Cloud-native Multimedia Functions and 6G Technologies in 6G-XR

Roberto Viola

Vicomtech

6G-IA & 5G-MAG Joint Workshop on "Media beyond 5G"

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www.6g-xr.eu

Agenda

- Overview of the project
- Multimedia use cases
- Cloud-native Multimedia Functions (XR Enablers)
- 6G Technologies for Multimedia (Network Enablers)
- Reference documentation

Overview of the project

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

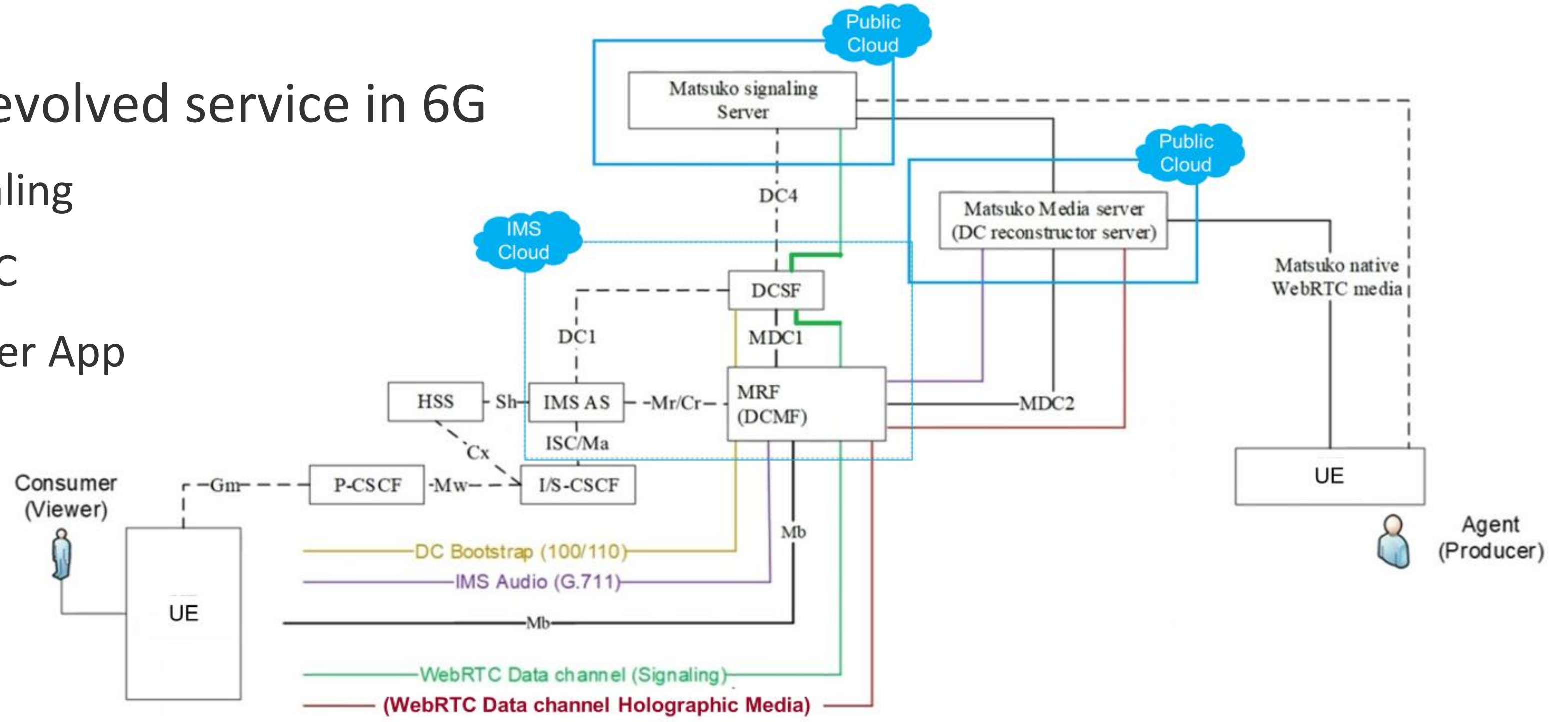
- SNS JU Phase 1 Stream C – SNS experimental infrastructures
- 15 partners from 8 countries
- 4 research infrastructures
  - North Node (Oulu, Finland): UOULU 5GTN and VTT 5GTN
    - https://5gtn.fi/
  - South Node (Spain):
    - 5GBarcelona (Barcelona): https://5gbarcelona.org/
    - 5TONIC (Madrid): https://www.5tonic.org/
- Three application areas with five use cases
- Three open calls
- Project website: https://www.6g-xr.eu/

Multimedia use cases

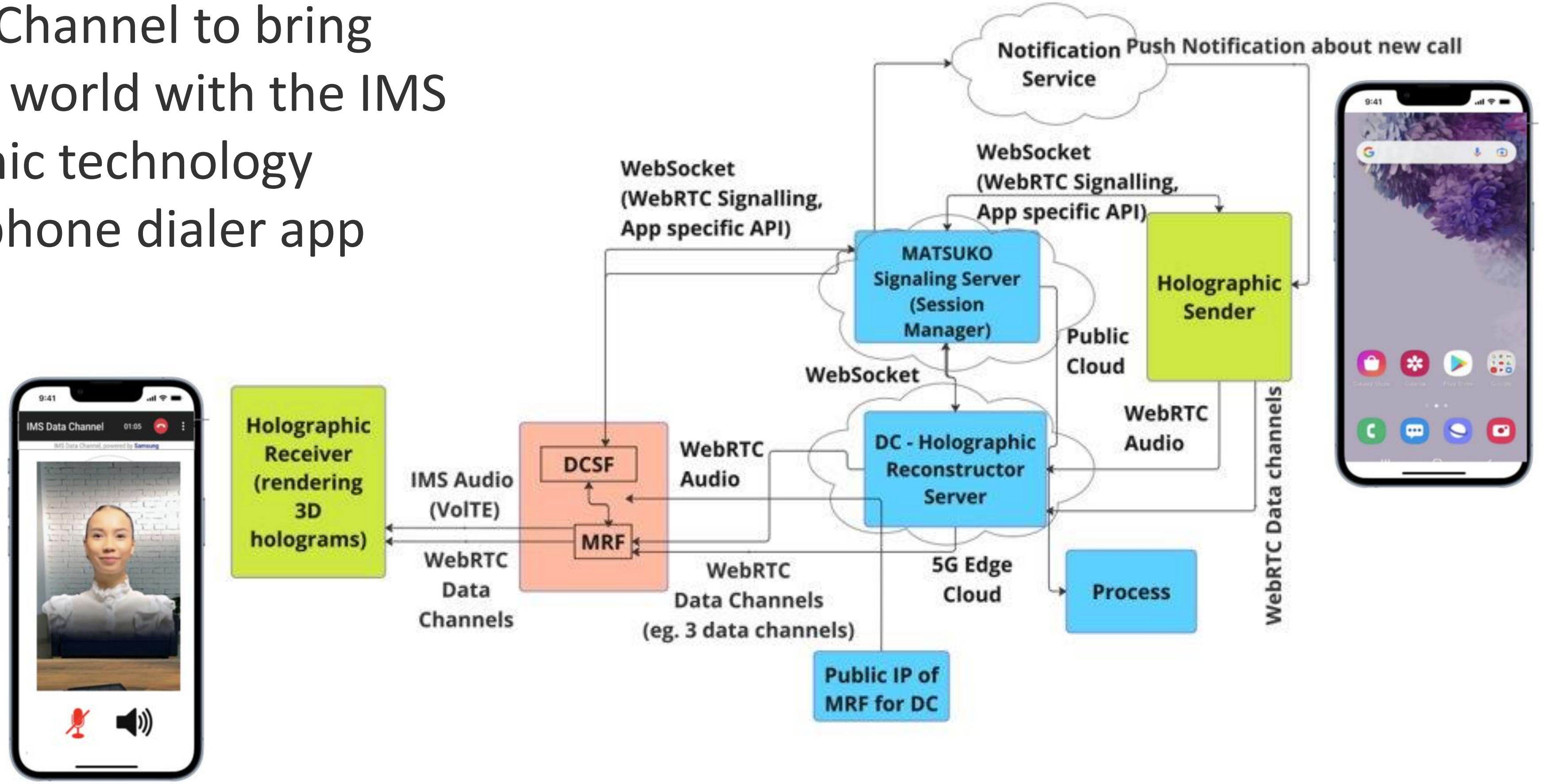
- **Real-Time Holographic Communications**
  - **UC1 - Network-assisted Rate Control (VR / 6G user plane)**
  - **UC2 - Edge Selection and Lifecycle Management (VR / 6G user plane)**
  - **UC3 - Control Plane Optimizations (AR / 6G control plane)**
- Collaborative 3D Digital Twin-like Environment
  - UC4 - Collaborative 3D Digital Twin-like Environment
- Energy Measurement Framework for Energy Sustainability
  - UC5 - Energy Measurement Framework for Energy Sustainability

Multimedia use cases (AR / 6G control plane)

- **UC3 - Control Plane Optimizations**
  - Evolution of IP Multimedia Subsystem (IMS)
    - Expand the IMS capabilities to new holographic communication technologies that require speed and high processing level.
  - Holographic communications as evolved service in 6G
    - Additional APIs to extend IMS signaling
    - IMS data channel based on WebRTC
    - Notification service and Phone Dialer App



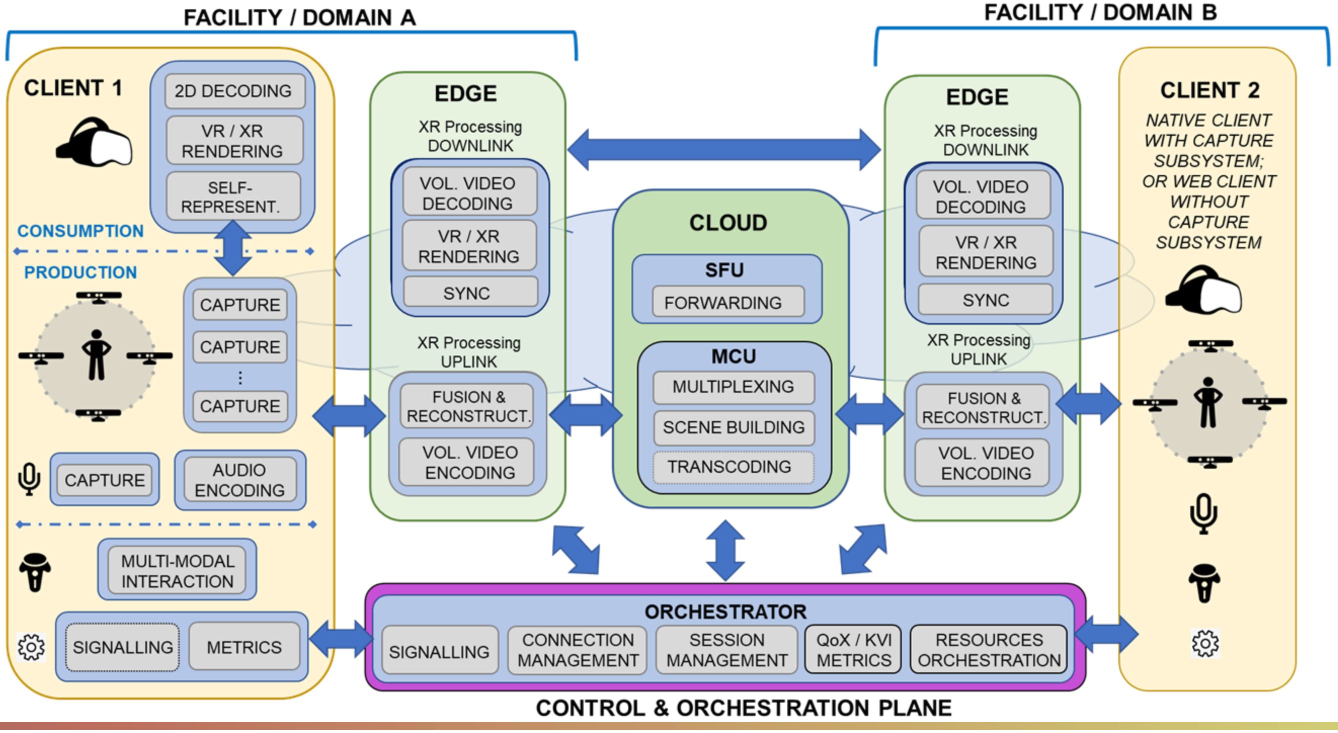
- WebGL hologram rendering
- Utilization of IMS Data Channel to bring together the streaming world with the IMS world having holographic technology available natively as a phone dialer app



Multimedia use cases (VR / 6G user plane)

- **UC1 - Network-assisted Rate Control**
- **UC2 - Edge Selection and Lifecycle Management**
  - Cloud/Edge to deploy Multimedia Functions
  - Holo Orchestrator vs Edge Orchestrator
  - Network Monitoring and APIs

    to trigger actions
    - UC1 - Media Flow Adaptation (resolution, framerate and bitrate)
    - UC1 - Media Flow Priorization (request Quality on Demand from network)
    - UC2 - Best Edge selection and routing

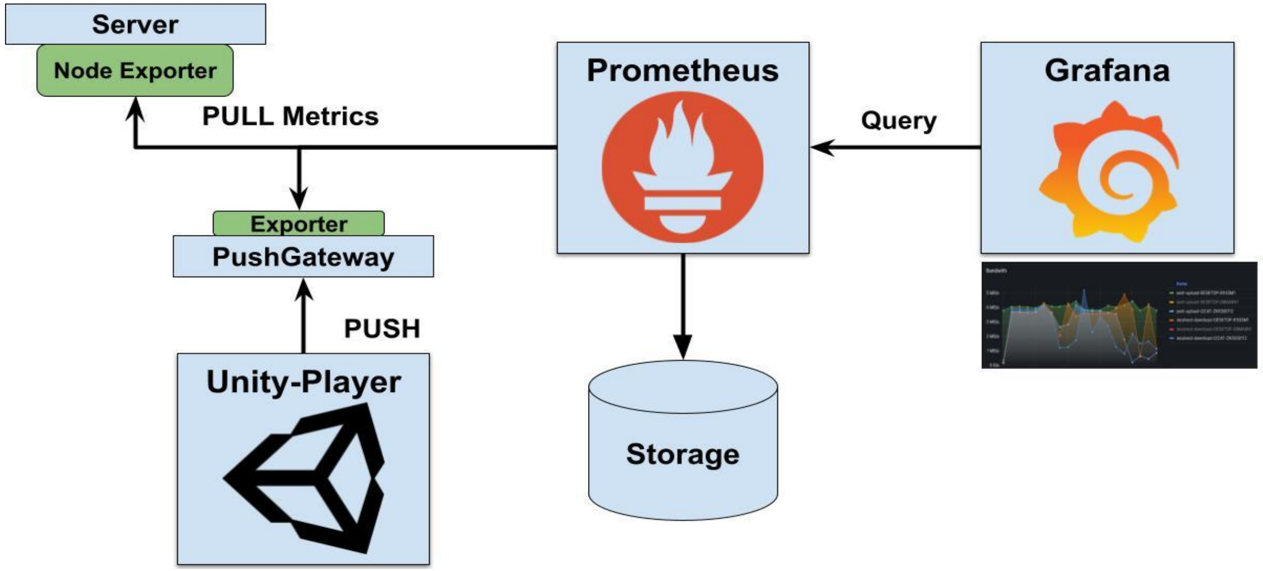


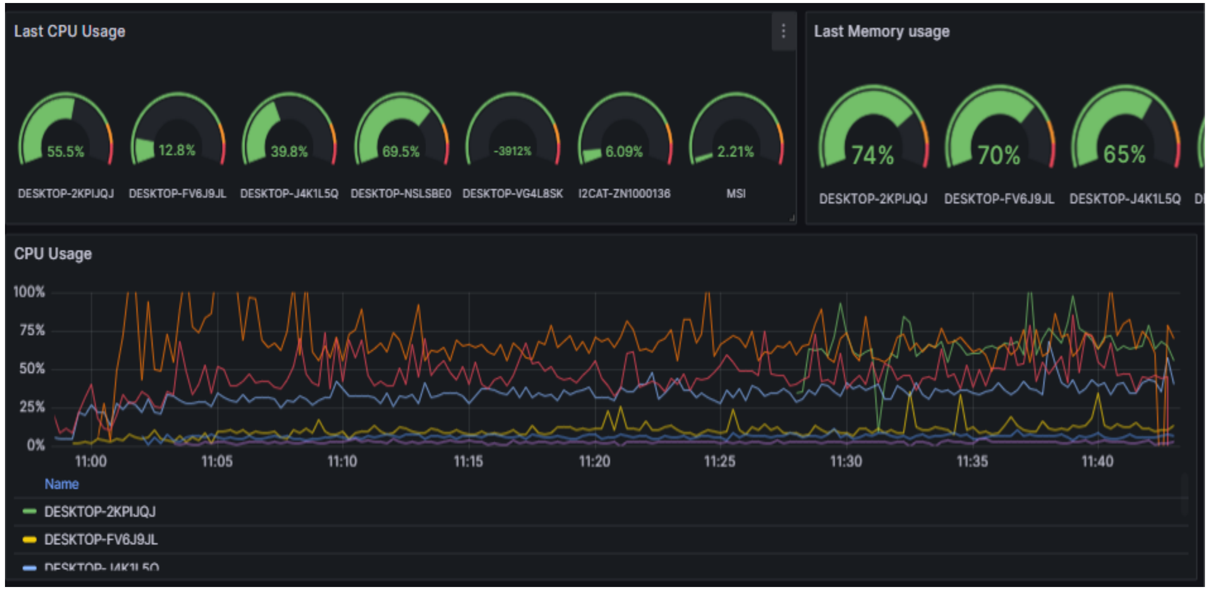
Cloud-native Multimedia Functions (XR Enablers)

- Multi-camera volumetric capture system and calibration
- Volumetric reconstruction and fusion algorithms
- Remote rendering for low computation user devices
- Selective Forward Unit (SFU) and Multipoint Control Unit (MCU)
- Low-latency streaming protocols (DASH, WebRTC, QUIC*)
  - Missing: standard codecs for Volumetric video
  - *addressed/employed in 6G-XR Open calls

Cloud-native Multimedia Functions (XR Enablers)

- Clock and Media Synchronization across multimedia functions and devices
- Holo Orchestrators of multimedia sessions
- Telemetry to support decision-making algorithms
  - Network, multimedia and energy monitoring





6G Technologies for Multimedia (Network Enablers)

Addressed/employed in 6G-XR
Addressed/employed in 6G-XR Open Calls
Not addressed/employed in 6G-XR

- Edge to Cloud Continuum
  - Cloud-native Multimedia Functions
  - Computation offloading (Edge-assisted processing)
  - Edge onboarding and discovery
  - Load balancing and service migration
- Network monitoring and analytics (ML/AI)
  - NWDAF, NEF
- APIs to request network capabilities
  - CAMARA APIs (QoD and Edge), CAPIF
  - Harmonizing of APIs is required

6G Technologies for Multimedia (Network Enablers)

Addressed/employed in 6G-XR
Addressed/employed in 6G-XR Open Calls
Not addressed/employed in 6G-XR

- Media synchronization in 3GPP releases
- Evolution of RAN
  - Multi-RAT (5G + WIFI)
  - Increased bandwidth and ultra-low latency
  - Need to cope with increased traffic due to volumetric video
- Evolution of IMS
  - APIs, signaling and data-channel

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Reference documentation

- Deliverables: https://www.6g-xr.eu/deliverables/
  - D1.1 Requirements and use case specifications
  - D2.1 Orchestration, AI techniques, End-to-end slicing and signaling for the core enablers – design
  - D4.1 State-of-the-art analysis and initial design of beyond 5G RAN, core, and open-source networks, disruptive RAN technologies and trial controller (coming soon)
  - D1.2 Reference architecture description (coming after June 2024)
  - D3.1 Initial versions of XR enablers (coming after June 2024)
- Publications: https://www.6g-xr.eu/scientific-publications/
  - Montagud, M et al. "AwareXR: A NaaS architecture to enhance XR services over beyond 5G networks", submitted to IEEE Network Magazine
  - Yeregui, I et al. "Edge Rendering Architecture for multiuser XR Experiences and E2E Performance Assessment", accepted at IEEE BMSB 2024

Thanks

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