1st 6G-XR Open Call

Platform and Network Enablers

6G eXperimental Research infrastructure to enable next-generation XR services (6G-XR)

Co-funded by the European Union

6G SNS

WWW.6G-XR.EU

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6G-XR Consortium			
No	**Partner Organisation Name**	**Short name**	**Country**
1	OULUN YLIOPISTO	UOULU	Finland
2	TEKNOLOGIAN TUTKIMUSKESKUS VTT OY	VTT	Finland
3	NOKIA SOLUTIONS AND NETWORKS OY	NOKIA	Finland
4	FUNDACIO PRIVADA I2CAT, INTERNET I INNOVACIO DIGITAL A CATALUNYA	I2CAT	Spain
5	TELEFONICA INVESTIGACION Y DESARROLLO SA	TID	Spain
6	ALTRAN INNOVACION SL	CGE	Spain
7	MATSUKO S.R.O	MATSUKO	Slovakia
8	ERICSSON ESPANA SA	ERI	Spain
9	INTEL DEUTSCHLAND GMBH	INTEL	Germany
10	FUNDACION CENTRO DE TECNOLOGIAS DE INTERACCION VISUAL Y COMUNICACIONES VICOMTECH	VICOM	Spain
11	RAYTRIX GMBH	Raytrix	Germany
12	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM	IMEC	Belgium
13	INSTITUTO DE TELECOMUNICACOES	IT	Portugal
14	MARTEL GMBH	MAR	Switzerland
15	INTERDIGITAL EUROPE	IDE	UK

1. GENERAL OPEN CALL INFORMATION

INTRODUCTION

The 6G-XR project hereby announces its first Open Call to provide financial support to third parties.

This Call focuses on the development and extension of the four research infrastructures. The project is looking for **1) networking, computing enablers; 2) XR enablers; 3) RAN enablers; and 4) Sustainability enablers for local green energy, controlling energy sources and charging/discharging, energy measurement and optimization solutions** in terms of the following implementations. Each topic is supervised by a project partner (mentor) who is responsible for supporting the experimenters during execution and following up on the experiment results.

1. Automated IP network measurement system [Mentors: UOULU, VTT]
2. Edge discovery API [Mentors: CGE, TID]
3. Holographics API [Mentors: MATSUKO, TID]
4. CAMARA QoD implementation over Open5GS [Mentor: i2CAT]
5. Fab Lab digital twin environment [Mentor: UOULU]
6. Advancing Heterogeneous XR Capture Systems [Mentors: Raytrix, VICOM]
7. XR fusion [Mentor: Raytrix]
8. Wireless Connectivity for XR Sensors [Mentor: Raytrix, i2CAT]
9. Encoding solutions optimized for Point Cloud/Volumetric Video compression [Mentor: VICOM]
10. Low-latency or scalable streaming protocols and methods for XR [Mentors: VICOM, i2CAT]
11. QoE assessment models and methods for XR experiences [Mentor: VICOM]
12. XR Interaction and Collaboration Software Modules and APIs [Mentor: i2CAT]
13. Multi-sensory communications and interactions [Mentor: i2CAT]
14. End-to-end slicing with RAN resource sharing [Mentor: UOULU]
15. RAN enablers or/and Sustainability enablers for local green energy, controlling energy sources and charging/discharging, energy measurement and optimization solutions [Mentor: Based on proposal]

In this context, prospective proposals may span the four aforementioned domains.

Number	Title	Networking and Computing Enablers	XR Enablers	RAN Enablers	Sustainability Enablers
1	Automated IP network measurement system	X			X
2	Edge discovery API	X	X		
3	Holographics API	X	X		
4	CAMARA QoD implementation over Open5GS	X	X	X	
5	Fab Lab digital twin environment		X		
6	Advancing Heterogeneous XR Capture Systems		X	X	
7	XR fusion	X	X		
8	Wireless Connectivity for XR Sensors		X	X	
9	Encoding solutions optimized for Point Cloud/Volumetric Video compression	X	X		X

10	Low-latency or scalable streaming protocols and methods for XR	X	X		X
11	QoE assessment models and methods for XR experiences		X		
12	XR Interaction and Collaboration Software Modules and APIs	X	X		
13	Multi-sensory communications and interactions	X	X		
14	End-to-end slicing with RAN resource sharing	X		X	
15	RAN or/and Sustainability enablers			X	X

1.1 CALL INFORMATION

Project full name: 6G eXperimental Research infrastructure to enable next-generation XR services

Project Grant Agreement number: 101096838

Call identifier: 6G-XR-OC1

Call title: 1st 6G-XR Open Call – Platform and Network Enablers

Feasibility check deadline: 31 October 2023 @17:00 CET

Final Submission deadline: 27 November 2023 @17:00 CET

Information Webinar on Open Call 1: 29 September 2023 @11:00 AM CET

1.2 AVAILABLE BUDGET

Open Call	Project duration	Max funding (€)	No of projects	Total funding (€)
6G-XR-OC1	6 months	60.000	8	480.000 €

For the implementation of the third party project, a total lump sum of the awarded amount will be paid upon the completion of the project. No advance payments will be made. The payment of the total amount will be made once the project activities have been performed completely, the deliverables and final report have been reviewed and accepted by the 6G-XR project and a final decision on the approval of the third party project and deliverables has been issued.

1.2.1 Requirements related to the proposer:

- Proposers must be **eligible for funding in the Horizon Europe programme** and be established in an EU Member State or in an Associated Country.
- Proposals will only be accepted from a **single party**.
- A proposer can only be selected for funding for one proposal, even if the proposer submitted multiple proposals that are ranked high enough to be selected for funding. In the latter case, the proposer may be given the opportunity to choose the one to be retained for funding.
- To avoid potential conflict of interest, **proposals will not be accepted from individuals or organisations who are partners in the 6G-XR consortium or who are formally linked in any way to partners of the consortium**. All proposers will be required to declare that they are aware of no such potential conflict of interest that should prevent them from applying.
- A proposer must select a single Node or single infrastructure to conduct their experiment.
- Language in which the proposal must be submitted: **English**.
- Proposals must follow the provided **template** (see Appendix A of this document).

- Proposals (draft as well as final proposals) must be submitted through the **online submission portal** (www.6g-xr.eu/open-calls/oc1/)

1.3 TIMETABLE AND DEADLINES

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

2 THE 6G-XR PROJECT

6G eXperimental Research's ambition is to strengthen European leadership in 6G technologies by enabling next-generation XR services and infrastructures that will provide beyond-state-of-the-art capabilities towards the 6G era. The project will develop an experimental multisite Research Infrastructure (RI) to provide a validation platform for various 6G-use cases by developing enablers for networking and computing, radio access technologies beyond 5G, enablers for XR services with in-build federation, trial management, abstraction tools as well as energy measurement frameworks.

2.1 INTRODUCTION TO THE PROJECT

Objectives and Approach - 6G-XR is building its objectives, ambition, and methodology on top of four state-of-the-art research (SoTA) RIs, namely 5GTN UOULU, 5GTN VTT, 5TONIC, and 5GBarcelona. These well-developed RIs represent the most evolved open environments for communications research in Europe. 6G-XR project will enhance the capabilities of these research infrastructures to provide beyond-state-of-the-art (BSoTA) capabilities towards 6G by:

- Building a multisite Research Infrastructure that can provide validation platform for multitude of foreseen (extreme) 6G use cases by developing enablers for networking and computing, radio access technologies beyond 5G, enablers for XR services with in-build federation, trial management, abstraction tools as well as energy measurement framework.
- Validating multi access edge computing scenarios and their integration into a complete cloud continuum, support innovative use cases with vertical actors, beyond 5G capabilities, and support showcasing events.
- Demonstrating and validating performance of innovative 6G applications with a focus on demanding immersive applications such as holographics, digital twins, and XR/VR.

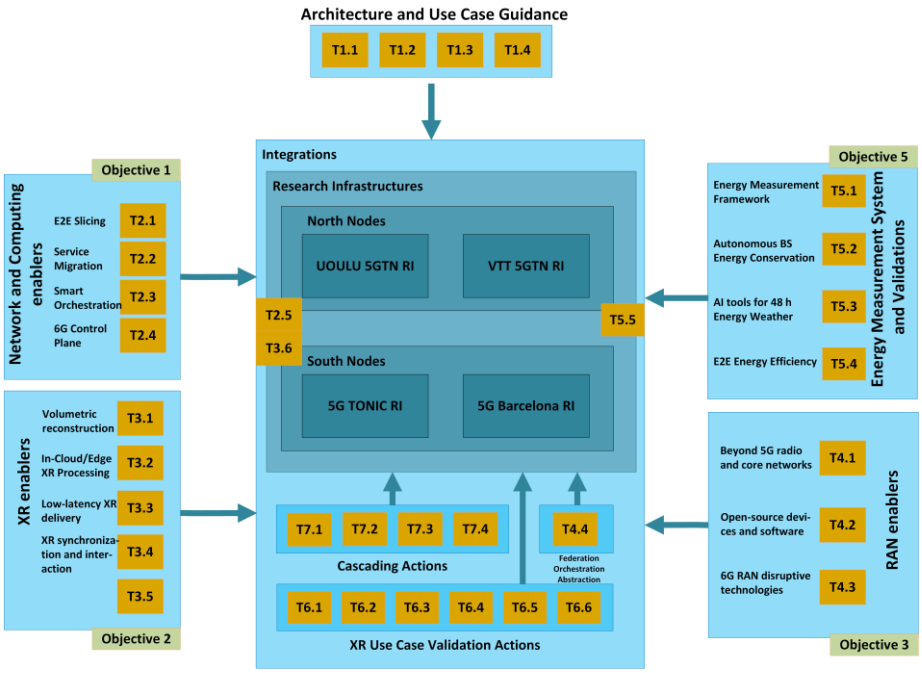

Figure 1. The Approach and objectives of 6G-XR project

Initial Use Case 1: Real-time holographic communications - Key challenges are addressed to successfully deliver real-time multi-party holographic communication services at scale and over heterogeneous environments. 6G-XR will go beyond the state-of-the-art in this field with the goal of increasing the visual resolution of holograms, as well as the performance, scalability, interoperability, and efficiency of such services. The envisioned next-generation holographic services will adopt many new features fully compliant with 6G architectural and communication paradigms, and it will be expected to contribute to the maturity, robustness, and wide adoption of high-quality, scalable, and affordable holographic communication services.

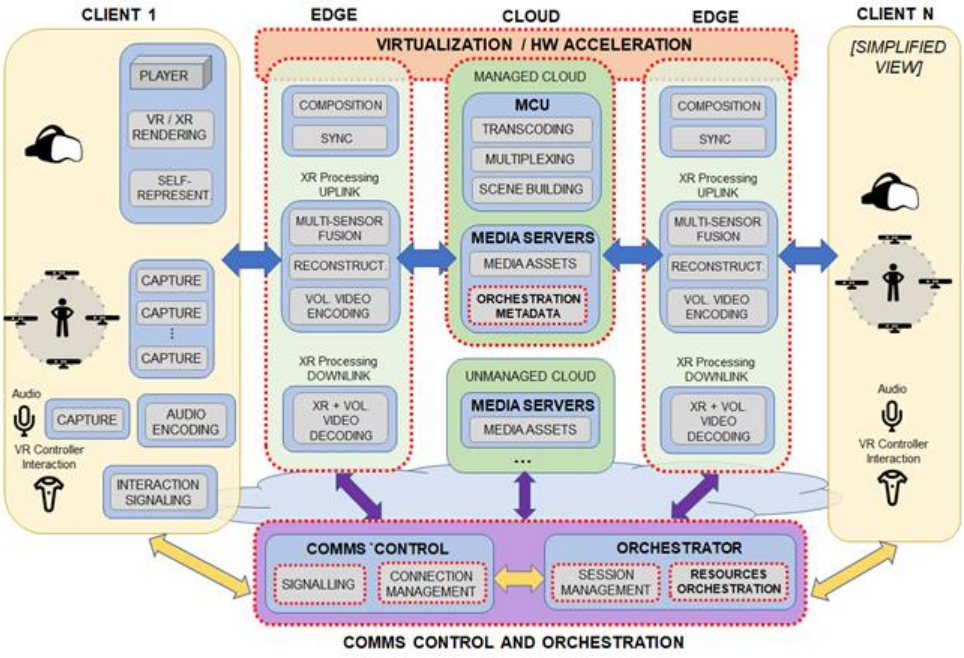

Figure 2. Envisioned evolution of HoloMIT in 6G-XR (newly envisioned components and components to be significantly evolved represented as boxes with red dashed lines).

Initial Use Case 2: Collaborative 3D Digital Twin Environments - The scale of blending digital and physical in VR is still narrow, restricted to simple application areas, and the full potential of XR has not yet been met. There are some state-of-the-art systems aiming at extending the virtual across the XR spectrum in addition to increasing the entanglement of the digital and physical. Interestingly, collaborative 3D digital twin environments take advantage of existing 3D material for building a mirror world like VR and enhance this environment with remote operation capabilities for robotics and computer mediated collaboration e.g. using private 5G advanced and emerging 6G devices and networks.

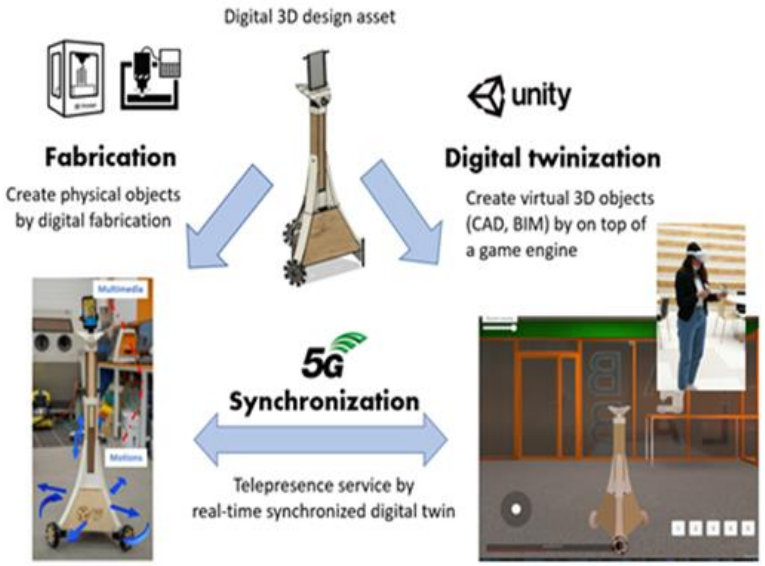

Figure 3. 3D Digital Twin like environment, a cyber-physical system that leverages 5G combining teleoperation of robots via virtual environments and IoT.

2.2 RESEARCH INFRASTRUCTURES

6G-XR North Node (UOULU 5GTN and VTT 5GTN)

The **University of Oulu** (UOULU) has 5G Test Network (UOULU 5GTN) with campus-wide small cell, macro-cell and distributed antenna based cellular network to be complemented by NFV based EPC and 5G backhauling solution (http://5gtn.fi/).

The Full-scale 5G Test Network in the University of Oulu supports usage of 5G devices, higher frequency bands, cognitive management functionalities, system testing tools for new solutions. The 5G Test Network feature evolution follows 5G research and standardisation progress, acting as verification platform for theoretical 5G research. The cellular devices part of the network is composed of 30 LTE small cells (700 MHz, 2.1, 2.3, 2.6, 3.5 GHz) and 2 macro cells (2.3 GHz). The network has two 5GNR base stations (3.5 GHz) complemented with several tens of User Equipment from various manufacturers that are easily integrated to any device, and tens of 5G enabled mobile phones from several vendors. The network is currently being complemented by commercial mmW (24-28 GHz) 5G NR base stations with several mmW capable UE's as well as with 36 remote radio head (RRH) based cloud RAN 5G NR devices. The network is controlled by operator grade EPC (Evolved Packet Core), thus making UOULU in practice a network operator with own SIM production for mobile devices. The current operational EPC version is 5G NSA compliant, but for research purposes 5G stand-alone (SA) solution with its own core and macro base station is also available. The network within the campus is complemented by wireless sensor network (IoT, internet of things) extension with estimated 2000 different kinds of sensors with wireless connectivity through NB-IoT, LTE-M and LoRa. Furthermore, the network has big data computing servers for network data analytics purposes. Some of these servers are distributed as edge servers within the network thus allowing multi-access edge computing (MEC).

On top of the commercial 4G, 5G and mmW solutions also open standard solutions are offered. Several different 4G and 5G core solutions are available for research use. Technologies in use are for example Open5GS core, Open Air Interface (OAI), different kinds of USRP radios, etc.

Several different kinds of test equipment and software is offered to be used. There are for example commercial grade radio parameter measurement equipment and software available. For IP network traffic an extensive Quality of Service (QoS) test software is in use.

VTT Technical Research Centre of Finland Ltd (VTT) is operating 5G Test Network (VTT 5GTN) with several private 5G network deployments in different locations in Finland including outdoor coverage as well indoor coverage in several buildings and areas. The main site for 6G-XR experiments is located in Oulu, but all VTT sites are connected via fibre connections for resource sharing and it is possible to create connections to remote experimentation infrastructures via virtual private network (VPN) or direct fiber links. The current radio coverage is deployed with LTE, 5G NR, Wi-Fi 6 and LoRa technologies. The current deployment includes the following frequency bands: LTE 450Mhz (BW:5Mhz), 700Mhz (BW:10MHz),1800MHz 2100MHz (BW:10MHz), 2300Mhz (BW20 MHz), 2600MHz (BW:10MHz), 5GNR 3500MHz (BW:60MHz), 5GNR mmW band N258 (BW:800MHz).

The network has been designed to support dynamicity in the experimentation. Network configurations (e.g., number of cells, frequency) and antenna setups including transmitting power may be changed towards specific vertical use case requirements. While the network coverage with high frequency 5G NR is typically < 1 km, with cellular IoT technology such as, NB-IoT the coverage will reach above 10 km distances for mMTC. In addition to LTE and 5G NR coverage test sites include indoor deployments with WiFi6 technology. The available user equipment (UE) includes newest commercial UEs, evaluation boards as well as a software-defined radio (SDR) based UE emulator (Keysight) capable of emulating with current setup up to 1000 LTE and 100 5G NR UEs. For the deployed core networks there are carrier-grade telco cloud and open-source instances available.

Edge processing has been deployed with several edge platform implementations with local data break out following the ETSI multi-access edge computing (MEC) specifications and application development in local / private networks. Edge solutions include general hardware and open-source software as well as well as commercial proprietary solutions. Deployment includes Nvidia Tesla server platform for AI processing as mobile network edge server, which can be tailored to process application/service data or large telecom data from our carrier-grade cellular network. Fixed backbone includes 40/100 Gb connections on site as well as 10 Gb links towards world-wide internet connection. The test site also includes an off-grid powering system for the cellular network site components including local power production with solar cells. The system is modular and capable of supplying both 48 VDC and 230 VAC for the indoor and outdoor RAN components

6G-XR North Node Beyond State-of-the-Art

VTT 5GTN and UOULU 5GTN will be upgraded to allow B5G and 6G experimentation and research activity. 3GPP 5G advanced evolution will be supported by upgrading the 5G core software (commercial and open source) and RAN with 3GPP Rel. 16 and 17 base stations and user equipment at 3.5 GHz and 24 GHz to support URLLC as well at lower frequencies at 450-850MHz for supporting mMTC. Possible new frequency bands and support for both 5G NR TDD and FDD is expected. For non-3GPP technology, WiFi 7 technology will be adopted when it comes available.

The different nodes comprising the experimental facility will adopt Open RAN (O-RAN) architecture and interfaces at some extend to study the impact of having virtualised distributed function splits in the RAN. The different RAN functionalities will be managed and monitored by the near-time and non-real-time Radio Intelligent Controller (RIC) both the controlling and monitoring aspects of O-RAN will enable AI algorithms for RAN optimisations and the energy-efficiency RAN control. Virtualised radio

unit (RU) functionalities will run on SDR platforms providing up 140 MHz radio links and MIMO schemes.

Atomic clock-based time synchronisation will be deployed for accurate and robust indoor time synchronisation. Time synchronisation plays a key role for the accurate data delivery and measurement timings needed in the various validation cases.

For developing and validation purposes of sustainable and energy-efficient 5G-Advanced, as well upcoming 6G technology, this project will build a validation environment providing E2E energy forecasting system, storing assets and autonomous base station(s) with energy optimization features. The network will be equipped with intelligent off-grid power systems as well to maximize the utilization of renewable and local energy by the network components.

6G-XR South Node (5GBarcelona and 5TONIC)

i2CAT Foundation offers 5GBarcelona, a fully-fledged 5G network for experimentation purposes in the city of Barcelona (https://5gbarcelona.org/). This is a multi-site network distributed in various locations of the Barcelona metropolitan area, mixing indoor and outdoor deployments. Sites are interconnected with dedicated point-to-point fibre links (10 Gbps) to i2CAT's headquarters. 5G Barcelona covers media, health, industry, transport, security, and automation, among other services, ranging from encouraging the adoption and validation of 5G technology, and the transfer of knowledge in 5G, to the creation of business opportunities. Its current equipment can be categorized in the (1) radio, (2) edge and (3) datacentre segments. Under an open and multi-vendor perspective, the (1) radio infrastructure is composed three 4G small cells (two in b43 and one in b42, both with a maximum bandwidth of 20MHz), one 5G small cell (N77 with a maximum bandwidth of 100 MHz and a starting frequency of 3900 MHz), as well as 23 multi-purpose SDRs (each of them with a maximum bandwidth of 50MHz, central frequencies of 100-6000 MHz, and featuring 4G and 5G in NSA/SA modes). The cellular infrastructure is connected to a fully virtualized 5G core (5GC) from different open-source projects (i.e., Open5GS, Free5GC, OpenAirInterface), and all of them support NSA and SA modes. Regarding non-3GPP radio access, 5GBarcelona has six WIFI nodes (five WIFI 5 and one WIFI 6), that can be used either as access points or as backhaul links. On the (2) edge segment, 5GBarcelona features 3 NUCs with a combined maximum theoretical capacity of ~700 vCPUs and 192 GB of memory. Finally, the (3) datacentre segment consists of 3 servers with a maximum capacity of ~2600 vCPUs and 512 GB of memory. The whole cellular and WIFI infrastructure is managed by a radio controller developed by i2CAT. On top of this, i2CAT's Slicing and Orchestration Engine manages the whole lifecycle of network slices. 5GBarcelona will be interconnected with 5TONIC with the best available alternative in terms of throughput and latency with the objective of easing the federation of resources across network slices.

Telefónica/Ericsson/Capgemini Spain operate 5TONIC, an open research and innovation laboratory focusing on 5G technology integration, adoption, and evolution (https://www.5tonic.org/). 5TONIC aims to create an open global environment where members of industry and academia alike can work together on specific research and innovation projects related to 5G technologies with their combined insight allowing them to boost technology and business innovation ventures. Ericsson is the partner that provides the RAN and the 5G core network of the laboratory. The infrastructure supports common 5G Services: (1) enhanced Mobile Broadband (eMBB), (2) massive Machine Type Communication (mMTC) and (3) Ultra Reliable Low Latency Communications (URLLC). It provides a 5G NR access network in low, mid and millimetre waves bands with different bandwidths (20,40,50, 60, 100 MHz) and with the possibility of doing carrier aggregation, to achieve sustained throughput beyond the Gbps and lower latency than LTE networks (up to 4 milliseconds in the access network). The access network also supports MIMO technology, NB-IOT and Cat-M for testing machine-to-machine use cases, and a

dedicated edge data network that is in less than 1 millisecond from the access and allows to deploy vertical applications at the network edge.

5TONIC also provides a full-fledged portable 5G network that can be used for demonstrating use case in the vertical premises or in an event. It allows for exploring and validating a variety of Edge Computing models by extending the URLLC slice towards the location of the use case. The portable network is composed by a Radio Access Network and the 5G core user-plane, which are the elements deployed near the users, and allows to connect through a secure connection with the 5TONIC central core for managing the control plane. The portable system support two kind of antennas for providing outdoor (e.g., a 5G MIMO mid-band antenna) and indoor (e.g., Ericsson Dot system) coverage. Such coverage is used to extend 5G coverage in vertical offices or in events. 5TONIC regularly cooperates with 5G handset and CPE manufacturers for their use in E2E validation activities of mutual benefit. 5TONIC establishes regular cooperation with 5G handsets and CPE manufacturers for their use in E2E validation activities of mutual benefit. WNC, Fivecomm, Xacom and ASKEY are representative manufacturers engaged in 5TONIC activities. 5TONIC also integrates in its 5G Core a MEC implementation that offers multiple capabilities, accelerators and frameworks for rapid development of MEC solutions with optimized HW infrastructure resources and increased computing and IOPS (Input/output Operations per Second) performance and reduced network latency. The platform integrates OpenNESS and can reside on micro data centres close to the access network, aggregation points, regional data centres and central offices, as best suited for edge app developers. The platform offers API integrations compliant with GSMA Operator Platform and ETSI MEC.

6G-XR South Node Beyond State-of-the-Art

5GBarcelona and 5TONIC will see upgrades on its equipment and functionality to support the 6G capabilities by addressing four main pillars: (1) AI/ML powered XR service awareness; (2) holistic end to end XR awareness, service migration and continuity, (3) XR-aware eMBB/URLLC; and (4) native XR session control. The infrastructure will also be upgraded to meet these capabilities. Firstly, (1) the AI/ML powered XR service awareness aims to integrate decision-making components and algorithms that enable to optimize the usage of resources (e.g., XR applications, energy efficient policies) in each segment and keep track of their serving needs across multiple domains. Secondly, (2) the holistic E2E XR awareness, an extension to AI/ML-powered XR service awareness that will require extending the inter-domain and intra-PLMN mechanism and APIs defined by the GSMA and TMF, as well as mechanisms for edge federation and PLMN roaming / federation with focus at service migration / continuity. Thirdly, (3) the XRaware eMBB/URLLC is an evolution of the eMBB/URLLC use case aiming at dealing with superior downlink and uplink bandwidths and, at the same time, minimizing E2E application delay. In practice, this evolution for XR will require the use of additional carriers or RATs (Radio Access Technology) and an optimal selection of edge resources based on load conditions and/or proximity to the end user to reduce latencies. Finally, (4) the Native XR session control will take care of the integration of the XR service control layer (e.g., IMS) with the XR services and ecosystem (e.g., the media session orchestrator), as well as with the holistic XR orchestrators mechanism derived from above mentioned development.

Besides this, the infrastructure will also be upgraded: (i) RAN will be extended to operate in new mid and mmW bands with commercial and open solutions, as well as updating the existing radio infrastructure to 3GPP Release 16 and 17 and WIFI 7. (ii) The edge will add new servers, mostly focusing on cores and memory processing (considering both CPU and GPU resources, e.g., to use with AI workloads). The (iii) data centre will introduce new servers in 5TONIC to achieve full compliance of the 5G core network with 3GPP releases 16 and 17. Finally, (iv) 5GBarcelona will incorporate XR infrastructure, in particular, two volumetric, light field powered, capture sub-systems and four holo-portation nodes, including VR headset, VR-ready PCs or laptops, and RBG-D capture sensors.

3 SCOPE OF THE CALL

The purpose of the open call is to address identified gaps in the 6G-XR infrastructures and targets the development and extension of the four research infrastructures to make them ready for advanced experimentation in upcoming project open calls for experimentation. In particular, the project is looking for networking, computing enablers, XR enablers, RAN enablers and Sustainability enablers in terms of the following implementations.

1. Automated IP network measurement system [Mentors: UOULU, VTT]
2. Edge discovery API [Mentors: CGE, TID]
3. Holographics API [Mentors: Matsuko, TID]
4. CAMARA QoD implementation over Open5GS [Mentor: i2CAT]
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15. RAN enablers or/and Sustainability enablers for local green energy, controlling energy sources and charging/discharging, energy measurement and optimization solutions

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 more detailed description of the above topics is as follows.

1. Automated IP network measurement system

Currently, testing is done manually. Test systems are planned case-by-case in need of testing done in live 5G network. Firstly, the system is defined and documented. Secondly, the required SW is installed, and the system is configured. Thirdly, the system is tested, and possible corrections are made. Only after that can testing be started. Lastly, after the manual setup process also the testing itself is done manually and the results are stored manually on the database.

The expectation is to have an automatic testing system created at first phase for the Qosium tool utilized for network related KPI measurements at the 6G-XR North Node. The intention is to reduce the amount of manual work done for each testing item to a minimum. Outcome of the project is to create an automatic test system utilizing the Qosium tool so that the system is defined, documented, installed, and tested according to mutually agreed requirements for the system that are based on the 6G-XR KPI's. Intention is to install required SW (and possibly HW) modules to the entire 5G Test Network so that it enables easy configurability and execution of the IP related parameters of the test network in question.

In 6G-XR, sustainability is not just a trendy term, it's a deep-rooted commitment we uphold strongly. We fully acknowledge the pivotal role that locally sourced renewable energy resources play in mitigating our carbon footprint and nurturing a more environmentally friendly future. To ensure the effective utilizing of these renewable assets, we are integrating beyond state-of-the-art technology into our energy measurement framework and sustainability use case. An important component of our approach involves the implementation of an automated IP network measurement system. This innovative system not only supports the dependability and performance of our localized renewable energy sources but also facilitates data-centric decision-making processes.

Following features are needed for the automated test system from the sustainability perspective:

Traffic Monitoring: It tracks the flow of data packets within the network, identifying patterns, bottlenecks, and potential issues that may affect IP-network performance.
Security Monitoring: It can detect unusual or suspicious IP-network activity that may indicate security breaches or cyberattacks.
Alerting and Reporting: The system can generate automated alerts and reports when predefined thresholds or anomalies are detected, enabling network administrators to take timely corrective actions.
Historical Data Analysis: It stores historical network performance data, allowing for trend analysis, capacity planning, and the identification of long-term network improvements.

2. **Edge Discovery API**

The expected outcome of the project is to create a development of opensource code implementation of the CAMARA Edge Discovery API that can connect SBI to the NEF APIs from the network to provide NBI a list of potential best edges based on the network information that can be collected from SBI APIs and considering the mapping in between edge locations and UPF locations. Aligned with CAMARA Edge Discovery API subgroup.

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, this Edge Platform provides an API and SDK for the user client that considers the UE location. This API will support efforts in South Node Use Cases.

With this open call, the intention is to look for a solution of Edge Discovery API that can be developed and will support the experimental infrastructure.

Thus, this potential topic encompasses two categories of the Open Call: Network and Computing Enablers (primary) and XR enablers (secondary).

3. Holographics API

The expected outcome is an API plugin that exposes functions for third parties to create services based on the holographic service. This can be both for real time holographic meetings/rooms and to delayed streaming holograms. Therefore, some of the key functions of the API will be at a very high level:

- To create URL links to holograms (either delayed streaming or live holograms).
- To manage such links and the associated holograms (either delayed streaming or live).
- To browse the available holograms for a given user and obtain the hologram URL links.

6G XR will define and provide the experimental infrastructure for the 6G Control Plane for XR communications. Initially, this will be based on IMS and IMS Data Channel for XR session-oriented applications and on top of this, the Matsuko holographics service platform will be integrated as a driving use case. The basic session XR Management functions offered by this so-called 6G Control Plane is powerful but very low level and for certain third parties to exploit and create application use case can be complex. The expectation is to create a more abstracted higher-level exposition for third parties coming to 6G-XR to create and validate use cases using holographic communications.

4. CAMARA QoD implementation over Open5GS

The expected outcome is an open-source implementation of CAMARA QoD API validated over a lab based 5G testbed provided by the 6G-XR. The laboratory testbed will consist of:

1. An Amarisoft based gNB,
2. An Open5GS core network, and
3. Two UEs connected to the 5G network.

The open call winner will implement the CAMARA QoD and will connect it to the Open5GS instance running in a 6G-XR lab. The validation of the CAMARA QoD API should demonstrate how one of the UEs can dynamically gain a priority over the air interface when the application function triggers the CAMARA QoS API.

The 6G-XR Use Case 1 requires CAMARA QoD API (**https://github.com/camaraproject/QualityOnDemand**) to prioritise a traffic flow from an XR device upon a trigger issued by the application function. The CAMARA project defines the north-bound interface towards the application function but does not release the implementation of the backend that enforces the priority for the required session. The goal of this open call project is to demonstrate an implementation of CAMARA QoD API over a testbed featuring an open5gs (**https://open5gs.org/)** 5GSA core.

Thus, this potential topic encompasses three categories of the Open Call: Network and Computing Enablers (primary), RAN enablers (secondary), and XR enablers (secondary).

5. FabLab digital twin environment

The expected outcome of the project is to create a digital twin of the University of Oulu Fab Lab that can then be utilized in the "Collaborative 3D Digital Twin-like Environment" use case. The environment is to be fully integrated and ready to be used. The virtual FabLab should reflect the real world Fab Lab one-to-one. User interfaces(es) are needed to control the handling of the 3D model that is being reviewed and to control printing process in the real-world 3D-printer.

In 6G-XR the Use Case "Collaborative 3D Digital Twin-like Environment" the digital twin environment is used to evaluate 3D objects by a remote user and Fab Lab Instructor. After accepted review of the modelling, the object is printed from the Digital Twin environment in the real-world Fab Lab using a real 3D-printer. Printed object is then delivered to the remote user.

6. Advancing Heterogeneous XR Capture Systems

The expected outcome of the project should focus on two specific areas:

1. **Emerging Volumetric Capture Approaches**: 6G-XR encourages proposals exploring innovative and cost-effective volumetric capture approaches, particularly those with a low barrier to entry, and considering multi-sensor setups. This could involve the inventive use of smart devices and their sensors to achieve volumetric capture. Proposals should aim to broaden accessibility and affordability, enabling a wider range of users to participate in XR experiences through affordable and wireless-enabled end devices. However, proposals with a stronger focus on professional fields, like multi-sensor Free Viewpoint Video (FVV) capture setups, are also in scope.
2. **User-Friendly Extrinsic (Self-)Calibration Methods**: 6G-XR seeks proposals for user-friendly calibration methods for vision-based volumetric capture systems. Current calibration processes can be complex, time-consuming, and may vary between different systems, posing challenges for users. Therefore, 6G-XR encourages the development of intuitive and streamlined calibration methods that simplify the setup process for users. Additionally, these methods may lay the groundwork for further sensor fusion in XR capture, enhancing the overall capture quality and user experience.

Proposals should clearly outline the technical approach, potential impact, and feasibility of the proposed solutions. Emphasis should be placed on practical implementation, scalability, and compatibility with existing XR capture systems and RAN capabilities. Furthermore, proposals should consider the user experience and strive for intuitive and efficient calibration processes.

The 6G-XR project is dedicated to generating high-quality XR environments through the utilisation of mixed capture systems and enabling cross-device participation. This heterogeneous environment is crucial for enhancing engagement with XR experiences. Participants in these environments may employ a wide range of technologies and sensors based on their individual needs and resources.

Thus, this potential topic encompasses two categories of the Open Call: XR Enablers (primary) and RAN enablers (secondary).

7. XR fusion

The expected outcome of the project is to explore innovative approaches for achieving the highest possible fidelity of mixed sensor capture systems for XR. The proposed innovations should run on the Edge allowing for efficient processing and minimizing latency.

A major challenge in mixed (multi-sensor) sensor capture systems for XR is fully utilizing the available data and a priori knowledge to achieve the highest possible fidelity of the fused content. Also, 6G-XR looks for innovative approaches such as Neural Radiance Fields (NeRF), which offer a powerful method for 3D scene representation and reconstruction from sparse data as it would be provided by the sensors of the volumetric capture system, or more general subjects-aware fusion, which identifies subjects/objects, and fuses data onto an initial generic model.

Completion methods and algorithms for volumetric video formats, with a key focus on Point Clouds and/or NeRF, are also in scope. These would allow to complete hidden or non-visible parts of for instance a captured hologram, by relying on known information from a dataset. In addition, these would allow to correct wrong estimations and reconstructions.

Thus, this potential topic encompasses two categories of the Open Call: XR enablers (primary) and Network and Computing Enablers (secondary).

8. Wireless Connectivity for XR Sensors

6G-XR is seeking proposals with the expected outcome of enabling wireless transmission of XR sensor data using either a hardware dongle that translates HDMI or USB signals to 5G or 6G and back, or by converting existing hardware such as wireless HDMI streaming to VR headsets. The proposed solution should be able to handle the high data rate of XR sensor data and provide reliable wireless connectivity with low latency. 6G-XR welcomes proposals that utilise novel approaches to wireless XR sensor connectivity, including hardware dongles or software solutions based on existing hardware. The proposed solution should also consider the security and privacy of the transmitted data. The solution should provide robust security measures to prevent unauthorised access to the transmitted data and ensure the privacy of users.

The proposed solution should be designed with the end-users in mind, ensuring that it is user-friendly and intuitive to use. The proposal should include a detailed plan for testing and validation of the proposed solution to demonstrate its effectiveness.
Thus, this potential topic encompasses two categories of the Open Call: XR Enablers (primary) and RAN enablers (secondary).

9. Encoding solutions optimised for Point Cloud/Volumetric Video compression

The expected outcome of the project should be the development of new encoding/decoding solutions to be integrated as new XR Media Function in the 5GBarcelona research infrastructure. The final XR Media Function should be able to receive raw Point Cloud/Volumetric video formats as input and provide compressed media streams as output and vice versa. The integration should be made by generating a containerised (Docker) network function (VNF/CNF) to be run on top of Kubernetes.

Specifically, proposals should address one or more the following aspects:

- Reference or standardised encoder/decoder: new encoders/decoders that are tailored or natively designed for Point Cloud or Volumetric Video compression. The proposals may include state-of-the-art experimental solutions or standardised ones. For example, the proposals may take into account the new codecs proposed by the MPEG standardisation group (**https://mpeg.chiariglione.org/standards/mpeg-i/point-cloud-compression**). MPEG also provides some reference implementations, even they are meant only for evaluation purpose and may require improvements to be mature enough for a real deployment. In any case, the proposals should not limit to standard-compliant solutions and other (beyond) state-of-the-art ones are also welcome.
- Scalable methods for encoding: pre-processing can reduce the amount of processing resources for compression and the final amount of compressed data. For example, partitioning the original image into tiles (tile-based video coding) or defining a region-of-interest (ROI-based video coding) allow to fine tune the encoding bitrate. Complex tiles or more important ROIs may require higher quality and then, higher bitrate to encode them compared to the rest of the image. Thus, a non-uniform distribution of the quality across the image may be employed to reduce the processing resources. This kind of methods to reduce the processing resources are envisioned in order increase the scalability of the encoding operations.
- Motion/time-aware/differential reconstruction and encoding: solutions that exploit the spatial and temporal redundancy are considered of high interest in order to reduce the amount of data to be transmitted over the network. To stream a new video frame, the encoded information can ideally contain only the variations/changes of the scene compared to the last video frame.
- GPU-acceleration: encoder/decoder that uses the GPU in order to accelerate the processing of Point Cloud/Volumetric Video. NVIDIA GPU-enabled or other acceleration solutions may be integrated in order to speed up the encoding process and provide also a reduction in end-to-end latency.
- Supersampling methods for Volumetric Video (on Edge): supersampling can increase the quality the displayed image, allowing to render higher resolution images and perceive a better quality when they are later displayed. This operation can be done at the Edge such to not increase the processing at the client node.

With this open call, the intention is to evolve the current encoding/decoding solutions and/or to develop new ones as an XR Media Function to be integrated in 6G-XR research infrastructure. The objective is to provide enhanced encoding schemes or methods that can reduce the computational load of the system, increase the resolution, and/or save network bandwidth when transmitting the volumetric video, with a key focus (yet not limitation) to holographic user representations. Optionally,

the proposed solutions can also address the integration with the Edge or methods to monitor their energy consumption.

Thus, this potential topic encompasses three categories of the Open Call: XR Enablers (primary), Networking and Computing enablers (secondary) and Sustainability enablers (secondary).

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

The expected outcome of the project should be the development of new streaming solutions to be integrated as new XR Media Function in 6G-XR research infrastructure. The final XR Media Function should be able to receive an encoded video stream and stream it to a video player compliant with the developed streaming protocol. The integration should be made by generating a containerized (Docker) network function (VNF/CNF) to be run on top of Kubernetes.

Specifically, proposals could address one or more the following aspects:

- QUIC as transport-layer protocol: current streaming protocols are based on UDP (WebRTC) or TCP (DASH) transport-layer protocols. However, the HTTP/3 protocol is designed to work on top of the new QUIC transport-layer protocol which has some intrinsic advantages compared to previous one. First, QUIC includes encryption as mandatory feature to secure the communication. Moreover, it includes congestion-control mechanisms on top of UDP such to guarantee a reliable delivery like TCP but reducing the overhead. For these reasons, solutions such as WebRTC over QUIC (and ingestion standard mechanism such as WHEP) and DASH over HTTP/3 could be suitable for low-latency and scalability of XR video delivery, respectively.
- Adaptative streaming strategies for volumetric video streaming: adaptive streaming is meant for on-demand 2D video content where network performance metrics can be assessed at the media player to select the appropriate video representation. However, when dealing with XR video content and/or low latency constraints, the widely used adaptation algorithms may not be the optimal solutions and can generate unfair XR experiences among the users. New methods are required in order to provide a coordinated adaptation of XR media content that aims at guaranteeing the best quality of experience to the users, also taking into account intrinsic characteristics of volumetric video contents (e.g., viewpoints, distances, non-visible areas, etc.).
- Tiled streaming of large volumetric scenes: legacy streaming protocols are designed to send consecutive temporal video segments including all the spatial information. When considering XR video content, spatial tiles can be defined such to divide the entire virtual scene in several spatial sections. Considering the position of the viewer at any moment, it should be possible to send only a part of all sections (a limited subsection of the entire environment) as some sections are not in the viewer's field of view. Thus, it allows to prioritize the stream of the viewable video content and reduce the bandwidth utilisation.

With this open call, the intention is to accommodate innovative and beyond state-of-the-art streaming solutions, employing standard streaming protocols and methods or integrating emerging ones. In particular, the streaming server should be developed as an XR Media Function to be integrated in 6G-XR research infrastructure. The objective is to provide enhanced streaming solution that try to

minimize the end-to-end latency and/or increase the scalability of the media delivery. The target solutions and methods should be also compliant with emerging delivery paradigms in which Edge processing typically intervenes in client-to-client or server-to-client communications. Optionally, the proposed solutions can also address methods to monitor their energy consumption.

Thus, this potential topic encompasses three categories of the Open Call: XR Enablers (primary), Networking and Computing enablers (secondary) and Sustainability enablers (secondary).

11. QoE assessment models and methods for XR experiences

The expected outcome of the project is to create an initial version of a QoE model and evaluation methods to assess XR experiences and supplement the KPI and QoS telemetry measurement system that is going to be deployed in the 6G-XR project. This enables a complete multilayer monitoring system integrated at a 6G-XR testbed.

Monitoring, modeling, and estimating the Quality of Experience (QoE) in video streaming sessions is crucial for providing users with a satisfactory and enjoyable experience. For traditional 2D video streaming, there exist numerous studies on modelling the user's QoE that employ objective Quality of Service (QoS) metrics to estimate the QoE. In contrast, the assessment of QoE for XR experiences is still in its initial phases and there is a lack of analytical QoE models that researchers can leverage. A QoE model for XR experiences should consider various objective factors such as visual quality, interactive and motion capabilities and performance, and audio quality, among others, to assess the overall quality of the user's experience. Moreover, it is also influenced by a wide range of factors apart from the mentioned ones and specific of each XR application or use case. The large space formed by these factors make the construction of QoE models much more challenging than conventional videos. A deep analysis of the monitored service is required in order to select the parameters that are going to feed the QoE model.

The intention in this open call is to develop QoE assessment models and methods for XR experiences that supplements the XR enablers monitorisation system.

12. XR Interaction and Collaboration Software Modules and APIs

The expected outcome of this project is modular software libraries, SDKs, and APIs, easily integrable in (Windows-based) Unity projects and aimed at providing a multi-modal interaction and collaboration tools / features for both single-user and multi-user holo-portation VR/XR scenarios.

In the path towards the Metaverse, (virtual representations of) humans are also expected to conduct activities with and within the XR environments, potentially in a collaborative manner with other remote humans. Nowadays, a wide set of Social Virtual Reality (VR) or Metaverse applications exist, which already provide a wide set of multimodal interaction and collaboration features. Examples include: (shared) video watching, (shared) boards, (co-)design and (co-)creation tools, gamification tools, etc.

Proposals aimed at delivering both state-of-the-art and innovative tools, SDKs and APIs to enable rich multi-modal interaction and collaboration in XR services (with a strong focus on VR), thus augmenting the possibilities offered by multi-user holographic communications are encouraged. Tools and features aimed at enabling interaction and conducting tasks with the VR / XR environment (e.g., using PC features and tools within VR) are also in scope.

These tools and software modules must be compliant with Unity engines and make use of off-the-shelf (and preferably affordable) VR / XR hardware.

Thus, this potential topic encompasses two categories of the Open Call: XR enablers (primary) and potentially Network and Computing Enablers (secondary).

13. Multi-sensory communications and interactions

The expected outcome of the project is hardware accompanied with modular software libraries, SDKs, and APIs easily integrable in (Windows-based) Unity projects and aimed at providing multi-sensory communication and interaction solutions for both single-user and multi-user holo-portation VR/XR scenarios.

In the path toward the Metaverse, both the audiovisual interaction with and within the XR / VR environments and between multiple (remote) users are expected to be augmented with multi-sensory stimuli and data. Among them, haptic communications are acquiring an increased relevant, a wide set of solutions are being proposed by the community, ranging from low-cost (vibration-based) methods to more advanced force-feedback methods, via gloves, suits and other existing mechanisms.

Proposals aimed at delivering both state-of-the-art and innovative hardware solutions accompanied with tools, SDKs and APIs to enable rich multi-modal interaction, collaboration and communications in XR services (with a strong focus on VR), thus augmenting the visual and auditive senses with other multi-sensory channels and stimuli, with a strong focus on haptics are encouraged.

These tools and software modules must be compliant with Unity engines, make use of off-the-shelf (and preferably affordable) VR / XR hardware and/or ad-hoc but fully functional easily-replicable prototypes.

Thus, this potential topic encompasses two categories of the Open Call: XR enablers (primary) and potentially Network and Computing Enablers (secondary).

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

End-to-end network slicing is a concept in telecommunications and networking that involves creating customizable and isolated virtual network segments, or "slices," within a single physical network infrastructure to cater to the specific needs and requirements of different applications, services, or user groups. These slices provide dedicated resources and connectivity tailored to the unique demands of the applications or services they serve, while ensuring isolation and security from other slices. The

key elements of and end-to-end network slicing include: Customization, Isolation, Single Physical network, Dedicated Resources, Dynamic and Scalable, Management and Orchestration, and Use cases,

RAN slicing is a technology in 5G and mobile networks that divides the Radio Access Network into separate, dedicated virtual slices to tailor the allocation of radio resources, latency, and capacity for specific applications and services while maintaining network isolation and performance guarantees. Key elements in RAN slicing are Customization, Resource Allocation, Isolation, QoS, 5G Networks.

The area for development lies in the RAN resource sharing of the End-to-end slicing. 5G system in use in 6G-XR North Node is Open5GS Core with OAI RAN SW with USRP n310 radio. Another option for the system is to use Open5GS Core with SRS-RAN + USRP n310 radio. Target is to create several 5G End-to-end slices with each slice having their own resource allocation of the 5G network. The need is to implement slicing also in the RAN so that all the RAN resources are dynamically and efficiently allocated to the created slices.

15. RAN enablers or Sustainability enablers for local green energy, controlling energy sources and charging/discharging, energy measurement and optimization solutions

This topic is looking for proposals in two distinctive areas: RAN enablers and sustainability enablers for local green energy. The RAN enablers sought out for need to be interesting and innovative, but sufficiently mature, RAN technologies that

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

The sustainability enablers for local green energy, controlling energy source and charging/discharging, energy measurement and optimization solutions is looking for proposals for the 6G-XR north node. Suitable proposals provide enhancements to, for example, the monitoring and collection of infrastructure's components' energy consumption data, provide predictive elements to infrastructure's energy consumption, provide a continuous environmental sustainability indicator of operation, and energy consumption optimization mechanisms.

A topic of interest on joint RAN and Sustainability enablers is the deployment of the Network Exposure Function (NEF) as essential for enabling the smooth exchange of information between radio access and core network systems. NEF will be utilized to incorporate energy weather forecasts into a north node research infrastructure to facilitate horizontal integration. NEF is expected to provide an exposed weather forecast API for more frequent data transmission. This capability can be integrated into the higher application layer and made accessible to developers for application development.

4 GUIDE FOR PROPOSERS & SUBMISSION

4.1 ELIGIBILITY

A proposal will be considered eligible for the 6G-XR Open Call if it complies will ALL the following rules:

- The proposal is submitted by a legal entity established and based in one of the EU Member States or a Horizon Europe Associated country. The targeted organisations in this Call are (i) SMEs; (ii) Industry; (iii) Research/scientific organisation; (iv) Academia.
- The proposal is submitted by a single party. The submission of proposals by consortia is not eligible.
- The proposer **CANNOT BE AFFILIATED TO ANY OF THE CONSORTIUM PARTNERS OF THE 6G-XR PROJECT**.
- The proposal complies with the type of activity qualified for financial support: (i) Personnel costs for development of software and equipment; (ii) Travel costs; (iii) Overhead costs (25% of the direct costs).
- The proposal is submitted in English.
- The proposal is submitted through the official Open Call Submission Tool on the 6G-XR website providing all the required documents (completed proposal template and declaration of honour).
- The proposal has been submitted within the deadline set in this document. Late proposals will not be admitted.
- The proposal complies with the Regulation (EU) 2016/679 (General Data Protection Regulation) regarding all personal data that might be included in the proposal.

4.2 PROPOSAL TEMPLATE

The use of the specific proposal template is mandatory.

The full proposal template can be found in Appendix A of this document.

Please note that in the draft proposal that will be submitted for the feasibility check, **at least sections A, B, C and J should be fully completed**. Please be aware that the partner responsible for the feasibility check will NOT review draft proposals or propose any changes to the proposal. The partner will only give feedback on the feasibility of the proposed Experiment based on the completed sections A, B, C and J. The feasibility check does not provide a commitment that the proposal will be selected.

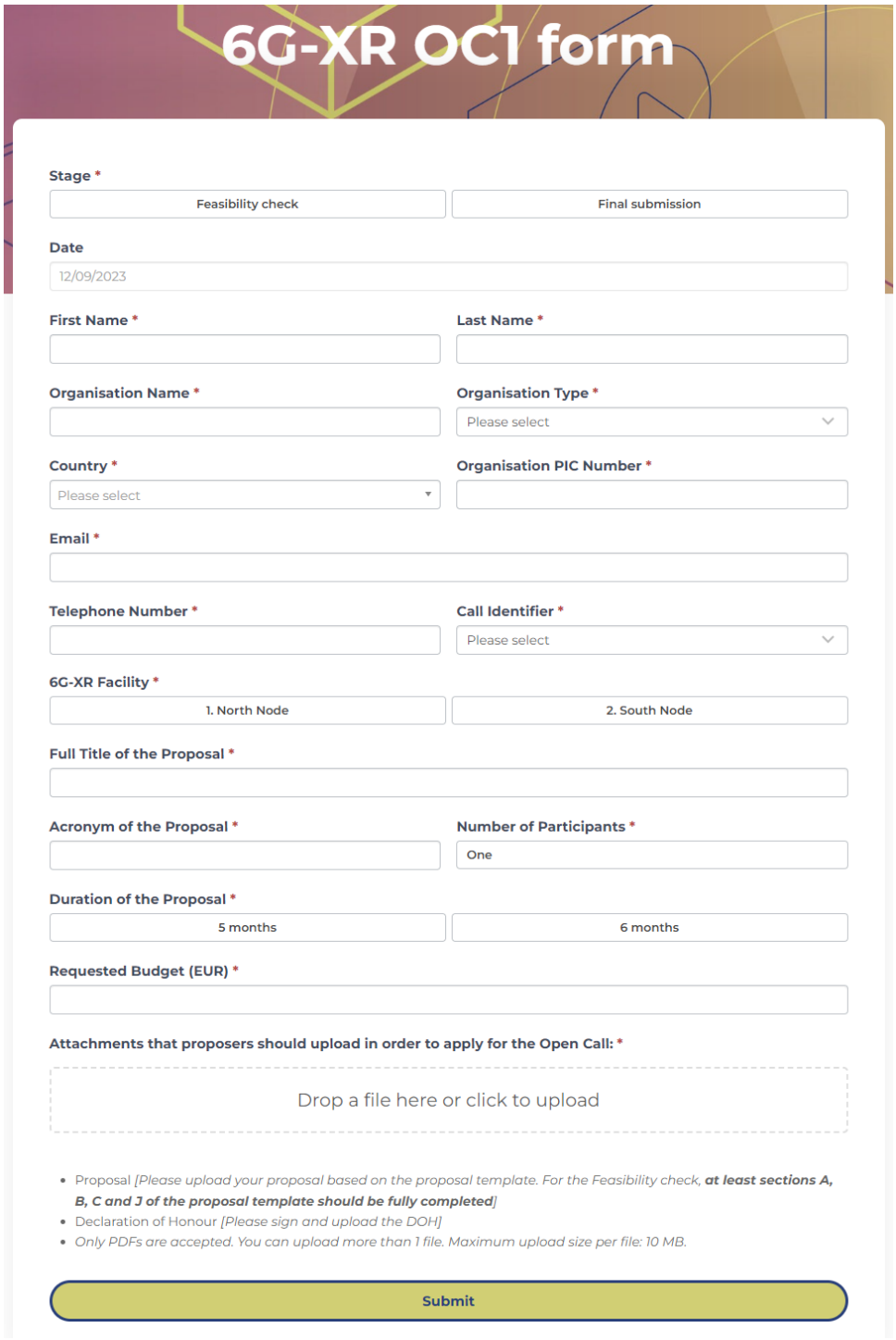
4.3 SUBMISSION PROCESS

Before submitting the proposal, please download and carefully read the provided documentation and templates through the link below:

www.6g-xr.eu/open-calls/oc1

The proposal must be submitted in English and through the 6G-XR online form that is located on the same page.

All form fields should be filled with no exceptions. The online form, as presented below, contains key information about the proposer, the proposal, and the requested budget.



A feasibility check is required before submission. Proposers are **STRONGLY** encouraged to submit their draft proposal by Tuesday 31 October 2023 at 17:00 CET (for more details see Section 4.4).

Once the deadline for submitting a proposal is reached, the call will be closed and the evaluation process will start. The duration of the evaluation of the proposals and approval by the EU is planned to be kept within one month. The outcome of the evaluation will be communicated to the proposers via email as soon as the process is completed. The notification will include a report of the evaluation process where for each criterion the score and the motivation of the evaluators will be reported.

It is highly recommended to submit your proposal well before the deadline. If the proposer discovers an error in their submitted proposal, and provided that the call deadline has not passed, the proposer can re-submit it (for this purpose please contact us at opencalls@6g-xr.eu).

Failure of the proposal to arrive within the deadline for any reason, including network communications delays or working from multiple browsers or multiple browser windows, is not acceptable as an extenuating circumstance.

Selected experiments can start at the earliest on 15 December 2023, but no later than 15 January 2024. Please note that a later start may imply a shorter experiment.

4.4 FEASIBILITY CHECK & MENTORING

The Open Call 1 is looking for proposals in the 6G-XR enablers domain. In particular, enablers suited for the development of holographic communications, digital twinning, and network measurement and quality assurance automation are being sought after.

The open call proposers are encouraged to contact the 6G-XR consortium and share their intentions in order to verify the feasibility of their proposals to be implemented in the scope of the project. The feasibility check will be carried out by the 6G-XR consortium partners acting as Mentor organisations with the support of other partners as needed. The description of the experimental facilities in Section 2 of this document provides insights of the state and targets of each of the facilities and hence proposals should adhere to those targets. Initial feedback will be provided for the proposed planned activities. In order to receive feedback, a description of planned experiment (sections A, B, C and J of the proposal template) must be submitted through the 6G-XR Open Call Submission Tool on the project's website by the designated deadline www.6g-xr.eu/open-calls/oc1 (Tuesday, 31 October 2023 at 17:00 CET). Under the tab 'Stage', please select the option 'Feasibility Check' in order to submit your proposal for a feasibility check. Please note that in order to make a final submission, you have to select 'Final Submission' under the tab 'Stage'. **If you have submitted your proposal under the 'Feasibility Check' option, it will not be considered as a final submission and will not be evaluated.**

Actual feasibility check of the proposal will be conducted after the submission deadline.

Each awarded project will be supervised by a project partner (mentor) who is responsible for supporting the experimenters during execution and following up on the experiment results.

The key responsibilities of the mentors to the third-party experimenters will be to:

- Understand the requirements and needs of the experiment.
- Providing insight into the technical capabilities.
- Follow the progress and reporting process for each experiment.

- Making recommendations to the 6G-XR consortium (Work Packages 2-6) for upgrades and helping validate the experiment's applicability.
- Coach the experimenter during the execution phase.
- Follow up on the results/outputs of the experiment.
- Identifying issues to be escalated to the 6G-XR partners which pose a risk to the experiment.

4.5 FURTHER ASSISTANCE & CONTACT INFORMATION

Important information is already included in the available Open Call 1 documents (Information Document, Proposal Template, Declaration of Honour, Draft Third Party Agreement). Please review thoroughly these documents as well as the Frequently Asked Questions section of the Open Call 1 page.

If the answer to your question cannot be found in the documentation, you can send your question to the following email address: opencalls@6g-xr.eu. In case your question refers to technical details of the offered research infrastructure, you can send your question to the same email address opencalls@6g-xr.eu, clearly mentioning which infrastructure the question relates to.

Questions can be sent at the latest 7 calendar days before the submission deadline.

5 EVALUATION AND AWARD PROCEDURE

Evaluation and ranking will be carried out by an external jury of experts, which cannot be part of the consortium and cannot evaluate proposals where a conflict of interest can be identified. For each of the received proposals, at least two assigned experts will perform reviews independently of each other. Afterwards, consensus meetings for all proposals among involved experts will be held, where a common opinion and rating will be built up for all the proposals. The last step in the evaluation process will be to create ranking among all received proposals, which will be done in cooperation with all independent experts involved in the evaluations.

Proposals submitted by Parties meeting the requirements will be further evaluated according to the following criteria:

1. **Clarity and methodology:** Soundness of the approach and credibility of the proposed methodology
2. **Ambition:** Advancement regard the state-of-the-art and expected output.
3. **Impact:** Technology and domain fit to 6G-XR scope and objectives.
4. **Replicability** of the proposed solution.
5. **Contribution to standardisation** of the proposed solution.
6. **Team capacity to perform**; knowledge, technological and business expertise; commitment; research domain & track-record.
7. **Value for money:** quality and effectiveness of the requested resources.
8. **SME participation** is encouraged.
9. **Gender dimension awareness** requested to the proposers.
10. **Maturity/trajectory of the proposing organization/proposed development** in the specific field of their proposal.

Criterion	Short description	Weight	Maximum score	Minimum threshold
1	Clarity & methodology	1	5	2
2	Ambition	2	10	5
3	Impact	2	10	5
4	Replicability	2	10	5
5	Contribution to standardisation	1	5	2
6	Team capacity	2	10	5
7	Value for money	1	5	2
8	SME participation	1	5	n/a
9	Gender dimension awareness	1	5	2
10	Maturity of the proposing organisation	1	5	2
Maximum total score			**70 (max)**	**30 (min)**

Proposals not reaching the minimum thresholds either in individual criteria or in the overall score will not be considered for funding. The proposal template requires to provide an implementation plan including deliverables, and a cost estimate justifying the costs and resources. In the evaluation phase, the resource adequacy to fulfil the planned work will be assessed and the justification of the budgeted items. Before the award of the grant, it will be checked whether the third party is a legal entity with a stable financial history and has not been declared insolvent.

The evaluation of the proposals and approval by the Open Call Steering Committee is scheduled to be finalised within one month from the closure of the Call.

6 REPORTING

The third party will be required to submit a final report after completion of the Experiment. The below template, which is subject to changes, needs to be used and will include the following sections:

Part A. Summary

Part B. Detailed description

This section describes the details on the Experiment It includes:

- B.1 Concept, Objectives, Set-up and Background
- B.2 Technical results and Functionality Validation
- B.3 Impact

Part C. Feedback to 6G-XR

This section contains valuable information for the 6G-XR consortium and describes the third party's experiences while performing the Experiment.

Part D. Promotion Material

This section provides information that can be used to create communication material based on your Experiment for promotional purposes.

Part F. Method of Replicability

This section describes how the proposed solutions can be replicated.

This report will serve as an evaluation tool to approve the payment of the third party, but will also serve as: (i) input for the further development and/or extension of the 6G-XR facilities, and (ii) identification of gaps in the offered facilities and functionalities. Part of this report may be used by the 6G-XR consortium for inclusion in their reporting documents to the European Commission and in public presentations. Inclusion of confidential information should therefore be indicated and discussed with the 6G-XR consortium. This report will also be used for the formal review by the European Commission, which the third parties should attend if required by the European Commission. The final template will be made available during the execution of the Experiment.

7 FINANCIAL AND CONTRACTUAL INFORMATION

7.1 THIRD PARTY AGREEMENT

Once a proposer is selected to perform the proposed Experiment, the proposer will become a third party receiving financial support, and to this end needs to sign a Third Part Agreement.

The template that is available on the project website www.6g-xr.eu/open-calls/oc1 is a draft and is subject to changes.

PROPOSAL TEMPLATE

The proposal template is available on the project's website www.6g-xr.eu/open-calls/oc1 in a Word document format. Instructions for filling in all sections are included. Please follow the submission instructions.