

Abstract

REDIA (*Remote, Digital Assistant and Training System*) proposes a transformative approach to industrial training. Through **Skylife ULTIMATE**, REDIA delivers an innovative remote and multiplayer training platform based on extended reality technologies, allowing operators and technicians to acquire technical skills in highly realistic simulated environments—without the need for physical presence and with full scalability.

Objective

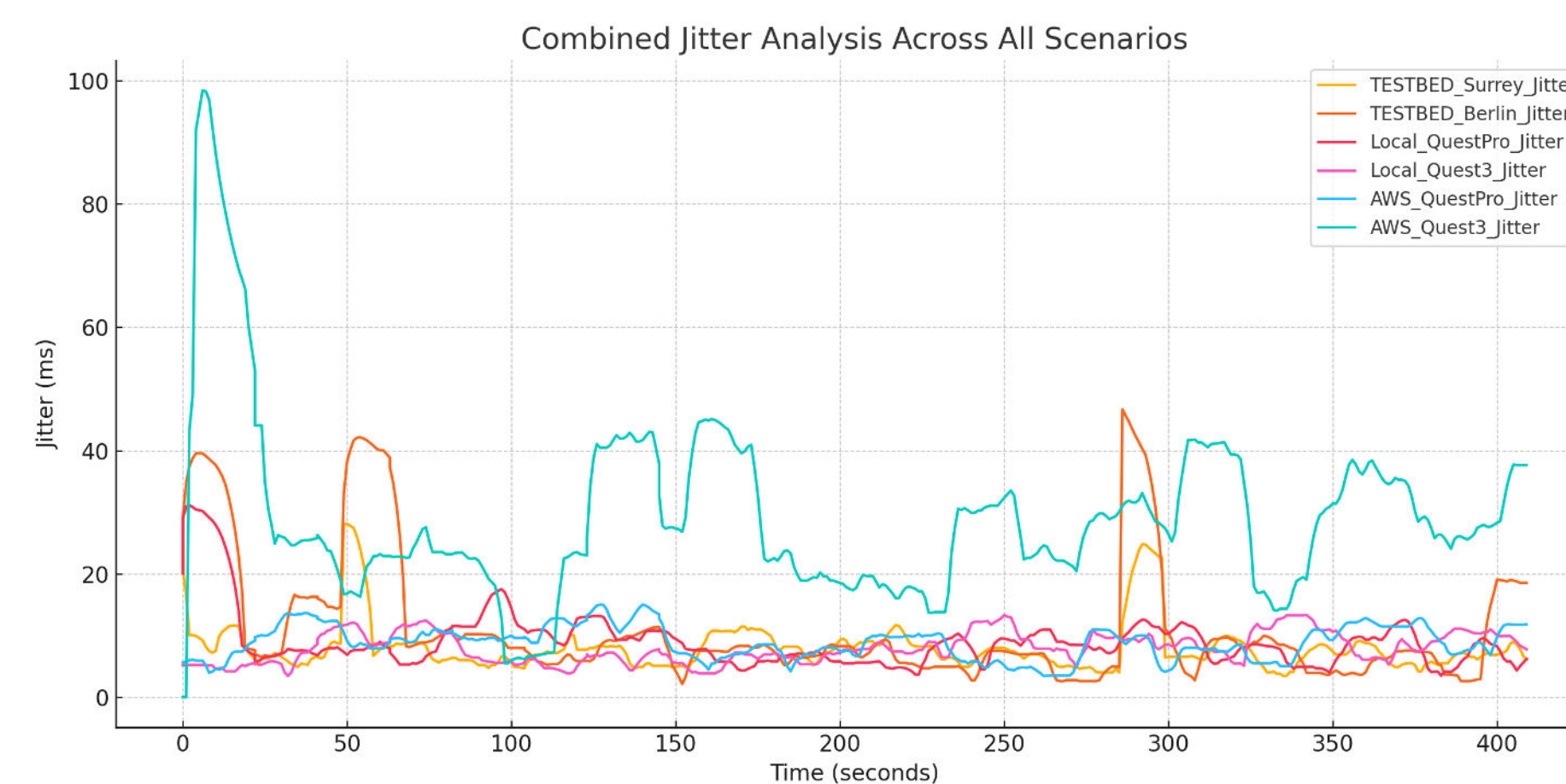
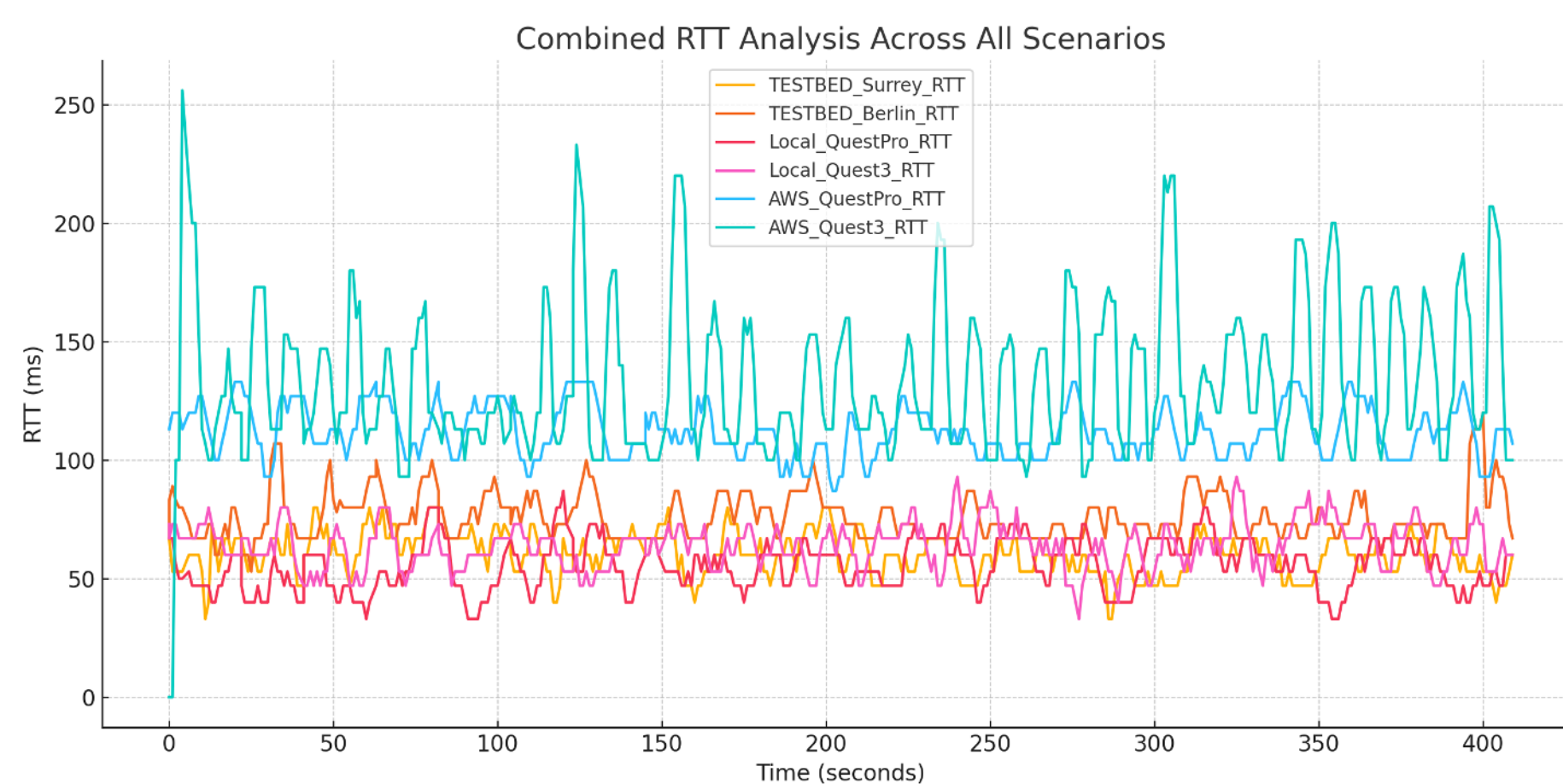
Skylife is revolutionising industrial training and assistance with **remote, multiplatform** and **multiplayer XR solution**.

The main REDIA objective was to research, develop and validate a multiplayer XR training framework that enables realistic remote interaction using **markerless full-body avatars** and **synchronized virtual environments**. It also had to ensure low latency, reliable spatial voice communication and compatibility with multiple XR devices. We will provide an adaptable platform for sectors such as aerospace, energy and manufacturing in an efficient and cost-effective training way.

Methodology and Results

Methodology: The REDIA platform was developed in **Unity 3D** for XR devices (Meta Quest 3 and Pro), integrating open-source components for multi-user interaction. Its architecture combines **FishNet** for deterministic network synchronization, **Dissonance** for real-time spatialized audio, and **Meta's Movement SDK** to enhance full-body avatar realism. Initial development focused on testing in isolated scenarios to ensure **OpenXR** compliance. Once validated, the system was integrated into the Skylife ULTIMATE training simulator, requiring custom adaptations. A multiplayer scenario was then implemented, enabling an operator and an expert to collaborate remotely in resolving technical issues using interactive objects and visual aids within a synchronized virtual environment.

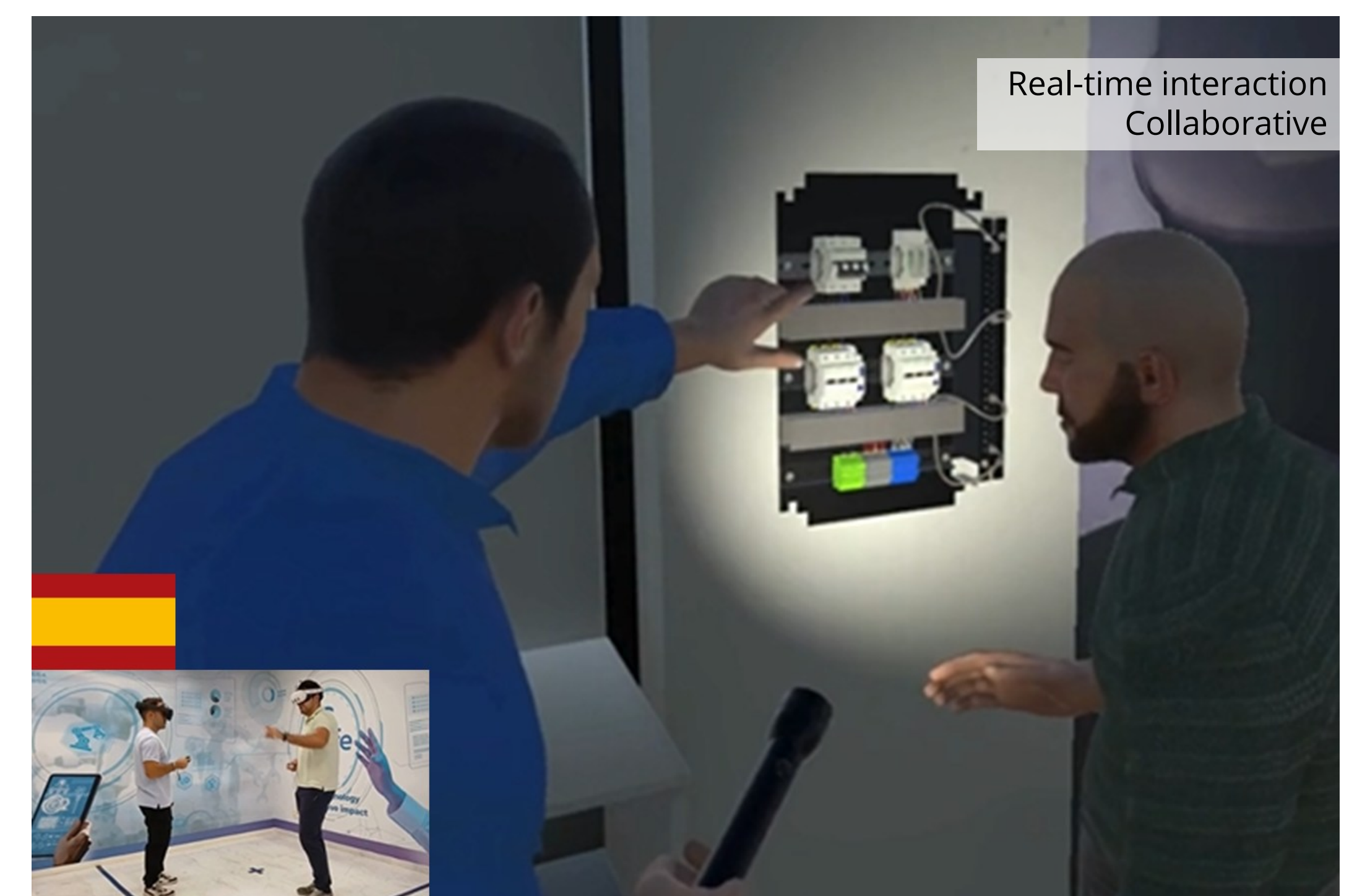
Results: We performed several cross-validations and demonstrations across three countries (Spain, the United Kingdom and Germany) and three different server deployments. In all cases, **RTT (Round-Trip Time)** and **jitter** remained within acceptable bounds for XR interaction.



On site validation within a controlled local network environment, where RTT mostly ranged between 50–70 ms with minimal jitter 5–15 ms.

Cross-Testbed validation between the SPIRIT TESTBEDs (University of Surrey and Fraunhofer Berlin) showed stable RTT values between 60–80 ms and jitter between 10–25 ms, despite the 1,600 km distance separation.

Cloud server validation, using AWS-hosted server, enabled remote sessions with RTT clustering around 100–140 ms, with occasional peaks. Jitter was generally below 40 ms, with brief spikes that were successfully mitigated by buffering.



Discussion and Impact

REDIA meets the performance thresholds required for interactive XR applications, with **latency** consistently **below 120 ms** and **jitter under 20 ms** across local, testbed and cloud deployments. Full-body avatars remained tightly synchronized, object interactions were immediate, and spatial voice communication stayed clear and stable.

Future work includes improving avatar expressiveness (facial animation, gesture recognition), integrating **biometric** signals and **AI avatars**, expanding authoring tools for instructors, and evaluating XR deployment constraints in real-world operational settings. The system aligns with Industry 5.0 principles by enhancing **human-centric, data-driven** training ecosystems.