ISO/IEC JTC 1/SC 24
메타버스 표준화동향 및 주요이슈

메타버스 국제표준기술 워크숍
(한국메타버스산업협회)

2025-09-16

이명원 (VRSTA Inc)

ISO/IEC JTC 1/SC 24 Chair (2017-2025)
ISO/IEC JTC 1/SC 24/JWG 12 Convenor (2022-현재)
ISO/IEC JTC 1/SC 24/AHG 3 Convenor (2025-2026)

Introduction

- JTC 1 Technical Trend Report (TTR) for the metaverse
- Relevant JTC 1 technologies
- Metaverse standardization areas
- Other standardization groups for the metaverse
- SC 24 projects for the metaverse
- Collaboration with other groups
- SC 24 Metaverse Ad Hoc Groups 2 and 3
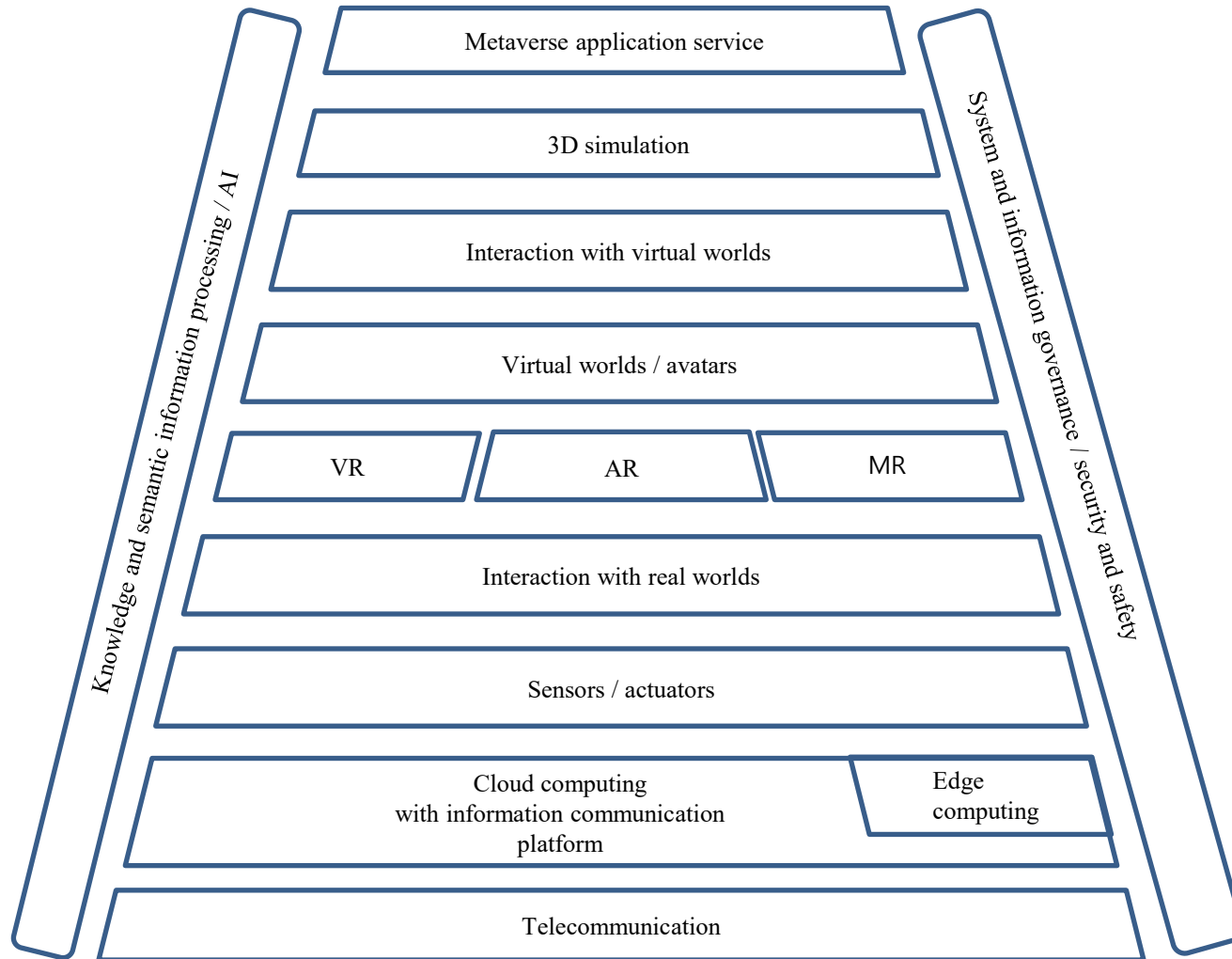- Future plans

JTC 1 TTR for the Metaverse

- Requirements for the metaverse
  - Standard technologies for connection and integration of the real world into virtual worlds
- JTC 1 standards and standardization for the metaverse
  - JTC 1 technologies
  - Metaverse service areas
  - JTC 1 standards and projects
  - JTC 1 governance for the metaverse
  - JTC 1 strategies for the metaverse
- Other standards development groups for the metaverse
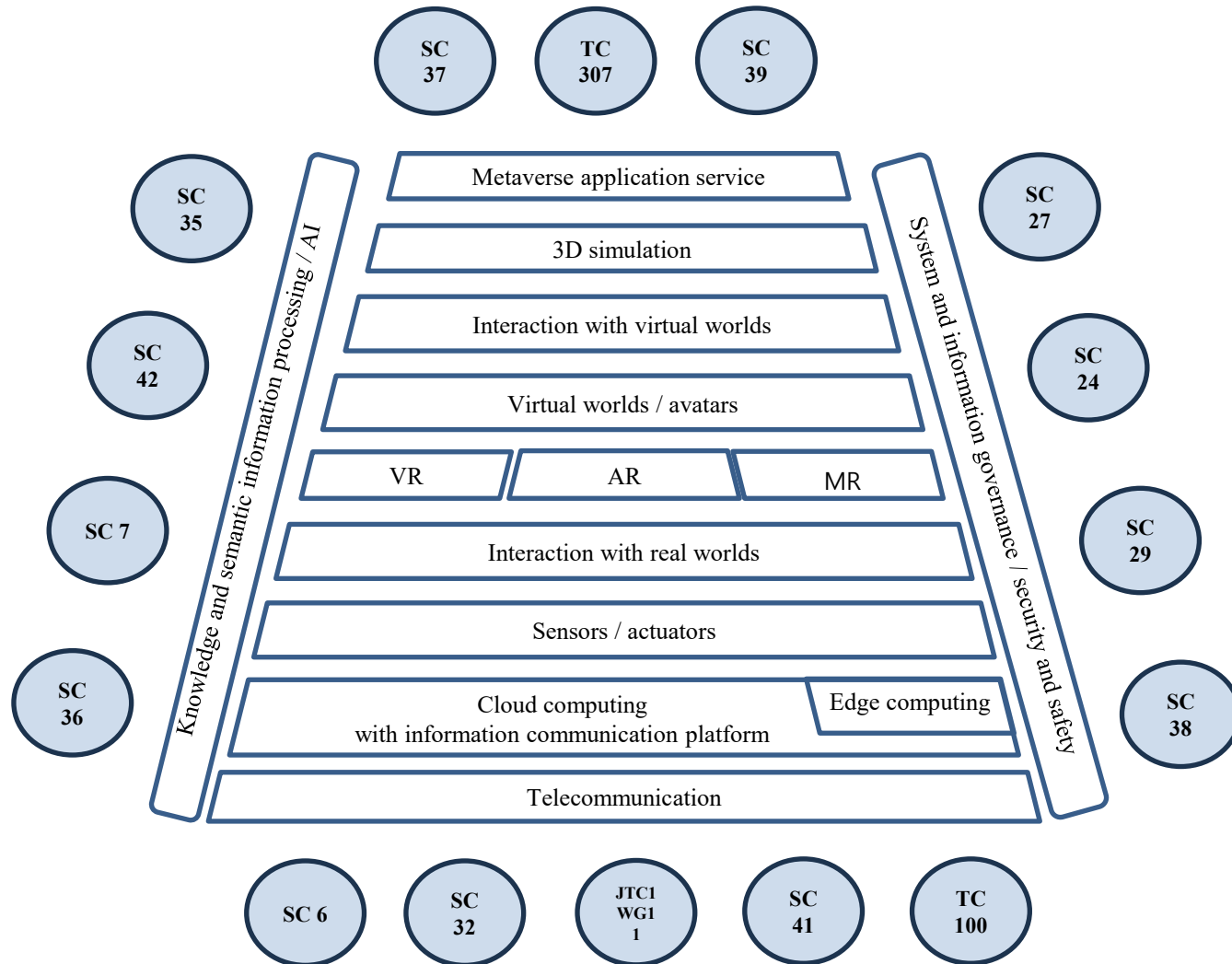- Direction of standards development

JTC 1 TTR on the metaverse
(https://jtc1info.org/)

JTC 1 Technologies for the Metaverse

Metaverse application service

3D simulation

Interaction with virtual worlds

Virtual worlds / avatars

VR | AR | MR

Interaction with real worlds

Sensors / actuators

Cloud computing
with information communication
platform

Edge
computing

Telecommunication

Knowledge and semantic information processing / AI

System and information governance / security and safety

Metaverse Standardization

ISO/IEC JTC 1/CG 1 – Strategic Coordination Group on Data Management and Data Governance
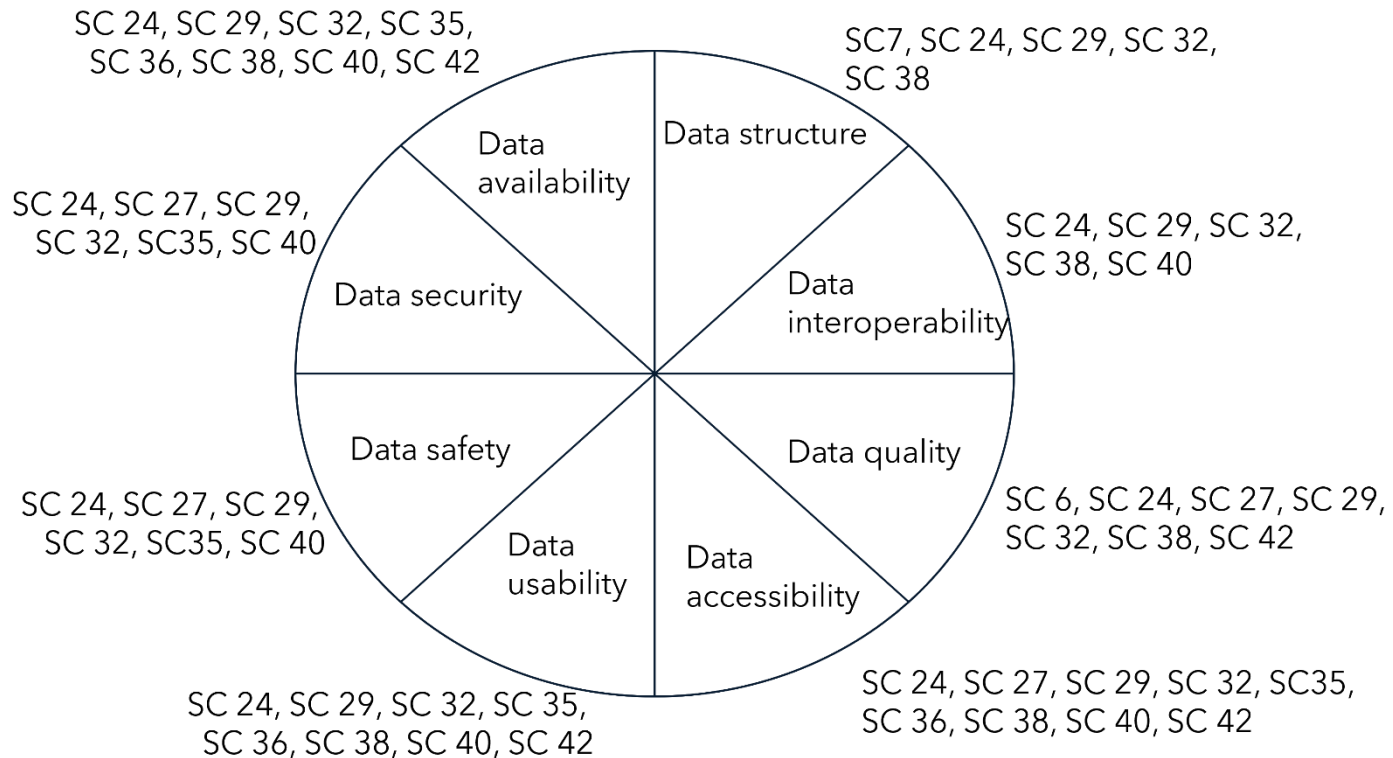
- Terms of Reference
  - Develop an integrated view of the JTC 1 and external environment in the Data Management and Data Governance domain.
  - Strategically review the opportunities and potential projects within the domain to address gaps and stakeholder needs.
  - Advise JTC 1 on action the Strategic Coordination Group and JTC 1 should take to maximize success for JTC 1 in this domain.
  - Facilitate communication, coordination, and information among member entities.
  - Identify cases of coordination needed among member entities on new or existing projects.
  - Explore opportunities with the constituent entities to communicate and promote the domain work through webinars and other activities and deliverables and facilitate its implementation.
  - Provide a report to JTC 1 at each JTC 1 Plenary. This report shall cover progress, plans, and recommendations to JTC 1.
- Establishment: 2024 May in the JTC 1 Darwin Plenary (two years)
- Convenor: Donald Deutsch (US)
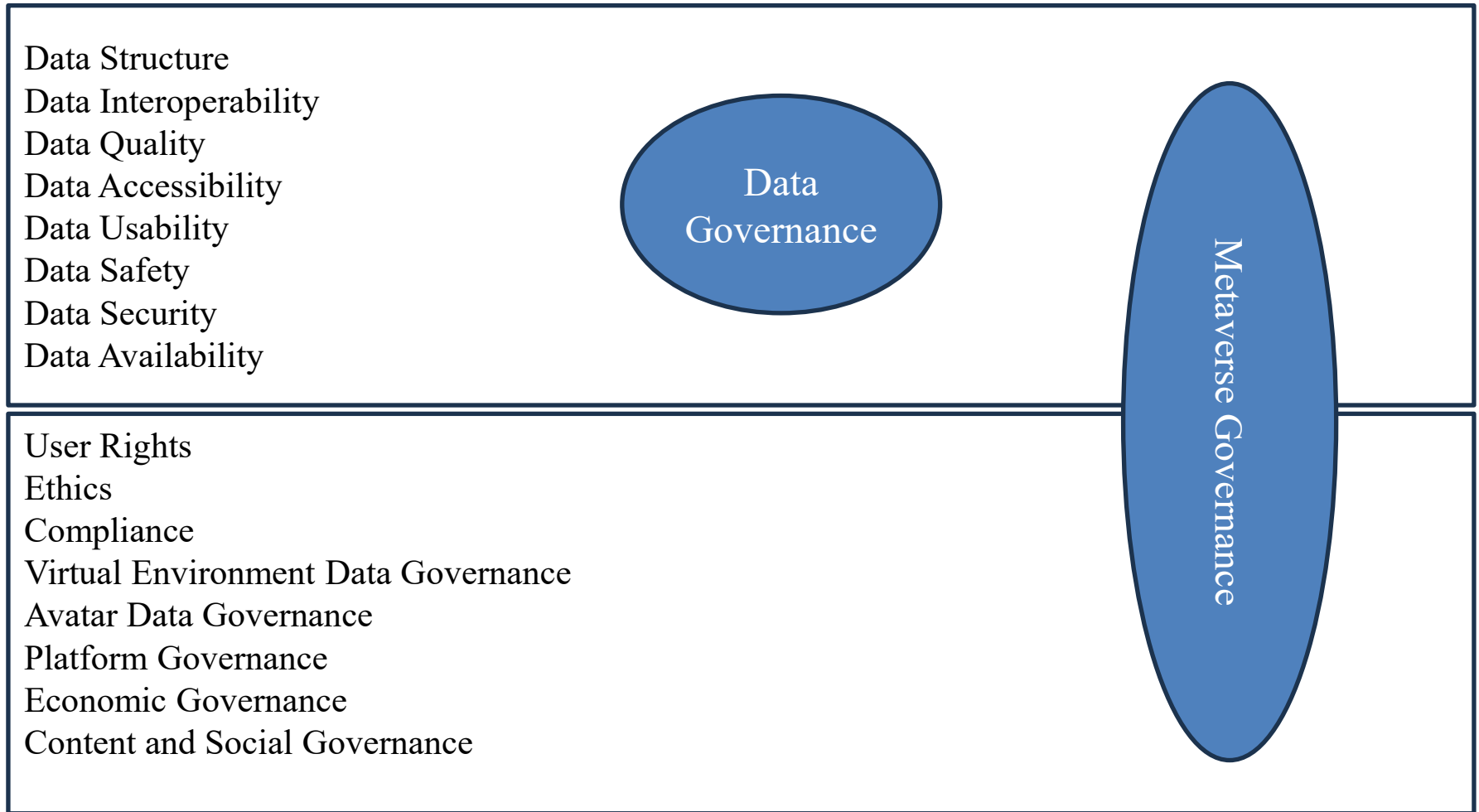
Data Governance in JTC 1/CG 1

- Data survey
  - Type and referencing
  - Level of standardization
  - Data-related topics of standardization
  - WG 11, SC 23, SC 24, SC 32, SC 38, SC 42
  - Results of data survey
    - ISO-IEC JTC 1-CG 1_N79_CG 1 Consolidated Data Survey Responses - 20250602.pdf
    - ISO-IEC JTC 1-CG 1_N80_CG 1 Consolidated Data Survey Responses Spreadsheet - 20250602.xlsx
    - JTC 1/WG 11, SC 23, SC 24,
- CG 1 work progress
  - Pictorial representation of JTC 1 areas of work (Martin / Trish)
  - Data interoperability (Frank)
  - Data governance (Myeong)

Data Governance in JTC 1/CG 1 (3)

- ISO/IEC JTC 1/CG 1 N 92 Data Governance – Updates
- Data Governance Coordination (Presented by Myeong Won Lee, SC 24, 2025-07-24 at CG 1 Meeting)

SC 24, SC 29, SC 32, SC 35,
SC 36, SC 38, SC 40, SC 42

SC7, SC 24, SC 29, SC 32,
SC 38

SC 24, SC 27, SC 29,
SC 32, SC35, SC 40

SC 24, SC 29, SC 32,
SC 38, SC 40

Data availability

Data structure

Data security

Data interoperability

Data safety

Data quality

SC 24, SC 27, SC 29,
SC 32, SC35, SC 40

SC 6, SC 24, SC 27, SC 29,
SC 32, SC 38, SC 42

Data usability

Data accessibility

SC 24, SC 29, SC 32, SC 35,
SC 36, SC 38, SC 40, SC 42

SC 24, SC 27, SC 29, SC 32, SC35,
SC 36, SC 38, SC 40, SC 42

Data Governance and Metaverse Governance

Data Structure
Data Interoperability
Data Quality
Data Accessibility
Data Usability
Data Safety
Data Security
Data Availability

Data Governance

Metaverse Governance

User Rights
Ethics
Compliance
Virtual Environment Data Governance
Avatar Data Governance
Platform Governance
Economic Governance
Content and Social Governance

ISO/IEC JTC 1/CG 2 – Strategic Coordination Group on Metaverse

- Terms of Reference
  - Develop an integrated view of the external environment in the Metaverse domain.
  - Strategically review the opportunities and potential projects within the domain to address gaps and stakeholder needs.
  - Advise JTC 1 on action the Strategic Coordination Group and JTC 1 should take to maximize success for JTC 1 in this domain.
  - Facilitate communication, coordination, and information among member entities.
  - Identify cases of coordination needed among member entities on new or existing projects.
  - Explore opportunities with the constituent entities to communicate and promote the domain work through webinars and other activities and deliverables and facilitate its implementation.
  - Provide a report to JTC 1 at each JTC 1 Plenary. This report shall cover progress, plans, and recommendations to JTC 1.
- Establishment: 2024 May in the JTC 1 Darwin Plenary (two years)
- Convenor: Fernanco Gebra Filho (2024, Brazil), Torbjorn Lahrin (Sweden, 2025)

Metaverse in JTC 1/CG 2 (1)

- ISO/IEC JTC 1 N 17307 CG 2 Convenor presentation to the May 2025 JTC 1 Plenary
  - Various standardization organizations addressing Metaverse
    - ITU-T focus group on metaverse, IEC SEG 15, ISO/IEC JTC 1 TTR, IEEE Metaverse standards committee, W3C Open Metaverse Interoperability Group, Open Geospatial Consortium, The Metaverse Standard Forum, World Economic Forum, etc.
  - ITU focus group on Metaverse
    - General, Applications and services, Architecture and infrastructure, Virtual/Real world integration, security, data and personally identifiable information (PII) protection, Economic, regulatory and competition aspects, Sustainability, accessibility and inclusion, Collaboration
  - Global initiative on virtual worlds and AI – Discovering the Citiverse
    - ITU, United Nations International Computing Centre (UNICC), and Digital Dubai
  - IEC SEG 15
    - Terms and definitions, Market and applications, Technology and architecture, Standards landscape, Regulatory and legal
  - IEEE Metaverse standards committee
    - Metaverse terminology, definitions, and taxonomy, Augmented reality on mobile devices, Ethically aligned design and operation of Metaverse systems, General requirements for identity framework for metaverse, Recommended practice for ethical assessment of extended reality, Guide for comfort requirements for extended devices

Metaverse in JTC 1/CG 2 (2)

– W3C Open Metaverse Interoperability Group + Metaverse interoperability community group
  - To bridge virtual worlds by designing and promoting protocols for idendity, social grphs, inventory, and more.
  - An open-source community of industry professionals, independent creators, and passionate enthusiasts building interoperable technology
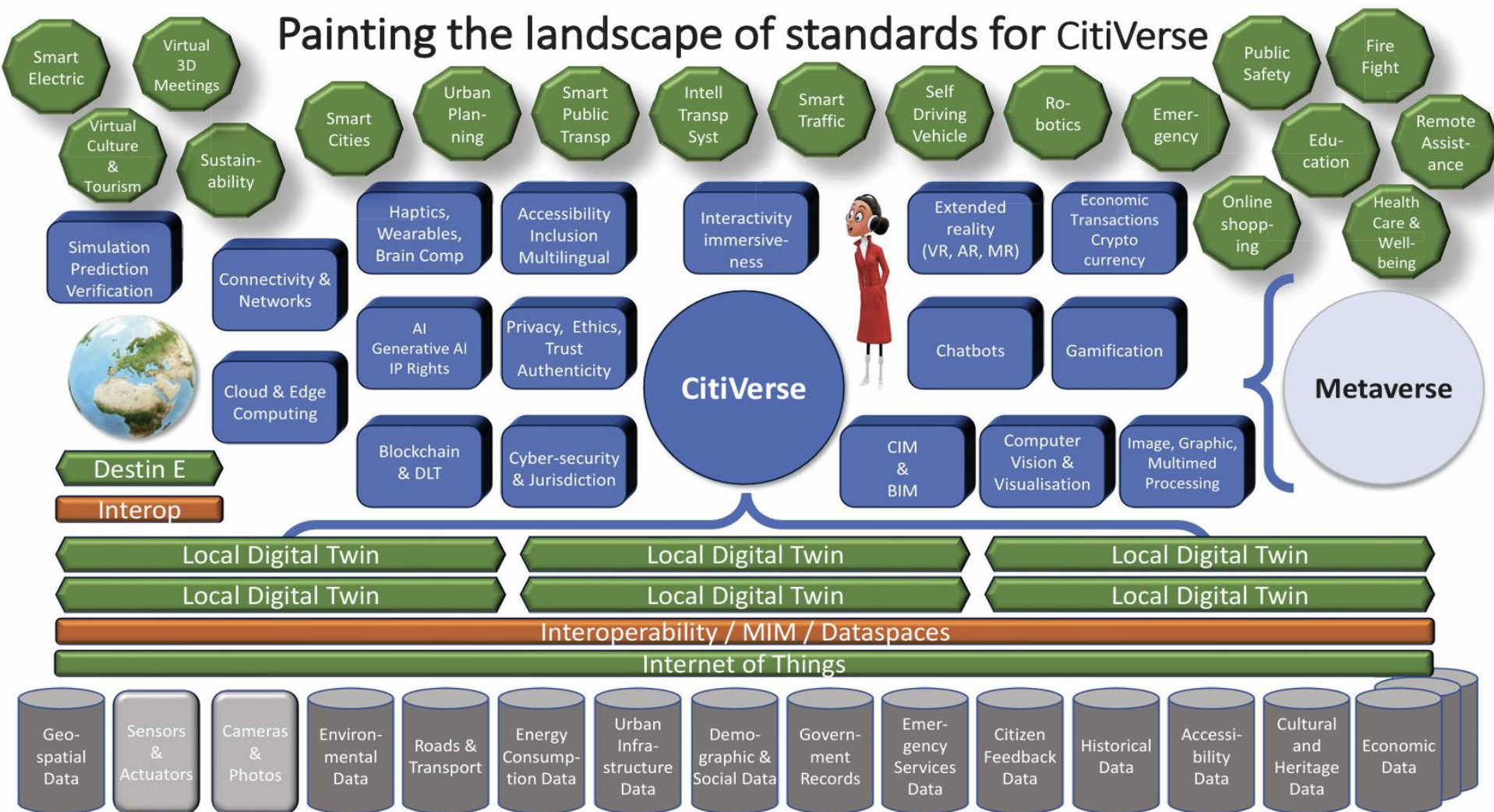– Landscape of standards for metaverse
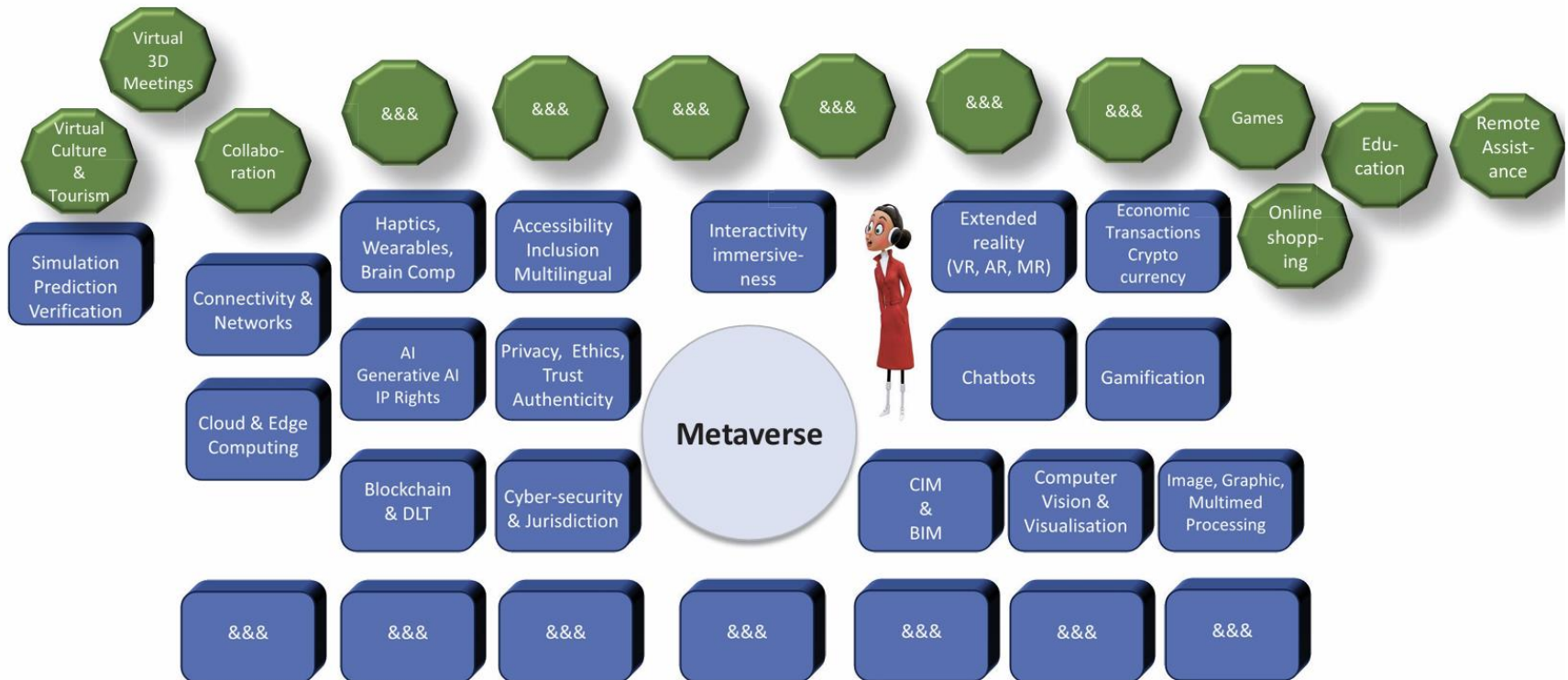
Metaverse and Citiverse in JTC 1/CG 2

Metaverse and
JWG between JTC1 and SyC Smart Cities on Urban Digital Twins and City Information Modelling
Co-Convenors: Chunlan Guo (SyC Smart Cities) and JTC 1 (Tobjörn Lahrin)

Other Standardization Groups for the Metaverse (1)

- **ISO/IEC JSEG 15**
  - Terms and definitions, market and applications, technology and architecture, standards landscape, regulatory and legal
- **ITU-T Focus Group on Metaverse (FG-MV)**
  - Terminology and definitions, applications and services, architecture, virtual/real world integration, interoperability, security and PII protection, economy and regulation, sustainability, accessibility and inclusion, and collaboration
- **IEC/TC 100**
  - AR technology, VR/AR/MR devices, multimedia systems and equipment for the metaverse
- **EC (European Commission)**
  - Open, human-centric virtual worlds and metaverses that reflect European values, principles, rules, and strategic interests - trustworthy, secure, and fully compliant with EU norms and legislation
- **IEEE**
  - Terminology and definitions, taxonomy, software framework, components and integration, ethically aligned design and operation of metaverse systems
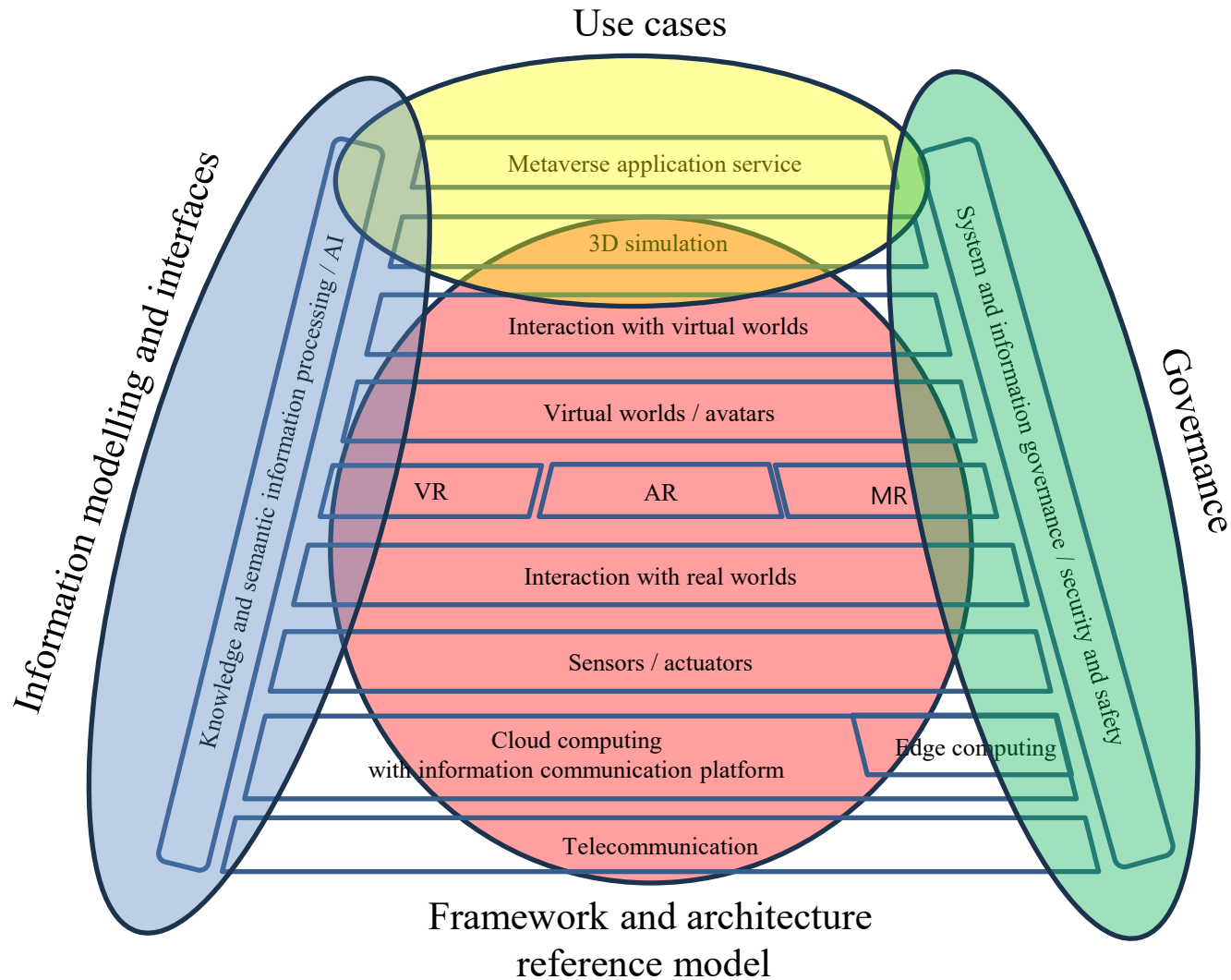
Other Standardization Groups for the Metaverse (2)

- ISO/TC 307
  - Blockchain and distributed ledger technology, metaverse transparency, reliability, and security of digital assets and transactions; reference architecture; taxonomy and ontology; auditing guidelines
- Alliance for OpenUSD (AOUSD)
  - Interoperability of 3D content, framework and ecosystem for describing, composing, simulating, and collaboratively navigating and constructing 3D scenes; standardization of material description and geometry description
- Metaverse Standards Forum
  - 3D asset interoperability; human interface and interaction paradigms; user-created content; avatars; identity management; privacy; financial transactions
  - The Khronos Group, W3C, Open Geospatial Consortium, Web3D Consortium, etc.
- Web3D Consortium
  - Exchangeable 3D virtual environment data; humanoid architecture and motion
- W3C
  - Web-based accessibility, privacy and security; standardized APIs; WebXR device APIs and WebXR modules

SC 24 Projects for the Metaverse

- ISO/IEC CD 24931-1 Information Technology – Metaverse – Part 1: Concepts, definitions and terminology
- ISO/IEC PWI 24931-2 Information Technology – Metaverse – Part 2: Framework and architecture
- ISO/IEC PWI 24931-3 Information Technology – Metaverse – Part 3: Use cases
- ISO/IEC PWI 24931-4 Information Technology – Metaverse – Part 4: Reference model
- ISO/IEC PWI 24931-5 Information Technology – Metaverse – Part 5: Information model
- ISO/IEC PWI 24931-6 Information Technology – Metaverse – Part 6: Governance
- ISO/IEC PWI 26951 Information Technology – Metaverse – Visual security in the metaverse

Metaverse Standards Development Areas

Use cases

Information modelling and interfaces

Governance

Knowledge and semantic information processing / AI

System and information governance / security and safety

Metaverse application service

3D simulation

Interaction with virtual worlds

Virtual worlds / avatars

VR

AR

MR

Interaction with real worlds

Sensors / actuators

Cloud computing
with information communication platform

Edge computing

Telecommunication

Framework and architecture
reference model

ISO/IEC DIS 24931-1 Information Technology – Metaverse – Part 1: Concepts, definitions and terminology

Contents

ISO/IEC PWI 24931-2 Information Technology – Metaverse – Part 2: Framework and architecture

- Scope: Define a framework and architecture for the metaverse
- Define system organization
- Define systems components based on the JTC 1 technologies.
- Define platforms and their functional components
- Define virtual worlds
- Define avatars
- Define interaction with the real world
- Define interaction with virtual worlds

Knowledge and semantic information processing / AI

System and information governance / security and safety

- Metaverse application service
- 3D simulation
- Interaction with virtual worlds
- Virtual worlds / avatars
- VR
- AR
- MR
- Interaction with real worlds
- Sensors / actuators
- Cloud computing with information communication platform
- Edge computing
- Telecommunication
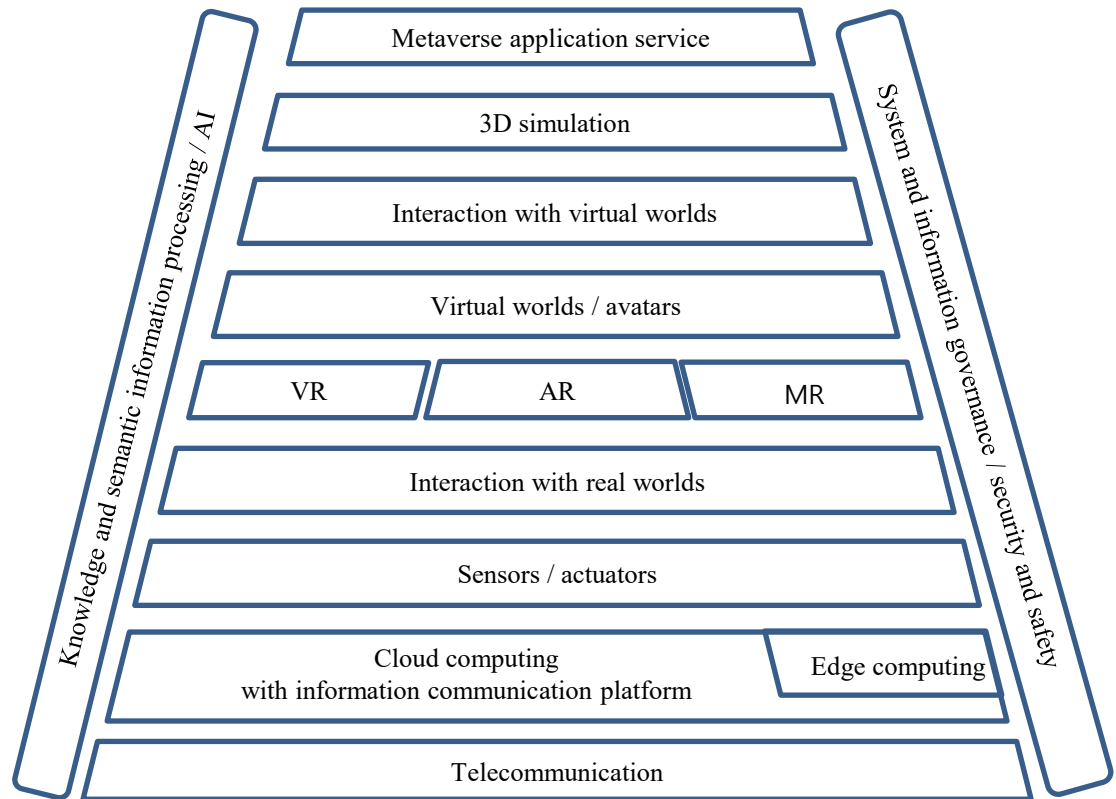
ISO/IEC PWI 24931-3 Information Technology – Metaverse – Use cases

- Scope: Describe a series of use cases to showcase metaverse applications
- Classify use cases and provide use case development guidance

- Education
- Training
- Health
- Medicine
- Safety
- Shopping
- Travel
- Entertainment
- Manufacturing
- Business
- Meetings
- Events
- Heritage
- Smart city
- Contests

OpenSim – Second Life

Historyofinformation.com

4 Ways VR Will Transform Healthcare Training a… medium.com

The New York Times

Metaverse education
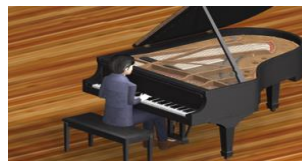AJU Business Daily

uxpa.org

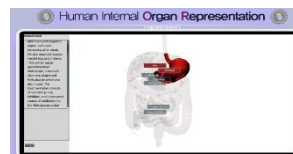ORINOX – Plant immersive training

Lalongerb.umwblogs.org

(a) education

(b) training

(c) event

(d) training

(e) medicine

(f) health and safety [Curtin U]

(g) Safety [AIST]

(h) travel

ISO/IEC PWI 24931-4 Information Technology – Metaverse – Part 3: Reference model

- Scope: a reference data model that can be used for generating data components and structures necessary for exchanging metaverse data between systems or platforms
- Define a data model for accessing and interfacing platforms
- Define a data model for virtual worlds
- Define a data model for avatars
- Define a data model for sensors
- Define a data model for interaction with the real world
- Define a data model for interaction with virtual worlds
- Define a data model for communication between virtual worlds and objects
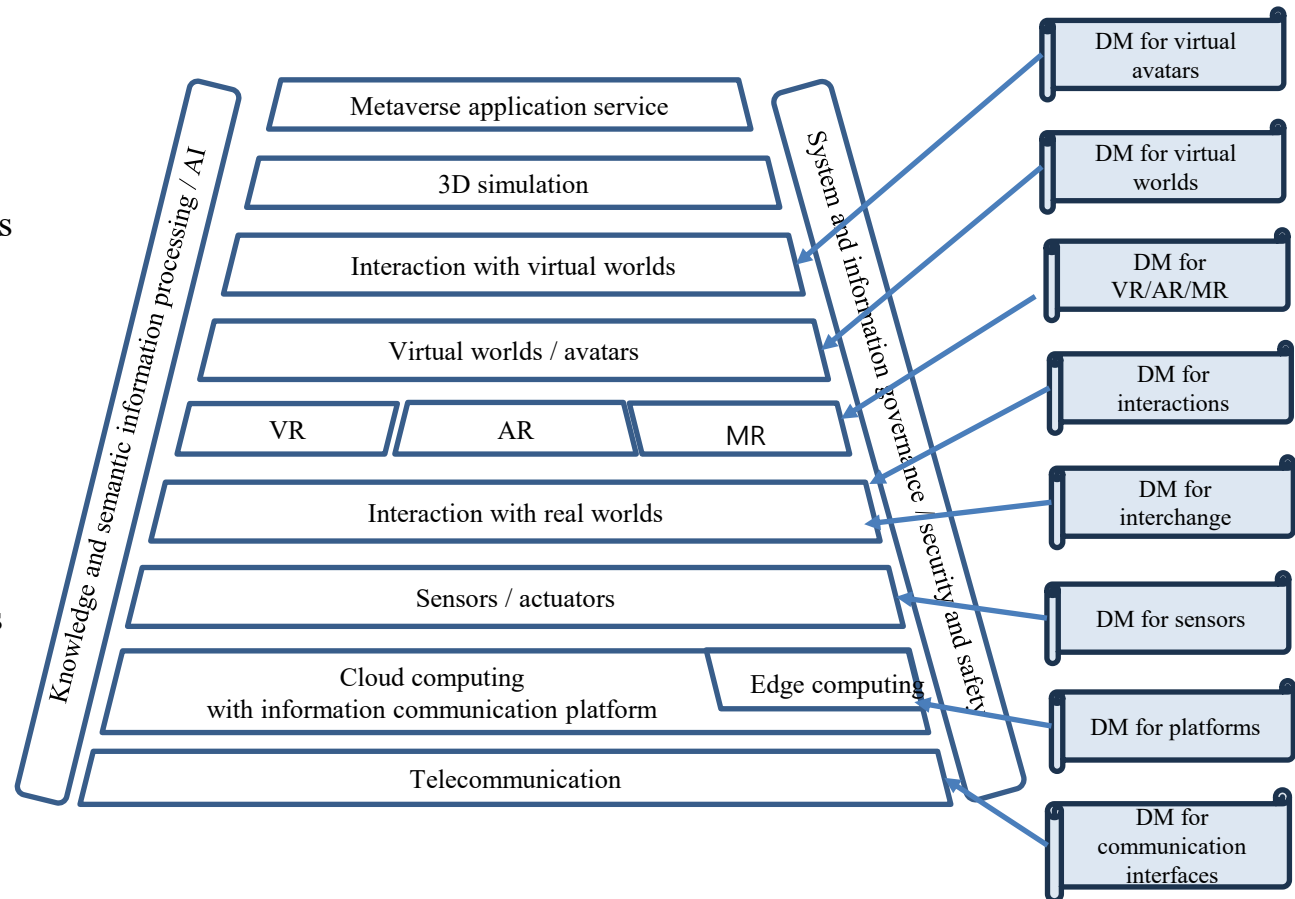
ISO/IEC PWI 24931-5 Information Technology – Metaverse – Part 5: Information model

- Scope: Define an information model necessary for providing metaverse services (includes semantic and service information and design guidance for application services)
- Define information organization and interfaces for accessing and interfacing platforms based on the data model
- Define information organization and interfaces for virtual worlds
- Define information organization and interfaces for avatars
- Define information organization and interfaces for sensors
- Define information organization and interfaces for interaction with the real world
- Define information organization and interfaces for interaction with virtual worlds
- Define information organization and interfaces for communication between virtual worlds and objects
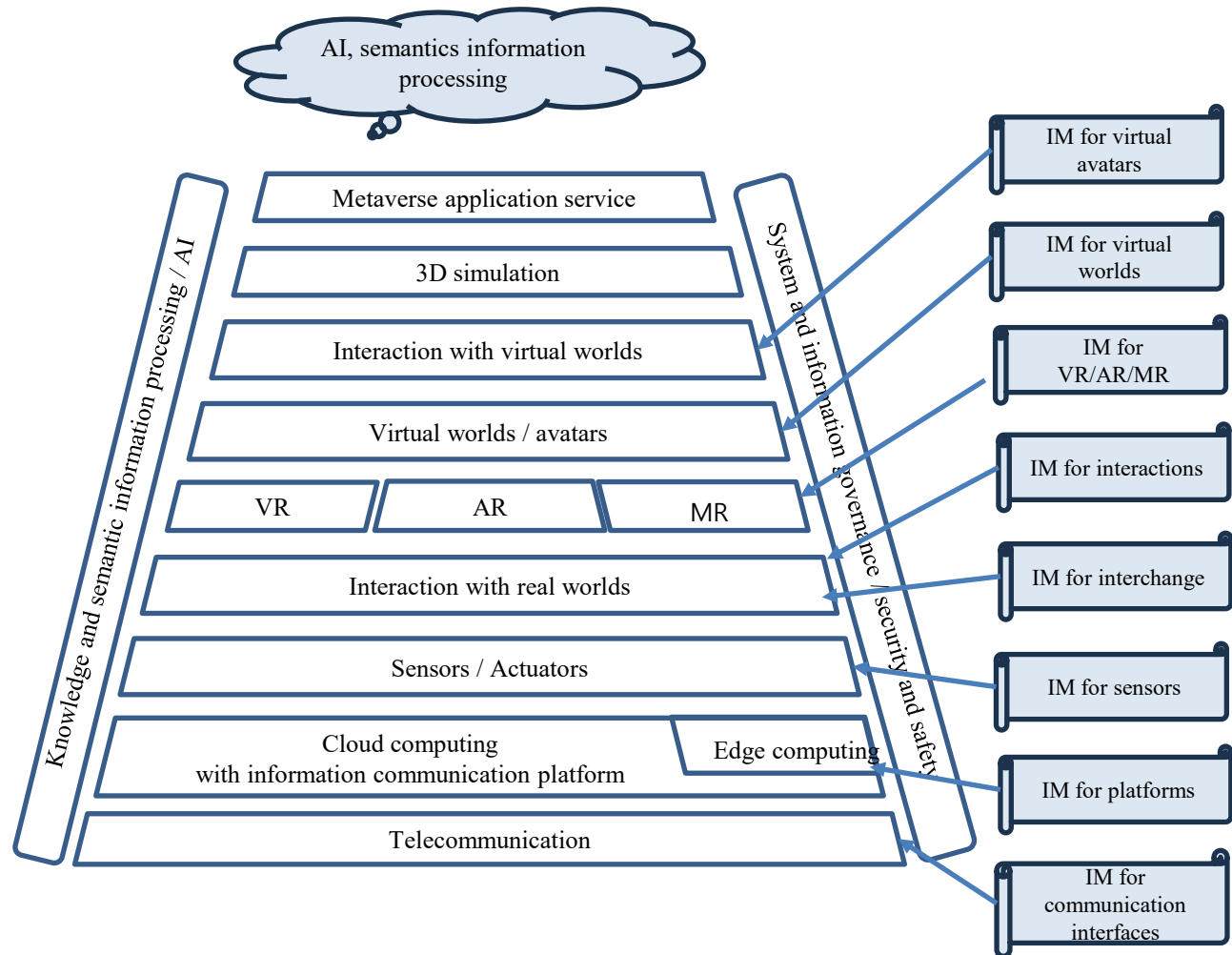
ISO/IEC PWI 24931-6 Information Technology – Metaverse – Part 6: Governance

- Scope: Define a governance reference for the metaverse for managing systems, data, and users
- Governance for users
  - Safety and security related to human health, both mental and physical, impacted by sensors or devices
- Governance for data
  - Securable, sharable, and interoperable between systems and users
- Governance for systems
  - Safety and security for platforms and virtual worlds
 - System performance and quality
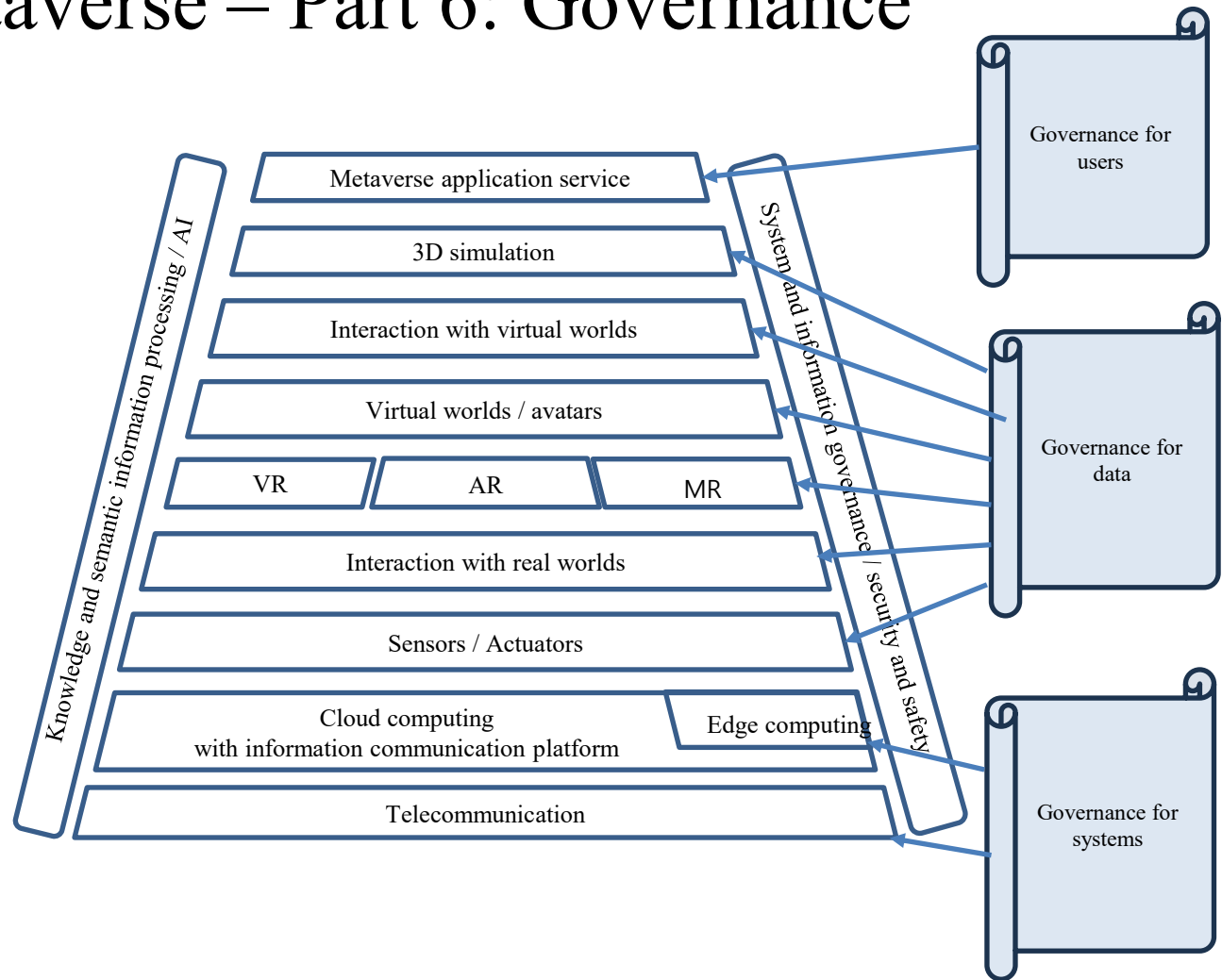
ISO/IEC PWI 26951 Visual Protection in the Metaverse

- Scope: Standard data model for mapping 2D images to 3D avatar faces using deepfake technology, enabling secure storage and exchange
- Face transformation
  - deepfake, face replacement
  - real-time modification, identity theft prevention
- Object replacement
  - visual alteration, replacement
  - protection of object details, context maintenance
- Background alteration
  - virtual background modification
  - privacy protection, sensitive information concealment
- Text obfuscation
  - text replacement, obscuration
  - unauthorized reading prevention, sensitive information protection

Visual protection for humans
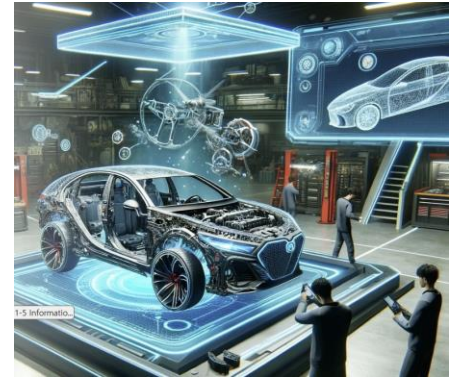
Visual protection for products

Visual protection for virtual environments

JTC 1/SC 24/Ad Hoc Groups for the Metaverse

- **Establishment of ISO/IEC JTC 1/SC 24/Ad Hoc Group 2 and 3**
  - ISO/IEC JTC 1/SC 24 Plenary and WG Meetings, Alexandria, VA, USA, July 7-11, 2025
- **ISO/IEC JTC 1/SC 24/AHG 2: Framework, architecture, and use cases for the metaverse (Convenor: Peter Ryan, Australia)**

  Terms of Reference:
  - Define a framework and architecture for the metaverse
  - Analyze a series of use cases to showcase metaverse applications and define guidelines for developing metaverse use cases
- **ISO/IEC JTC 1/SC 24/AHG 3: Reference model, information model, and governance for the metaverse (Convenor: Myeong Won Lee, Republic of Korea)**

  Terms of Reference:
  - Define a reference model for developing metaverse application systems
  - Define an information model for metaverse applications to generate, access, and exchange metaverse information and data
  - Define a governance reference for the metaverse on how to manage systems, data, and users

Ad Hoc Group 2 Meeting for the Metaverse Framework, Architecture, and Use Cases

- Metaverse projects for AHG 2
  - ISO/IEC DIS 24931-1 Information Technology – Metaverse – Part 1: Concepts, definitions and terminology
  - ISO/IEC PWI 24931-2 Information Technology – Metaverse – Part 2: Framework and architecture
  - ISO/IEC PWI 24931-3 Information Technology – Metaverse – Part 3: Use cases
- AHG 2 meeting schedule
  - September 24, 2025, Wed, at 13:00 UTC
  - November 26, 2025, Wed, at 21:00 UTC
  - January 28, 2026, Wed, at 13:00 UTC
  - March 25, 2026, Wed, at 21:00 UTC
  - May 27, 2025, Wed, at 13:00 UTC

Ad Hoc Group 3 Meeting for the Metaverse Reference model, Information model, and Governance

- Metaverse projects for AHG 3
  - ISO/IEC PWI 24931-4 Information Technology – Metaverse – Part 4: Reference model
  - ISO/IEC PWI 24931-5 Information Technology – Metaverse – Part 5: Information model
  - ISO/IEC PWI 24931-6 Information Technology – Metaverse – Part 6: Governance
- AHG 3 meeting schedule
  - October 22, Wed, 2025 at 13:00 UTC
  - December 17, Wed, 2025 at 21:00 UTC
  - February 25, Wed, 2026 at 13:00 UTC
  - April 22, 2026, Wed, at 21:00 UTC
  - June 24, 2025, Wed, at 13:00 UTC

One-Year Plan for Metaverse Projects (AHG 3)

- Preparation of overview slides for each project
- Development of a table of contents for each project
- Drafting of an initial Working Draft (WD) for each project
- Determination of the need to establish a JWG creation in collaboration with other groups
- Preparation of NP documents

Metaverse Collaboration with SC 24

- Steps to Join
  - Join ISO/IEC JTC 1/SC 24 as a member
    - First, join the ISO/IEC JTC 1/SC 24 Mirror Committee → Contact the TTA SC 24 Mirror Committee Secretary
  - Join ISO/IEC JTC 1/SC 24 liaisons from other standards groups
    - Contact the Committee Manager (CM) of your standards group if you are an expert in that group
    - Request the appointment of a liaison officer to SC 24 through the CM of the other group
- Ways to Collaborate
  - Participate in SC 24 projects as a reviewer, commenter, or co-editor
  - Propose new work items to the AHGs
  - Discuss adoption of new work items during AHG meetings
  - Assign project leaders and co-editors for new items in AHG meetings
  - Decide whether to establish a JWG (Joint Working Group)
  - Prepare NP (New Proposal) documents within the AHGs

Thank you.