

EXTENDED REALITY

AR, VR, XR AT A GLANCE

- **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 yet to be developed. XR covers the full spectrum of real and virtual environments.
- **Virtual Reality (VR)** immerses the user entirely in a virtual yet interactive environment that simulates a completely different reality than the one surrounding the user.
- **Augmented Reality (AR)** is the ability to mix in real-time spatially-registered digital content with the real world surrounding the user. Unlike VR, augmented reality does not block out our surroundings, it enhances our current state of presence in the real world.
- **Mixed Reality (MR)** blends the real and virtual worlds to create complex environments, where real-world and digital elements can interact in real-time. It can be viewed as a continuum between the real and the virtual worlds but excludes both of them.

AR technologies play an essential role in the development of many new business areas such as the digitization of industry and the successful deployment

and citizen adoption of smart city services. Mobility, retail, healthcare, education, public safety are other examples of domains where AR will enhance the overall user experience, and create innovative new services. AR is developing quickly, and many popular applications are enabling context-rich user experiences that combine sensors, wearable computing, Internet of Things data, and artificial intelligence. All of these building blocks will be supported by the next generation of converged networks that comprise the upcoming 5G network.

MAIN APPLICATIONS OF AR

In the **industrial domain**, the convergence of AR and IoT is already enabling the maintenance of complex machinery using real-time simulation of defective components, overlay text and circuit diagrams or other contextual information that facilitate the maintenance of the equipment and makes the process both safer and more efficient.

The **Healthcare sector** is already using AR to bring significant advantages to practitioners who can benefit from digital information projected over real-life images used to prepare operations. AR is also being used to

help medical students learn cutting-edge techniques and visualise complex medical interventions.

Tourism also applies augmented reality tools to enhance the experience of visitors to museums, art galleries, city monuments and large music or sports events, and therefore increase the attractiveness of cities. The same is true for many other applications in smart cities such as architecture and city planning, public safety and emergency services, urban mobility, transportation or enhanced social and educational activities.



ETSI WORK IN AUGMENTED REALITY

ETSI Industry Specification Group Augmented Reality Framework (ISG ARF)

The purpose of the ISG ARF is to define a framework for the interoperability of Augmented Reality (AR) components, systems and services. The AR framework 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 avoid vertical siloes and market fragmentation and enable players in the ecosystem to offer part(s) of an overall AR solution.

The Industry Specification Group (ISG) Augmented Reality Framework (ARF) addresses the following objectives:

- Ensure that Augmented Reality services and platforms will be easier to design, deploy and operate than today taking into account the advent of 5G networks.

- Enabling the development of high performance Augmented Reality components which are portable between different hardware vendors, different providers of software solutions and platforms.
- Achieving co-existence of legacy and proprietary platforms whilst enabling an efficient migration path to fully interoperable platforms.

During its initial phase ISG ARF published the following Group Reports: [GR ARF 001 V1.1.1](#) on the Augmented Reality standards landscape, including an analysis of current standardization work relating to AR in various standards setting organizations and industry fora; and [GR ARF 002 V1.1.1](#) which considers industrial use cases for Augmented Reality (AR) applications and services, seeking a deeper understanding of typical AR use cases with an initial focus on industry 4.0.

The Group Specification [GS ARF 003 V1.1.1](#) is also published, defining a modular reference architecture for AR solutions and forms the basis of the framework for the interoperability of AR components, systems and services.

ETSI Multi-access Edge Computing Industry Specification Group (MEC ISG)

To ensure the adoption of Augmented Reality technologies, the underlying network needs to deliver the required levels of performance, particularly low latency of the order of several milliseconds. Edge computing is necessary to deliver such performance. Augmented information pertaining to a point of interest is also highly localized and contextualized and thus hosting the information locally through a MEC server is advantageous compared with hosting it in the cloud.

Other ETSI groups involved in Augmented Reality

oneM2M, ETSI TC SmartM2M, ETSI TC ITS, ETSI EP eHealth, ETSI TC SmartBAN, ETSI TC SAFETY are also addressing this topic at various levels. The ETSI Technical Committee on Human Factors has identified accessibility barriers to these technologies and provided potential solutions in the ETSI guide EG 202 848.