture sub-systems via OC1 (Topic 6) are welcome (e.g., FVV, mobile phones…)

Gaps & Goals

- This topic aims for advanced, potentially AI-assisted, multi-sensor XR fusion methods to provide clean and high-fidelity reconstruction of holograms, ideally in real-time
- Focus: Full body human representations, real-time
- Formats: Volumetric Video (Point Cloud, RGB-D, Light Field), NeRF…
- Processing: GPU-friendly, offloading to Edge

TOP8. Wireless Connectivity for XR Sensors

Context

- 6G-XR encompasses usage of multi-sensor capture setups for volumetric video (light field, RGB-D sensors), which could be extended if successful application for Topic 6

--> complex and sensible cable connectivity issues, which not only affect aesthetically but interestingly in terms of complexity and agility (and thus costs) of deployment

- 6G-XR encompasses use of tethered VR headsets connected via cable to GPU-equipped PCs/laptops
- --> inconvenience (e.g., in terms of mobility)

Gaps & Goals

- Functional prototypes (or ideally higher TRL solutions) that minimize usage of cables for:

(i) connection of multi-sensor capture setups (e.g., USB-to-5G+, HDMI-to-5G+ dongles) to processing servers

(ii) connection of processing stations to XR/VR headsets

KPIs: (i) data rates >>100Mbps; (ii) few ms order latency (ideally sub-ms)

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TOP12. XR Interaction and Collaboration Modules and APIs

Context

- 6G-XR encompasses rich human-to-human audiovisual interaction (holographic communications)
- Typically, in Social VR/XR and Metaverse experiences, groups of users aim at conducting tasks together (e.g., gaming, collaboration, training, team work…)

Gaps & Goals

- This topic aims to enrich XR enablers from 6G-XR with third-party (ideally open-source, and extensible) software libraries, SDKs, and APIs to provide multi-modal interaction and collaboration tools / features for both single-user and multi-user holo-portation VR/XR scenarios
- Interactions can be via: VR controllers, hand-tracking, voice, gestures…
- Examples include: (shared) video watching, (shared) boards and annotation tools, (co-)design and (co-)creation tools, gamification / education / training tools, etc

TOP13. Multi-sensory comms and interactions

Context

- 6G-XR encompasses rich human-to-human audiovisual interaction (holographic communications)
- Typically, in Social VR/XR and Metaverse experiences, multiple senses can be recreated and stimulated (e.g., sense of touch, olfactory effects, ambient effects…)

Gaps & Goals

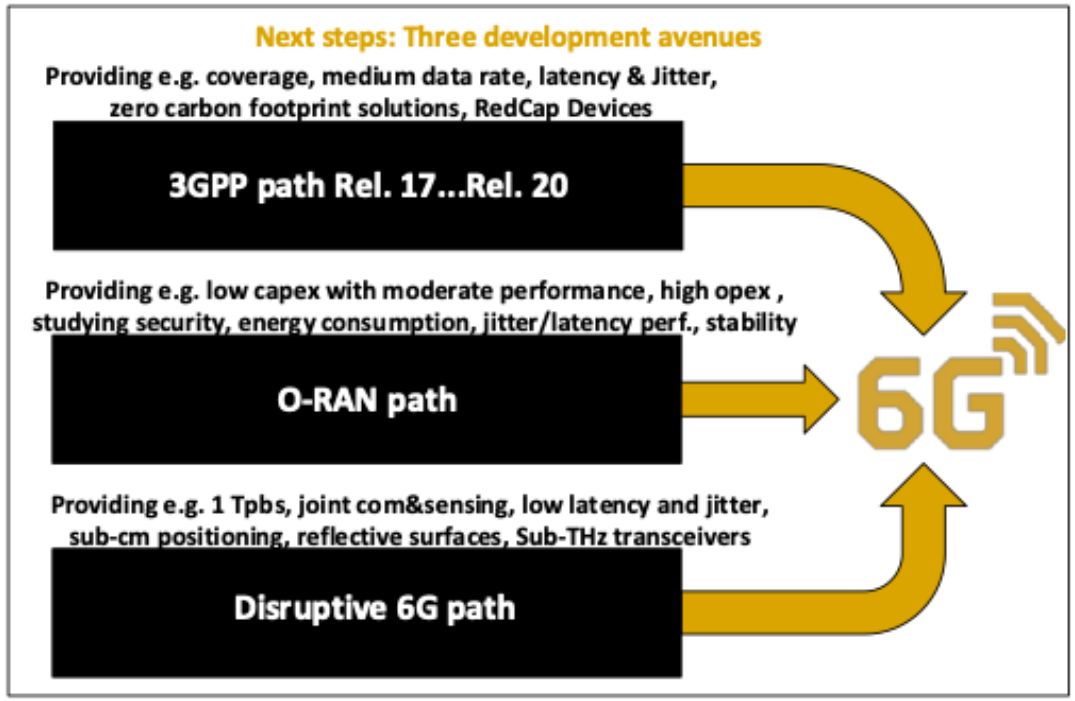
- This topic aims to enrich XR enablers from 6G-XR with third-party (ideally open-source, and extensible) software libraries, SDKs, and APIs to provide multi-sensory stimuli and experiences
- The strongest interest relies on **haptic communications** / feedback, but integration of other senses (e.g., olfaction) and IoT-enabled ambient effects are also within scope.
- Both low-cost (e.g., pressure- or vibration-based) and more advanced setups (e.g., haptic vests / gloves…) are within scope

TOP12 and TOP13

Preferences / KPIs

- Open-source and extensibility is a plus
- easily integrable in (Windows-based) Unity projects
- compliant with widely adopted VR/XR headsets (e.g., Oculus)
- preference on affordable and replicable solutions
- platform interoperability (e.g., via middleware on client or on Edge) is a plus
- Latency ~few ms, ideally support for sessions with N>8 users, multi-session support

TOP15. RAN or/and Sustainability enablers

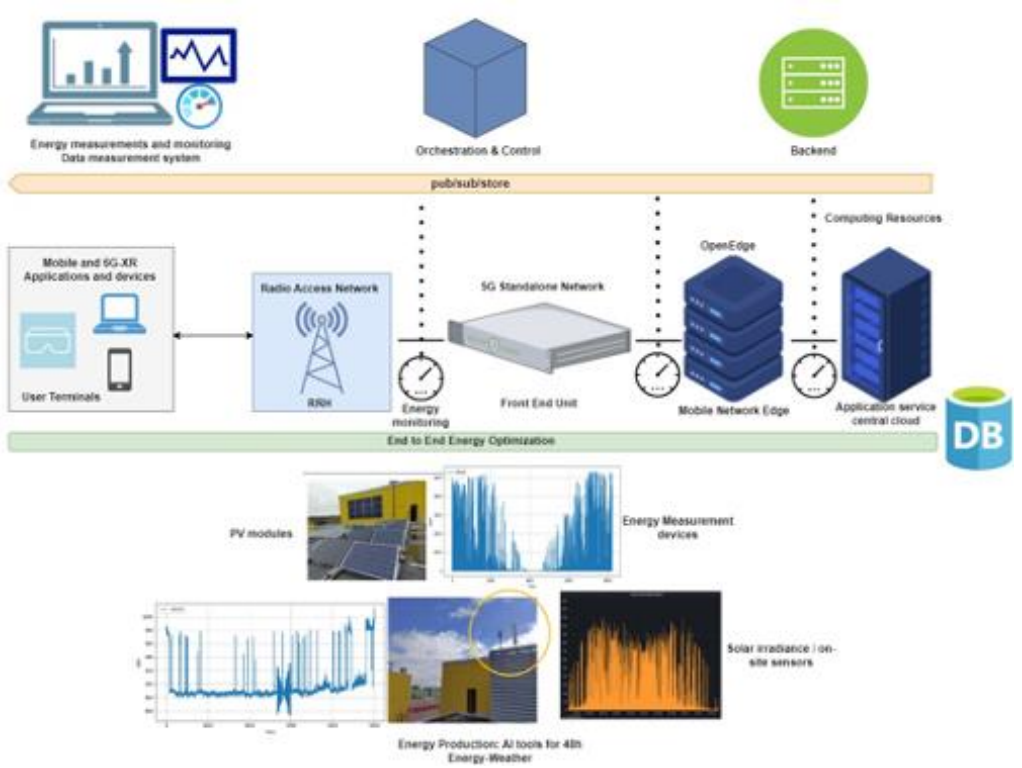


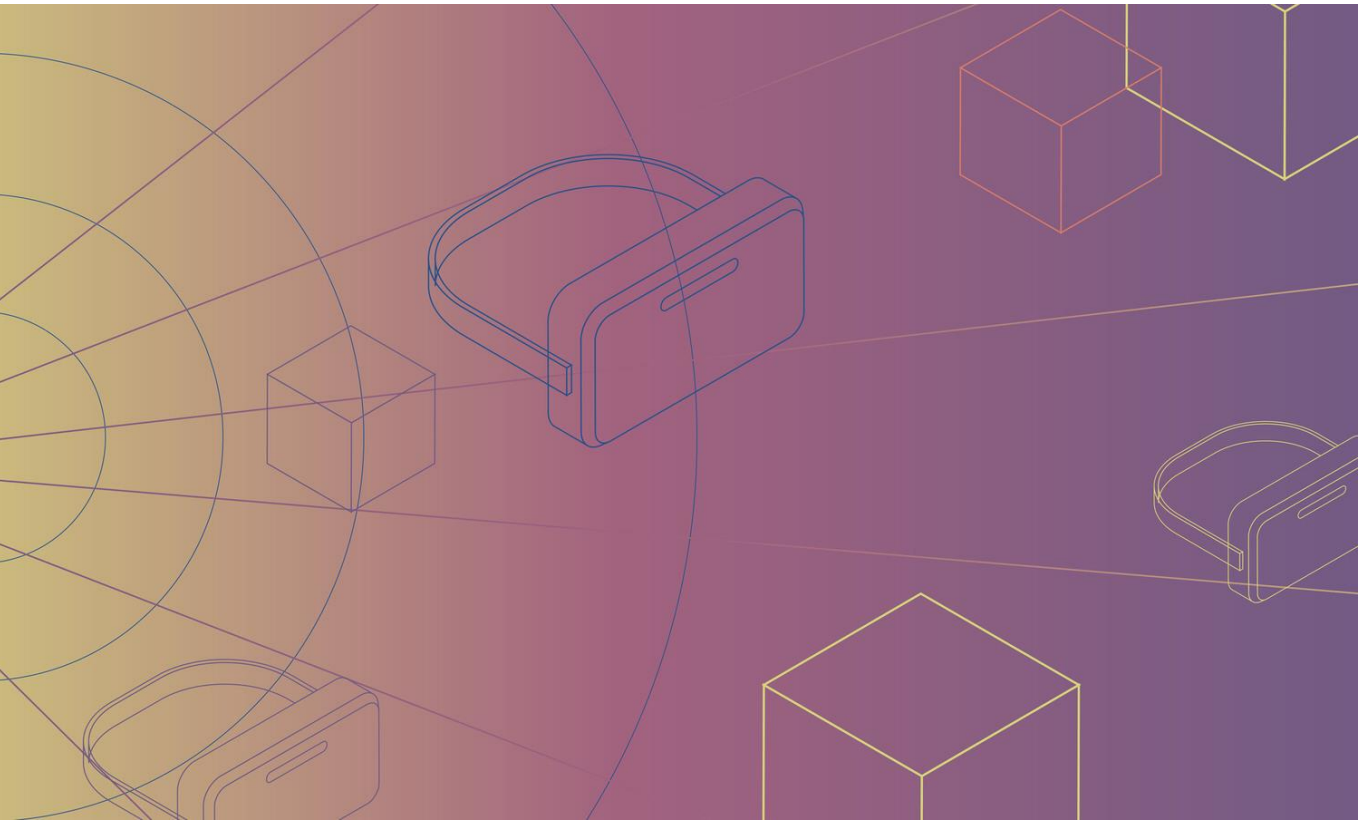
RAN enablers: interesting and innovative, but sufficiently mature, RAN technologies that

- fall within the scope of 6G-XR south node or north beyond state-of-the-art topics and
- can be integrated in the forementioned south node or north node research infrastructures.

Sustainability enablers for local green energy:

- controlling energy sources and charging/discharging,
- energy measurement and optimization solutions.





Questions & Answers

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

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Thanks

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6GSNS

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