



XR Standards Worldwide

A Global Monitor

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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





Standards in everyday life

Using a Smartphone for browsing (some of possibly involved standards) :

- User equipment regarding hardware
- characteristics, also taking into account safety issues
- Connectivity among user devices and wireless network as well as the functionality of the same network
- Functionality of the Internet and the protocols to support web browsing

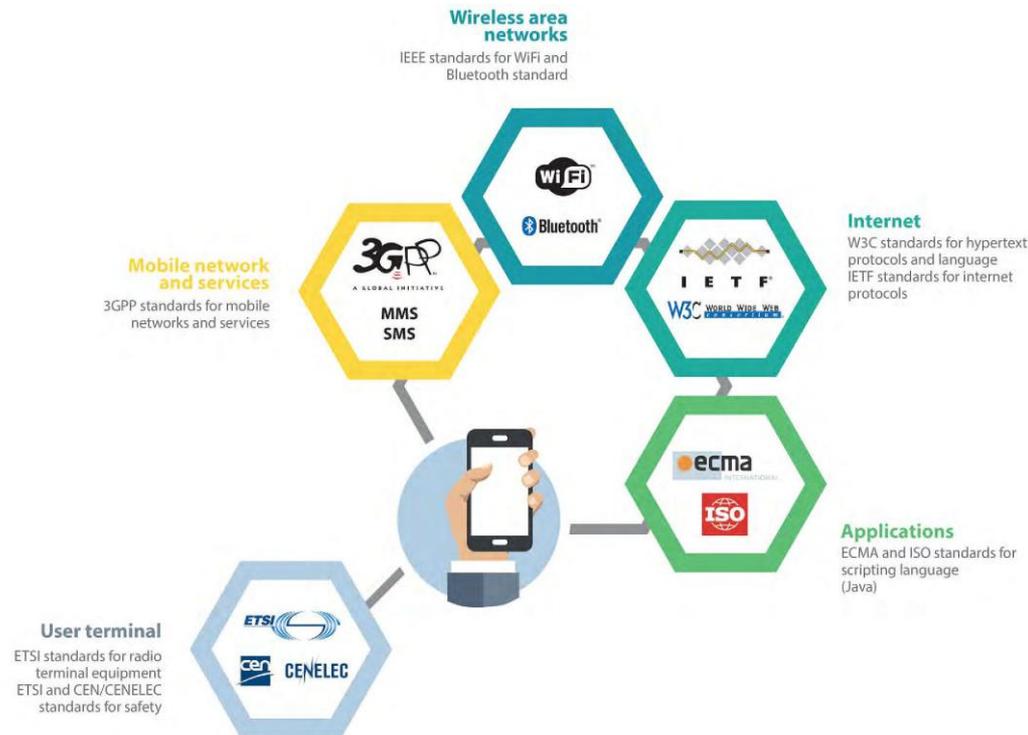


Fig. ETSI



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:

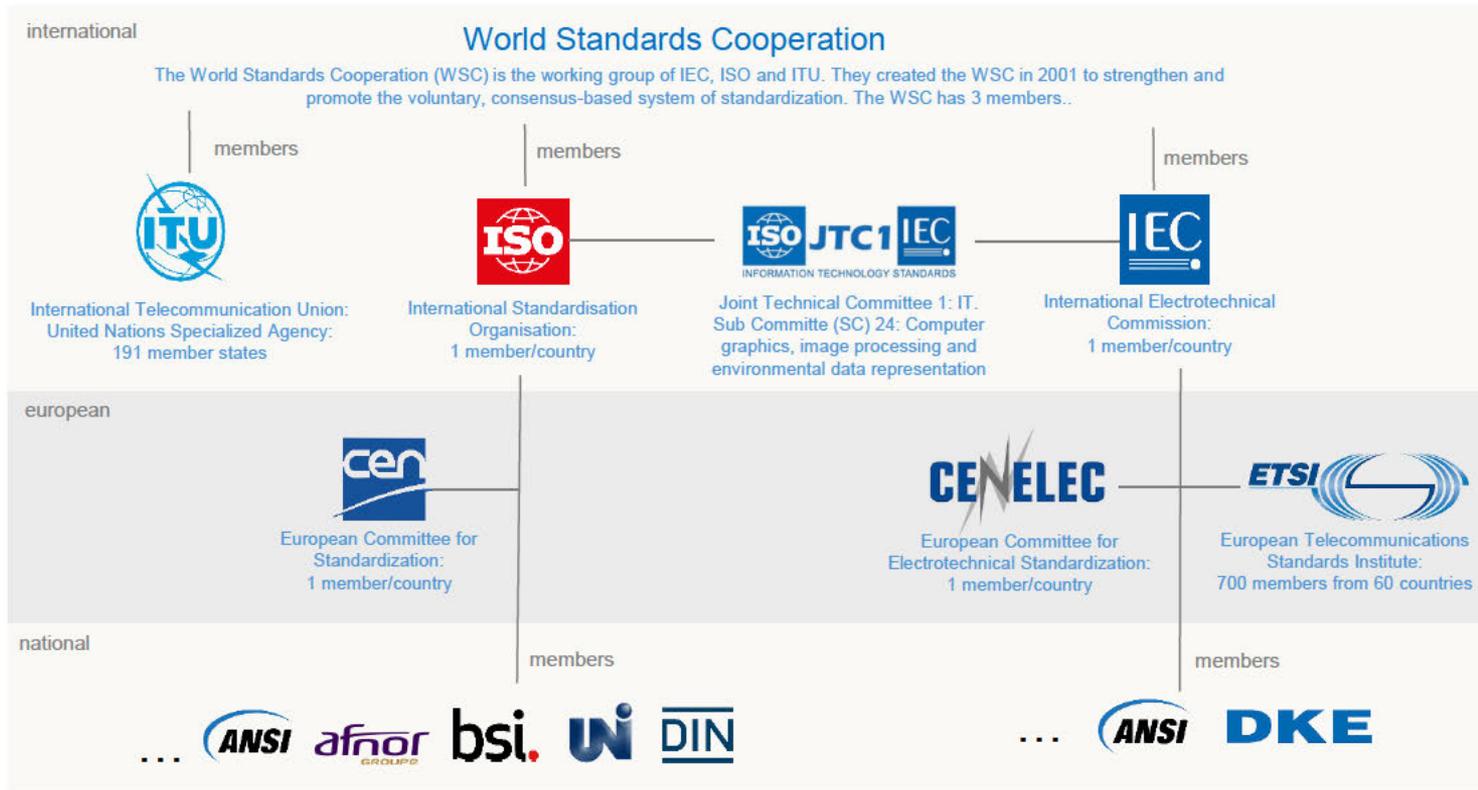
- These are not recognized by any political bodies
- IEEE is a primary SDO with a large number of active technical standards, ranging from wireless communications and digital health to cloud computing, power and energy, 3D video, electrical vehicle standards, and the Internet of Things. It was created 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.





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.





Anything about XR in this topic?!



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 Cao/AFP via Getty Images

BY GIAN VOLPICELLI

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



- Actively promote the consistent worldwide application of internationally recognized principles in the development of standards.
- work to prevent standards and their application from becoming technical trade barriers to U.S. products and services.
- Strengthen international outreach programs to promote understanding of how U.S. voluntary, consensus-based, market-driven standards can benefit businesses, consumers, and society as a whole.
- Respect diverse funding models for the U.S. standards system.
- Address the need for standards in support of emerging national priorities.



- supporting the EU's leading position as a forerunner in key technologies and promoting EU core values
- leveraging the European standardization system to deliver on the twin green and digital transition and support the resilience of the single market
- new High-Level Forum for Member States and European standardization organizations
- foster the development and deployment of international standards for a free, open, accessible and secure global internet
- establish an EU internet standards monitoring website
- monitor the effective implementation of existing commitments on standardization in EU trade agreements
- concerned about decision-making in ETSI



- 15-year plan to shape the future, to set the global standards for the next-generation of technologies.
- pushing domestic firms and experts to be part of the global effort to set standards
- research on China Standardization System, Method and Evaluation
- research on Supporting High-quality Development Standardization System
- research on Standardization Military-Civil Integration Development
- start with the national standards of **virtual reality technology**, integrated circuit design, intelligent health care and 5G key components, and gradually expand to the emerging areas of Internet of Things, photovoltaic, information equipment and other industries.



- Necessity of national standards
- Clarification of appropriate quality levels
- Revisions of the Industrial Standardization Law
- Observance of JIS standards and JIS markings
- Responses to Inappropriate ISO and IEC Standards
- Relationship with Standardization Organizations in Europe
- Support for Strategic Standard Proposal
- Active Contribution to Standardization Activities
- Programs for Developing Standardization Experts in Asia and the Pacific
- Standardization regarding Information Technology, environmental preservation, consumers, elderly people, and people with disabilities, manufacturing technology and industrial platform technology



- International and European trade is facilitated by standardization
- Standardization relieves the burden on government regulation and supports it
- Germany is driving forward standardization worldwide in future topics by networking stakeholders, establishing new processes and open platforms for coordination.
- Industry and society are the driving forces in standardization
- Standardization is used as a strategic and attractive tool, especially by companies.
- Standardization has a high status in the public perception

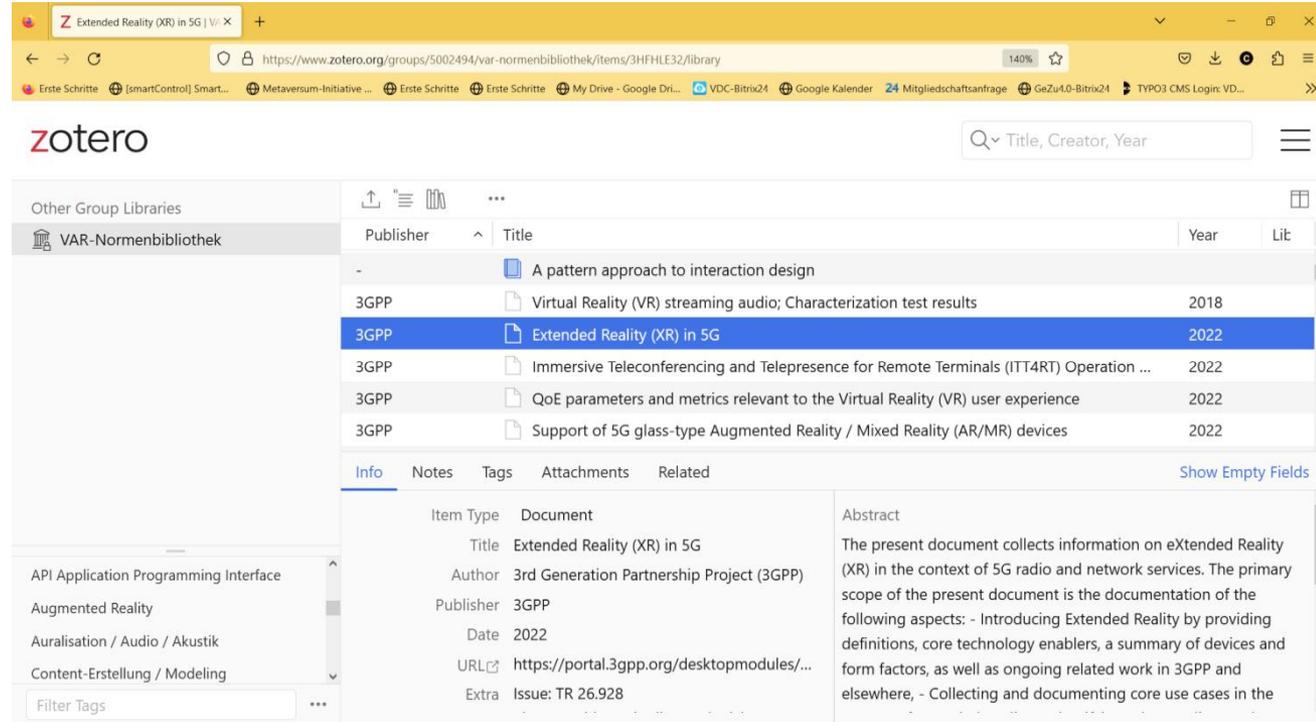


- advance national standards system
- innovate KS management system
- strengthen standard technology infrastructure
- advance measurement standards
- advance legal metrology system
- actively participate in international standardization activities
- lead the international de-jure standardization
- support international de-facto standardization
- address the technical barriers to trade (TBT)
- assist the private sector in increasing its capacity to develop standards
- foster standardization capacity of private sector
- promote standard development activity of producer group

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 web interface. The browser address bar displays the URL: <https://www.zotero.org/groups/5002494/var-normenbibliothek/items/3HFHLE32/library>. The page title is "Extended Reality (XR) in 5G | V...". The Zotero logo is visible at the top left. A search bar on the right contains the text "Title, Creator, Year". Below the search bar, there is a section for "Other Group Libraries" with a dropdown menu showing "VAR-Normenbibliothek". The main content area displays a list of publications with columns for Publisher, Title, Year, and Lit. The selected item is:

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	

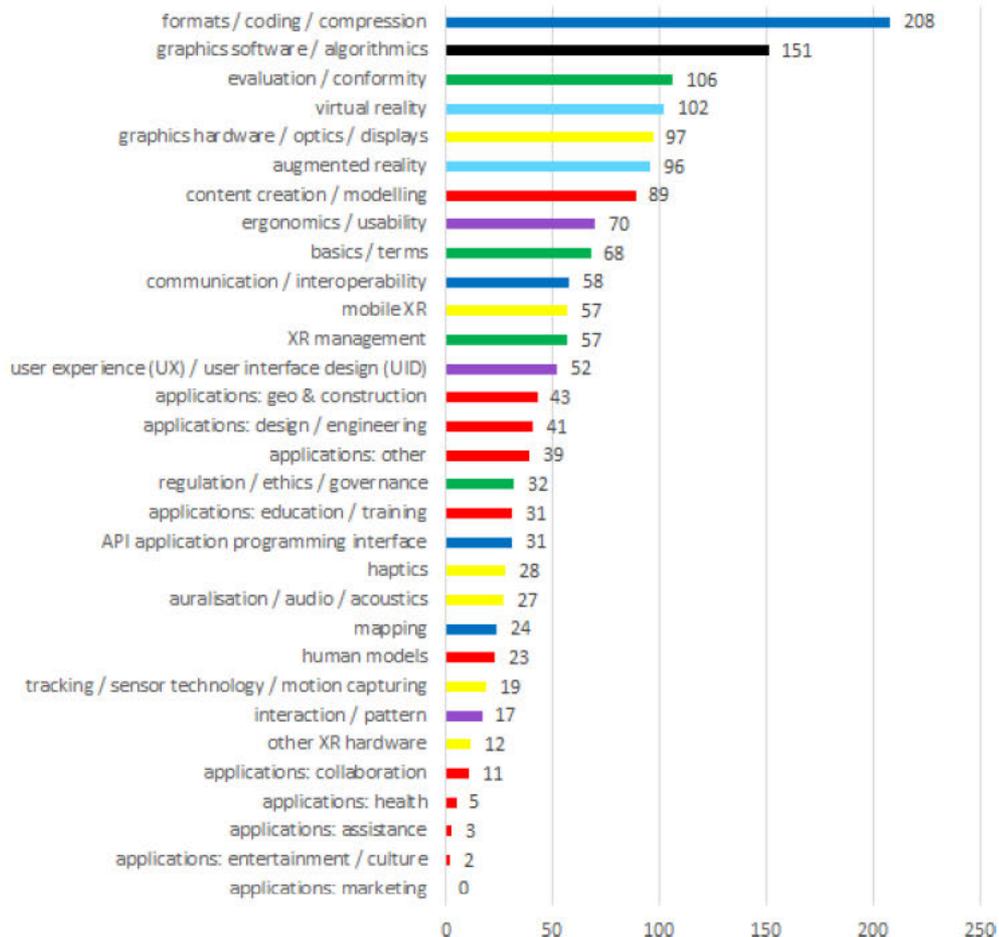
Below the list, there are tabs for "Info", "Notes", "Tags", "Attachments", and "Related". The "Info" tab is active, showing details for the selected item:

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	



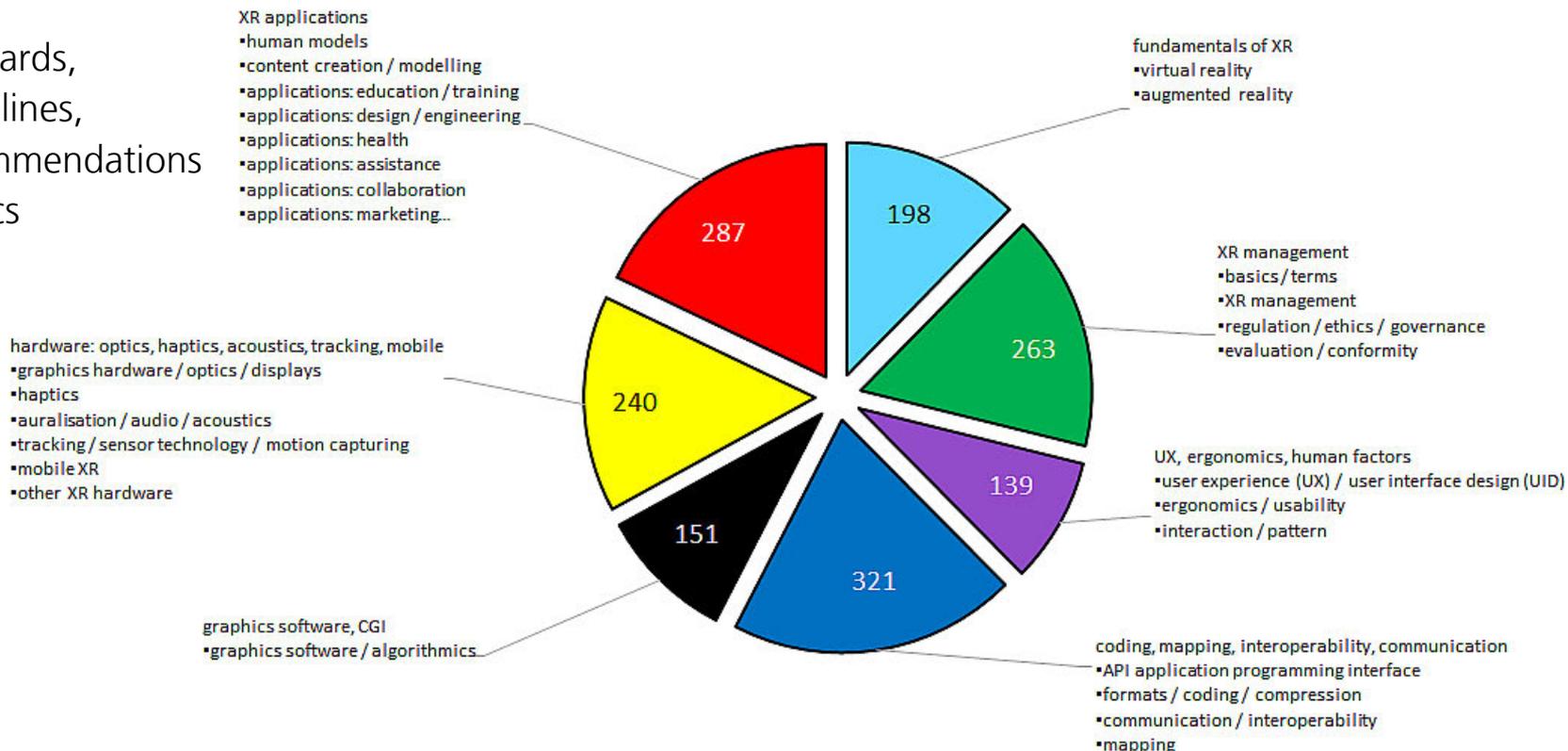
ranking

- XR standards,
 - XR guidelines,
 - XR recommendations
- by frequency of topic



clustering

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





DRAFT INTERNATIONAL STANDARD
ISO/IEC DIS 3721-1

ISO/IEC JTC 1/SC 24 Secretariat: BSI
Voting begins on: Voting terminates on:
2021-09-01 2021-11-24

Information technology — Computer graphics, image processing and environmental data representation — Information model for Mixed and Augmented Reality Contents —

Part 1:
Core Objects and Attributes

ICS: 35.140

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This document is circulated as received from the committee secretariat.



Reference number
ISO/IEC DIS 3721-1:2021 (R)

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INTERNATIONAL STANDARD ISO/IEC 23488

First edition
2022-05

Information technology — Computer graphics, image processing and environment data representation — Object/environmental representation for image-based rendering in virtual/mixed and augmented reality (VR/MAR)

Technologie de l'information — Infographie, traitement d'images et représentation des données environnementales — Représentation d'objets/environnements pour l'habillage à partir d'images réelles dans la réalité virtuelle/mixte et augmentée (VR/MAR)



Reference number
ISO/IEC 23488:2022 (R)

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INTERNATIONAL STANDARD ISO 17901-1

First edition
2015-07-01

Optics and photonics — Holography — Part 1: Methods of measuring diffraction efficiency and associated optical characteristics of holograms

Optique et photonique — Holographie — Partie 1: Méthodes de mesure de l'efficacité de diffraction et caractéristiques optiques associées aux hologrammes



Reference number
ISO 17901-1:2015 (R)

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International Telecommunication Union

ITU-T
TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.1035
(11/2021)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS
Multimedia Quality of Service and performance – Generic
and user-related aspects

**Influencing factors on quality of experience for
virtual reality services**

Recommendation ITU-T G.1035



NORTH ATLANTIC TREATY ORGANIZATION



SCIENCE AND TECHNOLOGY ORGANIZATION



AC/323(HFM-MSG-323)TF/1039

STO TECHNICAL REPORT

TR-HFM-MSG-323

**Guidelines for Mitigating Cybersickness
in Virtual Reality Systems**
(Guide d'atténuation du cybermalaise
dans les systèmes de réalité virtuelle)

Peer-reviewed Final Technical Report of the Human Factors and Medicine /
Modeling Simulations Group, Activity Number 323. This Report describes
the outcome of the activity performed during the study.



Published October 2021

Distribution and Availability on Back Cover

3GPP TR 26.928 V17.0.0 (2022-04)
Technical Report

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Extended Reality (XR) in 5G
(Release 17)**



A GLOBAL INITIATIVE

The present document has been developed within the 3rd Generation Partnership Project (3GPP)TM, and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval procedure by the 3GPP Organizational Partners and shall not be implemented. This document is provided for the development track 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 Publication Offices.



ETSI GS ARF 005 V1.1.1 (2022-09)



**Augmented Reality Framework (ARF);
Open APIs for the Creation and Management of the
World Representation**

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.

IEEE SA
STANDARDS
ASSOCIATION

**INDUSTRY CONNECTIONS
REPORT**



THE IEEE GLOBAL INITIATIVE ON ETHICS OF
EXTENDED REALITY (XR) REPORT

**EXTENDED REALITY (XR) ETHICS
AND DIVERSITY, INCLUSION, AND
ACCESSIBILITY**

Authored by
Dylan Fox
Isabel Guenette-Thornton
Chapter Leaders

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IEEE STANDARDS ASSOCIATION

**IEEE Standard for Distributed
Interactive Simulation—
Application Protocols**

IEEE Computer Society

Sponsored by the
SISO Standards Activity Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

19 December 2012

IEEE Std 1278.1™-2012
(Revision of
IEEE Std 1278.1-1995)



COLLADA

COLLADA – Digital Asset Schema Release 1.5.0

Specification

April 2008

Editors: Mark Barnes and Ellen Levy Finch, Sony Computer Entertainment Inc.

ANSI/CTA Standard

Definitions and Characteristics for VR Video and
VR Images

ANSI/CTA-2085

November 2019



Consumer
Technology
Association

Consumer
Technology
Association

CTA Standard

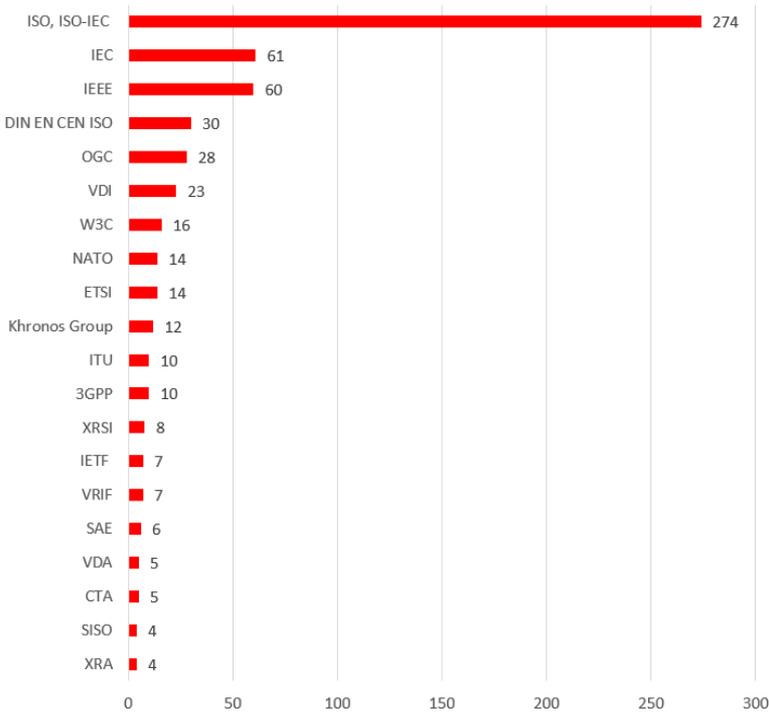
Best Practices for Limited Mobility in XR

CTA-2095

May 2021

XR Standard Development Organizations (SDOs)

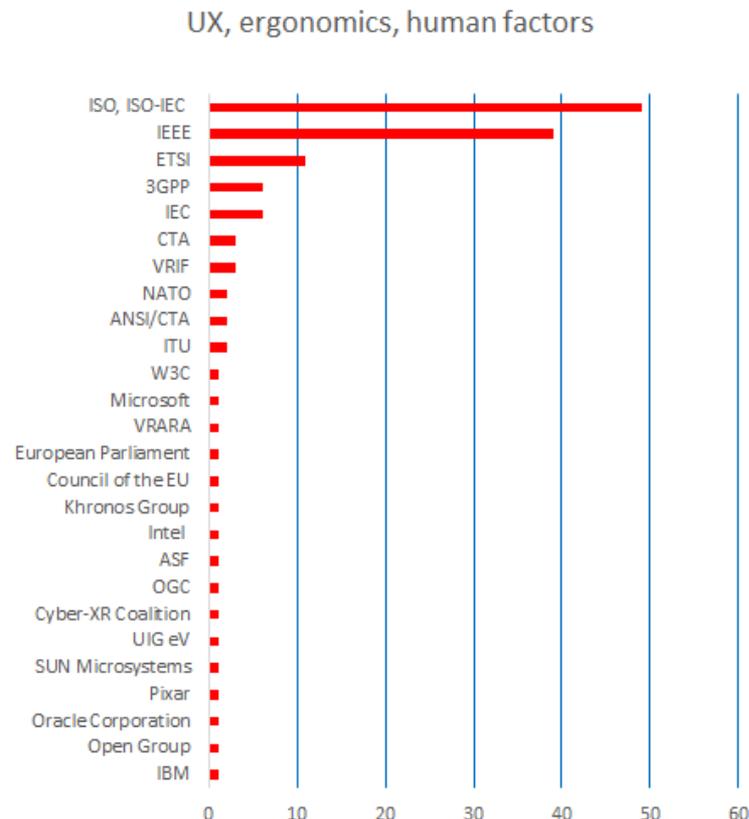
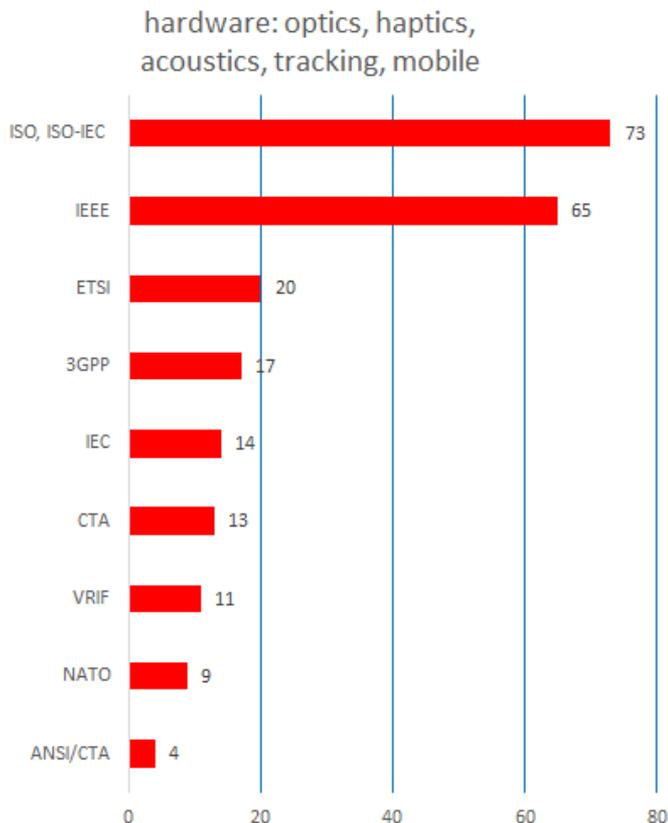
published XR norms, standards, guidelines, recommendation
[by organizations]



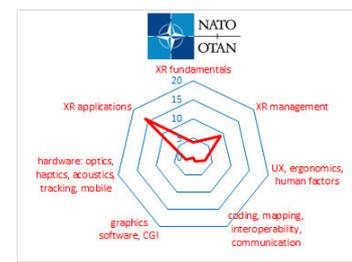
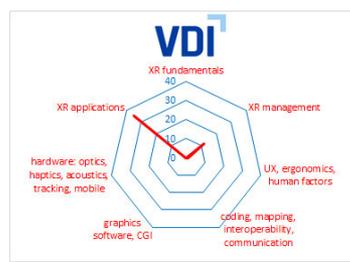
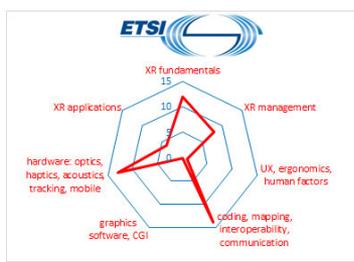
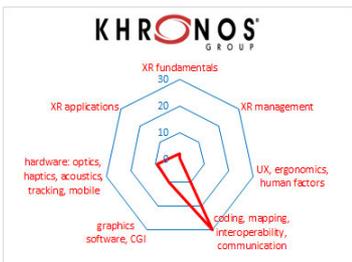
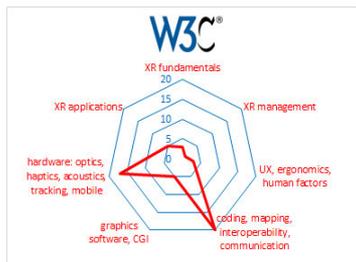
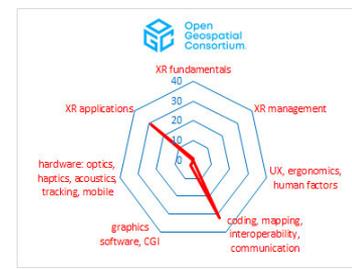
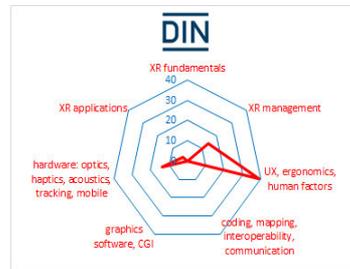
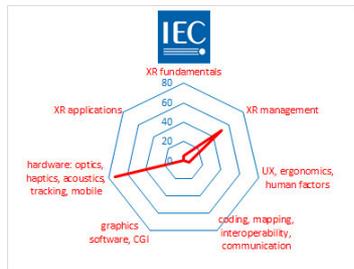
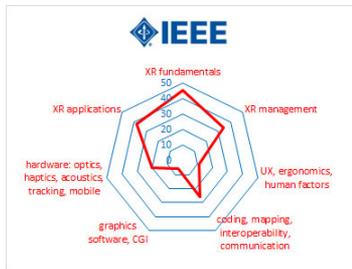
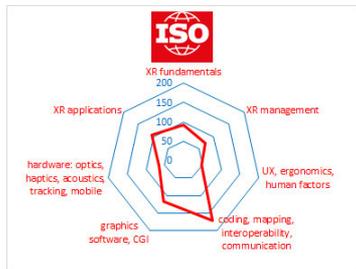
What XR SDOs work on which XR topics? Example.

analysis on the right hand side shows XR SDOs contributing with own documents to certain XR fields.

It becomes further obvious that certain XR topics are treated by SDOs in different number at total.

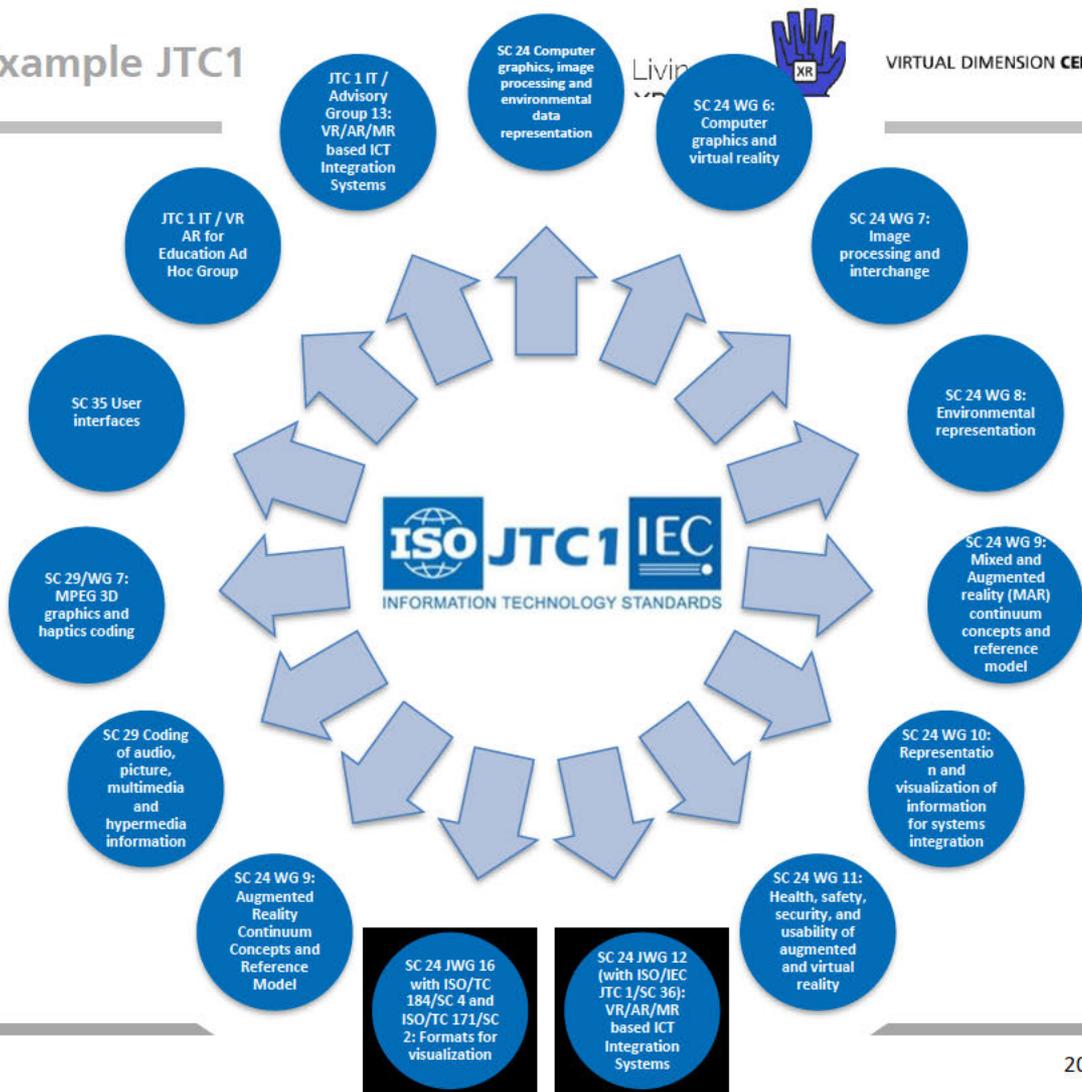


Focuses of XR standardization organizations varying

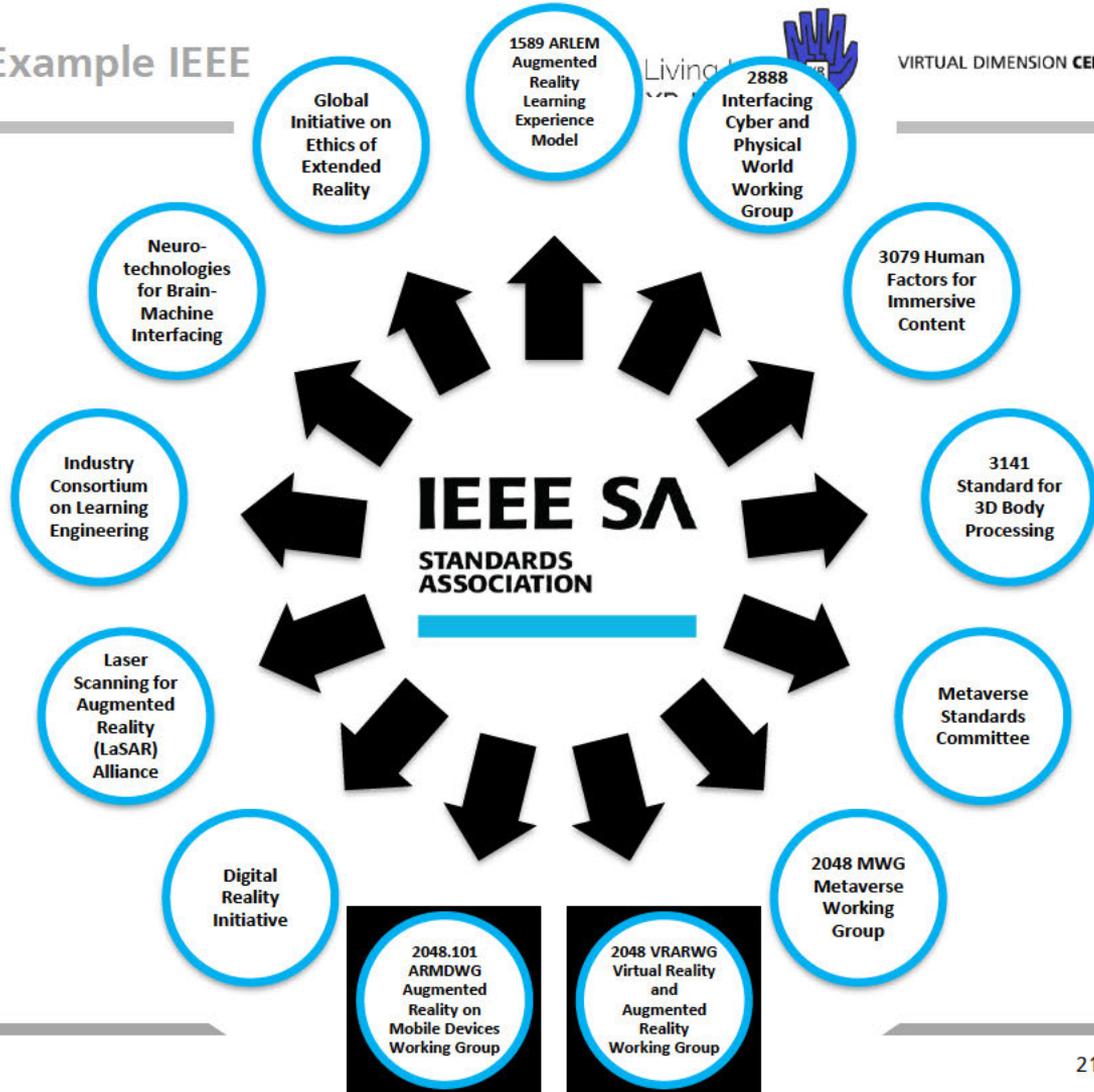




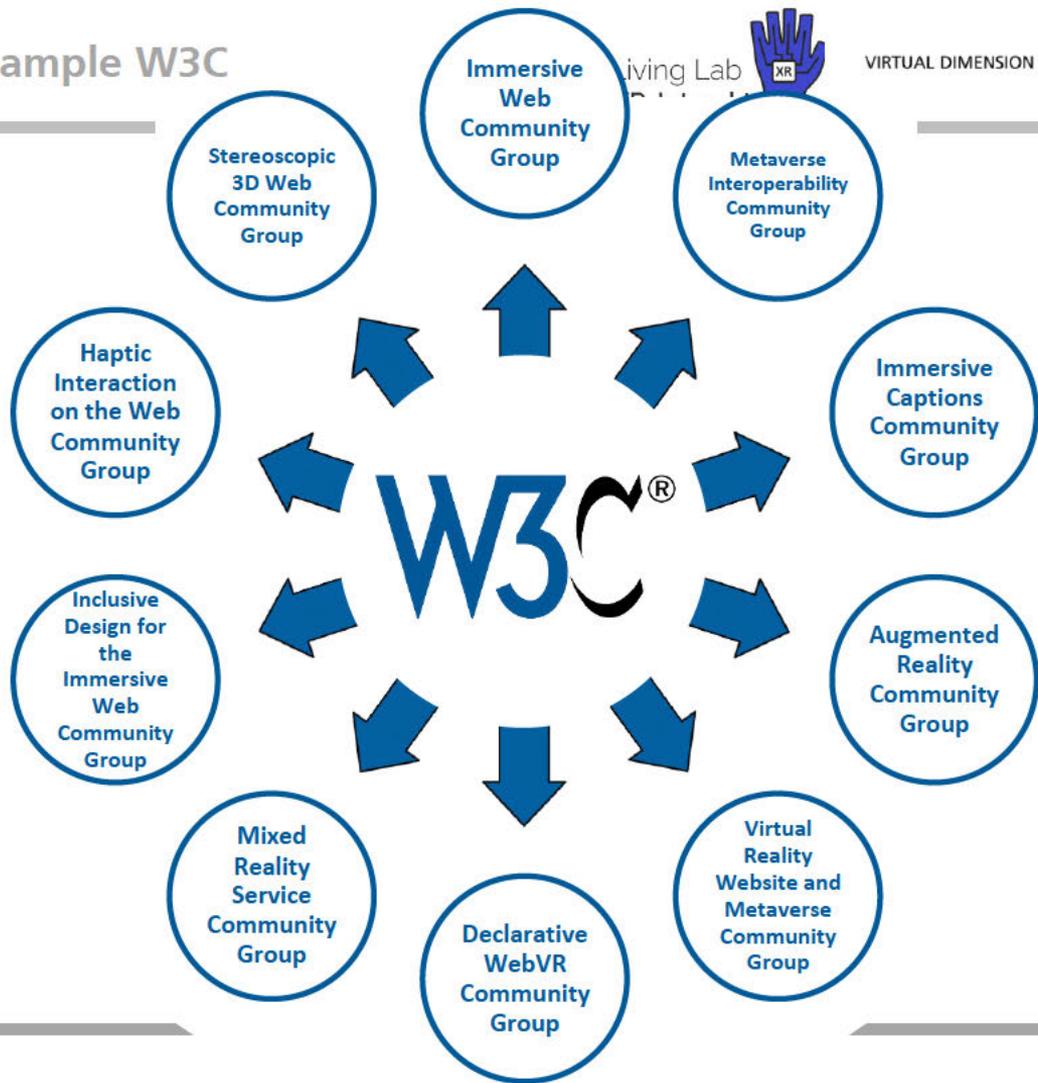
The **International Organization for Standardization (ISO)** is an independent, non-governmental organization, whose members consist of various national standardization bodies. As of 2022, there are 167 members who represent ISO in their country, with each country having only one member. The organization develops and publishes international standards in all technical and non-technical areas, except for electrical engineering and electronics, which fall under the jurisdiction of the International Electrotechnical Commission. By February 2023, ISO has developed over 24,676 standards that cover all areas from industrial products and technology to food safety, agriculture, and healthcare. **The Moving Picture Experts Group (MPEG)** is a group of experts dealing with the standardization of video compression and related areas, such as audio data compression or container formats. Colloquially, "MPEG" usually refers not to the group of experts, but to a specific MPEG standard. The MPEG meets three or four times a year for five-day meetings. About 350 experts from 200 companies and organizations from 20 countries participate in these meetings, the MPEG meetings. MPEG is part of ISO/IEC JTC1/SC29.



The **Institute of Electrical and Electronics Engineers (IEEE)** is a global professional association of engineers primarily from the fields of electrical engineering and information technology, legally based in New York City with operational headquarters in Piscataway, New Jersey. It organizes professional conferences, publishes various professional journals, and forms committees for the standardization of techniques, hardware, and software. Scientific contributions in journals or to IEEE conferences are generally presumed to be of particularly high professional quality. With publications like the IEEE Spectrum journal, the organization also promotes interdisciplinary information and discussion on the societal impacts of new technologies. The IEEE organizes several subgroups addressing VR or AR topics, including (1) Digital Reality, (2) Augmented Reality Learning Experience Model (AR-LEM), the (3) IEEE 2048 VR/AR Working Group (VRARWG), and a (4) Smart Glasses Interest Group. Additionally, the IEEE operates a Standards Group. Where the latter collaborates with one of the aforementioned four theme groups, V/AR-relevant norms, standards, and guidelines are created..

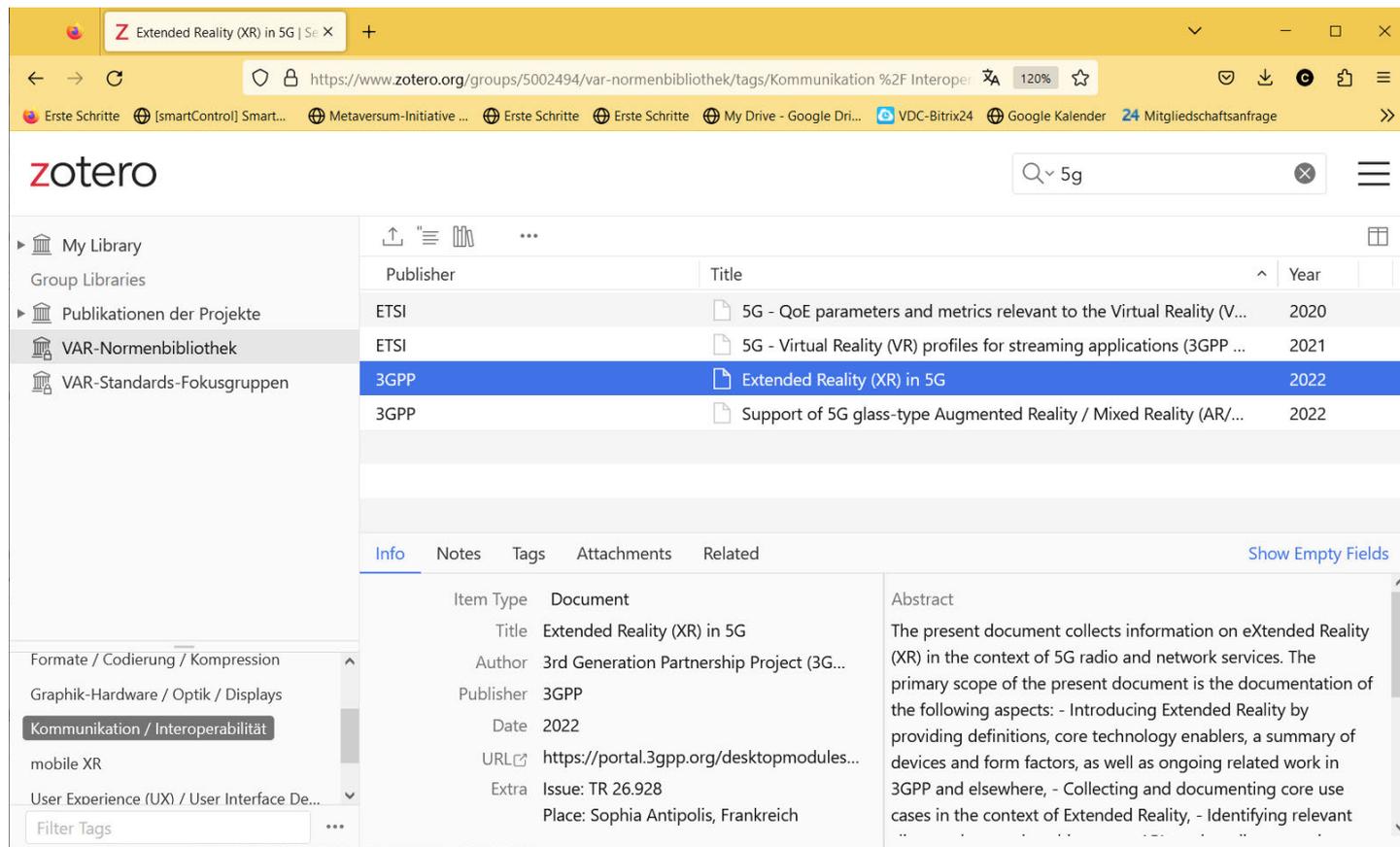


The **World Wide Web Consortium (shortly W3C)** is the body responsible for standardizing technologies on the World Wide Web. It was founded on October 1, 1994, at the MIT Laboratory for Computer Science in Cambridge, Massachusetts. The W3C is a membership organization. It develops technical specifications and guidelines through a mature, transparent process to achieve maximum consensus about the content of technical protocols, high technical and editorial quality, and approval by the W3C and its followers. Examples of technologies standardized by the W3C include HTML, XHTML, XML, RDF, OWL, CSS, SVG, and WCAG. Within its "Immersive Web Community Group," the W3C addresses VR and AR topics. Already in the early 1990s, ideas for a 3D extension of the internet emerged at the first HTML conferences, which then resulted in the Virtual Reality Language (VRML) as a counterpart to HTML.



An online accessible database (a common literature database) with

- references to all known documents. They are qualified (by tags) and with a searchable description. The document's entry further comprises the publishing authority, release date and a link to this resource in the WWW.



The screenshot shows a web browser window displaying the Zotero library interface. The search results table is as follows:

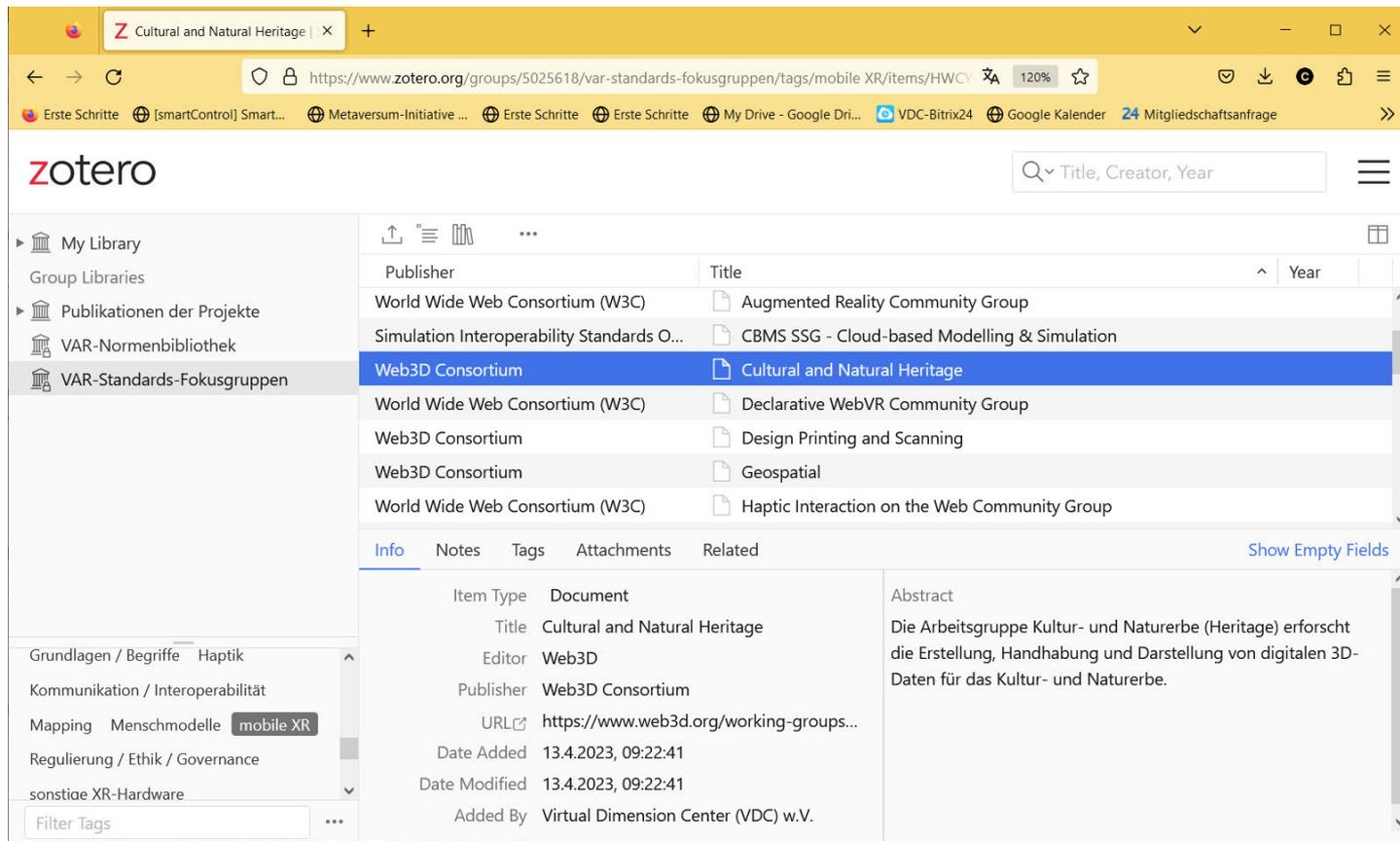
Publisher	Title	Year
ETSI	5G - QoE parameters and metrics relevant to the Virtual Reality (V...	2020
ETSI	5G - Virtual Reality (VR) profiles for streaming applications (3GPP ...	2021
3GPP	Extended Reality (XR) in 5G	2022
3GPP	Support of 5G glass-type Augmented Reality / Mixed Reality (AR/...	2022

Below the table, the 'Info' tab is selected, showing the following details for the selected document:

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 context of Extended Reality, - Identifying relevant
Author	3rd Generation Partnership Project (3G...	
Publisher	3GPP	
Date	2022	
URL	https://portal.3gpp.org/desktopmodules...	
Extra	Issue: TR 26.928 Place: Sophia Antipolis, Frankreich	

An online accessible database (a common literature database) with

- references to all known active XR SDO working groups. They are qualified (by tags) and with a searchable description. The group's entry further comprises the organizing/leading SDO and a link to this resource in the WWW.



The screenshot shows a web browser window displaying the Zotero library interface. The address bar shows the URL: [https://www.zotero.org/groups/5025618/var-standards-fokusgruppen/tags/mobile XR/items/HWC...](https://www.zotero.org/groups/5025618/var-standards-fokusgruppen/tags/mobile%20XR/items/HWC...). The page title is "Cultural and Natural Heritage".

The interface includes a search bar with the text "Title, Creator, Year". On the left, there is a sidebar with a tree view of libraries and tags. The "VAR-Standards-Fokusgruppen" library is selected, and the "mobile XR" tag is highlighted. Below the sidebar, there are filter tags: "Grundlagen / Begriffe", "Haptik", "Kommunikation / Interoperabilität", "Mapping", "Menschmodelle", "mobile XR", "Regulierung / Ethik / Governance", and "sonstige XR-Hardware".

The main content area displays a list of items. The selected item is:

Publisher	Title	Year
World Wide Web Consortium (W3C)	Augmented Reality Community Group	
Simulation Interoperability Standards O...	CBMS SSG - Cloud-based Modelling & Simulation	
Web3D Consortium	Cultural and Natural Heritage	
World Wide Web Consortium (W3C)	Declarative WebVR Community Group	
Web3D Consortium	Design Printing and Scanning	
Web3D Consortium	Geospatial	
World Wide Web Consortium (W3C)	Haptic Interaction on the Web Community Group	

Below the list, there are tabs for "Info", "Notes", "Tags", "Attachments", and "Related". The "Info" tab is active, showing the following details:

Item Type	Document	Abstract
Title	Cultural and Natural Heritage	Die Arbeitsgruppe Kultur- und Naturerbe (Heritage) erforscht die Erstellung, Handhabung und Darstellung von digitalen 3D-Daten für das Kultur- und Naturerbe.
Editor	Web3D	
Publisher	Web3D Consortium	
URL	https://www.web3d.org/working-groups...	
Date Added	13.4.2023, 09:22:41	
Date Modified	13.4.2023, 09:22:41	
Added By	Virtual Dimension Center (VDC) w.V.	

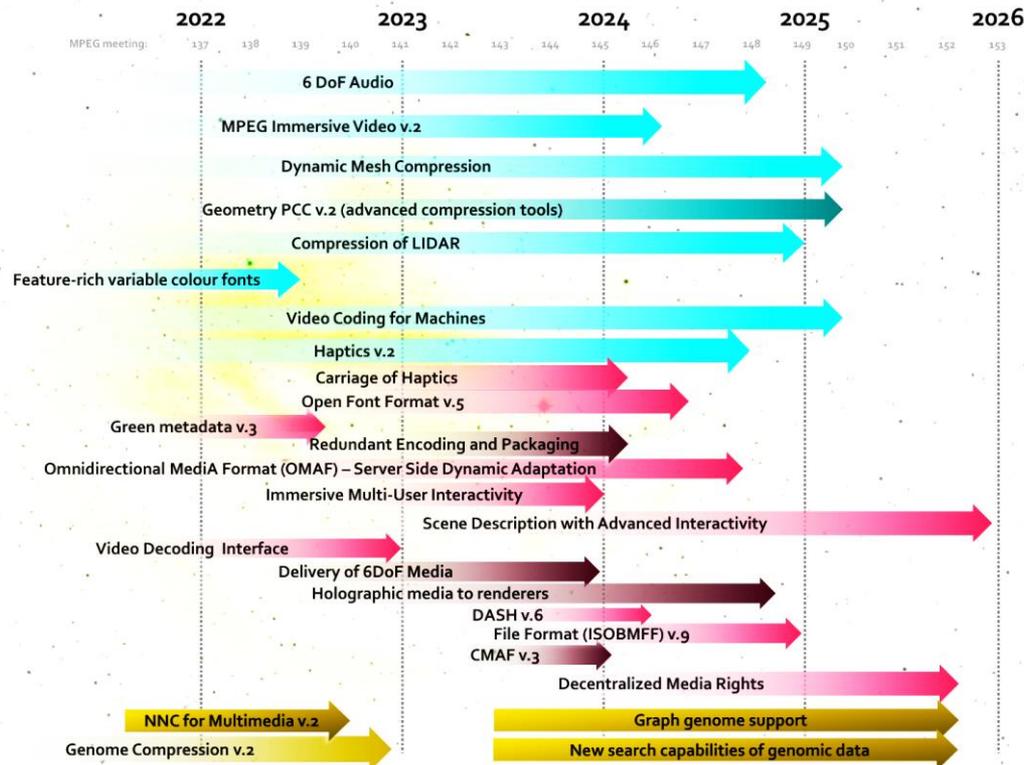
What's further interesting?

Many SDOs publish standardization roadmaps.

These roadmaps provide an excellent, combined perspective on many topics and their corresponding timelines.

This could well help to find a good starting point for an engagement.

Example on the right hand side: the MPEG roadmap



Media
Coding

Systems
and Tools

Beyond
Media

Example here: the OGC (Open Geospatial Consortium) roadmap

OGC Standards Roadmap

Progress of Official OGC Standards **OGC** & **Community Standards** **Community** 2021-05-27

	SWG Work / Work Item	OAB Review	OCC-NA Review	Public Review	Prepare for Approval	TC Approval to Vote	TC Vote	PC Vote	Public Release
Proposed Standards									
OGC Abstract Spec Topic 0 04-004		✓	✓	✓	✓	✓	✓	✓	✓
OGC Abstract Spec Topic 2 - Referencing by Coordinates 18-005		✓	✓	✓	✓	✓	✓	✓	✓
OGC Abstract Spec Topic 20 - Observations, Measurements and Samples 20-002		✓	✓	✓	✓	✓	✓	✓	✓
OGC Abstract Spec Topic 21 - DGGS v. 2.0 20-040		✓	✓	✓	✓	✓	✓	✓	✓
OGC Abstract Spec Topic 22 - Tiling 19-014		✓	✓	✓	✓	✓	✓	✓	✓
OGC Abstract Spec Topic 6 - Schema for coverage geometry and functions		✓	✓	✓	✓	✓	✓	✓	✓
OGC CDB 1.2		✓	✓	✓	✓	✓	✓	✓	✓
OGC CDB 2.0		✓	✓	✓	✓	✓	✓	✓	✓
OGC CityGML 3.0		✓	✓	✓	✓	✓	✓	✓	✓
Community CityJSON		✓	✓	✓	✓	✓	✓	✓	✓
OGC Common Object Model Container SWG		✓	✓	✓	✓	✓	✓	✓	✓
OGC Coverage Implementation Schema - ReferenceableGridCoverage Extension 1.1 16-0036		✓	✓	✓	✓	✓	✓	✓	✓
OGC EO Extension for OpenSearch 13-0299		✓	✓	✓	✓	✓	✓	✓	✓
OGC EO Product Metadata GeoJSON/USON-LD Encoding 17-003		✓	✓	✓	✓	✓	✓	✓	✓
OGC GeoAPI 09-0034		✓	✓	✓	✓	✓	✓	✓	✓
OGC GeoPackage 1.3 12-120118		✓	✓	✓	✓	✓	✓	✓	✓
OGC GeoPose		✓	✓	✓	✓	✓	✓	✓	✓
OGC GeoTIFF 19-008		✓	✓	✓	✓	✓	✓	✓	✓
OGC GroundwaterML2 v2.3 19-013		✓	✓	✓	✓	✓	✓	✓	✓
OGC HDF5 Core 18-043		✓	✓	✓	✓	✓	✓	✓	✓
Community IMDF 19-009		✓	✓	✓	✓	✓	✓	✓	✓
OGC IndoorGML 1.1 19-011		✓	✓	✓	✓	✓	✓	✓	✓
OGC MetOcean Profile and Extensions to WCS 2.1 15-045, 15		✓	✓	✓	✓	✓	✓	✓	✓
OGC Moving Features Encoding Extension - JSON 19-045		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Common 19-072		✓	✓	✓	✓	✓	✓	✓	✓

	SWG Work / Work Item	OAB Review	OCC-NA Review	Public Review	Prepare for Approval	TC Approval to Vote	TC Vote	PC Vote	Public Release
OGC OGC API - Coverages		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Environmental Data Retrieval 19-006		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Features - Part 1: Core 17-069		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Features - Part 2: Coordinate Reference System by Reference 18-050		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Features - Part 3: Filtering and the Common Query Language (CQL) 19-079		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Features - Part 4: Create, Replace, Update and Delete 20-002		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Features - Part 5: OpenAPI 3.1		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Maps		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Processes		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Records		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Styles		✓	✓	✓	✓	✓	✓	✓	✓
OGC OGC API - Tiles		✓	✓	✓	✓	✓	✓	✓	✓
Community OpenFlight 16.0		✓	✓	✓	✓	✓	✓	✓	✓
OGC OpenSearch GeoJSON/USON-LD Response Encoding 17-047		✓	✓	✓	✓	✓	✓	✓	✓
OGC PipelineML 19-073		✓	✓	✓	✓	✓	✓	✓	✓
OGC Semantic Sensor Network Ontology 18-079		✓	✓	✓	✓	✓	✓	✓	✓
OGC SensorML 2.1 12-00061		✓	✓	✓	✓	✓	✓	✓	✓
OGC SensorThings API 1.1 - Part 1 18-008		✓	✓	✓	✓	✓	✓	✓	✓
OGC Symbology Conceptual Model: Core 18-067		✓	✓	✓	✓	✓	✓	✓	✓
OGC Time Ontology in OWL 18-071		✓	✓	✓	✓	✓	✓	✓	✓
OGC TimeseriesML 1.3 15-0426		✓	✓	✓	✓	✓	✓	✓	✓
OGC Two Dimensional Tile Matrix Set 17-003		✓	✓	✓	✓	✓	✓	✓	✓
OGC Well Known Text Representation of Coordinate Reference Systems 18-010		✓	✓	✓	✓	✓	✓	✓	✓
Community Zarr		✓	✓	✓	✓	✓	✓	✓	✓



What's further interesting?

Some SDOs and more often consultants and policy makers publish standardization requirements.

These requirement analyses could provide a valuable starting point to start own initiatives together with an SDO.

1. Representation and exchange of three-dimensional data assets

- Graphics Language Transmission Format - glTF (Khronos Group)
- GL Binary – GLB (Khronos Group)
- Universal Scene Description – USD (Pixar)
- COLLABorative Design Activity – COLLADA (Khronos Group)
- Virtual Reality Modeling Language - VRLM

2. Cross-platform data/asset exchange APIs

- MPEG-V
- Khronos 3D Commerce

3. Extended reality (XR), including virtual reality (VR), augmented reality (AR) and mixed reality (MR) APIs and SDK

- OpenXR (Khronos group)
- OpenVR (Valve corporation)
- WebXR (W3C groups)

4. Real/virtual world integration, including positioning and orientation in 3D and 4D space

- GeoPose (Open Geospatial Consortium - OGC)

5. Avatars/characters interoperability

- Avatar API (ReadyPlayerMe)
- HAnim (Humanoid Animation)
- VRM (Khronos Group)

6. Identity, cybersecurity and privacy preservation

- Decentralised Identifier - DID
- OpenID Connect – OIDC
- OAuth 2.0
- InterPlanetary File System - IPFS

7. Networking protocols

- Hyperspace Modeling Language - HSML

8. Metadata and asset discoverability

- Cross-platform metadata – XMP (Adobe Systems)
- Dublin Core

Standards requirements from initiative paper „Next Generation Virtual Worlds“ (European Commission, July 2023)



*„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 Worldwide. A Global Monitor.



Bundesministerium
für Bildung
und Forschung

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