

ETSI GR ARF 012 V1.1.1 (2025-11)



GROUP REPORT

Augmented Reality Framework (ARF); Executive Summary of the Virtual World Standards Landscape Report and the Virtual World Standards Recommendations Report

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Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) Augmented Reality Framework (ARF).

The present document provides an executive summary of the ETSI GR ARF 010 [i.8] Standards Landscape report and the ETSI DMI ARF 011 [i.9] Recommendations Report.

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Executive summary

The present document consolidates insights from two reports focusing on Virtual Worlds standardisation processes, standards and the role of standards for enhancing the European Virtual Worlds ecosystem. It provides an overview of the current standards landscape covering 912 standards and 354 technical reports across eight Virtual Worlds domains. The landscape report published by ETSI in 2025 [i.8] is the most extensive of its kind to date. While many standards exist, adoption among major industry players remains low, limiting interoperability. A fragmented and poorly coordinated standardisation system presents major challenges to improving future prospects for scalable Virtual Worlds ecosystems. Structural issues such as power imbalances, overlapping mandates, and regulatory uncertainty hinder progress. The study identified such barriers and, in its Recommendations Report [i.9], provided recommendations to improve coordination, inclusivity, sustainability, and trust. If and when followed, the data-driven recommendations provided to policymakers will foster stakeholder engagement, collaboration, and coordination of organizations and working groups. Together, these can support growth of a secure, inclusive, and innovation-friendly European Virtual Worlds economy.

Introduction

Virtual Worlds technologies are transforming how people work, interact, learn, and create within persistent, interactive 3D environments. These experiences, delivered through immersive interfaces, increasingly blur the boundaries between physical and digital realities. As the European Commission emphasized in its 2023 communication on Virtual Worlds [i.10], a thriving ecosystem will rely on the convergence of enabling technologies such as AI, 5G/6G, and IoT - supported by open standards. However, limited interoperability, inconsistent data exchange, and weak integration of existing protocols remain critical barriers to value creation and innovation. The research which the present document summarises was initiated to examine these concerns and to guide public and private stakeholders toward coordinated, standards-based solutions to addressing barriers.

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1 Scope

The present document distils findings from two previously prepared ETSI Reports. They document the current state of Virtual Worlds standards and, based on standards and gaps, provide concrete recommendations. These reports are based on the systematic analysis of information in public documents, interviews with subject matter experts, standards, standardisation working group charters and documents, and reports of SDO activities about Virtual Worlds. The objectives of the research included identifying all standards and technical reports, in order to reduce duplication, conflicting initiatives, and to identify gaps in standards. Eight Virtual Worlds domains are defined and over 900 standards are examined for their technical coverage in the domains identified. Ongoing efforts, and coordination status were also assessed. Research also evaluated how structural and institutional limitations affect the development of standards and their adoption. Recommendations were framed around stakeholder groups including providers, policymakers, researchers, and end-users.

For policymakers seeking to expand the European standards-based Virtual Worlds ecosystem with support for innovation and through harmonized regulatory and technical approaches, the present document also summarises recommendations.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

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The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

- [i.1] [3GPP TS 26.566](#): "Immersive Audio for Split Rendering Scenarios".
- [i.2] [3GPP TR 26.866](#): "Immersive Audio for Split Rendering Scenarios; Performance characterization".
- [i.3] [AIMS - IP Media Experience \(IPMX\)](#).
- [i.4] CTA-2094: "HDR/XR metadata".
- [i.5] CTA-2097: "XR experience comfort metrics".
- [i.6] Eclipse Foundation: "[Dataspace Protocol 2025-1](#)", EDWG DSP, n.d.
- [i.7] [ETSI GS ARF 003](#): "Augmented Reality Framework (ARF); AR framework architecture".
- [i.8] [ETSI GR ARF 010 \(V2.1.1\)](#): "Augmented Reality Framework (ARF); Virtual World Standards Landscape Report".
- [i.9] ETSI DMI/ARF 0011 (V0.0.2) (2025-06): "Augmented Reality Framework (ARF); Virtual World Standards Recommendations Report Virtual World Standards Recommendations Report".
- [i.10] [COM\(2023\) 442/final](#): "Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions - An EU initiative on Web 4.0 and virtual worlds: a head start in the next technological transition".