ISG ARF TERMS OF REFERENCE

Terms of Reference (ToR) for

ETSI ISG Augmented Reality Framework (ISG ARF)

Approved by the Director-General on **24 October 2025** following Board#154 consultation

Scope

The purpose of the ISG ARF is to define a framework for the interoperability of Augmented Reality (AR) components, systems, and services. The framework under development will be referenced as “AR framework” in the present document. It defines an overall functional reference architecture, identifying key components and interfaces for an AR solution. The AR framework will allow AR components from different providers to interoperate through the defined interfaces. This will in turn limit vertical silos and market fragmentation and enable players in the ecosystem to offer part(s) of an overall AR solution.

The main objectives of ISG ARF are:

- to ensure that Augmented Reality services and platforms will be easier to design, deploy and operate than today taking into account the support of 5G mobile networks, edge computing, and the advent of the Metaverse and Digital Twin platforms,
- to enable the development of high-performance Augmented Reality components which are portable between different hardware vendors, and different providers of software solutions and platforms,
- to achieve the co-existence of legacy and proprietary platforms whilst enabling an efficient migration path to fully interoperable new generation augmented reality platforms.

ISG ARF will acknowledge the work of relevant standardisation bodies and open-source communities already developing technical solutions for AR and will ensure consistency with other activities in ETSI, for example with regards to IoT, edge computing, and 5G.

Areas of activity:

ISG ARF published the first version of the AR framework in March 2020, updated it in October 2024, and has been working on developing a set of interoperability requirements for AR components, systems, and services. The ISG ran a survey amongst its members to establish the list of Reference Points identified as high priority for achieving interoperability and of most interest to the group members. The first set of interoperability requirements between the World Storage and AR Authoring functions was published in July 2021 as GS ARF 004-2, followed until January 2023 by GS ARF 004-3 (interoperability requirements between the World Capture, World Analysis and Scene Management), by GS ARF 004-4 (interoperability requirements between World Analysis, World Storage and Scene Management) and GS ARF 004-5 (interoperability requirements between the Scene Management and external applications). GS ARF 004-6 regarding interoperability requirements for the representation of the real World between World Storage, AR Authoring and Scene Management will be published in 2025. Work will continue on other Reference Points identified by the survey as high priority and the results will be published as additional parts of GS ARF 004. However, not all Reference Points may be addressed.

The SG also updated and revised the ARF initial group report on AR standards landscape by writing a new report based on the functional reference model defined in GS ARF 003 allowing to identify which standards apply to each part of the ARF Architecture. It was published under GR ARF 007 V1.1.1 “Standards landscape for ETSI AR Functional Reference Model”

In July 2021, ISG ARF launched a call for expertise to set up a Specialist Task Force to accelerate the specification of the APIs to the World Storage function by following an implementation-driven standardisation approach. The World storage function is responsible for storing information that is required to track elements in the real world and to determine the actual position of an AR system in the real world. Activities started in January 2022 and were successfully finalised in autumn 2022. The World Storage API is available on ETSI Forge. The structure of this API and its usage is specified in GS ARF 005.

In June 2023, ISG ARF launched a call for expertise to set up a Specialist Task Force to accelerate the specification of the APIs of World Analysis functions to pursue an implementation-driven standardisation approach. In AR scenarios, this function is responsible for the exact registration of elements of the real and the virtual world for the presentation of a mixed environment. Activities started in January 2024 and were successfully finalised in autumn 2024. The updated World Storage World Analysis APIs are available on ETSI Forge. The structure of this API and its usage are specified in GS ARF 005 V2.1.1 for the World Analysis and in GS ARF 008 for the World Analysis.

Our implementation-driven standardisation approach uses open-source software development to support the API development and ensure that the APIs are complete and validated with several implementations at the time of their publication. An end-to-end AR application based on a data-centre maintenance has been developed, with several AR runtimes and AR spatial computing platform, as a proof of concept illustrating the World Storage and World Analysis APIs. This application and associated libraries are available on the ETSI gitlab.

Since January 2025, ISG ARF supervises a new Specialist Task Force (STF 686) following EISMEA Call 2024 opening for Action grants “Topic 21 SMP-STAND-2024-ESOS-01-IBA Study: Standards for virtual worlds". They aim to realise a state of the art in virtual world standards and draw up a list of recommendations for the European Commission. The activities shall be finalised in December 2025 with the publication a summary report describing the insights about the standard landscape and recommendations.

Regarding the interoperability requirements that have to be fulfilled at the reference points of the functional architecture (see GS ARF 003), the group will focus its activities on the last prioritised reference point that has not been specified:

- AR4 “User Interactivity” is responsible for the interoperability between the User Interactions and the Scene Management, focusing on delivering the capacities, signals, and states of input devices. Links to existing standards as identified in the standards landscape document will be incorporated.

The interoperability requirements regarding this reference point will be published as additional parts of GS ARF 004.

As a new topic, the group also aims to investigate the usage of the functional reference architecture for Digital Twin systems. Creating interfaces between Digital Twin platforms and ISG ARF framework will unlock a lot of use-cases, e.g., in the industry, retail, tourism, or smart cities. This connection is not currently addressed in any standard and the work performed in the context of ETSI ISG ARF can provide a basis to foster interoperability between such systems. The gaps in existing standards will be highlighted in the context of STF 686, allowing to extend the reference architecture proposed by the ISG and to identify and address new reference points

Having ETSI GS ARF 003 as the foundation for these activities will ensure that the European-developed reference model is widely accepted. Furthermore, as a result of the breadth and depth of the ETSI ISG ARF functional reference model, SDOs and other stakeholders in the AR industry will be able to use with confidence the updated and new specifications for their developments.

Where existing standards have been identified and fulfil the interface requirements, they will be referenced by the AR framework. When extensions are required, the requirements will be contributed to the corresponding standards organisations.

Where interfaces in the reference architecture have been identified as key interoperability points but no standards could be identified, new technical specifications relating to APIs, interfaces or data models will be developed within ETSI or in external groups if deemed more appropriate.

The workplan of the ISG is summarised in figure 1 below.

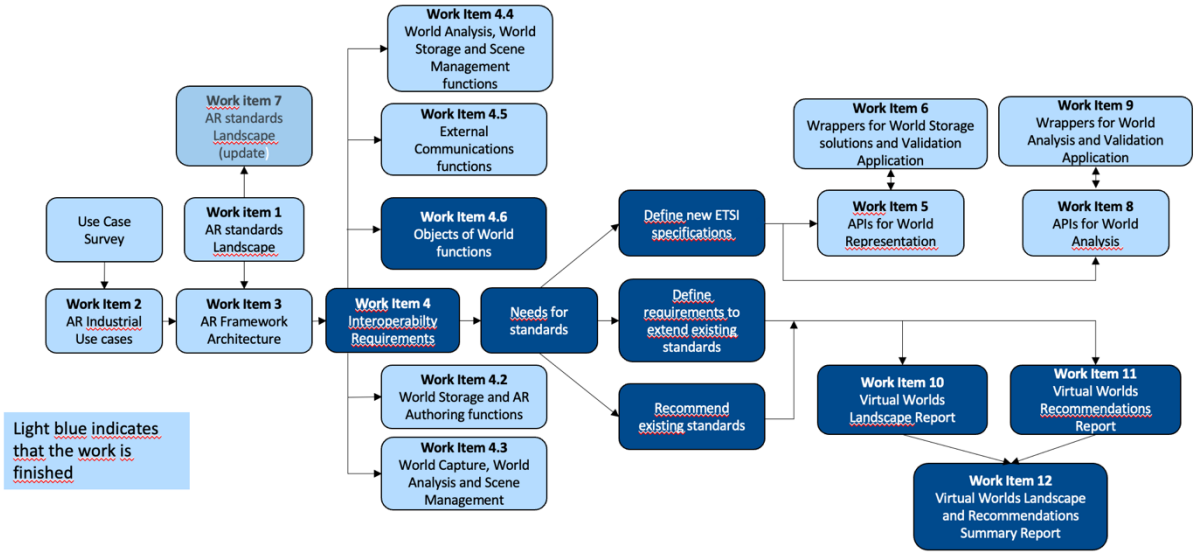

Figure 1: ISG ARF Workplan

ANNEX (Informative): collaboration with other bodies

ISG ARF will set-up the appropriate communication channels to groups both within and outside of ETSI.

ETSI groups

- ETSI ISG MEC
- 3GPP/SA4-Codec

External Groups

- IEEE
- ISO MPEG
- W3C AR Community Group
- ITU-T
- Khronos
- The AREA
- Open AR Cloud
- Metaverse Standards Forum (by individual membership).