

Standards on mobile/ubiquitous XR, assistance AR and connectivity.

The status quo and path
ahead of us.

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We find ourselves in a platform economy.

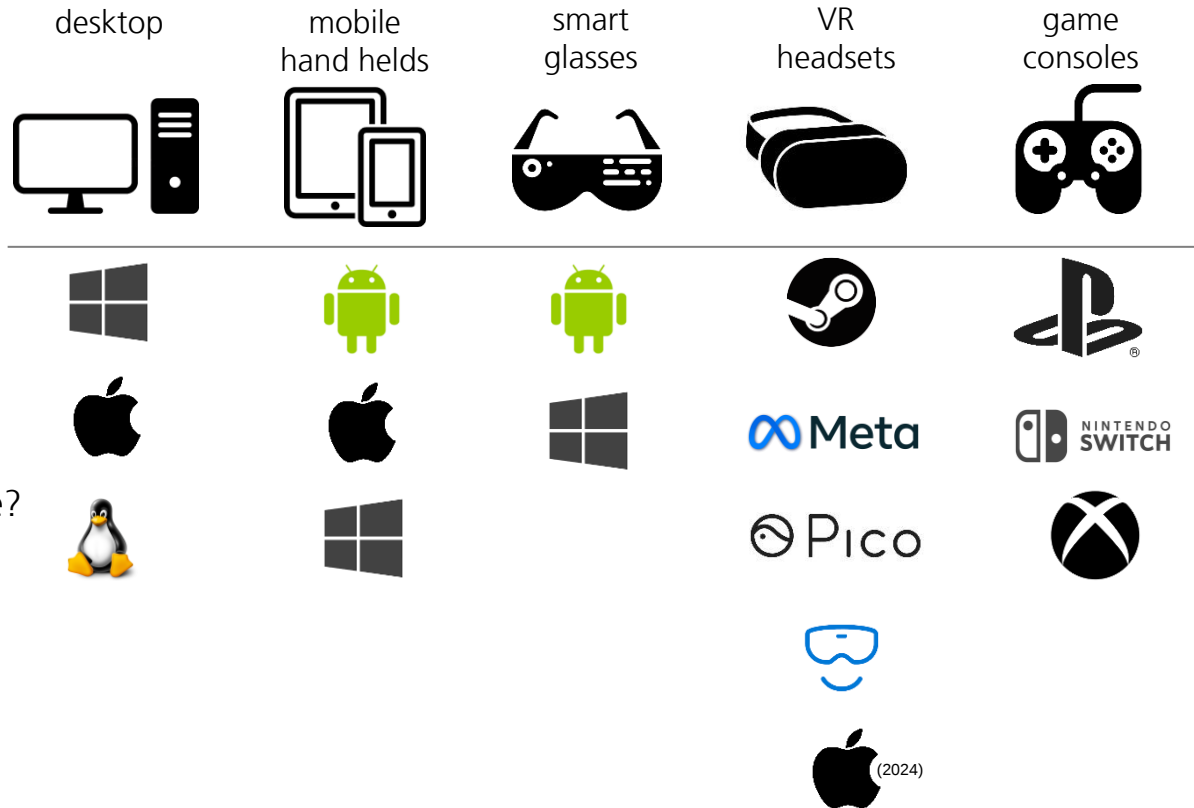
problem:

- The XR platforms are in the hand of a few.
- those aim at vendor lock-in.

thus:

- what options for action do we have?
- how to guarantee interoperability and exchangeability?

=> **standardization!**



Why standards?

- save (manufacturing, information, transaction, shipping, distribution, change,...) costs
- simplify work
- increase market transparency
- concentrate on innovative aspects
- increase interoperability
- increase exchangeability
- intensify competition, price depression
- reversal of the burden of proof by using standards





Chris Kremidas-Courtney, senior fellow at Brussels think tank „Friends of Europe“ and Lecturer for Institute for Security Governance (ISG) in Monterey, California.

He said that China plans to “*be the world leader in metaverse development,*” a technology that dovetails with its plan for a state-controlled digital renminbi. Standard-setting is the natural first step in that roadmap.

“If you want to seize the future,
you set the standards for it”

Chris said.

POLITICO

Enter keyword



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POLITICO PRO

FROM POLITICO PRO

Beijing is coming for the metaverse

Proposals reviewed by POLITICO show China wants to assert state control over virtual environments.



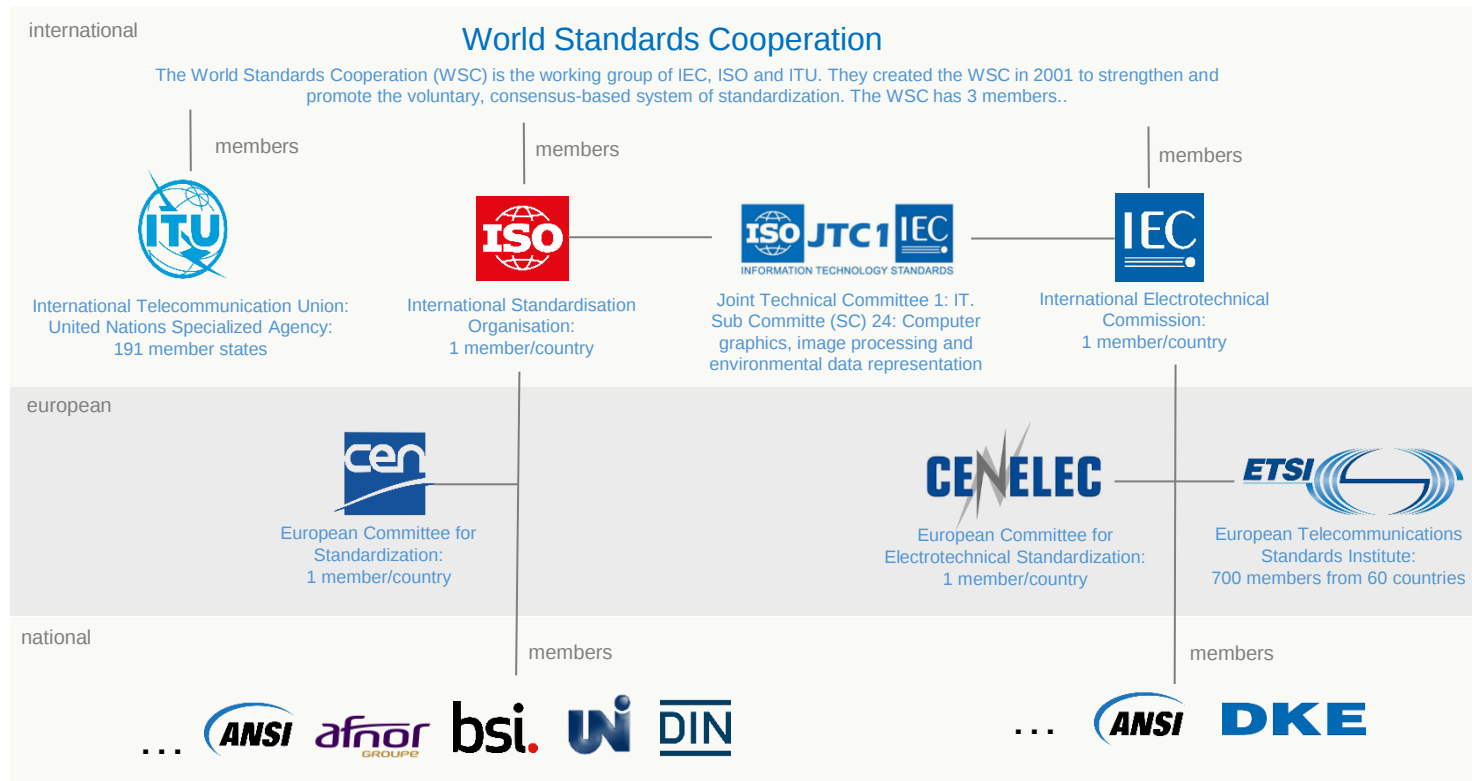
Experts that reviewed the proposal at the request of POLITICO said it risks violating principles of privacy and freedom | Jade Gao/AFP via Getty Images

BY GIAN VOLPICELLI

AUGUST 20, 2023 | 4:00 PM CET | 5 MINUTES READ

Structure of International Standardization

National SDOs organize so-called "mirror committees" to ISO and IEC committees. They represent national input and interests in ISO and IEC and feed information from ISO and IEC back to their homeland.





Recognized SDOs:

- These are officially recognized by regulation systems or political bodies
- ITU, UN specialized agency for information and communication
- UE regulation 1025/2012 rules the standardization at an European level and lists a set of reference SDOs with either an international (ISO, IEC, and ITU) or European scope (CEN, CENELEC, and ETSI)

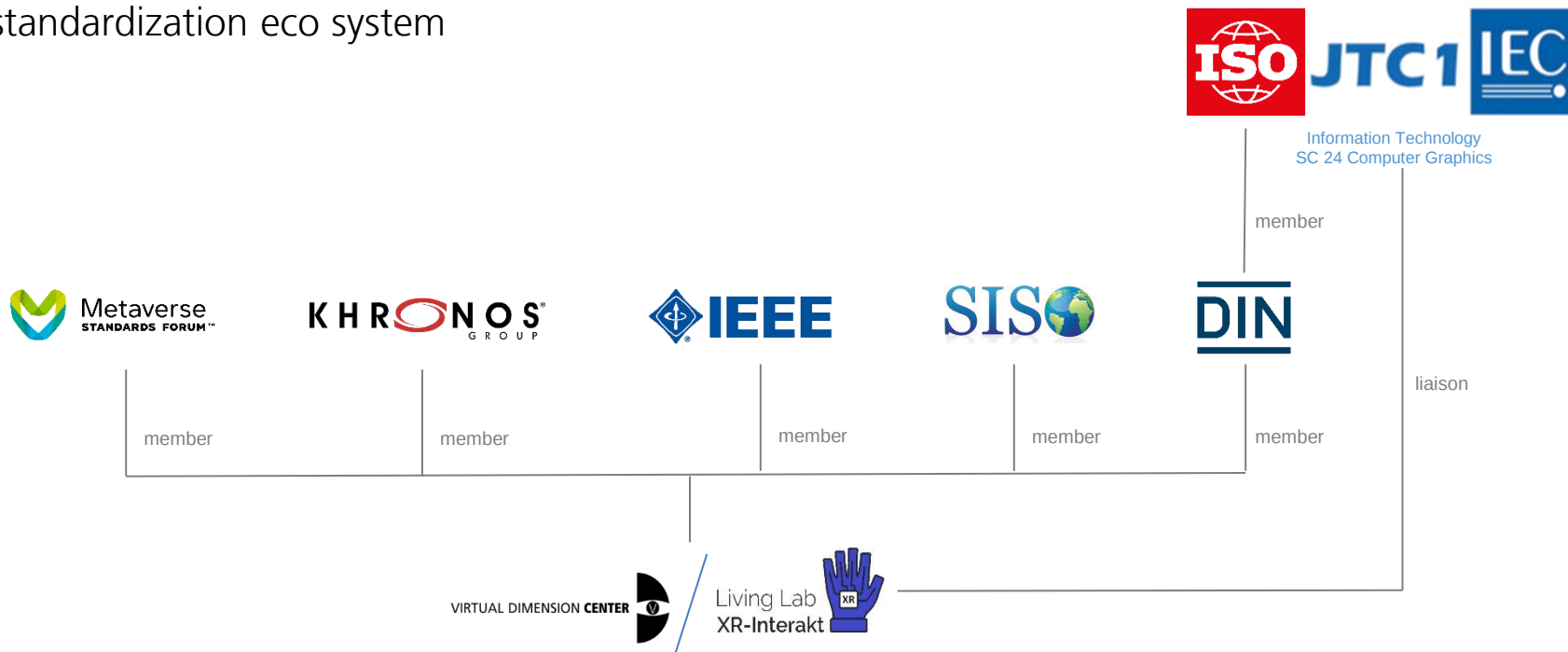


Not Recognized Organizations:

- These are not recognized by any political bodies
- IEEE is a primary SDO with a large number of active technical standards, ranging from wireless communications and digital health to cloud computing, power and energy, 3D video, electrical vehicle standards, and the Internet of Things. It was created by the Institute of Electrical and Electronics Engineers (IEEE), the American association of Electrical and Electronics Engineers and it brings together and organizes members from all over the world.



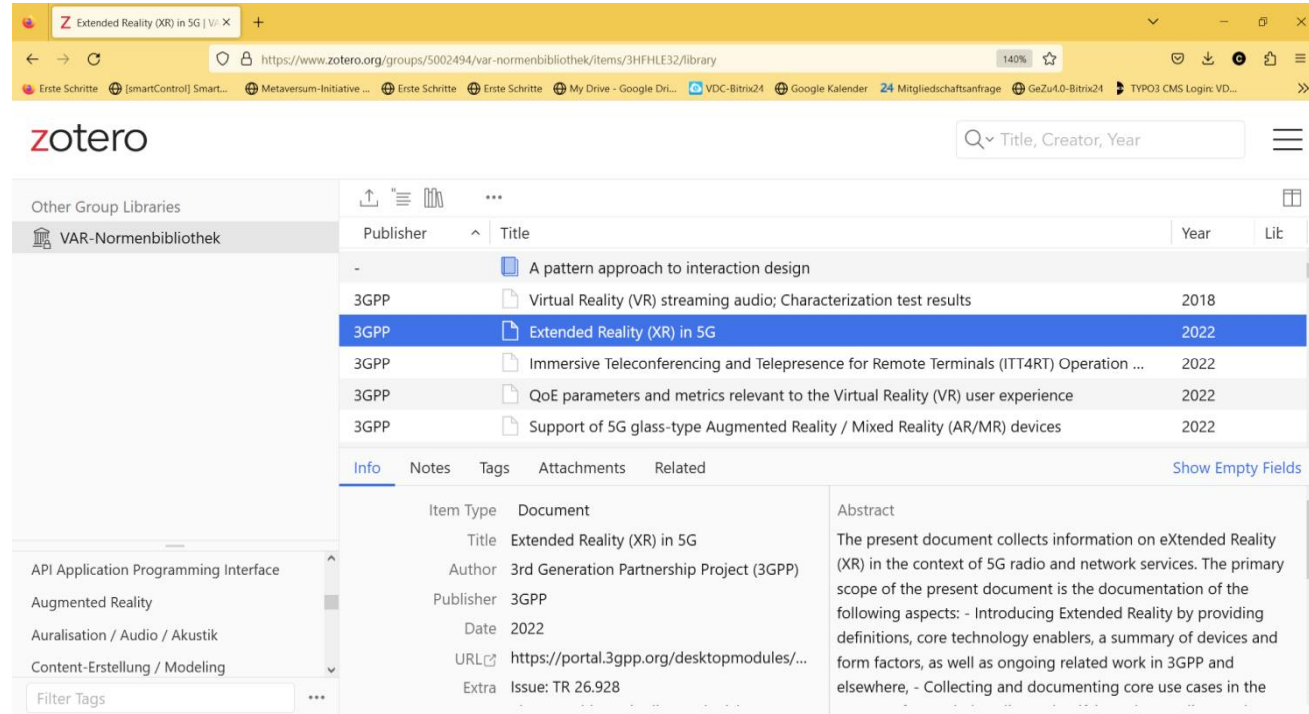
We got involved in the
standardization eco system



We found:

XR norms,
XR standards,
XR recommendations,
XR guidelines:

- 600+ published
- 100+ being created right now
- by 75+ active initiatives actually working on them



The screenshot shows a Zotero library interface. The top bar displays the Zotero logo and a search bar. Below the search bar, there is a list of documents. The selected document is 'Extended Reality (XR) in 5G' by 3GPP, published in 2022. The interface includes a search bar, a list of documents, and a detailed view of the selected document.

Publisher	Title	Year	Lit
-	A pattern approach to interaction design		
3GPP	Virtual Reality (VR) streaming audio; Characterization test results	2018	
3GPP	Extended Reality (XR) in 5G	2022	
3GPP	Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT) Operation ...	2022	
3GPP	QoE parameters and metrics relevant to the Virtual Reality (VR) user experience	2022	
3GPP	Support of 5G glass-type Augmented Reality / Mixed Reality (AR/MR) devices	2022	

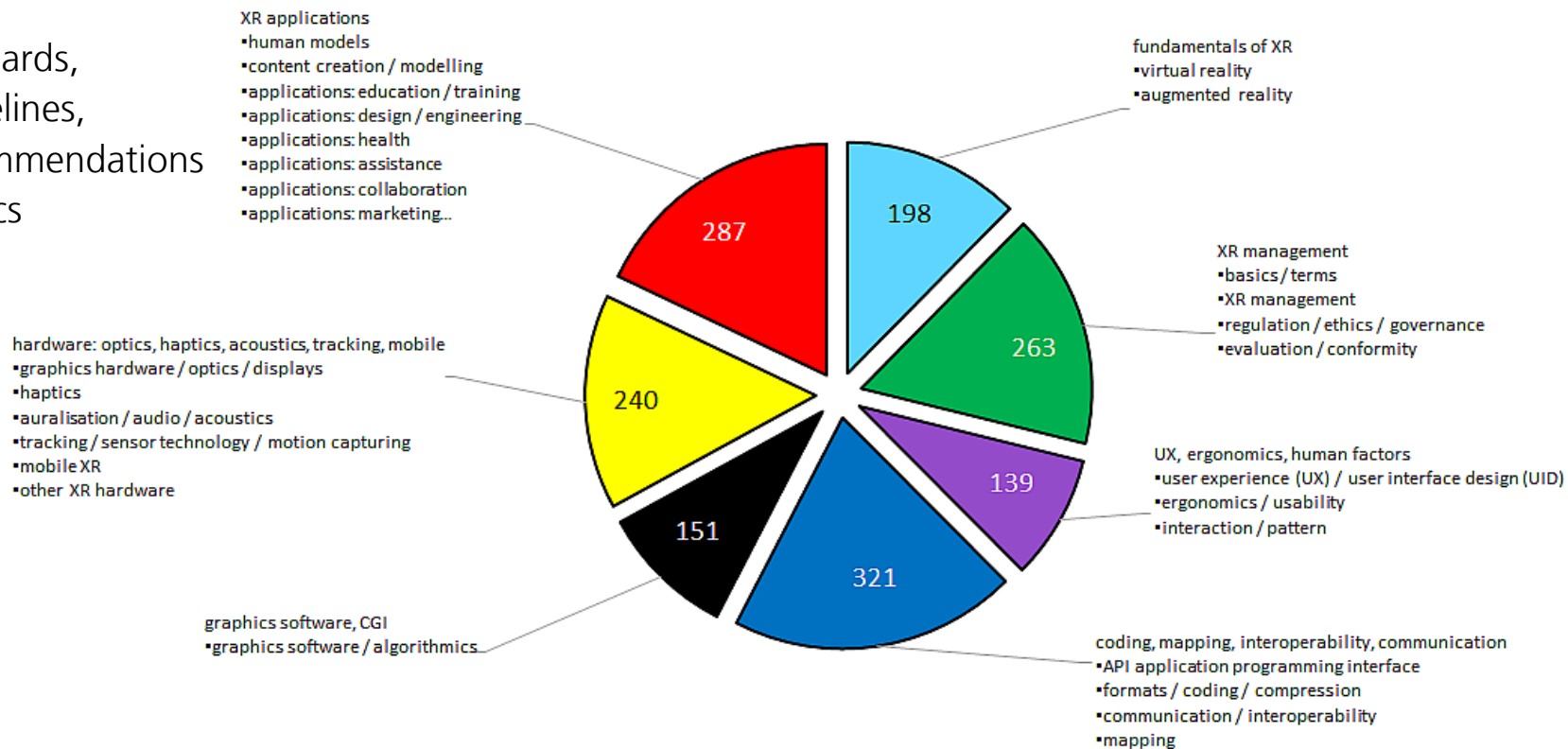
Info Notes Tags Attachments Related Show Empty Fields

Item Type	Document	Abstract
Title	Extended Reality (XR) in 5G	The present document collects information on eXtended Reality (XR) in the context of 5G radio and network services. The primary scope of the present document is the documentation of the following aspects: - Introducing Extended Reality by providing definitions, core technology enablers, a summary of devices and form factors, as well as ongoing related work in 3GPP and elsewhere, - Collecting and documenting core use cases in the
Author	3rd Generation Partnership Project (3GPP)	
Publisher	3GPP	
Date	2022	
URL	https://portal.3gpp.org/desktopmodules/...	
Extra	Issue: TR 26.928	



clustering

- XR standards,
 - XR guidelines,
 - XR recommendations
- into 7 topics

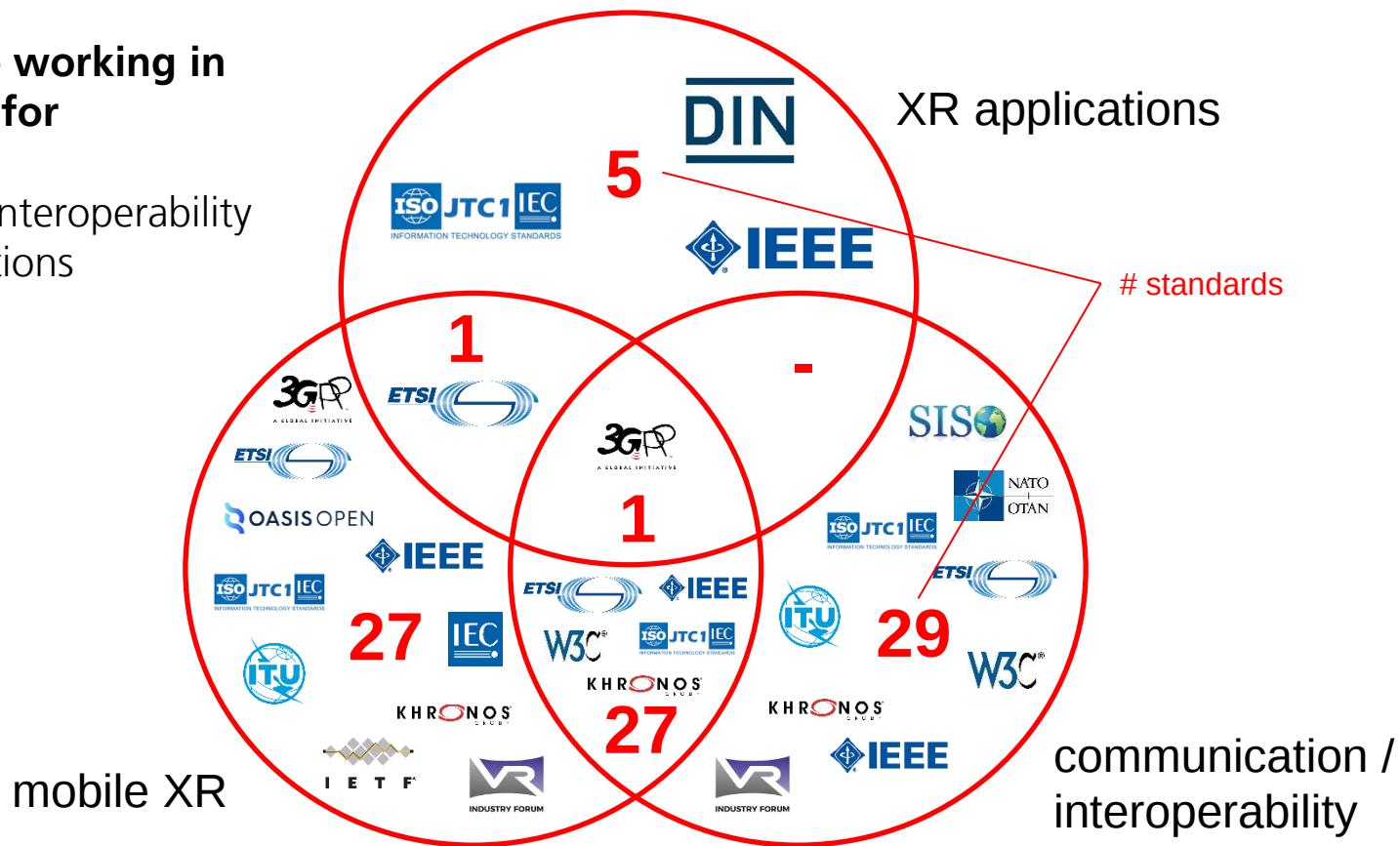




What initiatives are working in XR standardization for

- mobile
- communication / interoperability
- assistance applications
- and collaboration

?





European Telecommunications Standards Institute

- ETSI is an independent, not-for-profit, standardization organization in the field of information and communications. ETSI supports the development and testing of global technical standards for ICT-enabled systems, applications and services.
- the “**Augmented Reality Framework (ARF)**” defines a framework for the interoperability of AR components, systems and services that specifies relevant components and interfaces required for an AR solution. Augmented Reality is the ability to mix in real-time spatially-registered digital content with the real world surrounding the user:
 - 001 AR standards landscape
 - 002 Industrial use cases for AR applications and services
 - 003 AR framework architecture
 - 004-1 Interoperability Requirements for AR components, systems and services:
 - Part 1: Overview
 - Part 2: World Storage and AR Authoring functions
 - Part 3: World Capture, World Analysis and Scene Management
 - Part 4: World Analysis, World Storage and Scene Management functions
 - Part 5: External Communications
 - 005 Open APIs for the Creation and Management of the World Representation

ETSI GS ARF 004-2 V1.1.1 (2021-08)



Augmented Reality Framework (ARF)
Interoperability Requirements for AR components,
systems and services
Part 2: World Storage and AR Authoring functions

Disclaimer

The present document has been produced and approved by the Augmented Reality Framework (ARF) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in the ISG. It does not necessarily represent the views of the entire ETSI membership.



Joint Technical Committee 1 of ISO and IEC

- ISO/IEC JTC 1, entitled "*Information technology*", is a joint technical committee of the International Organization for Standardization and the International Electrotechnical Commission. Its purpose is to develop, maintain and promote standards in the fields of information and communications technology.
- **ISO/IEC 19778 "Information technology. Learning, education and training. Collaborative technology - Collaborative workplace"** is applicable to collaborative technologies used to support communication among learners, instructors and other participants. The implementation and communicative use of these technologies entails the creation of information related to participant groups, and to the collaborative environments, functions and tools that are set up for, and used by, these groups.
 - Part 1: Collaborative workplace data model
 - Part 2: Collaborative environment data model
 - Part 3: Collaborative group data model

INTERNATIONAL
STANDARD

ISO/IEC
19778-3

Second edition
2015-10-15

Information technology —
Learning, education and training
— Collaborative technology —
Collaborative workplace —

Part 3:
Collaborative group data model

*Technologies de l'information — Apprentissage, éducation et
formation — Technologies collaboratives — Lieu de travail
collaboratif —*

Partie 3: Modèle de données du groupe collaboratif



Reference number
ISO/IEC 19778-3:2015(E)

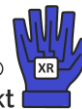
© ISO/IEC 2015



International Electrotechnical Commission

- The International Electrotechnical Commission is an international standards organization that prepares and publishes international standards for all electrical, electronic and related technologies – collectively known as "electrotechnology".
- **IEC 63203 "Wearable electronic devices and technologies"** deals with wearable electronic devices and technologies, near-body wearable electronics, on-body wearable electronics, in-body wearable electronics, and electronic textiles.
 - Part 101-1: Terminology
 - Part 201-1: Electronic textile - Measurement methods for basic properties of conductive yarns
 - Part 201-2: Electronic textile - Measurement methods for basic properties of conductive fabrics and insulation materials
 - Part 201-3: Electronic textile - Determination of electrical resistance of conductive textiles under simulated microclimate
 - Part 204-1: Electronic textile - Test method for assessing washing durability of e-textile products
 - Part 250-1: Electronic textile - Snap fastener connectors between e-textiles and detachable electronic devices
 - Part 401-1: Devices and systems: functional elements - Evaluation method of the stretchable resistive strain sensor
 - Part 402-1: Performance measurement of fitness wearables - Test methods of glove-type motion sensors for measuring finger movements
 - Part 402-2: Performance measurement of fitness wearables - Step counting
 - Part 406-1: Test method for measuring surface temperature of wrist-worn wearable electronic devices while in contact with human skin
 - Part 801-1: Smart body area network (SmartBAN) - Enhanced ultra-low power physical layer
 - Part 801-2: Smart body area network (SmartBAN) - Low complexity medium access control (MAC) for SmartBAN





3rd Generation Partnership Project

- The 3rd Generation Partnership Project is an umbrella term for a number of standards organizations which develop protocols for mobile telecommunications.
- standards group **3GPP TR 26.xxx**:
 - TR = technical report
 - 26 = codecs: speech and other codecs (video etc.)
 - 118 Virtual Reality (VR) profiles for streaming applications
 - 818 Virtual Reality (VR) streaming audio; Characterization test results
 - 905 mobile stereoscopic 3D video
 - 918 virtual reality (VR) media services over 3GPP
 - 926 Feasibility Study on Typical Traffic Characteristics for XR Services and other Media
 - 928 extended reality (XR) in 5G
 - 998 support of 5G glass-type Augmented Reality / Mixed Reality (AR/MR) devices
 - 999 Virtual Reality (VR) streaming interoperability and characterization

3GPP TR 26.998 V17.1.0 (2022-09)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Support of 5G Glass-type Augmented Reality / Mixed Reality
(AR/MR) devices;
(Release 17)

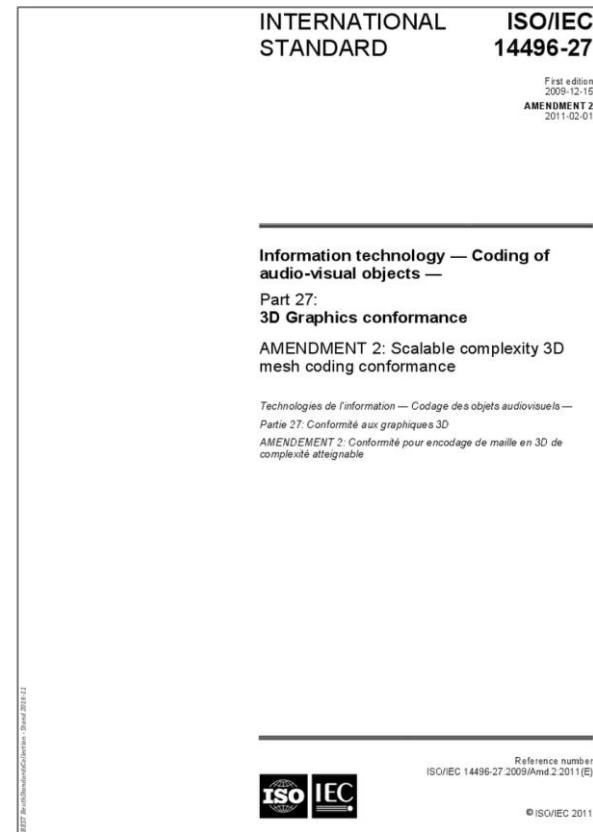


The present document has been developed within the 3rd Generation Partnership Project (3GPPTM) and may be further developed for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented. This Report is provided for future development work within 3GPP only. The Organizational Partners accept no liability for any use of this Specification. Specifications and Reports for implementation of the 3GPPTM system should be obtained via the 3GPP Organizational Partners Publications Offices.



Joint Technical Committee 1 of ISO and IEC

- **ISO/IEC 14496 "coding of audio-visual objects"** specifies system level functionalities for the communication of interactive audio-visual scenes, i.e. the coded representation of information related to the management of data streams (synchronization, identification, description and association of stream content):
 - Part 1: Systems
 - Part 2: Visual
 - Part 3: Audio
 - Part 4: Conformance testing
 - Part 5: Reference software
 - Part 6: Delivery Multimedia Integration Framework (DMIF)
 - Part 7: Optimized reference software for coding of audio-visual objects
 - Part 18: Font compression and streaming
 - Part 19: synthesized texture stream
 - Part 29: Web video coding
 - Part 31: Video coding for browsers
 - Part 26: Audio conformance
 - Part 27: 3D Graphics conformance
 - Part 27: 3D Graphics conformance - Amendment 2: Konformität von Scalable complexity 3D mesh coding
 - Part 27: 3D Graphics conformance - Amendment 3: Konformität von skalierbar komplexem 3D Mesh Coding in 3D GCM
 - Part 27: 3D Graphics conformance - Amendment 4: Conformance for efficient representation of 3D meshes with multiple attributes
 - Part 27: 3D Graphics conformance - Amendment 5: Multi-resolution 3D mesh compression
 - Part 27: 3D Graphics conformance - Amendment 6: Pattern-based 3D mesh coding conformance



communication/interoperability + mobile XR + Application: collaboration ISO-IEC

[01] 3GPP TR 26.962 Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT) - Operation and Usage Guidelines

communication/interoperability + mobile XR

3GPP

- [02] TR 26.118 Virtual Reality (VR) profiles for streaming applications
- [03] TR 26.918 Virtual Reality (VR) media services over 3GPP
- [04] TR 26.926 Feasibility Study on Typical Traffic Characteristics for XR Services and other Media
- [05] TR 26.928 Extended Reality (XR) in 5G
- [06] TR 26.998 Support of 5G glass-type Augmented Reality / Mixed Reality (AR/MR) devices
- [07] TR 26.999 Virtual Reality (VR) streaming interoperability and characterization
- [08] TR 26818 Virtual Reality (VR) streaming audio; Characterization test results

ETSI

- [09] 126118 V 16.2.1, 3GPP TS 26.118 Version 16.2.1 Release 16 5G - Virtual Reality (VR) profiles for streaming applications (3GPP TS 26.118 version 16.2.1 Release 16)
- [10] 126918 V 16.0.0, 3GPP TR 26.918 Version 16.0.0 Release 16 Universal Mobile Telecommunications System (UMTS) - LTE - Virtual Reality (VR) media services over 3GPP (3GPP TR 26.918 version 16.0.0 Release 16)
- [11] GR ARF 001 V1.1.1 Augmented Reality Framework (ARF); AR standards landscape
- [12] GR ARF 004-1 V1.1.1 Augmented Reality Framework (ARF) Interoperability Requirements for AR components, systems and services; Part 1: Overview
- [13] GS ARF 004-3 V1.1.1 Augmented Reality Framework (ARF); Interoperability Requirements for AR components, systems and services; Part 3: World Capture, World Analysis and Scene Management
- [14] GS ARF 004-4 V1.1.1 Augmented Reality Framework (ARF); Interoperability Requirements for AR components, systems and services; Part 4: World Analysis, World Storage and Scene Management functions
- [15] GS ARF 004-5 V1.1.1 Augmented Reality Framework (ARF); Interoperability Requirements for AR components, systems and services; Part 5: External Communications

IEEE

- [16] 1857.7 Standard for Adaptive Streaming
- [17] P2200 Standard Protocol for Stream Management in Media Client Devices

[18] 40500 W3C Web Content Accessibility Guidelines (WCAG) 2.0

[19] 14496-8 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 8: Übertragung von ISO/IEC 14496 Inhalten über IP-Netzwerke

[20] 23001-10 Informationstechnik - MPEG-Systemtechnologien - Teil 10: Beförderung von zeitgesteuerten Metadatenmetriken von Medien im ISO-Basis-Mediendateiformat

[21] 23001-10 AMD 1 Unterstützung für die inhaltsgesteuerte Transkodierung und die räumliche Beziehung von immersiven Medien

Khronos Group

[22] OpenXR 1.0 OpenXR

W3C

[23] Media Capture and Streams Recommendation Media Capture and Streams

[24] SVG 1.1 Recommendation Scalable Vector Graphics (SVG) 1.1 (Second Edition)

[25] WebXR Device API WebXR Device API

[26] WebXR Layers API Level 1 WebXR Layers API Level 1

[27] Working Draft HTML 5.3

[28] XML 1.1 Recommendation Extensible Markup Language (XML) 1.1 (Second Edition)

mobile

IEEE

[29] P2048.03 Standard for VR and AR: Immersive Video File and Stream Formats

[30] P2048.101 Standard for Augmented Reality on Mobile Devices: General Requirements for Software Framework, Components, and Integration

3GPP

[31] TR 26.905 Mobile stereoscopic 3D video

ETSI

[32] GS ARF 003 V1.1.1 Augmented Reality Framework (ARF); AR framework architecture

[33] GS ARF 004-2 V1.1.1 Augmented Reality Framework (ARF) Interoperability Requirements for AR components, systems and services Part 2: World Storage and AR Authoring functions

[34] GS ARF 005 V1.1.1 Augmented Reality Framework (ARF); Open APIs for the Creation and Management of the World Representation

IEC

[35] 63203-101-1 Tragbare elektronische Geräte und Technologien - Teil 101-1: Terminologie

[36] 63203-402-1 Tragbare elektronische Geräte und Technologien - Teil 402-1: Produkte und Systeme - Zubehör - Prüf- und Bewertungsverfahren für

handschuhartige Bewegungssensoren zur Messung der Fingerbewegungen

IEEE

[37] 1857.5 Standard for Advanced Mobile Speech and Audio

ETF

[38] RFC 1889 RTP: A Transport Protocol for Real-Time Applications

[39] RFC 2326 Real Time Streaming Protocol (RTSP)

[40] RFC 3550 RTP: A Transport Protocol for Real-Time Applications

[41] RFC 7826 Real-Time Streaming Protocol Version 2.0

ISO-IEC

[42] 14496-17 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 17: Format für Streamingtexte

[43] 14496-18 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 18: Font-Komprimierung und Streaming

[44] 14496-19 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 19: Synthetisierter Texture Stream

[45] 14496-29 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 29: Video-Web-Codierung

[46] 14496-31 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 31: Videokodierung für Browser

[47] 15444-11 Information technology — JPEG 2000 image coding system - Part 11: Wireless

[48] 23008-2 Informationstechnik - High efficiency coding und Media Delivery in heterogenen Umgebungen - Teil 2: High efficiency Video coding

[49] 23008-2 Amd 1 Information technology — High efficiency coding und media delivery in heterogeneous environments — Part 2: High efficiency video coding — Amendment 1: Shutter interval information SEI message

[50] 23090-18 Informationstechnik - Kodierte Darstellung immersiver Medien - Teil 18: Beförderung von Geometrie-basierter Point Cloud Compression Data

[51] 23090-8 Informationstechnik - Codierte Darstellung immersiver Medien - Teil 8: Netzwerk-basierte Medienverarbeitung

TU

[52] H.264 Advanced video coding for generic audiovisual services

Khronos

[53] Group OpenML OpenML

OASIS

[54] Open MQTT Message Queuing Telemetry Transport OASIS Message Queuing Telemetry Transport (MQTT) TC

VRIF

[55] Guideline v1.0 Volumetric Video Volumetric Video Guidelines v1.0

communication / interoperability

IEEE

[56] P2048.08 Standard for VR and AR: Interoperability between Virtual Objects and the Real World

ETSI

[57] 126929 V 16.1.0, 3GPP TR 26.929 Version 16.1.0 Release 16 5G - QoE parameters and metrics relevant to the Virtual Reality (VR) user experience (3GPP TR 26.929 version 16.1.0 Release 16)

ISO-IEC

[58] 14496-26 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 26: Audiokonformität

[59] 14496-27 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 27: 3D Grafikkonformität

[60] 14496-27 AMD2 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 27: 3D Grafikkonformität - Änderung 2: Konformität von Scalable complexity 3D mesh coding

[61] 14496-27 AMD3 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 27: 3D Grafikkonformität - Änderung 3: Konformität von skalierbar komplexem 3D Mesh Coding in 3D GCM

[62] 14496-27 AMD4 Informationstechnik — Coding of audio-visual objects — Part 27: 3D Graphics conformance — Amendment 4: Conformance for efficient representation of 3D meshes with multiple attributes

[63] 14496-27 AMD5 Informationstechnik — Coding of audio-visual objects — Part 27: 3D Graphics conformance — Amendment 5: Multi-resolution 3D mesh compression

[64] 14496-27 AMD6 Informationstechnik — Coding of audio-visual objects — Part 27: 3D Graphics conformance — Amendment 6: Pattern-based 3D mesh coding conformance

[65] 14496-4 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 4: Konformitätsprüfung

[66] 14496-5 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 5: Referenzsoftware

[67] 14496-6 Informationstechnik - Codierung von audio-visuellen Objekten - **mobile XR + application: assistance**

Teil 6: Darstellung des Multimedia integrierten Rahmens (DMIF)

[68] 14496-7 Informationstechnik - Codierung von audio-visuellen Objekten - Teil 7: Optimierte Referenzsoftware zur Codierung von audio-visuellen Objekten

[69] 15444-4 Information technology — JPEG 2000 image coding system - Part 04: Conformance Testing

[70] 23005-5 Informationstechnik - Medienkontext und -steuerung - Teil 5: Datenformate für Interaktionsgeräte

[71] 23090-13 Informationstechnik - Kodierte Darstellung immersiver Medien - Teil 13: Videodekodierungsschnittstelle für immersive Medien

ITU

[72] 4064 Interoperability testing requirements for a virtual broadband network gateway

Khronos Group

[73] COLLADA COLLADA 3D Asset Exchange Schema

[74] glTF GL Transmission Format (glTF) (Version 2.0)

[75] glTF 2.0 glTF 2.0

[76] OpenGL 3.0 OpenGL 3.0

[77] OpenGL 4.6 OpenGL Graphics System, OpenGL 4.6 Core Profile

[78] OpenVG 1.1 OpenVG

[79] Vulkan 1.3 Vulkan 1.1 API Specifications

NATO

[80] MSG-ET-30 Immersive Environments Interoperability Requirements

SISO

[81] GUIDE-010-2020 Guide for Command and Control Systems - Simulation Systems Interoperation

VRIE

[82] Guideline v1.1 draft 009 Guidelines 1.1

W3C

[83] WebRTC 1.0 Recommendation WebRTC 1.0: Real-time Communication Between Browsers

[84] WebXR DOM Overlays Module WebXR DOM Overlays Module

[85] ETSI GR ARF 002 V1.1.1 Augmented Reality Framework (ARF). Industrial use cases for AR applications and services

application: assistance

[86] IEEE P2048.11 Standard for VR and AR: In-Vehicle Augmented Reality

[87] DIN EN ISO 92419 Grundsätze der ergonomischen Gestaltung assistiver Systeme

application: collaboration

ISO-IEC

[88] 19778-1 Informationstechnik - Lernen, Ausbildung und Weiterbildung - Kooperative Technologien - Kooperative Arbeitsplätze - Teil 1: Datenmodell für kooperative Arbeitsplatzumgebungen

[89] 19778-2 Informationstechnik - Lernen, Ausbildung und Weiterbildung - Kooperative Technologien - Kooperative Arbeitsplätze - Teil 2: Datenmodell für kooperative Arbeitsplatzumgebungen

[90] 19778-3 Informationstechnik - Lernen, Ausbildung und Weiterbildung - Kooperative Technologien - Kooperative Arbeitsplätze - Teil 3: Datenmodell für kooperative Gruppen



What is about to come in this topic?

- in total: 100+ standardization project actually ingoing!
- some actual projects:
 - IEC 63203-301-1 *Wearable electronic devices and technologies–*
Part 301-1: test method of electrochromic films for wearable equipments
 - IEEE P2048.03 Standard for VR and AR: Immersive Video File and Stream Formats
 - IEEE P2048.08 Standard for VR and AR: Interoperability between Virtual Objects and the Real World
 - IEEE P2048.11 Standard for VR and AR: In-Vehicle Augmented Reality
 - IEEE P2048.101 Standard for Augmented Reality on Mobile Devices:
General Requirements for Software Framework, Components, and Integration
- further:
 - IEC 62629 series display technology
 - IEC 63145 series eyewear display
 - ISO 23090 series coded representation of immersive media
 - (as guidelines mainly) ethical, legal, social aspects
- actually a lot of activities in the Metaverse area (e.g. Metaverse Standards Forum)



- there is already a vast number of XR standards out there.
- as cross-cutting technology, XR standardization is scattered among many organizations: thus hard to get an overview.
- individuals and companies are apparently not totally aware of what's on the table; lack of tech transfer
- Existing XR standards provide an excellent basis to build on, avoiding to re-invent the wheel and ensuring to concentrate on the real innovative aspects of one's work
- standards pave the way for today's and future markets

=> let's use them and extend them, engage!





*„Without standards,
there can be no improvement.“*

Ōno Taiichi

(* 29 February 1912 in Manchuria; † 28 May 1990) was the inventor of the Toyota production system. He developed today's basic logistics methods, the Kanban system and just-in-time production, between 1950 and 1982. The Japanese management concept Kaizen is also based on his ideas.

Thank you for your attention.

XR Standards in Health & Care. The status quo and path ahead of us.



Bundesministerium
für Bildung
und Forschung

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XR
EXPO
2024



3rd - 4th April 2024 - Stuttgart