

# GISC 2025

## Global ICT Standards Conference 2025

(세션 2) 후세대 전문가를 위한 국제표준 노하우 가이드  
(Session 2) International Standard Know-how Guidance for Next Expert

### 글로벌 표준화 이니셔티브 주도, 메타버스 (Leading Global Standardization Initiative, Metaverse)

Shin-Gak KANG, Ph.D

ETRI

ICT Standards and Intellectual Property:  
AI for All

주최 과학기술정보통신부 지식재산청 주관 국립전파연구원 TTA IITP KEA Kista ETRI

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- 01** Standardization activities and issues on metaverse in ITU-T
- 02** Standardization Initiatives on metaverse in ITU-T
- 03** How to take a leading role in emerging & future standardization issues

## Abstract

| 메타버스에 대한 ITU-T에서의 국제표준화 추진 현황 및 주요 이슈를 공유하고,  
글로벌 표준화 의제 선점 및 기술표준화 활동 주도 전 과정 소개를 통해  
후세대 전문가를 위한 기술표준화 활동 실전 노하우 가이드스 제공

## ICT Standards

미래 표준화 이슈에 대한 글로벌 표준화 정책과 의제 선점, 그리고 기술 표준화 활동 주도에 대한 사례로서  
대한민국의 메타버스 분야 표준화 정책과 의제 선점을 통한 글로벌 표준화 이니셔티브 확보,  
Correspondence Group, Focus Group, ITU-T 세계표준총회(WTSA) 결의 제정, 글로벌 표준화 협력  
및 조정그룹(JCA) 신설, 그리고 관련 그룹 의장직 수임을 통해 글로벌 메타버스 기술표준 개발을 선도한  
전 주기 활동 내용을 공유하여 미래 기술표준화 선도 실전 노하우 공유

# Standardization activities and issues on metaverse in ITU-T

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Shin-Gak KANG, ETRI, Korea (Republic of)

Vice-Chair ITU-T SG21 (Multimedia, content delivery, Cable TV)

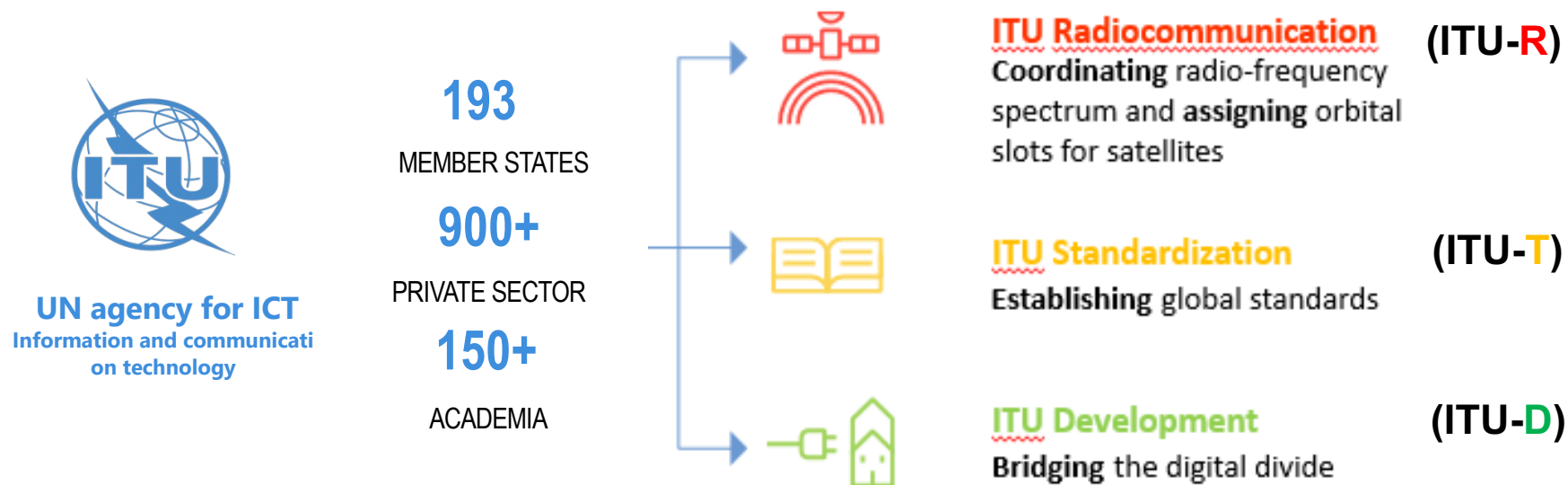
Chair ITU-T SG21 WP4 (Infrastructure for multimedia systems, services and applications, including metaverse)

Convenor ITU-T SG21 AHG-MV (metaverse)

Chair ITU-T TSAG JCA-MV (Metaverse Standardization)



# ITU – Who we are – Our Membership



*A unique platform for governments, private sector and academic institutions to build consensus on important and pressing ICT technical and regulatory issues facing our society today*

# Pre-standardization work on metaverse in ITU-T

## **FG-MV was unanimously established by TSAG in December 2022**

- ❖ *(ITU) 193 Member States as well as more than 900 companies, research institutes and International Organizations*



**FG: Open to non-ITU members;**

**Free of charge;**

Physical meetings with remote participation & E-meetings



**Diverse management team:**

- Government, Industry, Academia, UN agencies
- Africa, Asia, Europe, Americas

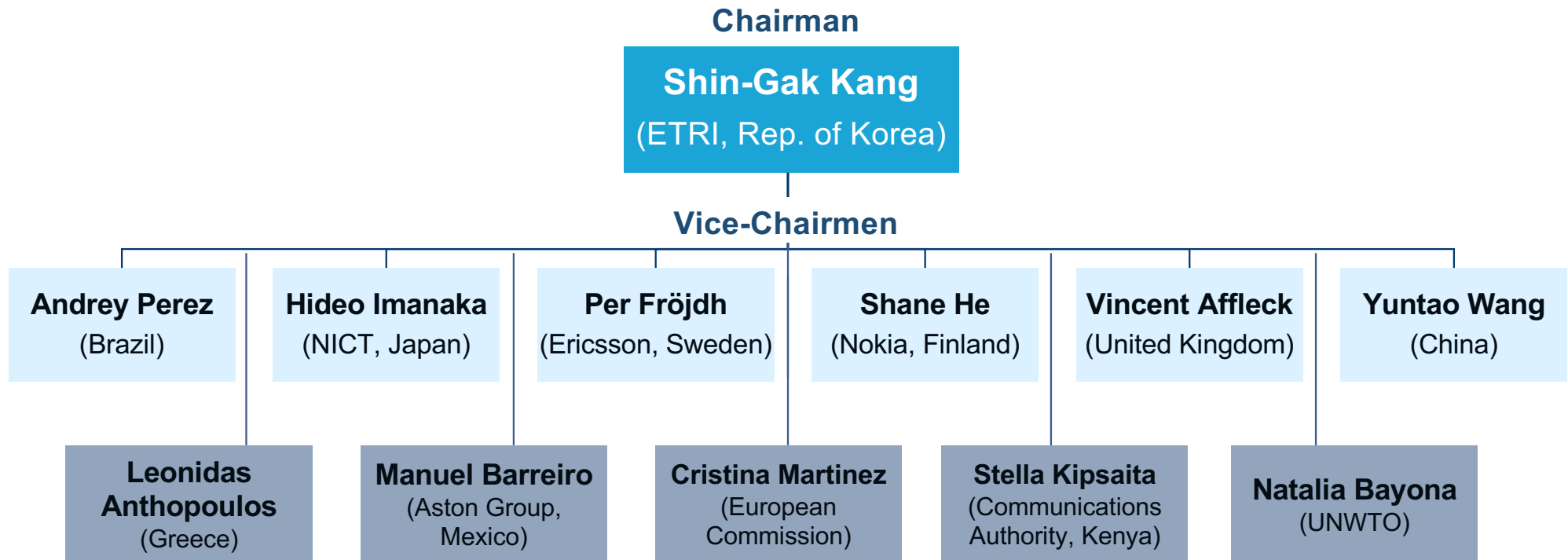


**63 Work programs**

including Technical Specifications & Reports



**More than 500 experts involved in the FG-MV**



- ❖ A unique collaboration platform to shape an open, secure, and interoperable metaverse
- ❖ **9 WGs** (Working Groups) and **18 TGs** (Task Groups)



## WORKING GROUP 1

General



## WORKING GROUP 2

Applications & Services



## WORKING GROUP 3

Architecture & Infrastructure



## WORKING GROUP 4

Virtual/Real World Integration



## WORKING GROUP 5

Interoperability



## WORKING GROUP 6

Security, Data & PII Protection



## WORKING GROUP 7

Economic, Regulatory & Competition Aspects



## WORKING GROUP 8

Sustainability, Accessibility & Inclusion



## WORKING GROUP 9

Collaboration

**FG-MV Lifetime: December 2022 ~ June 2023 (about 18 months)**

**Regular FG-MV meetings: held 7 times**



**500+**

Experts involved

- 1st FG-MV meeting: 8~9 March 2023, Riyadh, Saudi Arabia;
- 2nd FG-MV meeting: 4~6 July 2023, Shanghai, China;
- 3rd FG-MV meeting: 3~5 October 2023, Geneva, Switzerland;
- 4th FG-MV meeting: 4~7 December 2023, Geneva, Switzerland;
- 5th FG-MV meeting: 5-8 March 2024, Queretaro, Mexico;
- 6th FG-MV meeting: 30 April 2024, Virtual;
- 7th FG-MV meeting: 12-13 June 2024, Geneva, Switzerland.

**155 WGs/TGs (e)-meetings**

# Journey of ITU FG-MV and related events



**First meeting &  
1<sup>st</sup> ITU Forum** "Embracing  
the metaverse"

8-9 March 2023,  
Riyadh, Saudi Arabia



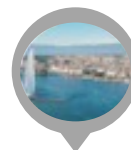
**Second meeting &  
2<sup>nd</sup> ITU Forum** "Creating a  
metaverse for all through i  
nt. standards"

4-6 July 2023,  
Shanghai, China



**Special session &  
3<sup>rd</sup> ITU Forum** "Cities and  
the metaverse: Shaping a  
citiverse for all"

12-13 September 2023,  
Arusha, Tanzania



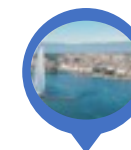
**Third meeting**

2-5 October 2023,  
Geneva, Switzerland



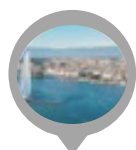
**Special Session to promot  
e FG-MV standardization a  
ctivities**

18 October 2023,  
Riga, Latvia



**Fourth Meeting**

4-7 December 2023, Genev  
a, Switzerland



**ITU-T TSAG meeting**  
(Allocate 22 Deliverables)

22 - 26 Jan. 2024, Geneva,  
Switzerland



**Fifth meeting &  
4<sup>th</sup> Forum** "Shaping the Cit  
iverse: People-centered citi  
es & virtual worlds"

4-8 March 2024,  
Queretaro, Mexico



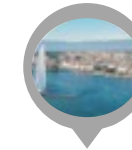
**Sixth meeting**

30 April 2024,  
Virtual



**Seventh meeting &  
5<sup>th</sup> Forum** "Integrating virtua  
l and physical worlds in the  
metaverse with digital twin"

& **UN Virtual Worlds Day**  
12-14 June 2024,  
Geneva, Switzerland



**ITU-T TSAG meeting**  
(Allocate 30 Deliverables)

29 July - 2 Aug. 2024, Gene  
va, Switzerland

**Total work programs (June 2024): 63**

**Deliverables approved: 52** (including a definition of metaverse)

- ❖ March ~ December 2023: **22**
- ❖ January ~ June 2024: **30**

**Deliverables unfinished: 11**

**Allocation of FG-MV deliverables to ITU-T Study Groups by TSAG**

- ❖ TSAG meeting in January 2024 (22 deliverables)
- ❖ TSAG meeting in August 2024 (30 deliverables)

### The metaverse is...

An integrative ecosystem of virtual worlds offering immersive experiences to users, that modify pre-existing and create new value from economic, environmental, social and cultural perspectives.

**NOTE** – A metaverse can be virtual, augmented, representative of, or associated with the physical world.

## Developed ITU FG-MV deliverables & current status (1/6)

| No.                     | Title                                                                                                                               | TSAG Allocation                                  | Current status                                         |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------|
| <a href="#">FGMV-01</a> | Technical Report on Exploring the metaverse: opportunities and challenges                                                           | All for information                              | SG 21 allocated to Q9/21 for further work.             |
| <a href="#">FGMV-02</a> | Technical Report on Metaverse: an analysis of definitions                                                                           | All for information                              | SG 21 allocated to Q9/21 for further work.             |
| <a href="#">FGMV-03</a> | Technical Report on Guidelines to assess inclusion and accessibility in metaverse standard development                              | ITU-T SG16                                       | SG 21 decided not consider further work.               |
| <a href="#">FGMV-04</a> | Technical Specification on Requirements of accessible products and services in the metaverse: Part I – System design perspective    | ITU-T SG16, ITU-T SG9, ITU-T SG20                | SG21 adopted as a new work of F.ACC-MV-SD (Jan. 2025). |
| <a href="#">FGMV-05</a> | Technical Specification on Requirements of accessible products and services in the metaverse: Part II – User perspective            | ITU-T SG16, ITU-T SG9, ITU-T SG20, and ITU-T SG2 | SG21 adopted as a new work of F.ACC-MV-UP (Jan. 2025). |
| <a href="#">FGMV-06</a> | Technical Report on Guidelines for consideration of ethical issues in standards that build confidence and security in the metaverse | ITU-T SG17                                       | Need further observation.                              |
| <a href="#">FGMV-07</a> | Technical Report on Policy and regulation opportunities and challenges in the metaverse                                             | ITU-T SG3                                        | Need further observation.                              |
| <a href="#">FGMV-08</a> | Technical Specification on Design criteria and technical requirements for sustainable metaverse ecosystem                           | ITU-T SG5 and ITU-T SG20                         | SG20 interested.                                       |
| <a href="#">FGMV-09</a> | Technical Report on Power metaverse: Use cases relevant to grid side and user side                                                  | ITU-T SG20 and ITU-T SG13                        | SG20 adopted as a new work of Y.PM-FUSG (Jan. 2025).   |
| <a href="#">FGMV-10</a> | Technical Report on Cyber risks, threats, and harms in the metaverse                                                                | ITU-T SG17                                       | SG17 adopted as a new work of TR.cr-mv (April 2025).   |

## Developed ITU FG-MV deliverables & current status (2/6)

| No.                     | Title                                                                                                                                                | TSAG Allocation                                   | Current status                                                                                                                                                                                                                                |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">FGMV-11</a> | Technical Report on Embedding safety standards and the user control of Personally Identifiable Information (PII) in the development of the metaverse | ITU-T SG17 and ITU-T SG11                         | Need further observation.                                                                                                                                                                                                                     |
| <a href="#">FGMV-12</a> | Technical Report on Children's age verification in the metaverse                                                                                     | ITU-T SG17                                        | Need further observation.                                                                                                                                                                                                                     |
| <a href="#">FGMV-13</a> | Technical Report on Responsible Use of AI for Child Protection in the metaverse                                                                      | ITU-T SG17                                        | Need further observation.                                                                                                                                                                                                                     |
| <a href="#">FGMV-14</a> | Technical Report on Regulatory and economic aspects in the metaverse: Data protection-related                                                        | ITU-T SG3 and ITU-T SG17                          | Need further observation.                                                                                                                                                                                                                     |
| <a href="#">FGMV-15</a> | Technical Specification on Accessibility requirements for metaverse services supporting IoT                                                          | ITU-T SG20 and ITU-T SG16                         | SG20 adopted as a new work of Y.ACC-IoTMV (July 2024).                                                                                                                                                                                        |
| <a href="#">FGMV-16</a> | Technical Report on Accessibility in a sustainable metaverse                                                                                         | ITU-T SG16                                        | SG16 published as a FSTP-ACC-MV-SUST (April 2024).                                                                                                                                                                                            |
| <a href="#">FGMV-17</a> | Technical Report on Guidelines and requirements on interpreting in the metaverse                                                                     | ITU-T SG16                                        | SG21 adopted as a new work of HSTP-ACC-MV-INTERPR (April 2024).                                                                                                                                                                               |
| <a href="#">FGMV-18</a> | Technical Report on Guidance on how to build a metaverse for all – Part I: Legal Framework                                                           | ITU-T SG16 and ITU-T SG3                          | SG21 allocated to Q1/21 for further work.                                                                                                                                                                                                     |
| <a href="#">FGMV-19</a> | Technical Specification on Service scenarios and high-level requirements for metaverse cross-platform interoperability                               | ITU-T SG16, ITU-T SG20, ITU-T SG13 and ITU-T SG11 | SG21 adopted as a new work of H.MV-PIOP (Jan. 2025).                                                                                                                                                                                          |
| <a href="#">FGMV-20</a> | Technical Specification – Definition of metaverse                                                                                                    | ITU-T SG16                                        | SG 21 allocated to Q9/21 for further work.<br>SG17, SG20 proposed to modify definition.<br><i>NOTE: TSAG allocated the harmonization work on definition of metaverse to JCA-MV (May 2025). It was discussed at the 1st JCA-MV (Oct. 2025)</i> |

## Developed ITU FG-MV deliverables & current status (3/6)

| No.                     | Title                                                                                                                                    | TSAG Allocation     | Current status                                          |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------|
| <a href="#">FGMV-21</a> | Technical Report on Principles for Building Concepts and Definitions Related to metaverse                                                | All for Information | SG 21 allocated to Q9/21 for further work.              |
| <a href="#">FGMV-22</a> | Technical Specification on Capabilities and requirements of Generative Artificial Intelligence in metaverse applications and services    | ITU-T SG16          | SG 21 allocated to Q5/21 for further work.              |
| <a href="#">FGMV-23</a> | Technical Report on Considering online and offline implications in efforts to build confidence and security in the metaverse             | SG17                | Need further observation.                               |
| <a href="#">FGMV-24</a> | Technical Report on A framework for confidence in the metaverse                                                                          | SG17                | Need further observation.                               |
| <a href="#">FGMV-25</a> | Technical Report on Near-term and long-term Implications for people in the metaverse                                                     | All SGs             | SG 21 allocated to Q9/21 for further work.              |
| <a href="#">FGMV-26</a> | Technical Specification on Requirements for communication between human-avatar languages in the metaverse                                | SG16 and SG13       | SG 21 allocated to Q1/21 for further work.              |
| <a href="#">FGMV-27</a> | Technical Report on Guidelines for metaverse application in power system                                                                 | SG20                | SG20 adopted as a new work of Y.MetaSkISys (Jan. 2025). |
| <a href="#">FGMV-28</a> | Technical Specification on Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds     | SG20                | SG20 adopted as a new work of Y.dtmv-reqts (July 2024). |
| <a href="#">FGMV-29</a> | Technical Specification on Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds | SG20                | SG20 adopted as a new work of Y.dtmv-ref (July 2024).   |
| <a href="#">FGMV-30</a> | Technical Report on Overview of the application requirements of metaverse on emergency management in chemical industrial parks           | SG20                | SG20 adopted as a new work of Y.CIP (July 2024).        |

## Developed ITU FG-MV deliverables & current status (4/6)

| No.                     | Title                                                                                                                                        | TSAG Allocation | Current status                                                                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">FGMV-31</a> | Technical Specification on Requirements, functional framework and capability of IoT for metaverse                                            | SG20            | SG20 adopted as a new work of Y.IoT-MV (Jan. 2025).                                                                                                                                 |
| <a href="#">FGMV-32</a> | Technical Report on Overview of metaverse                                                                                                    | All SGs         | SG 21 allocated to Q9/21 for further work.                                                                                                                                          |
| <a href="#">FGMV-33</a> | Technical Specification on Glossary for metaverse                                                                                            | All SGs, SCV    | SG 21 allocated to Q9/21 for further work.<br><i>NOTE: It may need to be further developed in JCA-MV for coordination with other groups, including ITU-T SGs and relevant SDOs.</i> |
| <a href="#">FGMV-34</a> | Technical Report on Definitions of CitiVerse                                                                                                 | SG20            | SG20 adopted as a part of a new work of Y.citiverse-reqts (Jan. 2025).                                                                                                              |
| <a href="#">FGMV-35</a> | Technical Report on Building a People-centred CitiVerse                                                                                      | SG20            | SG20 adopted as a part of a new work of Y.citiverse-reqts (January 2025).                                                                                                           |
| <a href="#">FGMV-36</a> | Technical Report on The future of travel in the metaverse: landscape and use cases                                                           | SG16, SG20      | SG21 allocated to Q3/21 for further work.<br>SG20 adopted a new related work of Y.MetaExpSys (Jan. 2025).<br><i>NOTE: Y.MetaExpSys is not based on FGMV-36.</i>                     |
| <a href="#">FGMV-37</a> | Technical Report on Landscape and Use cases for the Industrial metaverse                                                                     | All SGs         | SG20 interested.<br>SG21 interested and allocated to Q9/21 for further work.                                                                                                        |
| <a href="#">FGMV-38</a> | Technical Specification on Framework and requirements for the construction of human-driven 3D digital human application system for metaverse | SG16            | SG 21 allocated to Q9/21 for further work.                                                                                                                                          |

## Developed ITU FG-MV deliverables & current status (5/6)

| No.                     | Title                                                                                                            | TSAG Allocation | Current status                                                                                                                                       |
|-------------------------|------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">FGMV-39</a> | Technical Specification on Use case and requirements for virtual and real fusion coding in metaverse application | SG16            | SG 21 allocated to Q6/21 for further work.                                                                                                           |
| <a href="#">FGMV-40</a> | Technical Specification on Multimedia aspect of metaverse architecture                                           | SG16            | SG21 adopted as a new work of H.MV-MAMA (Jan. 2025).                                                                                                 |
| <a href="#">FGMV-41</a> | Technical Specification on the reference framework of industrial metaverse                                       | SG20            | SG20 interested.                                                                                                                                     |
| <a href="#">FGMV-42</a> | Technical Report on Interoperability of identity of things across metaverse platforms                            | SG20            | SG20 published as a Y.4812 (Jan. 2025)                                                                                                               |
| <a href="#">FGMV-43</a> | Technical Specification on High-level interoperability architecture for cross-platform metaverse                 | SG16            | SG21 adopted as new works:<br>- H.MV-HIA (Jan. 2025)<br>- H.MV-FRAVI (Jan. 2025)<br>- H.MV-FRADAI (July 2025)<br>SG21 Consentrd H.MV-HIA (Oct. 2025) |
| <a href="#">FGMV-44</a> | Technical Report on Security for things across metaverses in aspects of data processing and management           | SG17            | SG17 adopted as a new work of X.stm-dpm (Sept. 2024).                                                                                                |
| <a href="#">FGMV-45</a> | Technical Report on Challenges to achieving trustworthy metaverse                                                | SG17            | SG17 adopted as a new work of TR.trust-metaverse (April 2025).                                                                                       |
| <a href="#">FGMV-46</a> | Technical Report on The essential components of trusted data use in building a trustworthy metaverse             | SG17            | Need further observation.                                                                                                                            |

## Developed ITU FG-MV deliverables & current status (6/6)

| No.                     | Title                                                                                               | TSAG Allocation | Current status                                                                                                                       |
|-------------------------|-----------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">FGMV-47</a> | Technical Report on Economic Value Creation and Competition in metaverse                            | SG3             | Need further observation.                                                                                                            |
| <a href="#">FGMV-48</a> | Technical Report on Guidance on how to build a metaverse for all: Part II - Survey                  | All SGs         | SG21 allocated to Q1/21 for further work.                                                                                            |
| <a href="#">FGMV-49</a> | Technical Report on Metaverse Sustainability: Driving energy efficiency and GHG emissions reduction | SG5             | Need further observation.                                                                                                            |
| <a href="#">FGMV-50</a> | Technical Specification on Methodology on assessment of GHG emissions of metaverse                  | SG5             | Need further observation.                                                                                                            |
| <a href="#">FGMV-51</a> | Technical Report on Standardization roadmap for metaverse                                           | All SGs         | SG 21 allocated to Q9/21 for further work.<br><i>NOTE: It will be used to develop "metaverse standardization roadmap" in JCA-MV.</i> |
| <a href="#">FGMV-52</a> | Technical Report on Metaverse standardization landscape for gap analyses                            | All SGs         | SG 21 allocated to Q9/21 for further work.<br><i>NOTE: It will be used to develop "metaverse standardization roadmap" in JCA-MV.</i> |

# Unfinished work items of FG-MV

| Type     | Title of deliverable                                                                                                             | FG-MV WG/TG                                 |
|----------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Draft TR | Pre-standardisation roadmap for an inclusive and sustainable CitiVerse                                                           | WG1/TG-pre-standardization for the CitiVers |
| Draft TS | Use cases and requirements on immersive audio coding for metaverse applications and services                                     | WG2/TG-media coding                         |
| Draft TS | Requirements and framework for extended reality content creation system based on artificial intelligence                         | WG2/TG-Generative AI                        |
| Draft TR | Use case and requirements for remote amusement service with automatic movable robot (AMR) with multimedia functions on metaverse | WG2/TG-metaverse tourism                    |
| Draft TR | Medical metaverse: Use-case Relevant to Medical Training and Hospital                                                            | WG2/TG-medical metaverse                    |
| Draft TR | Requirements and challenge associated with network infrastructure to enable the metaverse                                        | WG3                                         |
| Draft TS | Setting the framework for an ICT architecture to enable the metaverse                                                            | WG3                                         |
| Draft TR | The framework of building a trustworthy digital human                                                                            | WG6/TG-trustworthiness in MV                |
| Draft TS | Incentive strategies to boost high-impact sustainable metaverse applications                                                     | WG8/TG-sustainable MV design                |
| Draft TS | Metrics and indicators to drive the design of sustainable metaverse applications                                                 | WG8/TG-sustainable MV design                |
| Draft TR | Metaverse social safety: mitigating harassment in the metaverse                                                                  | WG8/TG-metaverse social safety              |

FG-MV had been concluded.  
But the work is not over yet...

**Moving forward to ITU-T SGs & other SDOs**

## New structure of ITU-T SGs – consolidation of SG9 and SG16

- ❖ 11 SGs (study period 2022~2024) → **10 SGs** (study period 2025~2028)
- ❖ **New SG21 - Consolidation of SG9 (CATV) and SG16 (Multimedia)**
  - \* SG21: Technologies for multimedia, content delivery and cable television

## WTSA Resolution 2 was approved

### *\* Resolution 2: Scope and mandate of the ITU-T study groups*

- General **areas of study** of ITU-T SGs
- **Lead ITU-T Study Groups** in specific areas of study
  - \* SG20: smart sustainable cities and communities and related digital services, including effective energy management, digital twins and **citiverse**
  - \* SG21: **immersive multimedia technologies, including metaverse**
- **Points of guidance** to ITU-T SGs for the development of the post-2024 work programme

## Organizational Structure of ITU-T SG21

- ❖ WP1: Integrated broadband and cable television systems
- ❖ WP2: Multimedia digital services and human aspects
  - Q1: Multimedia system, service and application accessibility for digital inclusion
  - Q4: Human factors for intelligent user interfaces and services
- ❖ WP3: Media authenticity, processing and AI-enabled applications
  - Q5: AI-enabled multimedia applications
- ❖ **WP4: Infrastructure for multimedia systems, services and applications, including metaverse**
  - Q8: Immersive live experience systems and services
  - **Q9: Multimedia framework, applications and services**
- ❖ AHG-FQS: Ad hoc Group on future questions structure
- ❖ AHG-MMA: Ad hoc Group on coded multimedia authenticity
- ❖ **AHG-MV: Ad hoc Group on metaverse** (*\*Concluded at SG21 meeting in October 2025*)
- ❖ IRG-AVA: ITU Inter-sector Rapporteur Group on Audiovisual Media Accessibility
- ❖ JVET: Joint Video Experts Team

## AHG-MV: Ad hoc Group on metaverse

- ❖ **Convenor: Shin-Gak KANG (Korea)**
- ❖ **Scope:** study relevant issues for the establishment of a new Question on metaverse in ITU-T SG21 until the next SG21 meeting in October 2025
- ❖ **Objective:** monitor the progress of metaverse related work in SG21 and carefully analyze advantages and disadvantages of **establishing a new Question**, along with analyzing the workload of existing Q9/21
- ❖ **Discussion results:** Proposed that it needs to establish a new Question on metaverse but it needs to be discussed at the AHG-FQS considering the numbers and workloads of relevant Questions in SG21

## Change the ToR of Q9/21 to enhance metaverse standardization work

- ❖ It was agreed at SG21 meeting in January 2025 and submitted to TSAG for endorsement
- ❖ The modified Q9/21 ToR **was approved at TSAG meeting** held in May 2025
  - Title: Multimedia framework, applications and services, **and related metaverse aspects**
  - Study general and common **multimedia aspects of metaverse applications, systems and services**, including definition and glossary
  - study use cases, requirements, framework, functional architectures, **protocols** on multimedia aspects of metaverse technologies, applications, systems and services for **supporting interoperability**;
- ❖ The modified Q9/21 ToR **was approved at SG21 meeting** held in October 2025

## Q9/21 work programs related to metaverse (2025.09)

### ❖ Metaverse platform, Interoperability, maturity

- H.MV-FRADAI: Functional requirements and architecture for digital asset interoperability in cross-platform metaverse
- H.MV-FRAVI: Functional requirements and architecture for avatar interoperability in cross-platform metaverse
- [H.MV-HIA: High-level interoperability architecture for cross-platform metaverse](#)
- H.MV-MAMA: Multimedia aspect of metaverse architecture
- H.MV-PIOP: Service scenarios and high-level requirements for metaverse cross-platform interoperability
- [TR.MV-MML: Maturity levels for metaverse service and application](#)

### ❖ Core technologies for metaverse

- F.3DCS-reqts: Requirements and functional architecture for 3D collaborative design services
- H.3DRS-PF: Requirements and functional architecture of real-scene 3D reconstruction system for power facilities
- H.CAR-FA: Functional Architecture for cloud-based augmented reality systems
- H.CVR-IF: Interfaces for interaction in cloud virtual reality systems
- H.CVR-OP: Functional architecture of optimized processing for cloud virtual reality systems
- H.LVR: Requirements and reference framework for large-scale virtual reality system

## Work programs related to metaverse in other Questions of SG21 (2025.09)

- F.ACC-MV-SD (Q1/21), Reqs. of accessible products and services in the metaverse - Part I System design perspective
- F.ACC-MV-UP (Q1/21), Requirements of accessible products and services in the metaverse - Part II User perspective
- HSTP-ACC-MV-INTERPR (Q1/21) Guidelines and requirements on interpreting in the metaverse
- J.CLE-ARVR (Q1/21), Terminology, Metrics and Functional reqs. for Cognitive Load Estimation for AR/VR services
- F.LVR-CHS (Q3/21), Requirements and reference framework for large-scale VR system of cultural heritage sites
- F.MRN-CHS (Q3/21), Requirements and framework of mixed reality navigation system for cultural heritage sites
- F.FDHC (Q4/21), Framework for digital human customization
- F.FLDH (Q4/21), Framework of human-machine interaction for developing intelligent digital humans
- F.GI-WD (Q4/21), Framework and requirements of gesture interaction in VR and AR environment with wearable devices
- F.DH-LM (Q5/21), Reference architecture and technical requirements of large model enhanced digital human system
- F.DH-PE (Q5/21), Requirements and evaluation methods of digital human platform
- F.DHPIE (Q5/21), Metrics and evaluation methods for the presentation and interactive effect of 3D digital human
- H.ILE-3DIT (Q8/21), Functional requirements and frameworks of 3D model-based immersive telepresence services
- H.ILE-3DINR (Q8/21), Framework and requirements of 3D reconstruction systems based on implicit neural representation for immersive live experience (ILE) services
- H.ILE-AR (Q8/21), Requirements and framework of augmented reality for immersive live experience (ILE) services

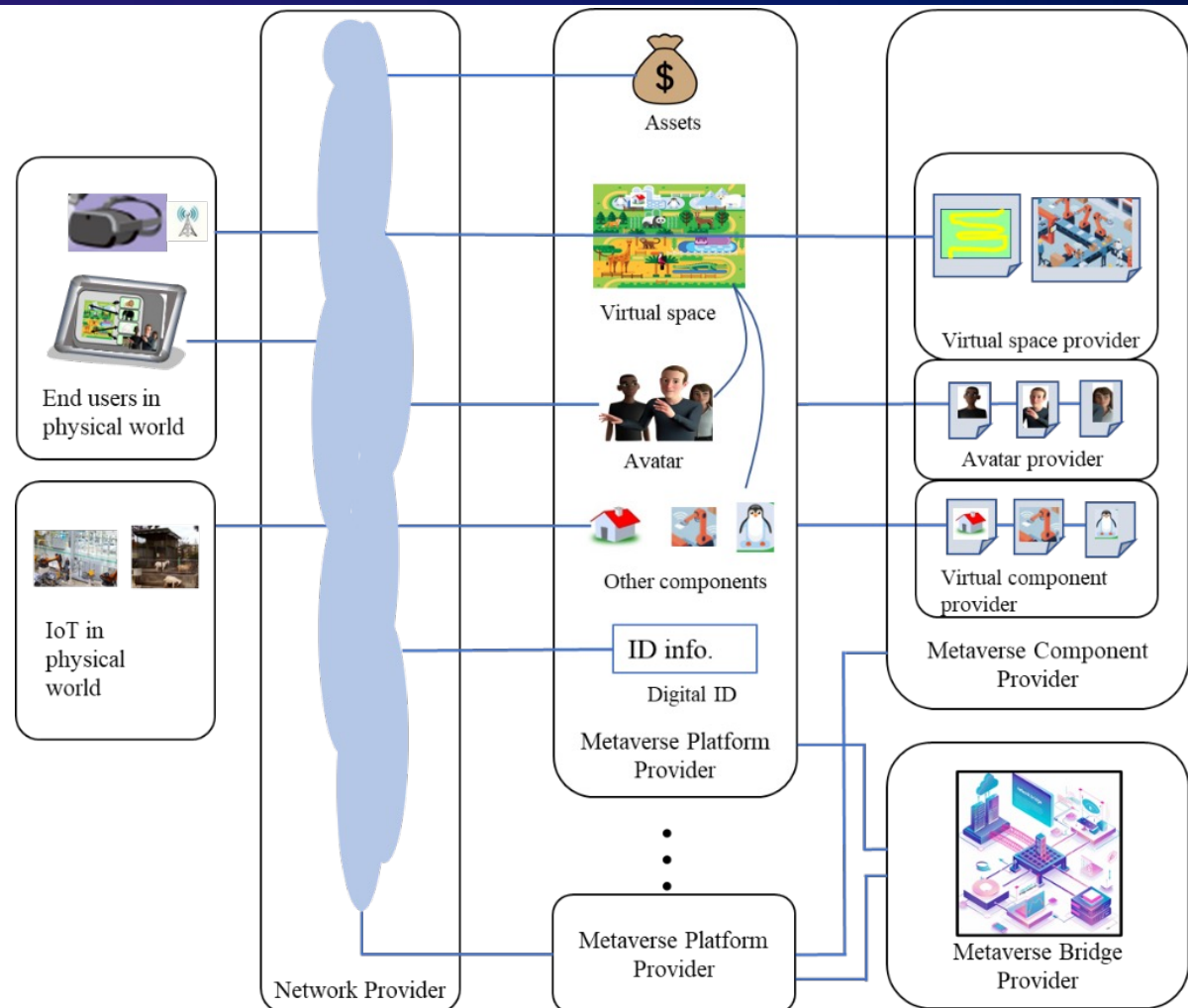
### Work programs related to metaverse in other ITU-T SGs that are not based on FG-MV deliverables (2025.09)

- Q8/11, Q.FITSM: Framework of interoperable telepresence suits for metaverse
- Q1/12, GSTR-MVQ: QoS and QoE standards related to the metaverse
- Q16/13, Y.trust-MVInf-fr: Framework of a trustworthy metaverse infrastructure
- Q6/17, X.sg-eimv: Technical Report - Technical challenges to achieving trustworthy metaverses
- Q7/17, TR.dpama: Technical Report - Landscape analysis for data protection of avatars in metaverse applications
- Q7/17, X.AA-LLM: Guidelines for Preventing and Mitigating Adversarial Attacks on LLMs in Metaverse and Digital Twin Environments
- Q1/20, Y.dtmv-if: Interface model and requirements for integrating virtual and physical worlds through digital twins in the metaverse
- Q3/20, Y.Fram-ssdp: Requirements and framework of metaverse simulation service for disaster prevention in electric power facilities
- Q6/20, Y.metaID: Framework and requirements for identity visualization in and across metaverse
- Q8/20, Y.Frwk-mwell: Requirements and capability framework for IoT enabled well-being methods measurement through metaverse

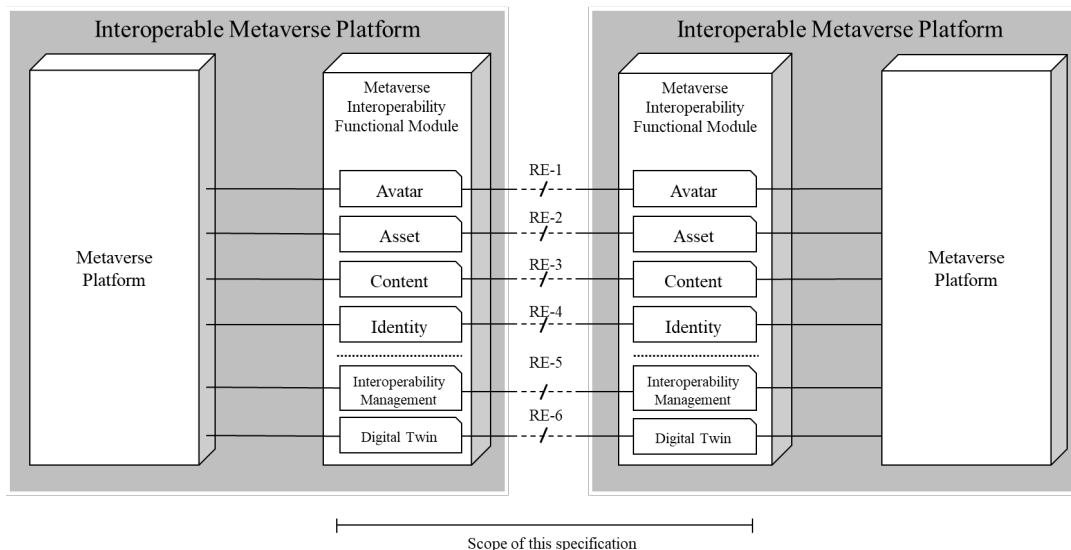
# SG21: Metaverse Platform Interoperability - Architecture

## High-level interoperability architecture for cross-platform metaverse

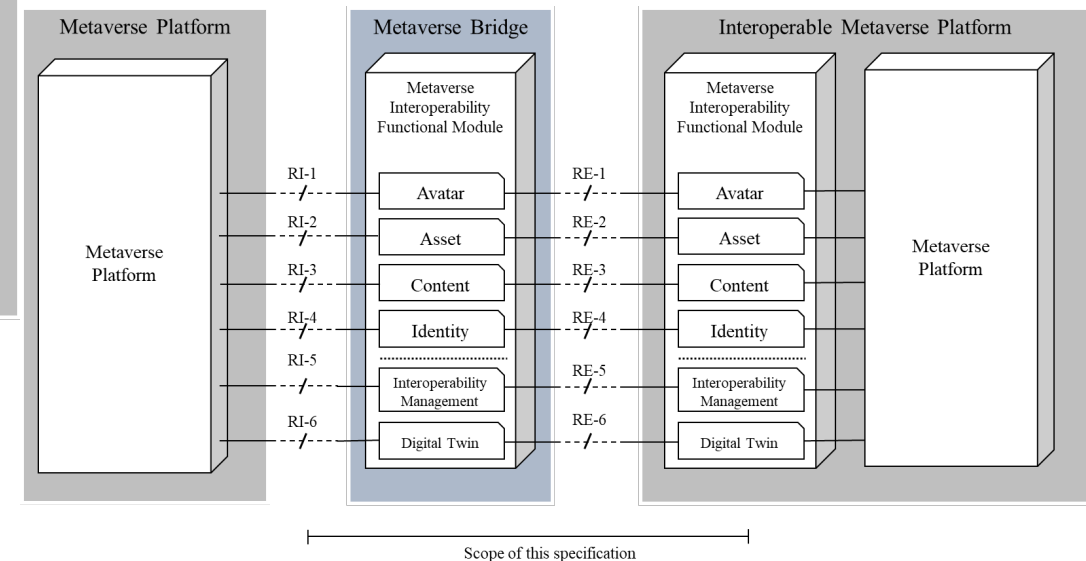
❖ Stakeholders for metaverse cross-platform interoperability



## Architectural overview of interoperation between metaverse platforms



## Architectural overview of interoperability using metaverse bridges



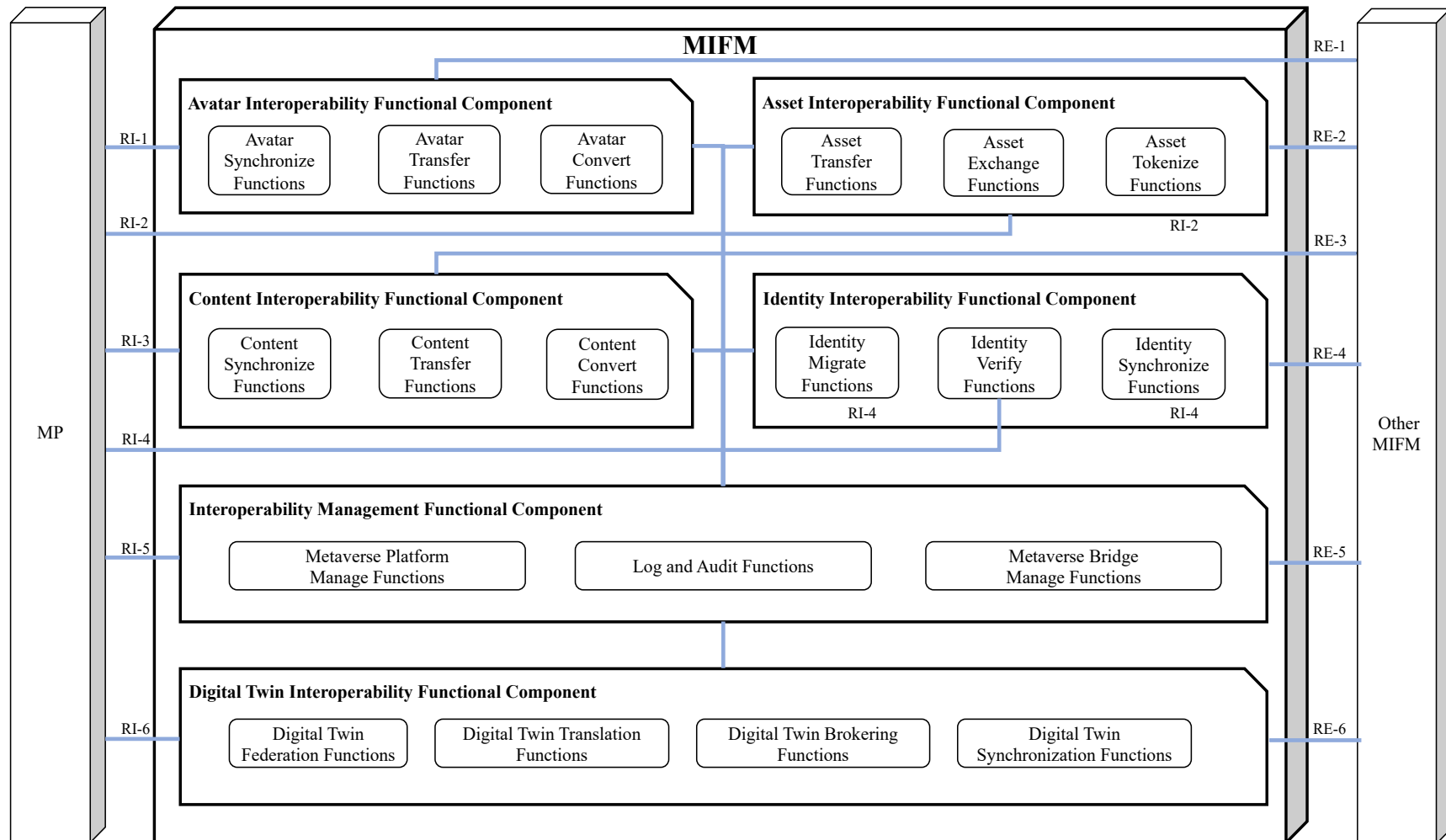
# SG21: Metaverse Platform Interoperability - Architecture

## High-level metaverse interoperability functional architecture

- Functional Components
- Reference points
- High-level Information Flows

### Information Flows:

- Avatar migration
- Asset migration
- Content migration
- Identity migration
- Metaverse platform registration for establishing an interoperable communication channel



# Standardization Initiatives on metaverse in ITU-T



## - New Delhi, India, 15 – 24 October 2024

\* WTSA is held every four years and defines the next period of study for ITU-T.

### **All regions of ITU-T proposed a new Resolution on metaverse standardization**

- APT – Asia-Pacific Telecommunity
- AST – League of Arab States / Arab Standardization Team
- ATU – African Telecommunications Union
- CEPT – European Conference of Postal and Telecommunications Administrations
- CITEL – Inter-American Telecommunication Commission
- RCC – Regional Commonwealth in the Field of Communications

*APT Common Proposal (ACP) on the new resolution for metaverse was adopted based on Korea's proposal and widely referenced by other regions*

### **New Resolution 105 was approved at WTSA-24**

❖ **Resolution 105: Promoting and strengthening metaverse standardization**

### Resolution 105 – Promoting and strengthening metaverse standardization

#### Resolves;

- to carry out standardization work to ensure that the various telecommunication/ICT components of metaverse can be effectively integrated and interoperated, including architectures, requirements, protocols, systems and services;
- to promote and strengthen the ITU-T SGs' standardization work related to enabling technologies, systems, applications, services, protocols, security, accessibility and sustainability for metaverse;
- to work collaboratively and cooperatively with other SDOs, recognized external organizations, industry and relevant entities;
- to promote the potential of an accessible and sustainable metaverse, including for enhancing the value of future telecommunication/ICT applications and services;
- to take necessary steps to achieve a comprehensive understanding of threats and foster cooperation among different stakeholders to develop a safe and secure metaverse environment that enhances the well-being of users;
- to ensure trust, confidence and security in metaverse applications and services, thereby providing a safe and secure environment for all users;
- to establish a joint coordination activity on metaverse (JCA-MV) under the TSAG to coordinate standardization activities on metaverse and to maintain a standardization roadmap for the purpose of having coordination across relevant ITU-T SGs and with related SDOs and relevant parties outside ITU-T;
- that ITU forums be held to present progress in the work and the results achieved by the ITU-T study groups in charge of metaverse standardization before the next WTSA

- ❖ ITU-T SG20 and SG21 meeting (January 2025, Geneva)
  - **Korea and Japan proposed the draft ToR for JCA-MV** to ITU-T SG20 and SG21 meeting
  - The harmonized ToR for JCA-MV was agreed at the joint meeting of SG20 and SG21
  - Draft ToR was submitted to TSAG for consideration
  
- ❖ ITU-T TSAG meeting (May 2025, Geneva)
  - **Korea proposed the establishment of JCA-MV** according to the WTSA Resolution 105
    - ✓ JCA-MV: Joint Coordination Activity on metaverse standardization
  - TSAG agreed to **establish a new JCA-MV under TSAG** & the ToR
  - **TSAG appointed JCA-MV Co-Chairs**
    - ✓ **Shin-Gak KANG (ETRI, Korea),**                      Muath AlRumayh (CST, Saudi Arabia)

## ❖ Scope

- to **coordinate ITU-T MV standardization work** and **foster collaboration** across all relevant SGs within ITU-T, while providing a visible contact point and coordinating communication **with external SDOs, consortia and forums** working on metaverse-related standards, enabling effective two-way communications with these bodies.

## ❖ Objectives

- To ensure that the ITU-T metaverse standardization work related to enabling technologies, systems, applications, services, protocols, security, accessibility, and sustainability for metaverse, progresses **in a well-coordinated manner among all relevant ITU-T study groups**;
- To encourage relevant groups in ITU-T, the ITU-R and the ITU-D to contribute to the JCA and share information;
- To **develop, maintain and update a roadmap for metaverse standardization**, taking into account ongoing and published standard deliverables from ITU, other relevant SDOs, consortia, and forums;
- To consider and promote **cooperation and complementarity** in the development of international standards for metaverse with relevant organizations;
- To **report to the TSAG whenever duplication of efforts or other issues requiring coordination are discovered**, to support TSAG coordination function among ITU-T study groups;
- To **act as a point of contact within ITU-T and with other SDOs, consortia and forums**, working on metaverse related standards especially **to avoid duplication of efforts**;
- To **maintain a list of contacts and representatives** of relevant ITU-T SGs and other related ITU groups;
- To maintain a list of contacts and representatives from other relevant SDOs, regional/national organizations, consortia, and forums who participate in the JCA-MV.

## ❖ Kick-off meeting of JCA-MV (<http://itu.int/en/ITU-T/jca/mv>)

- 9 October 2025 (Geneva), collocated with ITU-T SG21 meeting (6 to 17 October 2025)
- Chaired by Co-Chair, Shin-Gak KANG (ETRI, Korea)
- Outcomes of 1st JCA-MV meeting
  - ✓ Coordination of new work items between SG20 and SG21
  - ✓ Agreed to develop a deliverable “**Metaverse standardization roadmap**”
    - Editors: Hideki Yamamoto (OKI), Hideo Imanaka (NICT), Jungha Hong (ETRI)
  - ✓ Continue to discuss about the “**metaverse**” **definition**
    - Need to collaborate with ITU-T **Standardization Committee for Vocabulary (SCV)**
  - ✓ Decided to send **outgoing Liaison Statement** to all relevant SDOs and entities
    - Request **Liaison Representative information** of each group for collaboration & coordination
    - Request **information on standardization activities** of each group to develop “metaverse standardization roadmap” in JCA-MV
      - Preparing the “**Template**” to request information

# How to take a leading role in emerging & future standardization issues



## January 2022: ITU-T SG16 meeting

- ❖ The necessity of standardization work on multimedia related metaverse issues was first discussed.  
(Initiated by Chinese experts)
- ❖ **Correspondence Group on Metaverse (CG-Metaverse)** was established with ToR
  - **Co-chairman : Shin-Gak KANG (ETRI/Korea),**    Kepeng LI (Tencent/China)

Korean Expert contributed to reach consensus to establish the CG by active supporting and leading discussions based on experience and leadership role in SG16

## July-Sep. 2022: CG-Metaverse

- ❖ Discussed standardization issues and the need for FG establishment through 3 e-meetings
  - First (06 July 2022), Second (10 August 2022), Third (8 September 2022)
- ❖ **Decided to propose the establishment of a new Focus Group** for metaverse standardization issues and working methods to ITU-T SG 16 meeting in October 2022

Korean Expert led CG-Metaverse activities in ITU-T SG16 through the role of Convenor

## October 2022: : ITU-T SG16 meeting

- ❖ Decided to establish a new **FG-MV** and propose to ITU-T TSAG for approval  
(\* TSAG: Telecommunication Standardization Advisory Group)
- ❖ Agreed to establish **AHG-MV** for coordination on metaverse issues within ITU-T SG16
  - Convenor: **Shin-Gak KANG (ETRI/Korea)**

- Korean Expert played a leading role in proposing the establishment of the FG-MV
- Korean Expert led metaverse standardization efforts in SG16 and secured the leadership

## December 2022: ITU-T TSAG meeting

- ❖ Unanimously decided to **establish the Focus Group on metaverse (FG-MV)** under TSAG
- ❖ Appointed **FG-MV chair: Shin-Gak KANG (ETRI, Korea)**

- Korea actively supported the SG16's proposal to establish FG-MV
- Shin-Gak KANG was appointed as chairman after being recommended as the only candidate from a member countries, in recognition of his leading role in establishing the FG-MV

## January 2023 ~ June 2024: ITU FG-MV activities

- ❖ 7 times of FG-MV meetings and 155 WGs/TGs (e)-meetings
- ❖ Developed total of **52 FG-MV deliverables** over 18 months of life-time

- Korea has significantly contributed to the achievement of FG-MV's preliminary standard development work by leading FG-MV activities

## October 2024: WTSA-24 (World Telecommunication Standardization Assembly)

- ❖ Approved new **WTSA Resolution 105** (Promoting & strengthening metaverse standardization)
- ❖ Instructed to establish **JCA-MV** (Joint Coordination Activity on Metaverse Standardization)

- Korea played a key role in submitting the WTSA resolution proposal on metaverse standardization to WTSA-24 as an ACP (APT Common Proposal) through the APT WTSA Preparation meetings

- Korea had a major influence on proposing new metaverse resolutions not only in APT but also in six ITU-T regional organizations around the world

## January 2025: ITU-T SG21 meeting

- ❖ Korea and Japan proposed the **draft ToR for JCA-MV** to ITU-T SG20 and SG21 meeting
- ❖ The harmonized ToR for JCA-MV was submitted to TSAG
- ❖ **Established the SG21 AHG-MV** to discuss about the necessity of establishing new Question

- Korea continued to lead and preempt global metaverse standardization issues, following the successful completion of FG-MV activities and the adoption of new resolutions at WTSA-24

## May 2025: ITU-T TSAG meeting

- ❖ TSAG established new **JCA-MV under TSAG** with the **ToR** based on the proposal from Korea
- ❖ Appointed Co-chairs: **Shin-Gak KANG (ETRI, Korea)**, Muath AlRumayh (CST, Saudi Arabia)

## October 2025: Kickoff meeting of ITU-T TSAG JCA-MV

- ❖ Start to collaborate and coordination work in ITU-T SGs and other SDOs and Entities

- Korea officially proposed and led the establishment of JCA-MV based on WTSA-24 Resolution 105

- Through its role as Chair, Korea is taking the initiative in collaborating and coordinating global metaverse standardization efforts

- ❖ **Continuous participation**
- ❖ **Remembering history**
- ❖ **Active participation**
- ❖ **Become a technology expert**
- ❖ **Understanding rules and procedures**
- ❖ **Making yourself stand out (Gaining presence)**
- ❖ **Collaborating with others**
- ❖ **Supporting others**
- ❖ **Becoming a good big mouth**
- ❖ **Building a good reputation**
- ❖ **Gaining recognition and respect**

# The metaverse continues to evolve and the key is “**standardization**”.



**Website**

[www.itu.int/metaverse](http://www.itu.int/metaverse)

[itu.int/en/ITU-T/jca/mv](http://itu.int/en/ITU-T/jca/mv)



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# GISC 2025

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