ETSI Industry Specification Group ARF:
Building interoperability for AR systems

ISG ARF Leadership Team
Objectives and results

✔ To define a framework for the *interoperability* of AR components, systems and services, in order to reduce market fragmentation and enable providers to offer components of complete AR solutions

✔ To encourage an ecosystem with a diverse range of solution providers including smaller players, new entrants and academics

✔ Publication of a modular functional reference architecture for AR solutions with interoperability provided at the interfaces between building blocks
  ✔ An important step towards greater interoperability for AR (and more generally XR)
  ✔ The focus is on interfaces, defining requirements enabling interoperability between building blocks and APIs
Definition of Augmented Reality

✔ Augmented Reality (AR) is the ability to mix in real-time spatially-registered digital content with the real world.
✔ Combines real and virtual world
✔ Interactive in real-time
✔ Registered in 3D

[Augmented Reality - Azuma, 1997]
Scope of xReality

- eXtended Reality (XR) is the umbrella term used for Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), as well as all future immersive technologies.

Source of diagram: XR4ALL Landscape Report – available from xr4all.eu/resources, 2020

[Reality-Virtuality Continuum - Milgram, 1994]
ISG ARF Work Structure

- **Work Item 1**: AR standards Landscape
  - Use Case Survey

- **Work Item 2**: AR Industrial Use cases

- **Work Item 3**: AR Framework Architecture

- **Work Item 4**: Interoperability Requirements
  - Work Item 4.2: World Storage and AR Authoring functions
  - Work Item 4.3: World Capture, World Analysis and Scene Management
  - Work Item 4.4: World Analysis, World Storage and Scene Management functions
  - Work Item 4.5: External Communications functions
  - Needs for standards
  - Define requirements to extend existing standards
  - Recommend existing standards

- **Work Item 5**: APIs for World Representation

- **Work Item 6**: Wrappers for World Storage solutions and Validation Application

Light blue indicates that the work is finished.
Global overview of the architecture of an AR system

**Vision Engine**
- Localization, Mapping, Scene analysis, etc.

**3D Rendering Engine**
- Pose Estimation
- World knowledge (planes, occlusion meshes, lights, etc.)
- Interactive Contents
- Non interactive contents

**Hardware**
- Tracking Sensors
  - Vision
  - Proprioceptive
  - Exteroceptive
- Processing Units
  - Central Processing Unit
  - Graphics Processing Unit
  - Vision Processing Unit
- Rendering Interface
  - Video see-through AR
  - Optical see-through AR
  - Spatial AR
- Interaction Interfaces
  - Gesture
  - Vocal
  - Eye Tracking
  - Emotion

**Software**
- Vision Engine
- 3D Rendering Engine

**Data**
- Interactive Scenario
- Content Simplification, Interaction, Fusion, etc.

**Cloudification**
- Possibly distant
- Distant with difficulty (very low latency)
- Local
ISG ARF functional reference architecture

For more information see the webinar: "Overview of ETSI reference architecture for Augmented Reality solutions"
Development of interoperability requirements

For more information see the webinar: "Overview of ETSI reference architecture for Augmented Reality solutions"
Published Deliverables

✔ Standards Landscape: the role of existing standards relevant to AR  ETSI GR ARF 001 v1.1.1
✔ Industrial use cases for AR applications and services ETSI GR ARF 002 v1.1.1
✔ Reference architecture for AR solutions ETSI GS ARF 003 v1.1.1
✔ Interoperability Requirements; Overview ETSI GR ARF 004-1 v1.2.1
✔ Interoperability Requirements for World Storage and AR Authoring functions ETSI GS ARF 004-2 v1.1.1
✔ Interoperability Requirements for World Capture, World Analysis and Scene Management ETSI GS ARF 004-3 v1.1.1
✔ Interoperability Requirements for World Analysis, World Storage and Scene Management functions ETSI GS ARF 004-4 v1.1.1
✔ Interoperability Requirements for External Communications ETSI GS ARF 004-5 v1.1.1
✔ Open APIs for the Creation and Management of the World Representation ETSI GS ARF 005 v1.1.1
World Representation APIs - Implementation Driven Standards Development

- Iterative process
- Initial specification of the APIs
- Implementation of the APIs as Open Source
- Testing/validation on existing implementations through the development of dedicated wrappers and use cases
- Publication of an implementation-independent specification (see ARF GS 005 v1.1.1)

For more information see the webinar: "Towards an interoperable world representation for XR"
Coordination and collaboration are key

✔ Partnering with a range of organisations to coordinate efforts for the benefit of the XR ecosystem

By individual membership of participants

MoU in place

The Standards People

MoU in place

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Do get involved!

✔️ More information: https://www.etsi.org/committee/1420-arf

✔️ ISG ToR : Terms of Reference

✔️ If your company is an ETSI member, you can join the ISG ARF by sending email to isg_agreements@esti.org – please follow the process at joining ISG ARF; no additional cost

✔️ If your company is not an ETSI member, you can participate after signing the ARF participant agreement

✔️ Access to ISG ARF documentation, subscription to mailing list and participation to online conference calls are free

✔️ There is a small fee per day per plenary meeting (F2F/online participation)
THANK YOU