

XWORLDS'26. The 1st International Workshop on Advancing Interoperability in Virtual Worlds
Bari / Italy: Oct. 6th. 2026

The Global Race for Virtual Worlds Standards

Actors, Gaps and Coordination

Prof. Dr.-Ing. Dipl.-Kfm. Christoph Runde



EU-funded | Grant
Agreement #101296278



Liaison Type A with JTC1/SC24 *"Computer Graphics & XR"*

Liaison *"Joint Coordination Activity on Metaverse Standardization"*

Chair *"NA 043-01-24 AA Metaverse und Extended Reality"*

Chair *"Technical Working Group Virtual Worlds"*

Co-chair *"Metaverse Ecosystem Working Group"*

XR | Metaverse | Virtual Worlds Standards: a scattered landscape

VDC's register:

- 163 standards organization (SDOs)
- 416 standardization working groups
- 752 official Standards
- 275 industry Standards
- 310 Specifications
- 314 Recommendations / Guidelines
- 156 Technical Reports
- 112 other document types

Example queries to the VDC Register:

- show published standards for avatars
- show working groups on displays
- show ASTM publications
- show documents, orgs and WGs on "ethics"
- show current standardization projects of China (MIIT)
- ...

Public Register Interface - Full register view

This XR and Metaverse Standards Register is the worldwide largest, publicly-accessible register of standards, specifications, recommendations, guidelines, and other documents related to XR and Metaverse. [More](#)

data set type is: **standard (official)** **standard (industry)** Technology is: **XR Streaming & Media Transport** Application Field is: **Collaboration & Telepresence** [More](#) [Filter](#) [Sort](#) [Gallery](#) [Q](#)

Find an option

- ☒ XR Streaming & Media Transport
- ☐ APIs, Runtimes & Software
- ☐ Digital Humans & Avatars
- ☐ Reality Capture & Digital Content
- ☐ Protocols & Interoperability
- ☐ Network & Cloud Infrastructure
- ☐ Digital Identity & Credentials

3C Media Capture and Streams Recommendation

dia Capture and Streams

SISO STD-017-2022

Standard for Web Live, Virtual, Constructive Protocol

3GPP - 26.143

Messaging Media profiles

recommndation/guideline

published / active

2018

ITU-T H.430.1

Requirements for immersive live experience (ILE) services

recommndation/guideline

published / active

2018

ITU-T H.430.1

Architecture for live experience

recommndation/guideline

published / active

2017

3C Media Capture and Streams Recommendation

dia Capture and Streams

SISO STD-017-2022

Standard for Web Live, Virtual, Constructive Protocol

3GPP - 26.143

Messaging Media profiles

recommndation/guideline

published / active

2022

SISO STD-023-2024

Standard for Compressed Distributed Interactive Simulation (C-DIS)

11 Jan 2024

Prepared by: China Academy of Telecommunications Technology

Approved by: China Academy of Telecommunications Technology

IEEE-P1857-14

WORK IN PROGRESS

ITU-T-Y-ICN-ARM

WORK IN PROGRESS

Standards Register



Standards Register



Two main different types of "*standards*" and organizations:

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 a European level and lists a set of reference SDOs with either an international (ISO, IEC, and ITU) or European scope (CEN, CENELEC, and ETSI)

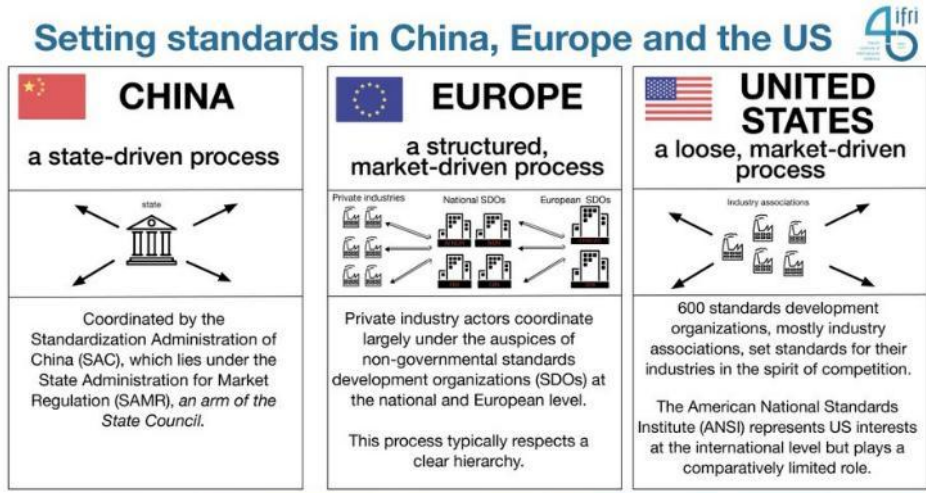


Industry Organizations:

- 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.

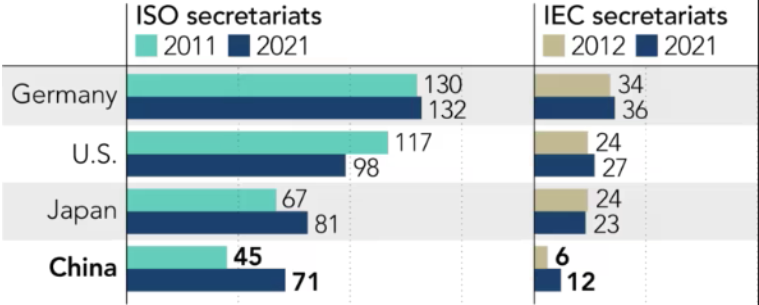


Standardization Strategies: global view



Source: John Seaman, "China and the New Geopolitics of Technical Standardization", Notes de l'Ifri, Ifri, January 2020

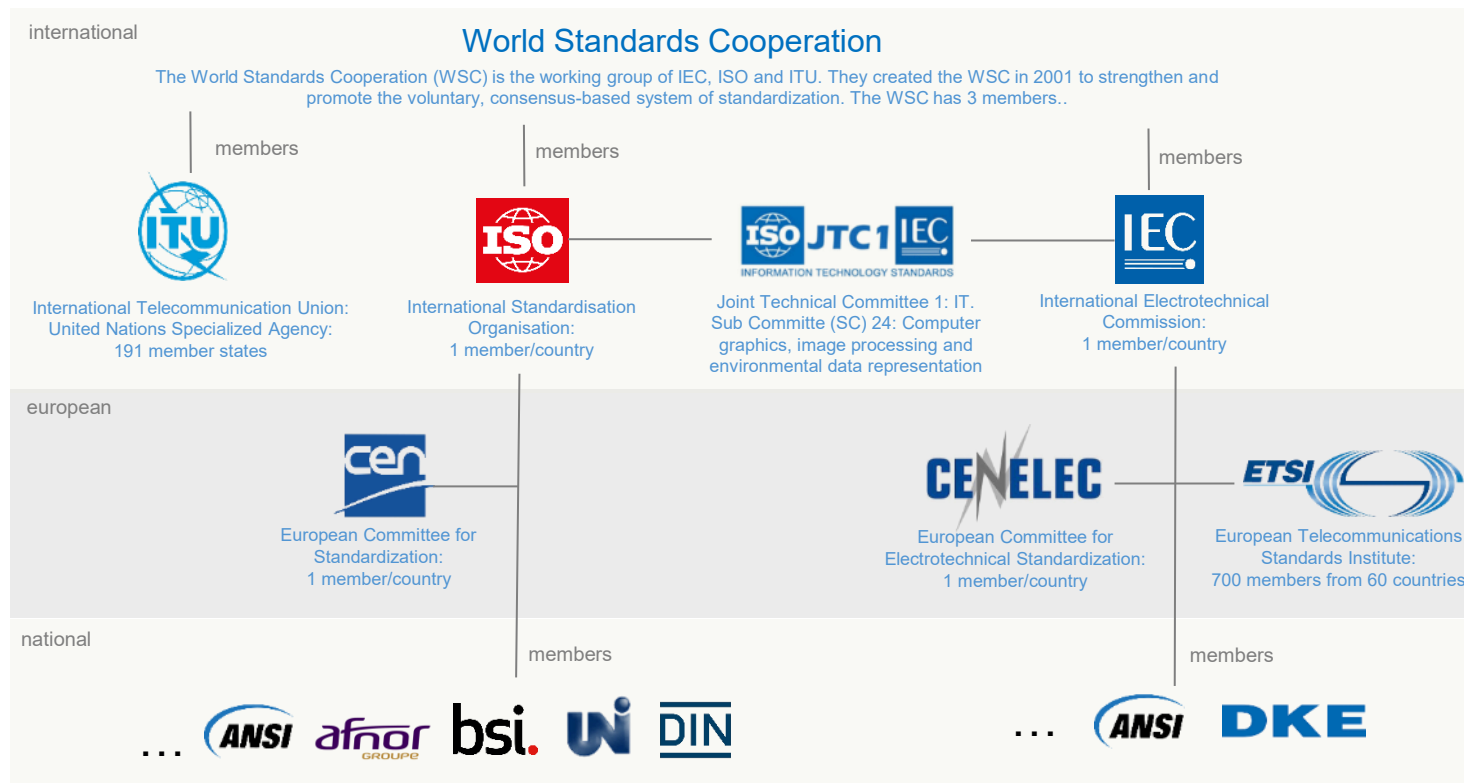
China’s growing clout in standardization organizations
 (Number of secretariat positions by country)



ISO stands for International Organization for Standardization, IEC for International Electrotechnical Commission; includes twinned ISO secretariats
 Source: ISO, IEC, U.S. National Institute of Standards and Technology

Structure of International Standardization

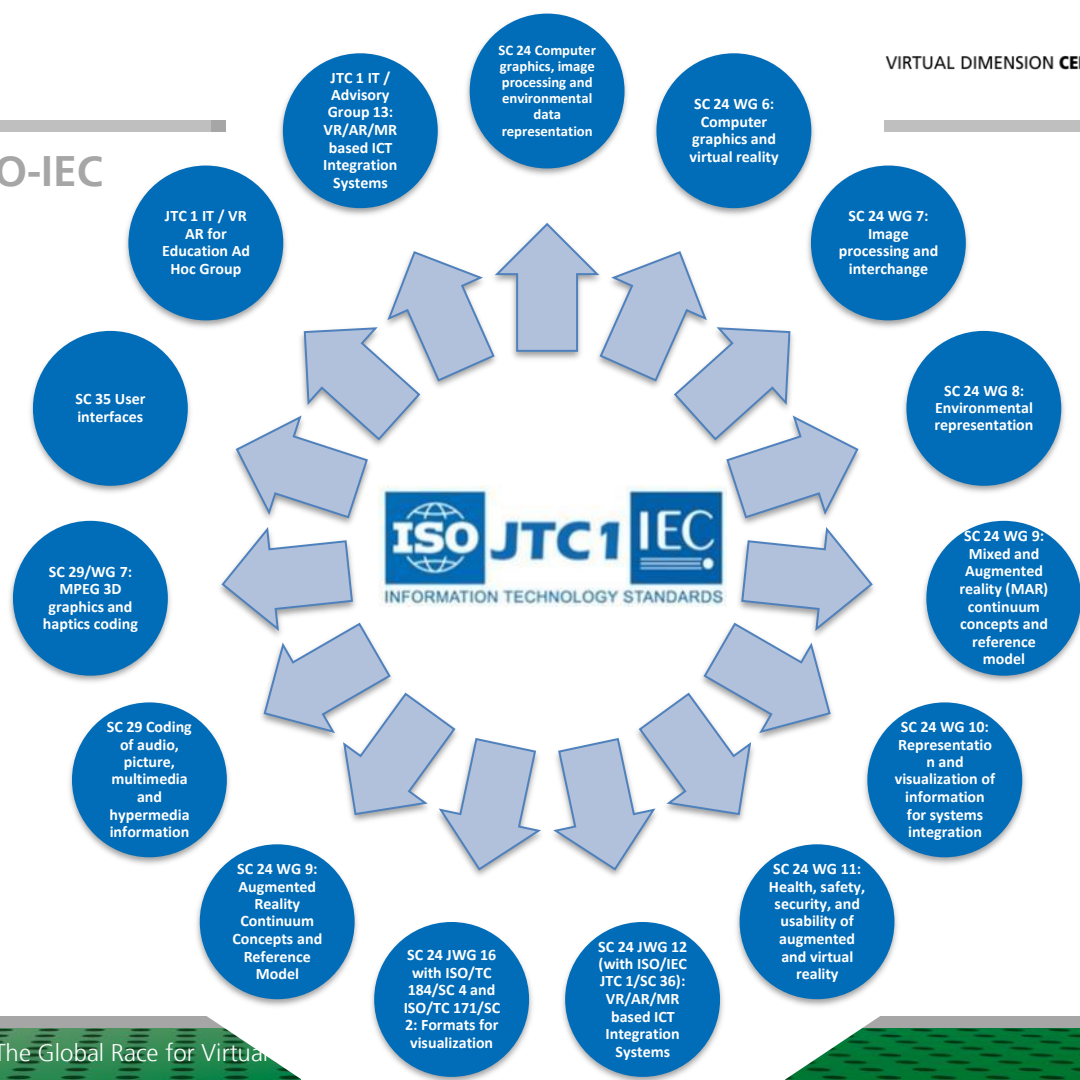
National SDOs organize so-called "mirror committees" to ISO and IEC committees. They represent national input and interests in ISO and IEC and feed information from ISO and IEC back to their homeland.





Standards Working Groups: ex. ISO-IEC

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.





countries and delegations in working group ISO/IEC JTC 1/SC 24 „Computer graphics, image processing and environmental data representation“:



Europe participating:

- France (AFNOR)
- Germany (DIN)
- United Kingdom (bsi)
- Finland (SFS): not active
- Ireland (NSAI): not active
- Switzerland (SNV): not active



others participating :

- Australia
- China
- India: not active
- Japan
- Kazakhstan: not active
- Korea
- Russia: not active
- Ukraine: not active
- United States



observing from Europe:

- Austria (ASI)
- Belgium (NBN)
- Belarus (BELST)
- Bosnia and Herzegovina (ISBIH)
- Czech Republic (UNMZ)
- Hungary (MSZT)
- Iceland (IST)
- Italy (UNI)
- Poland (PKN)
- Portugal (IPQ)
- Romania (ARSO)
- Serbia (ISS)
- Slovakia (UNMS SR)



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

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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

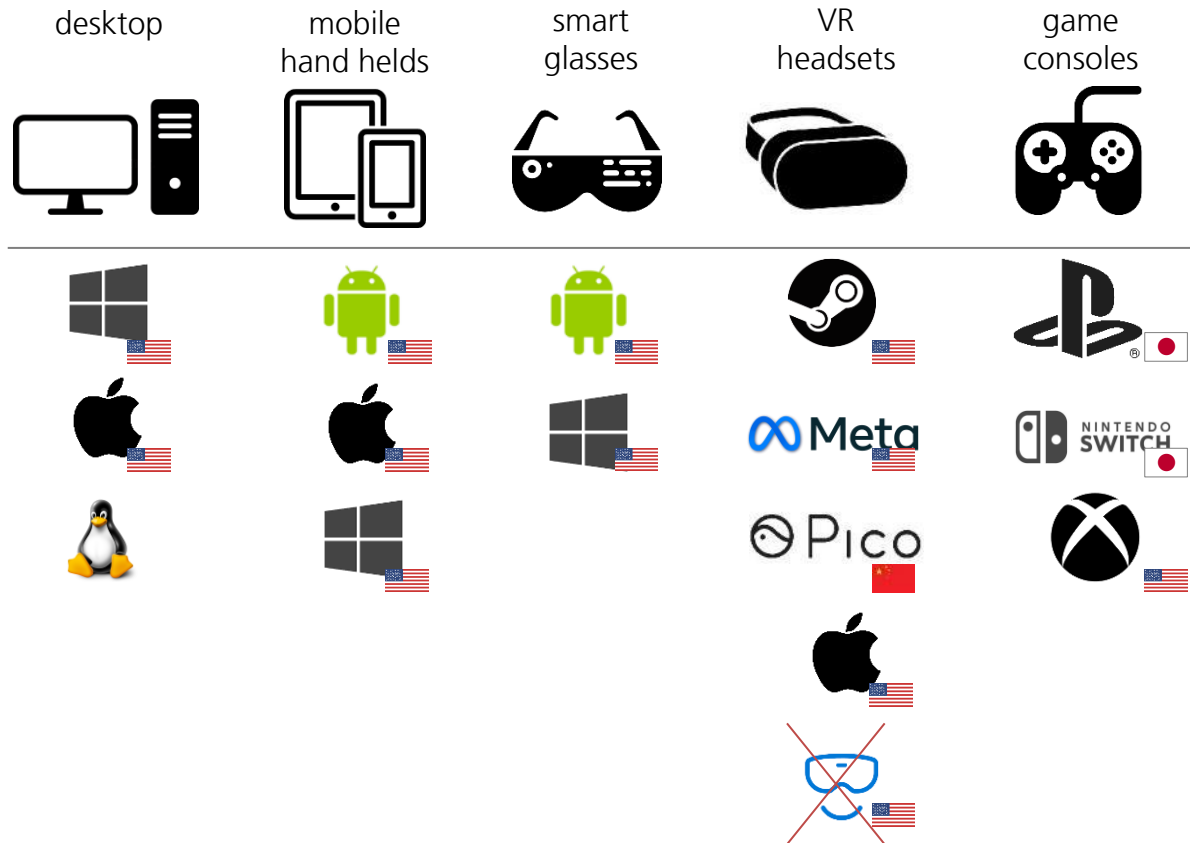
AUGUST 20, 2023 | 4:00 PM CET | 5 MINUTES READ

Europe finds itself only at the sideline of a fight for global XR ecosystems.

problem:

- Europe does not provide a huge, global platform provider
- platform providers aim at vendor lock-in

⇒ standardization and regulation
could be valid options for Europe.



Standardization Strategies: global view



- 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

Global Metaverse Strategies Comparison

strategy goals	target groups	strategy key elements	discrete measures
 China - world-leading industrial mature metaverse ecosystem - Metaverse as an important growth pole of the digital economy - establish three to five companies with global influence - establish a number of specialised SMEs - establish three to five industrial development clusters - establish yuan / renminbi universe - secure and efficient governance system for the metaverse	- industry - public administration - society	- upgrade key technologies - Promote an industrial ecosystem - enable the industrial metaverse - strengthen the industrial base (incl. standardization)	- metaverse business parks - MV infrastructure - MV standardization agencies - create MV best practices - create MV applications for digital life
 Dubai - turn Dubai into one of the world's top 10 metaverse ecosystems - turn Dubai into a global hub for the metaverse community - attract more than 1,000 companies - support more than 40,000 virtual jobs by 2030 - foster innovation; promote advanced ecosystems - foster talent - invest in future capabilities - create new governmental work models	- tourism - education - government services - retail and real estate [health care]	- XR and MV technologies - foster MV innovation and economic contribution - cultivate MV talent through education and training - develop MV use cases and applications in Dubai government - Adopting and scale globally - Dubai as the "crypto-capital" of the world - UAE as a "test bed" for new technologies	- over fifteen initiatives and strategies were announced in the 2022 assembly - MV virtual embassy - Emirates Airlines training in the MV
 European Union - boost the EU's technological capabilities - accelerate the uptake of new business models and solutions - support access to finance to support creators and to scale up innovative business models - support societal progress and improve public services	- industry - creative industry - society / consumers	- foster a supportive business environment; support SMEs, start-ups - Interoperability, standardisation, open standards and interfaces - support open-source community - build a talent pool of virtual world specialists - empower and protect children in virtual worlds - EU's robust legislative framework - IP protection	- skills development for MV technologies (Digital Europe programme) - guiding principles for virtual worlds through citizens' panel - research on impact of MV on people's health through Horizon Europe - develop a MV toolbox for the general public - create European initiative on Virtual Worlds - create EU partnership on virtual worlds - analysis of XR & MV standards landscape
 Finland - establish Finland as a leading architect and enabler for the Metaverse - Finland to be considered as a benchmark society - attract major foreign direct investments in all parts of the Metaverse value chain - avoid domination by a single company or country	- society - healthcare - industry	- Finish vision, values and strengths - boost economic growth - cross-boundary collaboration - education for the Metaverse - marketing and sales on a global scale - advance metaverse research	- Metaverse in Action Program (however just recommendations!): - support technology enablers - create / support business Networks - showcase industrial Metaverse - showcase Metaverse society - showcase Metaverse healthcare
 Japan - respond to rapidly growing demand for digital transformation (DX) for enterprises and government agencies - enable interoperability and collaboration between Metaverse platforms - serve as new social infrastructure for enterprise DX and employee experience (EX) transformation - promote metaverse business - expand the "Japan Metaverse Economic Zone" globally - respond to MV risks	- society / consumers - government services - enterprises	- agreement of numerous companies using their respective mature technologies to create an open Metaverse infrastructure supporting authentication, digital twins, NFTs, etc. - analysis by the "Study Group on Utilization of Metaverse, etc. for the Web3 Era" established by the Ministry of Internal Affairs and Communications	- create Metaverse economic zone „Ryugukoku“ - media conference
 Saudi Arabia - gaming and e-sports market: US\$ 13.3 billion to gross domestic product (GDP) and 39.000 jobs by 2030 - create digital MV twin of futuristic megacity NEOM	- e-games, e-sports - real estate - society / consumers	- MV is key part of Vision 2030 - launch of national „Gaming and e-Sports Strategy“	- the US\$ 500 billion futuristic megacity NEOM shall have its own metaverse - investment in metaverse gaming
 South Korea - take the upper hand in the global metaverse market (5th largest market share by 2026) - train metaverse experts (total of 40,000 people by 2026) - nurture metaverse service providers (220 companies by 2026) - discover metaverse best practices (total of 50 cases by 2026)	- society / consumers - government services - enterprises	- create world-class metaverse platform - create and support MV ecosystem - train Key players in the metaverse era - nurture specialized corporations that could lead the metaverse industry - build an exemplary metaverse world	- metaverse platform of the city of Seoul - diverse types of funds to be provided "Expanded Virtual World" marketing campaign - K-Metaverse pavilion: further showcases

In-depth analysis of Virtual Worlds Standardisation: The ViWISSO Project



Contracting authority

EU Commission / EISMEA
SMP-STAND-2024-ESOS-01-IBA

Lead & coordinator

ETSI ISG ARF · STF 686
Project no. 101196203

Experts

Christine Perey
Christoph Runde

Duration

13 mo.
2024–2025

Methodology

Desk research

912 standards · 354 TRs
71 landscape studies
AI-assisted analysis

Expert interviews

19 structured interviews
9 standardisation · 6 vendors
6 consortia · 5 researchers

Stakeholder survey

Open public call for input
SMEs · academia · EU projects
Industry consortia · associations

3 reports:



GR ARF 010

Standards Landscape Report
912 standards · 8 domains
179 SDOs · 388 WGs

PUBLIC

GR ARF 011

Recommendations Report
814 gaps · 549 deficits
10 recommendations

RESTRICTED · not public

GR ARF 012

Executive Summary
All key results consolidated
Free download · etsi.org

PUBLIC

No deficit

The XR industry has no standards deficit — it has a coordination deficit.

912 standards analysed · 814 gaps identified. The problem is not scarcity — it is fragmentation across 179 SDOs with no shared view and no coordination.

EU chance

Europe has a strategic opportunity in Virtual Worlds standardisation.

EU values — openness, interoperability, data protection, human control — are precisely the principles on which robust XR standards must be built. Shape the technology.

Act now

You can act today — three concrete steps

Use the Standards Register · participate in standardisation bodies · demand standards compliance in your procurement decisions.

Free downloads:

GR ARF 010 Landscape Report(public)
GR ARF 012 Executive Summary(public)

Standards Register:

vdc-fellbach.de

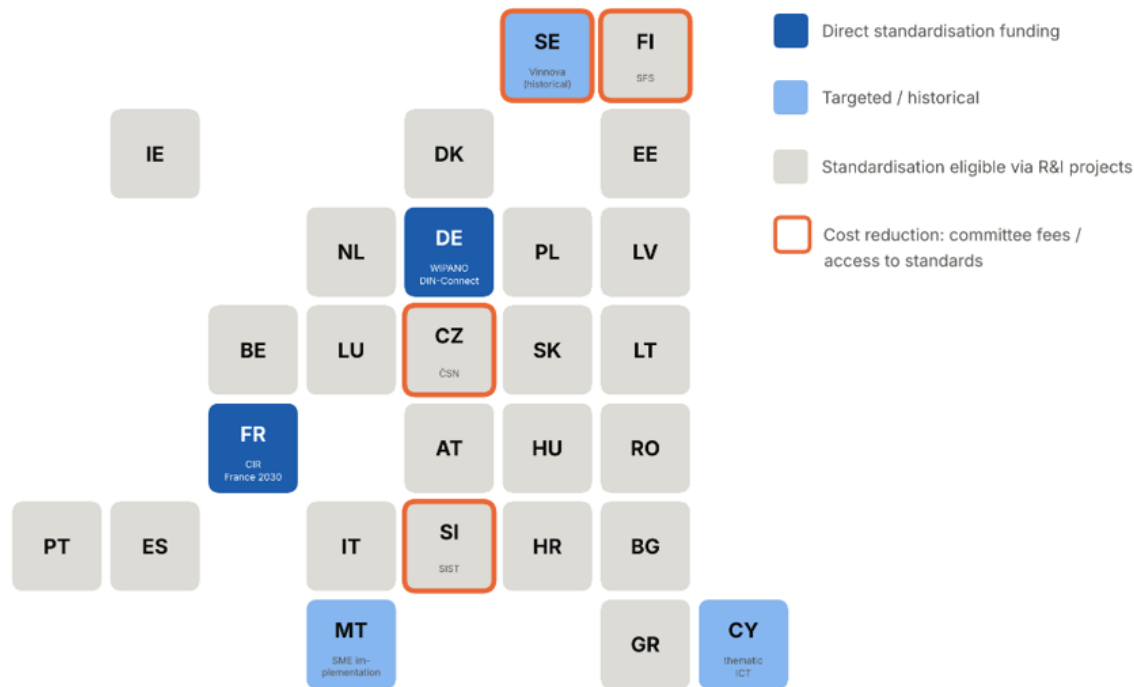
Contact:

Prof. Dr.-Ing. Christoph Runde
runde@vdc-fellbach.de



National funding landscape: direct standardisation funding is the exception

Screening of all 27 EU Member States – in most countries, standardisation is funded via general R&I programmes



2

of 27

countries with direct standardisation funding: Germany (WIPANO) and France (CIR tax credit, France 2030)

27

of 27

standardisation eligible as part of R&I projects – plan it as a concrete work package, not as a side note

4

countries

reduce costs via differentiated fees (SE, FI) or free access to standards (CZ, SI)

Additionally open to all 27 countries:

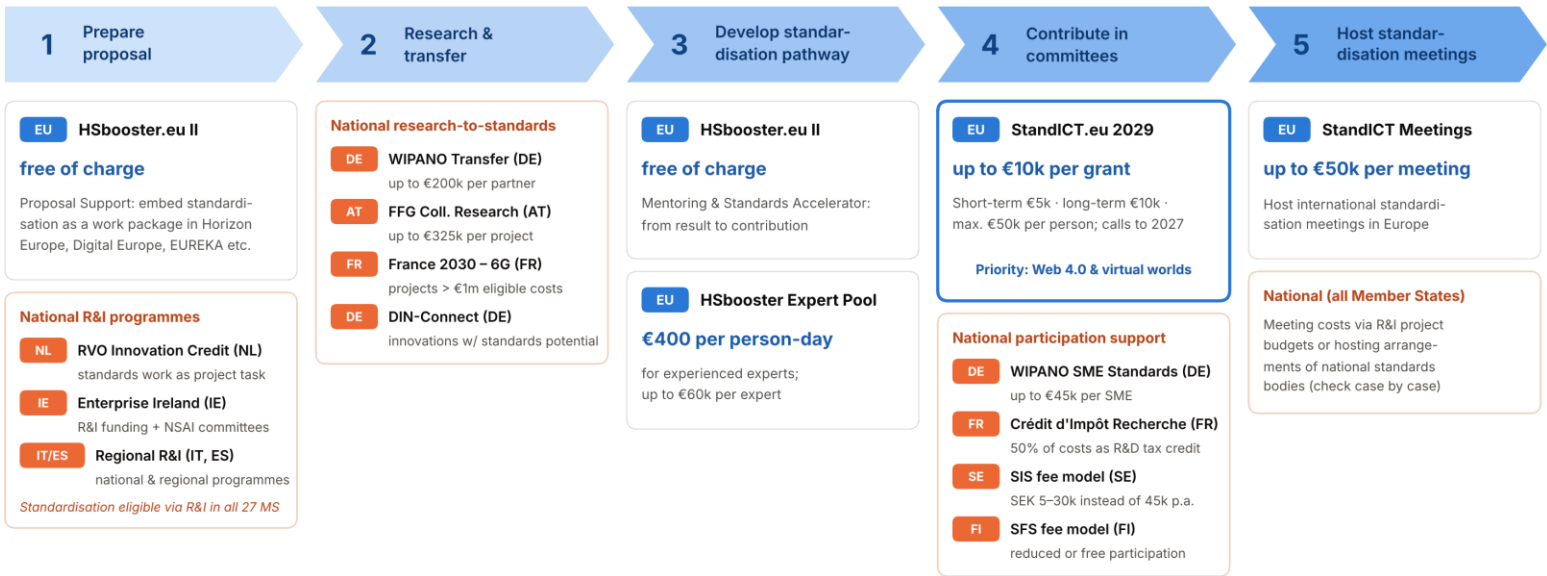
StandICT.eu 2029 (expert contributions, Web 4.0 & virtual worlds) and HSbooster.eu II (pathway support, free)



Funding along the standardisation pathway

EU European
 DE national (ISO country code)

European and national instruments for each standardisation activity – with a focus on XR / virtual worlds





*„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.