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| Title: ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATION STANDARDIZATION SECTOR**STUDY PERIOD 2022-2024 | TSAG-TD587 |
| TSAG |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 29 July - 2 August 2024 |
| **TD(Ref.:** [FG-MV-LS50](http://handle.itu.int/11.1002/ls/sp17-fg-mv-oLS-00050.docx)**)** |
| **Source:** | FG-MV |
| **Title:** | LS/i on Results of the seventh and final meeting of the FG-MV [from FG-MV] |
| **LIAISON STATEMENT** |
| **For action to:** | TSAG |
| **For information to:** | ITU-T SG2, SG3, SG5, SG9, SG11, SG12, SG13, SG15, SG16, SG17, SG20 |
| **Approval:** | FG-MV meeting (Geneva, 13 June 2024) |
| **Deadline:** | N/A |
| **Contact:** | Shin-Gak Kang FG-MV Chair | E-mail: sgkang@etri.re.kr  |

A new liaison statement has been received from FG-MV.

This liaison statement follows and the original file can be downloaded from the ITU ftp server at <http://handle.itu.int/11.1002/ls/sp17-fg-mv-oLS-00050.docx>.

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| A black and white logo  Description automatically generated with low confidence | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2022-2024 | **FG-MV-LS50** |
| **Focus Group on metaverse** |
| **Original: English** |
| **WG(s):** | PLEN | Geneva, 12-13 June 2024 |
| **Ref.: FG-MV-O-270-R2** |
| **Source:** | FG-MV |
| **Title:** | LS on Results of the seventh and final meeting of the FG-MV  |
| **LIAISON STATEMENT** |
| **For action to:** | TSAG |
| **For information to:** | all ITU-T Study Groups |
| **Approval:** | **FG-MV meeting (Geneva, 13 June 2024)** |
| **Deadline:** | N/A |
| **Contact:** | Shin-Gak Kang FG-MV Chair | E-mail: sgkang@etri.re.kr  |

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| **Abstract:** | This document contains information on the results of the seventh and final meeting of the FG-MV. |

The Focus Group on metaverse (FG-MV) was established under the ITU-T Telecommunication Standardization Advisory Group (TSAG) on 16 December 2022. FG-MV laid the groundwork for international standards that can help create an underlying technology and business ecosystem. The group analysed the technical requirements of the metaverse to identify fundamental enabling technologies in areas ranging from multimedia and network optimization to digital currencies, Internet of Things, digital twins, and environmental sustainability. It also provided a collaboration platform for dialogue, for identifying stakeholders with whom ITU-T could collaborate, and for enabling the inclusion of non-members to contribute to the international technical pre-standardization work. FG-MV has established nine working groups (WGs):

* Working Group (WG) 1 - General
* Working Group (WG) 2 - Applications & Services
* Working Group (WG) 3 - Architecture & Infrastructure
* Working Group (WG) 4 - Virtual/Real World Integration
* Working Group (WG) 5 - Interoperability
* Working Group (WG) 6 - Security, Data & Personally identifiable information (PII) ​Protection
* Working Group (WG) 7 - Economic, regulatory & competition aspects
* Working Group (WG) 8​ - Sustainability, Accessibility & Inclusion​ ​​
* Working Group (WG) 9 – Collaboration

# Meetings

FG-MV held seven meetings since its establishment, as summarized in the table below.

**Table 1 – FG-MV meeting summaries**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1st meeting****Riyadh, 8**–**9 March 2023** | **2nd meeting****Shanghai, 4**–**6 July 2023** | **3rd meeting****Geneva, 3-5 October 2023** | **4th meeting****Geneva, 4-7 December 2023** | **5th meeting****Queretaro, 5-8 March 2024** | **6th meeting****Virtual, 30 April 2024** | **7th meeting****Geneva, 12-13 June 2024** |
| **Input documents** | 91 | 172 | 222 | 201 | 197 | 91 | 187 |
| **Output documents** | 7 | 66 | 99 | 90 | 87 | 10 | 51 |
| **Meeting report** | [FGMV-O-006-R2](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-006-R2.docx) | [FGMV-O-068-R1](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-068-R1.docx) | [FGMV-O-133-R2](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-133-R2.docx) | [FGMV-O-199-R2](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-O-199-R2.docx) | [FGMV-O-249-R1](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-249-R1.docx) | [FGMV-O-250-R1](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-250-R1.docx) | [FGMV-O-289-R3](https://extranet.itu.int/sites/itu-t/focusgroups/mv/output/FGMV-O-289-R3.docx) |
| **Number of participants (on-site and remote)** | 650 | 1276 | 250 | 277 | 237 | 130 | 231 |
| **Number of participants (webcast)** | N/A | 859 | N/A | N/A | N/A | N/A | N/A |

**Focus Group leadership, structure and deliverables**

The management team consisted of the following:

**Chair:** Shin-Gak Kang (ETRI, Rep. of Korea)

**Vice-Chairs:**

* Andrey Perez (Brazil)
* Hideo Imanaka (NICT, Japan)
* Per Fröjdh (Ericsson, Sweden)
* Shane He (Nokia, Finland)
* Vincent Affleck (United Kingdom)
* Yuntao Wang (China)
* Leonidas Anthopoulos (University of Thessaly, Greece​)
* Manuel Barreiro (Aston Group, Mexico)
* Cristina Martinez (European Commission)
* Stella Kipsaita (Communications Authority, Kenya)
* Natalia Bayona (UN Tourism)

Please refer to Annex A for the final list of FG-MV structure, approved deliverables and work items that were not completed (Geneva, 12-13 June 2024) for more details. The FG-MV Workplan is also available at: <https://www.itu.int/en/ITU-T/focusgroups/mv/Pages/FG-MV-structure-and-workplan.aspx>

**Completed deliverables**

FG-MV has approved 52 deliverables. The FG-MV agreed to forward all its deliverables to TSAG for its action.

The FG-MV invites TSAG to allocate the deliverables to the relevant Study Groups.

Table 2 reflects the suggestions made by the FG-MV to TSAG.

**Table 2 – FG-MV approved deliverables (from January to June 2024)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Title** | **Approved**  | **Suggested by the FG-MV to be allocated to**  | **Summary of the deliverable** |
| [FGMV-23](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-23.pdf) | Technical Report on Considering online and offline implications in efforts to build confidence and security in the metaverse | March 2024 | SG17 | Summary:If the metaverse continues to progress towards the digital twinning of the world (possibly the universe), then presumably “everyone” is (or should be) represented in the metaverse and therefore the absence of participation (whether involuntarily or by choice) is not necessarily a path to opting out of the implications. With the metaverse still in its nascent phase, implications for participants and for non-participants alike are a new consideration; although early data would suggest that these range from issues relating to security, confidence, and trust, to ethical and other related issues.New frameworks on building confidence and security in the metaverse may be able to pre-empt negative outcomes by drawing on existing knowledge and trends around Trust and Safety, as well as digital inclusion and exclusion. Specifically, accounting for the broad spectrum of populations and related assets, actions, attitudes, relationships, and outcomes that is likely to characterize engagement with the metaverse.This Technical Report explores this further using the “User Confidence Framework” introduced in ITU FGMV-06 Technical Report on “Guidelines for consideration of ethical issues in standards that build confidence and security in the metaverse” (which was approved at the third meeting of the ITU Focus Group on metaverse, held from 3-5 October 2023 in Geneva, Switzerland), and its related framework for metaverse participation. |
| [FGMV-24](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-24.pdf) | Technical Report on A framework for confidence in the metaverse | March 2024 | SG17(SG13, SG16) | Summary:Still in its nascent phase, even as it rides the downward swing of a highly visible hype curve; the concept of “metaverse” remains undefined. Yet, the metaverse is emerging as a new frontier of social and economic interaction with the potential to transform the way we live, work and play.Given its potential to be highly disruptive, there is some urgency to develop a general understanding of the metaverse in this nascent phase, especially to avoid the pitfalls that continue to afflict its predecessors including Web 2.0 platforms like social media.To address this urgent need, the International Telecommunication Union (ITU) established the firstFocus Group on metaverse (FG-MV) in December 2022. A year later, in December 2023, FG-MV experts (brought together from around the world to shape the development of metaverse technology standardization for the benefit of all) proposed a baseline definition for the metaverse.This Technical Report (also a product of FG-MV) outlines an approach to pre-standardization of confidence in the metaverse by:1. Expanding the “User Confidence Framework” introduced in ITU’s FGMV-06: Technical Report on “Guidelines for consideration of ethical issues in standards that build confidence and security in the metaverse” (which was approved at the third meeting of the FG-MV, held on 3–5 October 2023, in Geneva, Switzerland), to include Security and Safety Dimensions in user confidence.2. Developing a new framework for metaverse participation that defines new user centric terms related to metaverse use and non-use as an approach to understanding user metaverse engagement.3. Discussing the concept of personhood for metaverse contexts to contextualize user presencein the metaverse. |
| [FGMV-25](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-25.pdf) | Technical Report on Near-term and long-term Implications for people in the metaverse | March 2024 | SG16(SG17) | Summary:Given that the industry has not yet converged on a precise understanding of what is commonly referred to as the “metaverse”, there is general confusion between definitions of this term based on Facebook’s transformation to Meta in 2021 and definitions that evolved from the concept that was popularized by Neal Stephenson’s novel, Snow Crash, in 1992. This has led to conflicting declarations of the metaverse as being both in its nascent phase and already dead. Nevertheless, as the world becomes increasingly digital, the metaverse (no matter the definition ascribed to it) is emerging as a new frontier of social and economic interaction; allowing people to create, connect, and collaborate in ways that were previously thought impossible. The promise of a post-COVID-19 metaverse is rapid acceleration of an already super-charged global digital transformation with the potential to transform our lives, livelihoods, and interactions, in the near-term and long-term, in ways that cannot be overstated. Neither can our lack of clarity around the implications. This Technical Report explores the near-term and long-term implications for people in the metaverse as a framework for understanding potential impacts and a guide for maximizing the benefits and minimizing associated risks. |
| [FGMV-26](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-26.pdf) | Technical Specification on Requirements for communication between human-avatar languages in the metaverse | March 2024 | SG16 | Summary:This Technical Specification provides requirements on how to develop the architecture for communication between humans, digital humans/avatars, and systems in the metaverse. This document considers language modalities, language writing systems, AI language communication technologies, co-linguistic communication, and language prevalence in terms of use. It provides guidance on a wide array of communication workflows for the metaverse. The document also makes recommendations on how communication modalities can be considered in the design of any scenario. |
| [FGMV-27](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-27.pdf) | Technical Report on Guidelines for metaverse application in power system | March 2024 | SG20 (SG16) | Summary:This Technical Report provides the connotation, mapping mode, and implementation logic of the power metaverse, provides the application framework and key technical details. For the convenience of understanding and use, it also lists three typical application scenarios aligned with power system business needs. This Technical Report provides reference for decision-making, technical research and application practice in power metaverse. |
| [FGMV-28](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-28.pdf) | Technical Specification on Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds | March 2024 | SG20(SG16) | Summary:This Technical Specification provides service scenarios and requirements for the digital twin-based integration of virtual and physical worlds. Three categories of use cases and their service scenarios are introduced, and requirements with respect to digital twin, metaverse, and system interaction are defined. |
| [FGMV-29](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-29.pdf) | Technical Specification on Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds | March 2024 | SG20(SG16) | Summary:This Technical Specification provides the reference model for the metaverse based on digital twins enabling the integration of virtual and physical worlds. In order to realize this integration of the virtual and physical worlds, a reference model for interaction is necessary, with digital twins serving as a key component of this model. This Technical Specification aims to establish the reference model for the metaverse based on digital twins, enabling the seamless integration of virtual and physical worlds. |
| [FGMV-30](https://www.itu.int/en/ITU-T/focusgroups/mv/Pages/deliverables.aspx) | Technical Report on Overview of the application requirements of metaverse on emergency management in chemical industrial parks | April 2024 | SG20(SG16)  | Summary:Chemical industrial parks, as the main sites of chemicals and chemical production, are confronted with a high safety risk. Once an accident occurs, it may result in large-scale loss of life and property. However, the application of metaverse can improve the efficiency of risk management and emergency management in chemical industrial parks. This Technical Report introduces the application requirements and scenarios of metaverse in emergency management within chemical industrial parks. The aim is to identify metaverse platform requirements and address potential issues, as well as enhance the emergency response capability of responders in chemical industrial parks. |
| [FGMV-31](https://www.itu.int/en/ITU-T/focusgroups/mv/Pages/deliverables.aspx) | Technical Specification on Requirements, functional framework and capability of IoT for metaverse | April 2024 | SG20(SG16) | Summary:This Technical Specification provides requirements, functional framework and capability of IoT for metaverse, including general requirements, high-level reference framework and associated capabilities. |
| [FGMV-32](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-32.pdf) | Technical Report on ​ Overview of metaverse | June 2024 | SG16(All SGs) | Summary:Metaverse is defined as 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 [b-ITU FGMV-20]. It serves as a virtual shared space accessible to everyone and also as a comprehensive term referring to the entire digital and virtual world. The metaverse represents the convergence of physical, augmented, and virtual reality within a shared online space. Key branches of the metaverse include CitiVerse, industry, power grid, tourism and so on. Within the metaverse, each user maintains their unique perspective on the virtual world, while the underlying environment ensures a consistent state for all users. This document presents an overview of metaverse technologies, encompassing overview, characteristics, metaverse elements and roles. |
| [FGMV-33](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-33.pdf) | Technical Specification on Glossary for metaverse | June 2024 | SG16 (All SGs, SCV) | Summary:This Technical Specification provides a set of core terms and associated definitions to reflect the basic concepts used in the metaverse. The document aims to encourage a mutual and consistent understanding of, and a coherent approach to, activities relating to the metaverse, and the use of harmonized terminology. It includes terms and definitions for the metaverse, which have been widely used in the FG-MV deliverables, including terms already defined in relevant standards development organizations (SDOs). This document is intended to be relevant for: a) people engaged in metaverse activities; b) people involved in metaverse activities at ISO, IEC, ITU-T, and other international standards bodies; and c) developers of national or sector-specific standards, guides, procedures, and codes of practice relating to the metaverse. |
| [FGMV-34](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-34.pdf) | Technical Report on Definitions of CitiVerse | June 2024 | SG20 | Summary:This Technical Report contains proposed definitions of CitiVerse for further consideration at ITU Study Groups. |
| [FGMV-35](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-35.pdf) | Technical Report on ​Building a People-centred CitiVerse | June 2024 | SG20 | Summary:This document presents the concept of the “CitiVerse” as the cross-sectoral adoption of the metaverse within cities, involving the interaction of digital and physical world objects with a given city’s envisioned digital ecosystem. It explores the CitiVerse’s potential to drive people-oriented urban digital transformation.The document provides real-life examples of the application of metaverse technologies in different cities, focusing on cases where cities have put the needs of their inhabitants at the heart of all the services offered in their versions of the CitiVerse.Despite the expanding application scenarios and potential of the CitiVerse, there is limited literature and research available on the topic as cities continue to grapple with issues relating to interoperability, digital identity, and jurisdiction. Global platforms such as the International Telecommunication Union (ITU)’s Focus Group on metaverse are paving the way for standardization within this domain to enable stakeholders to receive the required guidance for the adoption of the CitiVerse in their city in alignment with the Sustainable Development Goals (SDGs). |
| [FGMV-36](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-36.pdf) | Technical Report on The future of travel in the metaverse: landscape and use cases | June 2024 | SG16, SG20(SG5) | Summary:This Technical Report provides an in-depth background and a comprehensive view of the emerging nexus between the metaverse and tourism. This report highlights current tourism trends, devices used to enable the metaverse and explore promising areas of tourism. A comprehensive section of use cases, including case studies of successful implementations, provides practical insights into how the metaverse is being utilized for tourism around the world. This report also explores standardization issues of the metaverse in tourism, highlighting adoption challenges, security concerns and economic and social implications. |
| [FGMV-37](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-37.pdf) | Technical Report on Landscape and Use cases for the Industrial metaverse | June 2024 | SG20(SG16, SG13) | Summary:This Technical Report offers an in-depth background and a comprehensive view of the current landscape on the industrial metaverse, by exploring its current development stage, market analysis, key players, emerging technologies, challenges and opportunities. A section of applications, including case studies of successful implementations, provides practical insights. The report also focuses on standardization issues of industrial metaverse, covering technical difficulties, ethical, legal, and security concerns, and economic implications. |
| [FGMV-38](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-38.pdf) | Technical Specification on Framework and requirements for the construction of human-driven 3D digital human application system for metaverse | June 2024 | SG16 | Summary:In the future, the idea of 3D digital human will become familiar to people as “super agents”. Three-dimensional digital humans can display human characteristics such as facial appearance, gestures, and even a biological brain. Anthropomorphic behaviour of 3D digital humans can be generated through different driving technologies, which can be divided into intelligent-driven technology and human- driven technology.With the popularization of human-driven 3D digital human applications and the advancement of image recognition technology such as posture and facial expressions recognition algorithm, inertial or optical motion capture devices are no longer essential tools for driving the 3D digital human. Instead, ordinary cameras, combined with ideal recognition algorithms, can achieve accurate driving of the 3D digital human. This approach not only benefits from the inherent flexibility and interactive capabilities imparted by human operators but also substantially lowers the barriers to entry and cost associated with generating virtual content. Consequently, it facilitates the intelligent transformation of the content creation industry.This technical specification provides the framework and requirements of the 3D human-driven digital human application system for metaverse.  |
| [FGMV-39](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-39.pdf) | Technical Specification on Use case and requirements for virtual and real fusion coding in metaverse application | June 2024 | SG16 | Summary:Metaverse is an emerging research and application field with the combination of multiple technologies including digital twin, Internet of Things (IoT), digital assets, multimodal data fusion and artificial intelligence generated content (AIGC). Users need immersive experience such as playback of camera-captured 3D scenes with 6DoF of viewer position and orientation. The current video coding standard is optimized by 2D videos and the coding efficiency may not be enough. Therefore, the metaverse applications need an efficient virtual and real coding technology to support low-delay and immersive experience for users. The virtual and real coding technology can support affordable coded bit rate and high coding efficiency for immersive videos, omnidirectional videos, as well as the source content with high quality depth information. The interaction between digital human and users, online meetings, gaming, sports viewing can be the use cases benefiting from this coding technology.This Technical Specification provides the related requirements, reference model of application system and use cases of the virtual and real fusion coding in metaverse applications. |
| [FGMV-40](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-40.pdf) | Technical Specification on Multimedia aspect of metaverse architecture | June 2024 | SG16 | Summary:This Technical Specification provides reference architecture and functional blocks for multimedia aspect of metaverse architecture. The scope of this Technical Specification includes:* 1. Metaverse domain,
	2. Reference architecture and its functional blocks of metaverse

The metaverse functional architecture is based on the use of existing network components and technologies, as well as on IoT architectures and digital twin. This leads to three possible options for the architectural representations in this Technical Specification.  |
| [FGMV-41](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-41.pdf) | Technical Specification on The reference framework of industrial metaverse | June 2024 | SG20 (SG13, SG16) | Summary:This Technical Specification provides the main framework to implement the industrial metaverse (IMV) from the overall and technical perspectives, including the elemental composition, specific modules, and entities of IMV. At the same time, starting from the infrastructures required by IMV, the industrial perception, industrial control, industrial network, industrial computing and storage, IMV platform, assets, and IMV identity management in IMV domain are included in detail. In addition to the above content, the Technical Specification also involves the digital security, privacy protection, and so on, in order to provide a reference for the development of IMV. |
| [FGMV-42](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-42.pdf) | Technical Report on Interoperability of identity of things across metaverse platforms | June 2024 | SG20 (SG16) | Summary:With regard to Internet of Things (IoT) [ITU-T Y.4000], each IoT device may have a single or multiple unique identities in multiple IoT systems. Similarly, each IoT device also may have a single or multiple identities in multiple metaverses. An identity of an IoT device usually includes a unique identifier and a corresponding identity object [ITU-T Y.4811]. Although, it may take advantage of one IoT device having one unique identity in multiple metaverses, there are challenges; how those metaverses identify, authenticate and authorize the IoT devices when they roaming across metaverse platforms, and how the trustworthy shared storages interact with each other to support identity interoperability across storages.This Technical Report describes identity interoperability for IoT devices across metaverse platforms, and provides relevant technical features and reference framework. |
| [FGMV-43](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-43.pdf) | Technical Specification on High-level interoperability architecture for cross-platform metaverse | June 2024 | SG16(SG13, SG20) | Summary:This deliverable specifies the high-level interoperability architecture for cross-platform metaverse, highlighted for seamless integration and collaboration across different metaverse platforms. It provides a high-level functional architecture, outlining the key components and their interactions. Additionally, this identifies the reference points and information flows that enable interoperability between platforms.  |
| [FGMV-44](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-44.pdf) | Technical Report on Security for things across metaverses in aspects of data processing and management | June 2024 | SG17(SG16, SG20) | Summary:In Internet of Things (IoT) [ITU-T Y.4000], each physical/virtual thing (such as sensors, IoT devices, IoT systems, IoT gateways) manages and processes its data independently, directly by itself or via relevant IoT systems. If a thing is mapped into a metaverse, actively or passively, its data will be transferred into the target metaverse. Usually, a metaverse may manage and process data of its entities by itself. And when there are a large number of entities and data, it may use external computing resources and services to manage and process relevant data. A thing may be mapped into multiple metaverses. In this case, there are more challenges to manage and process the data of things, including to protect data security.This Technical Report analyses and provides solutions about security for things across metaverses in aspects of data processing and management, including at least relevant technical features, requirements and reference frameworks of security for things across metaverses in aspects of data processing and management. |
| [FGMV-45](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-45.pdf) | Technical Report on Challenges to achieving trustworthy metaverse | June 2024 | SG17(SG13, SG16, SG20) | Summary:The metaverse is an integrative ecosystem of virtual worlds, where participating entities may have one or more identities. Its essential enablers are cutting-edge technologies including Artificial Intelligence (AI), Web 3.0, Blockchain, Augmented Reality (AR), Virtual Reality (VR) and Internet of Things (IoT). When all these important and advanced technologies are applied and used in some scenarios, it will bring a serious of concerns and problems, such as the concerns of safety, security, ethics and problems of privacy, Intellectual Property Rights (IPR) and violence. In the metaverse, all these concerns and problems will occur and even other unexpected problems, and considering all these concerns and problems, trustworthiness and relevant issues become very important key issues for the metaverse and its development. Therefore, this deliverable presents key concepts, challenges and a reference model for a trustworthy metaverse including standardization landscape and roadmap.  |
| [FGMV-46](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-46.pdf) | Technical Report on The essential components of trusted data use in building a trustworthy metaverse | June 2024 | SG17(SG13, SG16, SG20) | Summary:In an era in which digital realities are increasingly as significant as physical ones, the rise of the metaverse offers exciting opportunities as well as formidable challenges. As users delve into these expansive virtual worlds, the foundation element of their interactions – trust – becomes crucial for seamless integration into daily activities. The nature of data usage within the metaverse can vary greatly; it can be trusted, untrusted, or not utilized at all. Employing trusted data involves the responsible, ethical and secure management of information. This not only enhances the confidence of users and stakeholders but also enriches the overall metaverse experience, fostering a community where trust is paramount. This technical report is dedicated to establishing a comprehensive understanding and outlining the essential components necessary for integrating trusted data within the metaverse to ensure its trustworthiness. The report starts by discussing three key aspects required to understand a trustworthy metaverse and conducts a comprehensive examination of characteristics of trusted data. It then outlines the essential groundwork needed to understand the symbiotic relationship that facilitates the use of trusted data in establishing and maintaining a trustworthy metaverse. Essential components proposed include strategies for the construction of trusted data, trusted data interactions, trusted execution environments, and trusted management policies.  |
| [FGMV-47](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-47.pdf) | Technical Report on Economic Value Creation and Competition in metaverse | June 2024  | SG3(SG5) | Summary:Metaverse is a nascent concept and potentially encompasses a broad set of technologies to create economic value. In this context, the identification of economic aspects is critical and imperative to capturing economic value. This Technical Report takes an economic perspective of metaverse to illustrate economic value creation and competition related aspects.More specifically, it provides an approach to:* Metaverse Value Chain
* Metaverse Economic Value Creation
* Competition Issues and Assessment for metaverse
* Metaverse Economy and Ecosystem Enhancement
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| [FGMV-48](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-48.pdf) | Technical Report on Guidance on how to build a metaverse for all: Part II - Survey | June 2024 | SG16(SG9, SG20) | Summary:The primary objective of this Technical Report is to report on the findings from the first UN survey of government, business and academic leaders on metaverse development. This document offers an initial understanding of the current metaverse development. The document also identifies the key challenges that hinder the achievement of equity, accessibility and inclusivity within the metaverse, and proposes suggestions to ensure equity, accessibility, and inclusivity are incorporated in metaverse development by default. |
| [FGMV-49](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-49.pdf) | Technical Report on Metaverse Sustainability: Driving energy efficiency and GHG emissions reduction | June 2024 | SG5(SG16, SG20) | Summary:This Technical Report explores the environmental impact of using metaverse applications and related devices. It offers guidance on how to make ICT devices and applications that support the operation of the metaverse more energy-efficient and sustainable. The goal is to reduce future greenhouse gas emissions. In addition, the document examines the current and potential ways by which the metaverse fosters the green and low-carbon development of different economic sectors and industries.The Technical Report recognizes the rapid development of digitalization, which has enabled and contributed to the growth of many sectors. The increasing use of the metaverse is deemed an additional tool empowering industries and impacting society and the economy. The document recognizes that among the horizontal priorities that need to be mainstreamed in metaverse development and usage is the environmental sustainability dimension, along with accessibility and inclusion. This document addresses the environmental sustainability of the metaverse and related technologies for a smooth and energy-efficient development of the metaverse. To realize the full benefits of technological innovation, including metaverse usage, rapid technological development should be anchored in the ongoing efforts towards achieving the UN Sustainable Development Goals, including environmental impact mitigation. |
| [FGMV-50](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-50.pdf) | Technical Specification on Methodology on assessment of GHG emissions of metaverse | June 2024 | SG5(SG16, SG20) | Summary:This Technical Specification deals with the environmental impact assessment of metaverse applications and solutions, including metaverse service, ICT networks, supporting ICT infrastructure and digital devices. This technical specification will complement existing Recommendations [ITU-T L.1410] “Methodology for environmental life cycle assessments of information and communication technology goods, networks and services”. |
| [FGMV-51](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-51.pdf) | Technical Report on Standardization roadmap for metaverse | June 2024 | SG16(All SGs) | Summary:Recently, metaverse has become one disruptive area of innovation with great potential to enhance our economy, and change the way of living. In this nascent phase of the metaverse, the industry is not yet clear about the direction and steps of technical development. This Technical Report is intended to outline a concise roadmap of metaverse standardization. In clause six, a framework of metaverse standards is provided. It is structured in four categories (i.e., General standards, Application and service standards, Enabling technology standards, Interoperability and ICT related infrastructure standards). In clause seven, the report presents the motivation of standardization and lists each metaverse-related standardization tasks, as well as relevant study groups of SDOs, consortium and forums that are working on the topic.This technical report will be beneficial to the standardization activities of ITU-T study groups, other SDOs, consortium and forums.  |
| [FGMV-52](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-52.pdf) | Technical Report on Metaverse standardization landscape for gap analyses | June 2024 | SG16(All SGs) | Summary:This technical report assists in the development of a gap analysis on metaverse standardization by examining existing standards and standards under development in key standards development organizations (SDOs). Its aim is to facilitate the development of comprehensive and interoperable metaverse-related standards.  |

**Table 3 – FG-MV approved deliverables (from March to December 2023)**

The table below contains the FG-MV approved deliverables from March to December 2023, which have been allocated by TSAG to various ITU-T Study Groups or sent as information only to all.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Title** | **Approved**  | **Sent as information only or Allocated**  | **Summary of the deliverable** |
| [FGMV-01](http://handle.itu.int/11.1002/pub/82047d78-en) | Technical Report on Exploring the metaverse: opportunities and challenges​ | July 2023 | All for information  | Summary:This Technical Report explores the opportunities and challenges, and clarifies the role of international standards and the potential for the metaverse in the achievement of the United Nations Sustainable Development Goals. |
| [FGMV-02](http://handle.itu.int/11.1002/pub/822e1df0-en) | Technical Report on Metaverse: an analysis of definitions | October 2023  | All for information | Summary: This Technical Report ITU FGMV-02 contains a detailed gap analysis in literature of "metaverse" definitions with an explained terminology. This Technical Report studied and analysed approximately 150 existing definitions of metaverse from various sources. |
| [FGMV-20](http://handle.itu.int/11.1002/pub/822f50fd-en) | Technical SpecificationDefinition of metaverse | December 2023 | ITU-T SG16  | Summary: This Technical Specification provides the definition of the term "metaverse". It leverages a detailed analysis of 150 existing definitions of metaverse that was undertaken for the development of the ITU Technical Report on "Metaverse: an analysis of definitions", which was approved at the third meeting of the ITU Focus Group on metaverse (FG-MV), held on 3-5 October 2023 in Geneva, Switzerland. |
| [FGMV-03](http://handle.itu.int/11.1002/pub/822e1f34-en) | Technical Report on Guidelines to assess inclusion and accessibility in metaverse standard development | October 2023 | ITU-T SG16  | Summary:This Technical Report ITU-T FGMV-03 discusses how to realize the principles on the metaverse by articulating accessibility. Promoting diversity, equity, and inclusion in the metaverse via accessibility implementation requires careful consideration of diverse factors. Values are generated through a mixture of virtual reality, augmented reality, mixed reality, and extended reality. [b-Dreamson]'s empirical study articulates six values: bottom-up, collaboration, authorship, ownership, interconnectivity, and community. This Technical Report investigates and improves upon limitations found in earlier research and practices and validates the United Nations' sustainable development goal (SDG) principles, along with the six metaverse values for digital transformation (Dx) creating new values and cultures. Using these justifications, it explores guidelines for aligning metaverse platforms with the SDGs based on Dx, addressing the user experience dimensions of the platforms: conception, interaction, interface, information and usability [b-Park-a]. Universal design is the process of making a product accessible for everyone, regardless of their physical, sensory, or cognitive abilities. In this sense, the metaverse should be inclusive of diverse cultures, languages, and perspectives, and should promote the SDG principles. By proposing guidelines and recommendations, the Technical Report strengthens the argument for articulating accessibility as a means of realizing inclusion in developing metaverse. The outcomes of the Report are to articulate the values for metaverse SDGs in terms of digital transformation, to develop a set of guidelines for assessing inclusion and accessibility in the metaverse, and to provide strategic and meaningful engagement with platforms towards SDGs. |
| [FGMV-04](http://handle.itu.int/11.1002/pub/822e20cf-en) | Technical Specification on Requirements of accessible products and services in the metaverse: Part I – System design perspective | October 2023 | ITU-T SG16, ITU-T SG9, ITU-T SG20  | Summary:This Technical Specification ITU FGMV-04 provides high-level requirements for designers and developers to create an accessible immersive experience in the metaverse. This Specification considers the common accessibility requirements for the design and development phases of born accessible products and services in the metaverse. It is also related to "Requirements of accessible products and services in the metaverse: Part II – User perspective" and provides common accessibility requirements. |
| [FGMV-05](http://handle.itu.int/11.1002/pub/822e20f7-en) | Technical Specification on Requirements of accessible products and services in the metaverse: Part II – User perspective | October 2023 | ITU-T SG16, ITU-T SG9, ITU-T SG20, and ITU-T SG2  | Summary:Technical Specification ITU FGMV-05 provides requirements on how to develop an accessible metaverse from a user perspective. This document considers the various metaverse components and the actions that users, regardless of their capabilities, may perform to access the metaverse, create an identity within the metaverse, navigate the metaverse and interact in the metaverse. This document is related to ITU FG-MV Technical Specification on "Requirements of accessible products and services in the metaverse: Part I – System design perspective" and provides requirements on the role of users in creating and assessing accessibility services. |
| [FGMV-06](http://handle.itu.int/11.1002/pub/822f50e6-en) | Technical Report on Guidelines for consideration of ethical issues in standards that build confidence and security in the metaverse | October 2023 | ITU-T SG17 | Summary:As the world becomes increasingly digital, the metaverse is emerging as a new frontier of social and economic interaction; allowing people to create, connect and collaborate in ways that were previously thought impossible. In its nascent phase of user adoption, this is a timely opportunity to formulate guidelines for meaningful engagement, as well as to help mitigate challenges that continue to afflict the digital platforms that make up its infrastructure and ecosystems.The need for trust and confidence, cornerstones in any environment necessitating user interaction and participation, is amplified in virtual environments [b-Gefen]. This need takes on increased significance as the participatory nature of the metaverse and vast amounts and increasingly personalized nature of data collected together usher in a new frontier for user safety and security.The objective of this Technical Report is to develop a set of guidelines that address ethical aspects in the establishment of standards for engagement within the metaverse.Given the importance of confidence to user engagement, the report puts forward a user-centric approach by emphasizing principles grounded in the Universal Declaration of Human Rights (UDHR) and the United Nations Sustainable Development Goals (SDGs).User expectations, especially as they relate to personal safety, are a central component of confidence in navigating the metaverse and other digital platforms. Yet historically, the reality (as it compares to these expectations) has fallen short, resulting in a discrepancy between anticipated and actual safeguards.The report will explore user expectations and propose a new framework to define user confidence and how it is expressed in immersive environments. It will also introduce guiding principles to bolster user confidence in navigating metaverse platforms, with a goal of fostering a sense of safety, control, user autonomy, fairness, transparency and access to adequate information during interactions within immersive spaces.Where confidence in metaverse environments shares similarities with confidence in existing digital platforms will also be discussed, as will unique considerations introduced by the immersive and comprehensive nature of the metaverse and ways in which these can be addressed.The Report will subsequently explore distinct elements necessary for fostering meaningful engagement within the metaverse context.By centring the user experience in building security and confidence in the metaverse, this Technical Report aims to support efforts to ensure the metaverse evolves in a way that serves its users and their needs while also adhering to the principles of sustainable development. |
| [FGMV-07](http://handle.itu.int/11.1002/pub/822f50e7-en) | Technical Report on Policy and regulation opportunities and challenges in the metaverse | October 2023 | ITU-T SG3  | Summary:The transformative potential of the metaverse will require policy-makers and regulators to strike the right balance between social, environmental, economic and legal aspects. To support policy-makers and regulators in this important endeavour, this Technical Report looks at the policy and regulatory challenges of the metaverse, including an overview of its key enabling technologies, and regional and national approaches to metaverse development.With around one third of humanity lacking digital connectivity completely, a primary policy and regulatory concern for the metaverse remains addressing the digital divide and ensuring an open, accessible and inclusive metaverse. To be accessible to all, the metaverse will require energy-intensive data centres and communication networks, presenting substantial environmental challenges. Policy-makers and regulators will need to address environmental concerns, including e-waste, while accelerating the adoption of energy-efficient metaverse practices enabled by Internet-of-Things and digital-twin technologies. Development of standards and interoperability will play a key role in identifying efficiencies as well as providing a seamless and enjoyable user experience in the metaverse while encouraging market competition.The immersive nature of the metaverse is expected to generate vast amounts of personally identifiable information, making privacy, security and trust vital concerns. Similarly, ethical and human-rights considerations will need to be considered to promote responsible behaviour in the metaverse. Policy-makers and regulators will need to develop guidelines and frameworks to address these concerns and ensure that the metaverse aligns with societal values.Lastly, the metaverse offers a unique opportunity for policy-makers and regulators to harmonize their policy and regulatory efforts related to the metaverse and its enabling technologies. As whole regions around the world, as well as countries and cities, embrace the potential social and economic benefits of the metaverse, policy-makers will need to be sensitive to different adoption and implementation approaches while promoting interoperability. The same applies to metaverse-enabling technologies such as artificial intelligence (AI), blockchain and cloud computing. This harmonization will not only ensure that the metaverse develops for the benefit of all users but also accelerates sustainable digital transformation and the achievement of the Sustainable Development Goals. |
| [FGMV-08](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-08.pdf) | Technical Specification on Design criteria and technical requirements for sustainable metaverse ecosystem | October 2023 | ITU-T SG5 and ITU-T SG20 | Summary:Metaverse holds promises on accelerating progress towards the UN Sustainable Development Goals (SDGs), for instance, in health, biology computation, automotive, aerospace, education, and mitigation of the effects of extreme climate events. However, digital spaces have inherent costs and pose new environmental, social, and economic risks. If not properly governed, the rise of metaverse could amplify adverse environmental consequences inherent to its enabling technologies (e.g., AI, A/R, blockchains, IoT and digital twins) leading to increased CO2-emissions, e-waste, and resource consumption, harming local ecosystems, communities, and their businesses.Moreover, emerging AI risks related, for instance, to manipulation, disinformation, isolation, echo chambers, and amplification of individual/group discriminations can be amplified by the metaverse. In business, high-performance hardware and costly resources needed to develop, test and maintain metaverse applications could be an economic barrier for SMEs, start-ups and non-profit organizations, thus deepening influence and power gaps. Moreover, the development of resource-intensive metaverse can amplify long-term rebound-effects risks, leading to a substantial increase in CO2 emissions and resource consumption. The contributions of this document are threefold: 1. A definition of a sustainable metaverse ecosystem; 2. Design criteria to integrate at design environmental, social and economic sustainability needs; 3. System requirements for sustainable metaverse ecosystems. |
| [FGMV-09](http://handle.itu.int/11.1002/pub/822f50e9-en) | Technical Report on Power metaverse: Use cases relevant to grid side and user side | October 2023 | ITU-T SG20 and ITU-T SG13 | Summary:This Technical Report provides steps for the realization of a power metaverse applied in the power system from the perspectives of the user and the grid, for relevant use cases. Each use case describes the application scenario, assumptions made and a service scenario. |
| [FGMV-10](http://handle.itu.int/11.1002/pub/822e2292-en) | Technical Report on Cyber risks, threats, and harms in the metaverse | December 2023 | ITU-T SG17 | Summary:Technical Report ITU FGMV-10 emphasizes the importance of understanding the cybersecurity landscape in the metaverse. It provides an overview of this emerging digital realm and its potential, highlighting its transformative nature. It also analyses and documents the specific cybersecurity risks, threats, and potential harms associated with the metaverse. This Technical Report covers areas such as identity theft, malware, data breaches, and social engineering. Moreover, it explores the background of cybersecurity risks in the metaverse. Additionally, this Technical Report examines the implications of these cybersecurity risks, including their impact on user trust, virtual economies, and assets. |
| [FGMV-11](http://handle.itu.int/11.1002/pub/822e22ae-en) | Technical Report on Embedding safety standards and the user control of Personally Identifiable Information (PII) in the development of the metaverse | December 2023 | ITU-T SG17 and ITU-T SG11 | Summary:Technical Report ITU FGMV-11 develops three key areas of a rights-based approach to embedding ethics and safety standards and user control of PII in developing the metaverse that build conceptually on each other: * Data control and agency of users in relation to their service and platform provider,
* Human rights test governing workflow design as well as the conduct of service and platform providers as that conduct relates to their public stakeholders, and
* Principles for the development of safety standards in line with the SDGs that can effectively govern user conduct within the metaverse spaces such providers offer.

The report further maps out key lenses in which these three areas interact with one another, with platform design considerations, and other stakeholders. It also offers a practical use-case on an open source and decentralized protocol demonstrating how technical infrastructure can enable user control of PII. |
| [FGMV-12](http://handle.itu.int/11.1002/pub/822e22fb-en) | Technical Report on Children's age verification in the metaverse | December 2023 | ITU-T SG17  | Summary:Technical Report ITU FGMV-12 aims to explore age verification methods in the context of the metaverse, focusing on the potential enhancement of these methods using metaverse technologies. The metaverse offers a rich, immersive digital experience encompassing extended reality (XR) technologies like virtual reality (VR), augmented reality (AR), and mixed reality (MR). With its potential to engage all human senses, the risks and online threats to children in the metaverse are intensified. These threats can originate from content, contact, or conduct, with the metaverse amplifying the impacts of such dangers. The ITU's child online protection (COP) guidelines stress that digital protection measures should not infringe on children's other rights, necessitating age-appropriate content controls. Age verification is pivotal in shielding children from online perils, prompting nations to impose age verification mandates. Methods such as self-declaration, credit cards, biometrics, profiling, digital IDs, and third-party verification serve as age verification mechanisms. Existing regulations, such as the general data protection regulation (GDPR) and California's age-appropriate design code Act (AADC), provide general guidelines on age verification and demand utilizing proper technology proportional to potential risks. The metaverse, with its array of sensors and devices, offers a unique avenue to bolster age verification procedures, especially with soft biometrics that do not compromise users' privacy. As online threats in the metaverse surge, platforms should institute risk assessment frameworks considering content and immersion levels. Age verification methods should align with the risk levels, ensuring that the data collected is minimal and solely serves verification purposes. For example, zero-knowledge proofs (ZKPs) can be used for age assertion without revealing exact ages. Trusted third-party verification is advocated because it enables platform interoperability and prevents sharing data with multiple sources. Thus, we discuss the potential challenges and provide general guidelines that should be helpful for implementing third-party age verification. |
| [FGMV-13](http://handle.itu.int/11.1002/pub/822e2315-en) | Technical Report on Responsible Use of AI for Child Protection in the metaverse | December 2023 | ITU-T SG17  | Summary:This Technical Report explores the scope for the responsible use of artificial intelligence (AI) for child protection in the metaverse as a contribution in this area to assist in the achievement of the United Nations sustainable development goals. |
| [FGMV-14](http://handle.itu.int/11.1002/pub/822f50ea-en) | Technical Report on Regulatory and economic aspects in the metaverse: Data protection | December 2023 | ITU-T SG3 and ITU-T SG17  | Summary:In a world still striving to secure data protection and data sovereignty, the metaverse is one of the latest trends in technological developments and waves, and one which involves a wide range of economic activities in a non-regulated new world. Similar to its previous counterparts, the idea opens up a multitude of risks and threats, which go hand in hand with the opportunities it creates. This Technical Report (TR) tries to explore the possible data protection concerns in the metaverse, in terms of regulatory and economic perspectives. This TR is divided into two parts: general data protection-related concerns and economic data protection-related concerns. The data protection topic is considered a foundational base for conducting economic activities in the metaverse and for regulating all activities of the metaverse. This contribution approaches this novel topic through the 'Life Cycle of Data Threat Model' that tries to pinpoint some threats at different stages of the data lifecycle. The model depends on dividing the lifecycle of data into seven stages: data generation, data transfer, data usage, data sharing, data storage, data archiving and data destruction. This contribution finally presents a data protection assessment framework that can be used to assess the level of threat of each of the challenges presented, and therefore policy priorities may be determined accordingly. |
| [FGMV-15](http://handle.itu.int/11.1002/pub/822f50eb-en) | Technical Specification on Accessibility requirements for metaverse services supporting IoT | December 2023 | ITU-T SG20 and ITU-T SG16 | Summary:The virtual world based on real-world data collected through IoT technology and using XR technology as a user experience (UX) is collectively referred to as a metaverse supporting IoT. The ideally constructed metaverse interface should prevent persons with disabilities and those with specific needs who have difficulty using certain senses in the real world from feeling this difficulty in the metaverse. This Technical Specification defines the accessibility requirements that metaverse services supporting IoT should have. |
| [FGMV-16](http://handle.itu.int/11.1002/pub/822f50ec-en) | Technical Report on Accessibility in a sustainable metaverse | December 2023 | ITU-T SG16  | Summary:This Technical Report ITU FGMV-16 promotes and instructs on the adaptation of an integrated approach to accessibility and sustainability in the metaverse. It explores the integration of accessibility products and services in the metaverse and their associated social benefit and environmental impact. Emphasizing the need for the early integration of accessibility and sustainability, this Technical Report presents information and guidance on how to incorporate sustainable accessibility products and services in the metaverse from the outset. Questions related to sustainability and accessibility in the metaverse need to consider the following: * Social benefit of sustainable accessibility products and services in the metaverse;
* Challenges and opportunities of an accessible and sustainable metaverse.
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| [FGMV-17](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-17.pdf) | Technical Report on Guidelines and requirements on interpreting in the metaverse | December 2023 | ITU-T SG16  | Summary:This document provides guidelines and requirements on interpreting in the metaverse. It summarises typical use settings that require interpreting in the metaverse, including conference interpreting, public service interpreting and sign-language interpreting. It describes technical requirements for interpreting in the metaverse. It also provides advice for all parties in interpreted events in the metaverse, including organizers, speakers, interpreters and audience in interpreting-facilitated events in the metaverse. |
| [FGMV-18](http://handle.itu.int/11.1002/pub/822f50ee-en) | Technical Report on Guidance on how to build a metaverse for all – Part I: Legal Framework | December 2023 | ITU-T SG16 and ITU-T SG3 | Summary:This Technical Report ITU FGMV-18 proposes some guidelines to ensure by default equity, accessibility, and inclusivity in the development of the metaverse. Its primary objective is to offer the context for the legal framework based on the United Nations (UN) mandates and the sustainable development goals (SDGs), along with the derived standards. This Report offers a comprehensive understanding of the current state of the background which should underlay any metaverse development. The document also identifies the key challenges that hinder the achievement of equity, accessibility, and inclusivity within the metaverse, and proposes potential roadmaps towards constructing a metaverse leaving no one behind. |
| [FGMV-19](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-19.pdf) | Technical Specification on Service scenarios and high-level requirements for metaverse cross-platform interoperability | December 2023 | ITU-T SG16, ITU-T SG20, ITU-T SG13 and ITU-T SG11 | Summary:This deliverable specifies the service scenarios and high-level requirements for metaverse cross-platform interoperability. With the increasing number of metaverse platforms being developed, there is a need to create an open and seamless metaverse interoperable environments between metaverse platforms that fosters innovation and collaboration. This deliverable aims to identify the various intended service scenarios and high-level requirements of four types of metaverse cross-platform interoperability: avatar interoperability, asset interoperability, content interoperability, identity interoperability. |
| [FGMV-21](http://handle.itu.int/11.1002/pub/822f50fe-en) | Technical Report on Principles for Building Concepts and Definitions Related to metaverse | December 2023 | All for Information | Summary:This Technical Report establishes the principles for building terms, concepts and definitions related to metaverse as the foundation for developing a technical specification of vocabulary for metaverse. |
| [FGMV-22](http://handle.itu.int/11.1002/pub/822f50ff-en) | Technical Specification on Capabilities and requirements of Generative Artificial Intelligence in metaverse applications and services | December 2023 | ITU-T SG16 | Summary:As technology continues to evolve, there is an increasing demand for generative artificial intelligence (GAI) technology in the metaverse. GAI is crucial for creating immersive and interactive experiences in the metaverse. It has numerous capabilities in metaverse applications and services, from creating personalized avatars and environments to generating more immersive and personalized services. These capabilities can enrich the content of metaverse in more forms and significantly enhance the user experience within metaverse, providing a more engaging and immersive environment.This Technical Specification describes the capabilities and requirements of GAI in metaverse applications and services. This document specifies four common capabilities of GAI in metaverse applications and services and analyses the description, assumption and service scenario. It also specifies the requirements of GAI in metaverse applications and services. |

Additional information on the FG-MV can be found at: <https://www.itu.int/en/ITU-T/focusgroups/mv/Pages/default.aspx>.

FG-MV invites TSAG to consider these deliverables as a basis for further consideration and appropriate action.

All interested parties are invited to use the approved deliverables in their related activities.

**Next steps**

FG-MV has concluded its work.

FG-MV has approved 52 deliverables (21 deliverables were approved in June 2024). FG-MV would like to invite TSAG to consider the suggested allocation to various ITU-T Study Groups and other entities as contained in Table 2.

A Global Initiative on Virtual Worlds – Discovering the CitiVerse is expected to be launched during the UN Virtual Worlds Day that will take place on 14 June 2024. More information is available at: <https://www.itu.int/metaverse/un-virtual-worlds-day/>.

To continue receiving news, updates, and invitations related to ITU activities on the metaverse and virtual worlds, please subscribe to the metaverse mailing list (metaverse@lists.itu.int) at: <https://www.itu.int/net4/iwm/?p0=0&p11=ITU&p12=ITU-SEP-ITU-T-SEP-Other%20Groups-SEP-metaverse&p21=ITU&p22=ITU>.

ANNEX 1 – Final List of FG-MV Workplan, structure, list of approved deliverables and work items that were not completed (Geneva, 12-13 June 2024)

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **FG/WGs** | **Subgroup** | **Leadership positions** | **ToR** | **Type** | **Title of deliverable** | **​Editors​** | **Approved** |
| **WG 1** | [**General**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-1.aspx) | Co-Chairs:* Mr Leonidas ANTHOPOULOS (University of Thessaly, Greece)
* Ms Radia FUNNA (Build n Blaze)

Vice-Chair:* Mr Younghwan CHOI (ETRI, Korea (Republic of))
 | * Business ecosystem
* Collection of best practices, including a gap analysis
* Roadmap for setting technical standards
* Overall concepts, service model, related technologies of metaverse platforms and services
* Issues outside the scope of other WGs
 | Technical Report[*Approved at the seventh FG-MV meeting*] | [Overview of metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-32.pdf) | Younghwan CHOI (ETRI, Korea (Republic of)) | June 2024 |
| Technical Report[*Approved at the second FG-MV meeting*] | [Exploring the metaverse: opportunities and challenges](http://handle.itu.int/11.1002/pub/82047d78-en) | Leonidas ANTHOPOULOS (University of Thessaly, Greece) | July 2023 |
| **TG-terminology & definitions** | Chair:* Ms Xiaomi AN (Renmin University of China)
 | * Definition and terminology
 | Technical Specification[*Approved at the seventh FG-MV meeting*] | [Glossary for metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-33.pdf) | Xiaomi AN, Jie HUANG, Rui WANG, Xiaoshuang JIA (Renmin, University of China)Jie SONG (State Grid Corporation of China)Radia FUNNA (Build n Blaze)Leonidas ANTHOPOULOS (University of Thessaly, Greece)Xing ZHAO (Fudan University)Shin-Gak KANG (ETRI, Korea (Republic of.))Heung Youl YOUM (Soonchunhyang University, Korea (Republic of.)) | June 2024 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Principles for building concepts and definitions related to metaverse](http://handle.itu.int/11.1002/pub/822f50fe-en) | Xiaomi AN (Renmin University of China)Rui WANG (Remin University of China)Jie HUANG (Remin University of China)Leonidas ANTHOPOULOS (University of Thessaly, Greece) | December 2023 |
| Technical Report[*Approved at the third FG-MV meeting*] | [Metaverse: An analysis of definitions](http://handle.itu.int/11.1002/pub/822e1df0-en) | Leonidas ANTHOPOULOS (University of Thessaly, Greece) | October 2023 |
| Technical Specification[*Approved at the fourth FG-MV meeting*] | [Definition of metaverse](http://handle.itu.int/11.1002/pub/822f50fd-en) | Leonidas ANTHOPOULOS (University of Thessaly, Greece)Xiaomi AN (Renmin University of China)Radia FUNNA (Build n Blaze)Christina Yan ZHANG (The Metaverse Institute) | December 2023 |
| Technical Report[*Approved at the seventh FG-MV meeting*] | [Definitions of CitiVerse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-34.pdf) | Radia FUNNA (Build n Blaze) | June 2024 |
| **TG-pre-standardization for the CitiVerse** | Co-Chairs:* Ms Cristina MARTINEZ (European Commission)
* Ms Christina Yan ZHANG (The Metaverse Institute)
 |  | Technical ​Report | Pre-standardisation roadmap for an inclusive and sustainable CitiVerse | Cristina MARTINEZMiguel Alvarez RODRIGUEZ (European Commission) | Not completed[FGMV-TG-collaboration-I-006](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/tg_input/FGMV-TG-collaboration-I-006.docx) |
| Technical Report[*Approved at the seventh FG-MV meeting*] | [Building a People-centred CitiVerse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-35.pdf) | Christina Yan ZHANG (The Metaverse Institute)Nicholas YOU (Guangzhou Institute for Urban Innovation)Teppo T Rantanen (The City of Tampere)Leonidas ANTHOPOULOS (University of Thessaly, Greece)Irina KARAGYAUR (BQ9 Sl)Radia FUNNA (Build n Blaze) | June 2024 |
| **TG-implications for people in the metaverse** | Chair:* Ms Radia FUNNA (Build n Blaze)
 |  | Technical Report[*Approved at the fifth FG-MV meeting*] | [Near-term and long-term Implications for people in the metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-25.pdf) | Radia FUNNA (Build n Blaze) | March 2024 |
| Technical Report[*Approved at the fifth FG-MV meeting*]​ | [A framework for confidence in the metaverse​](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-24.pdf) | Radia FUNNA (Build n Blaze) | March 2024 |
| **WG 2** | [**Applications & Services**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-2.aspx) | Co-Chairs:* Mr Yuntao WANG (CAICT, China)
* Ms Yuan ZHANG (China Telecom)

Vice-Chairs: ​* ​Mr Ismael ARRIBAS (Spain)
* Mr James Kunle OLORUNDARE (Nigeria)
* Mr Julien MAISONNEUVE (Nokia, Finland)
 | * Use cases for relevant applications and services required by interested parties in each domain, including vertical industries (e.g., Gaming and entertainment, remote work and collaboration, education and training, commerce, real estate, social interactions, health care, tourism, art and culture, etc.)
* High-level requirements for supporting related use cases for specific applications and services
 | Technical Report[*Approved at the sixth FG-MV meeting*]​ | [Overview of the application requirements of metaverse on emergency management in chemical industrial parks](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-30.pdf) | Ziqin SANG Keng LIHao WU (CICT, China) | April 2024 |
| **TG-media coding** | Co-Chairs:* Mr Zekun WANG, (China Telecom)
* Mr Marcelo MORENO, (Fraunhofer IIS, Germany)
 |  |  Tech​nical Specification[*Approved at the seventh FG-MV meeting*] |  [Use case and requirements for virtual and real fusion coding in metaverse application](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-39.pdf) | Zekun WANG (China Telecom) | June 2024 |
| Tech​nical Specification | Use cases and requirements on immersive audio coding for metaverse applications and services | Marcelo MORENO (Fraunhofer IIS, Germany)​ |  Not completed[FGMV-I-510](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-510.docx) |
| **TG- Generative Artificial Intelligence in the metaverse** | Chair:* Ms Qiuhong ZHENG (China Telecom)

Vice-Chair:* Ms Liang WANG (ZTE)
 |  | Technical Specification[*Approved at the seventh FG-MV meeting*] | [Framework and requirements for the construction of human-driven 3D digital human application system for metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-38.pdf) | Qiuhong ZHENG (China Telecom)Liang WANG (ZTE) | June 2024 |
| Technical Specification[*Approved at the fourth FG-MV meeting*] | [Capabilities and requirements of Generative Artificial Intelligence in metaverse applications and services](http://handle.itu.int/11.1002/pub/822f50ff-en) | Qiuhong ZHENG (China Telecom)Liang WANG (ZTE) | December 2023 |
| Technical Specification | Requirements and framework for extended reality content creation system based on artificial intelligence​ | ​Jiaxin WEI (China Unicom)Liya YUAN (ZTE)Zehua HU (China Telecom) | Not completed[FGMV-I-147](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-147.docx) |
| **TG-metaverse tourism** | Chair:* Ms Salma ARAFA (UN Tourism)

Vice-Chair:* Ms Victoria PAPP (BOMA)
 |  | Technical Report[*Approved at the seventh FG-MV meeting*] | [The future of travel in the metaverse: landscape and use cases](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-36.pdf) | Salma ARAFA (UN Tourism) | June 2024 |
| ​Technical Report | ​Use case and requirements for remote amusement service with automatic movable robot (AMR) with multimedia functions on metaverse | ​Hideki YAMAMOTO (Oki, Japan) | Not completed[FGMV-I-199](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-199.docx) |
| **TG-medical metaverse** | Chair:* Mr Robin ROWE (Heroic Robots)
 |  | Technical Report​ | ​Medical metaverse: Use-case Relevant to Medical Training and Hospital | Robin ROWE (Heroic Robots)​ | Not completed[FGMV-I-086](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-086.docx) |
| **TG-power metaverse** | Chair:* Mr Jie SONG (State Grid Corporation of China)
 |  | Technical Report[*Approved at the third FG-MV meeting*] | [Power metaverse: Use cases relevant to grid side and user side](http://handle.itu.int/11.1002/pub/822f50e9-en) | Jie SONG , Xingang YANG, Weiqiang YAO, Aiqiang PAN, Yi WU, Mengyuan ZHANG, Tangyun XU, Qin QIN, Yingjie TIAN, Hong GUAN (State Grid Corporation of China, China)Xing HE, Shuyan MA (Shanghai Jiao Tong University, China)Yuntao WANG (CAICT, China)Qingsong ZHANG, Juan YAN, Haiyang CHEN, Yan YANG, Fujin ZHONG (Chongqing University of Posts and Telecommunications, China)Guofeng WANG (Shanghai EBang Information Technology Co., Ltd, China)Juntao LIU (NARI, China)Qibin ZHOU, Si HUANG (Shanghai University, China)Xiaoyan BIAN (Shanghai University of Electric Power, China) | October 2023 |
| Technical Report[*Approved at the fifth FG-MV meeting*] | [Guidelines for metaverse application in power system](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-27.pdf) | Dong WANG, Da LI, Mingyang LEI, Bin HUA, Chenda ZHANG, Jun YAN, Tong LI, Ping SONG, Qiyu LU (State Grid Corporation of China)Yuntao WANG, Yihui ZHANG (CAICT, China)Tao WANG (CSG Electric Power Research Institute)Md. Selim REZA (Internal Resources Division, Bangladesh) | March 2024 |
| **TG-Industrial metaverse** | Chair:* Mr Julien MAISONNEUVE (Nokia, Finland)
 |  | Technical Report[*Approved at the seventh FG-MV meeting*] | [Landscape and Use cases for the Industrial metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-37.pdf) | Julien MAISONNEUVE (Nokia, Finland) | June 2024 |
| **WG 3** | [**Architecture & Infrastructure**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-3.aspx) | Chair:* Mr Hideki Yamamoto (OKI, Japan)

Vice-Chairs:* Ms Yuan ZHANG (China Telecom)
* ​Mr Wilmer Azurza Neyra (Ministry of Transport and Communications of the Administration, Peru)
 | * Infrastructure-related issues including use cases, requirements, technical solutions, capabilities for supporting of metaverse platforms and services (e.g., Cloud and edge computing infra, networking infra, blockchain infra, etc.)
* Architectures, their functionalities, interfaces, intelligent management mechanisms, connectivity technologies, APIs, and QoS/QoE, performance, minimum requirements for infrastructure requirements, etc.
 | Technical Report | Requirements and challenge associated with network infrastructure to enable the metaverse | Meiling DAI, Jingwen LI, Xingyu SHANG, Xiaoou LIU (China Telecom, China) | Not completed[FGMV-I-835](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-835.docx) |
| Technical Specification[*Approved at the sixth FG-MV meeting*]​ | [Requirements, functional framework and capability of IoT for metaverse](https://staging.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-31.pdf) | Yi XIE, Jie CHENG, Minshi CHEN, Yue WANG, Dong CHEN (China Mobile, China)Chao MA, Ye SUN (CAICT, China) | April 2024 |
| Technical Specification[*Approved at the seventh FG-MV meeting*] | [The reference framework of industrial metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-41.pdf) | Cheng CHI, Zihang YIN, Can LUO (CAICT, China) | June 2024 |
| Technical Specification | Settin​g the framework for an ICT architecture to enable the metaverse | Sophia PAPATHANASOPOULOU (General Secretariat of Telecommunications and Post of the Ministry of Digital Governance, Greece)Leonidas ANTHOPOULOS (University of Thessaly, Greece) | Not completed[FGMV-I-095](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-095.docx) |
| ​Technical Specification[*Approved at the seventh FG-MV meeting*] | ​[Multimedia aspect of metaverse architecture](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-40.pdf) | ​Hideki YAMAMOTO (OKI, Japan) | June 2024 |
| **WG 4** | [**Virtual/Real World Integration**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-4.aspx) | Chair:* Ms Shane HE (Nokia, Finland)

Vice-Chair:* Mr Julien MAISONNEUVE (Nokia, Finland)
 | * Interoperable technologies, including use cases and requirements, to enable the integration of virtual world with real world, and to enable the convergence between virtual world and real world (e.g., Mechanisms for synchronization)
* Structured data models for virtual and real worlds mapping
* Applications and services integration between virtual and real worlds
 | Technical Specification[*Approved at the fifth FG-MV meeting*] | [Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-28.pdf) | Changkyu LEE (ETRI, Korea (Republic of)) | March 2024 |
| Technical Specification[*Approved at the fifth FG-MV meeting*] | [Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-29.pdf) | Haksuh KIM, Changkyu LEE (ETRI, Korea (Republic of)) | March 2024 |
| **WG 5** | [**Interoperability**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-5.aspx) | Chair:* Mr Hideo IMANAKA (NICT, Japan)

Vice-Chair:* Mr Wook HYUN (ETRI, Korea (Republic of))
 | * Use cases and requirements for cross-platform interoperability
* Functional enablers for interoperability of services and applications
* Functional architecture and interfaces for cross-platform interoperability
* Interfaces amongst platform, users and devices
 | Technical Specification[*Approved at the fourth FG-MV meeting*] | [Service scenarios and high-level requirements for metaverse cross-platform interoperability](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-19.pdf) | Jungha HONG (ETRI, Korea (Republic of))Wook HYUN (ETRI, Korea (Republic of))MiYoung HUH (ETRI, Korea (Republic of)) Xiaojun MU (China Unicom) | December 2023 |
| Technical Report[*Approved at the seventh FG-MV meeting*] | [Interoperability of identity of things across metaverse platforms](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-42.pdf) | Xiongwei JIA (China Unicom)Ziqin SANG (CICT, China)Keng LI (CICT, China)Xiaojun MU (China Unicom)MiYoung HUH (ETRI, Korea (Republic of))  | June 2024 |
| Technical Specification[*Approved at the seventh FG-MV meeting*] | [High-level interoperability architecture for cross-platform metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-43.pdf) | Wook HYUN (ETRI, Korea (Republic of))Xiongwei JIA (China Unicom)Hideki YAMAMOTO (Oki, Japan) | June 2024 |
| **WG 6** | [**Security, Data & PII Protection**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-6.aspx) | Chair:* Mr Vincent AFFLECK (United Kingdom)

Vice-Chairs:* Ms Naying HU (CAICT, China)
* Ms Radia FUNNA (Build n Blaze)
* Ms Hlekiwe KACHALI (UNICEF)
* Mr Bhanujeet CHOUDHARY (XRSI)
 | * Use cases and requirements related to security and PII protection aspects
* Security of networks and technology underpinning the metaverse platform, including cybersecurity and identity management
* Building confidence and security including Personally identifiable information (PII) protection-related aspects plus preventing online and offline harm and considering ethical issues and standards
* Consider the issues on trustworthiness related to the metaverse
* Child online protection
* Data ownership and protection
* Digital asset ownership
 |  |   |  |  |
| **TG-cybersecurity** | Co-Chairs* Mr Christian ALVAREZ (UNICEF)
* Ms Hanna LINDERSTÅL (EARHART Business protection agency)
 |  | Technical Report[*Approved at the seventh FG-MV meeting*] | [Security for things across metaverses in aspects of data processing and management](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-44.pdf) | Xiongwei JIA, Xiaojun MU (China Unicom)Keng LI (CICT, China)Heung Youl YOUM (Soonchunhyang University, Korea (Republic of.)) | June 2024 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Cyber risks, threats, and harms in the metaverse](http://handle.itu.int/11.1002/pub/822e2292-en) | Aljawharah ALSALEM (NCA, Kingdom of Saudi Arabia)Hussain ALDAWOOD (NEOM, Kingdom of Saudi Arabia) | December 2023 |
| **TG-building confidence and security in the metaverse** | Chair:* Ms Radia FUNNA (Build n Blaze)
 |  | Technical Report[*Approved at the third FG-MV meeting*] | [Guidelines for consideration of ethical issues in standards that build confidence and security in the metaverse](http://handle.itu.int/11.1002/pub/822f50e6-en) | Radia FUNNA (Build n Blaze)Gayoung PARK(The State University of New York, Korea (Korea, (Republic of)) | October 2023  |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Embedding safety standards and the user control of Personally Identifiable Information (PII) in the development of the metaverse](http://handle.itu.int/11.1002/pub/822e22ae-en) | Jan EISSFELDT (Wikimedia Foundation)Sarah Nicole(Project Liberty Institute)Neha VIJAY(Radix) | December 2023 |
| Technical Report[*Approved at the fifth FG-MV meeting*] | [Considering online and offline implications in efforts to build confidence and security in the metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-23.pdf) | Radia FUNNA (Build n Blaze)Araba Sey (Research ICT Africa, South Africa) | March 2024 |
| **TG-child online protection** | Chair* Mr Muhammad Khurram KHAN (King Saud University, Kingdom of Saudi Arabia)
 |  | Technical Report[*Approved at the fourth FG-MV meeting*] | [Responsible use of AI for child protection in the metaverse](http://handle.itu.int/11.1002/pub/822e2315-en) | Muhammad Khurram KHAN (King Saud University, Kingdom of Saudi Arabia)Zaheema IQBAL (Global Foundation for Cyber Studies and Research)Paul GRAINGER (University College London)Farhan KHAN (Metaronical) | December 2023 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Children’s age verification in the metaverse](http://handle.itu.int/11.1002/pub/822e22fb-en) | Yazeed ALABDULKARIMuath ALDUHISHY Bushra ALAHMADI Louai ALARABI(SITE, Kingdom of Saudi Arabia) | December 2023 |
| **TG-issues on trustworthiness related to the metaverse** | Chair: * Mr Gyu Myoung LEE (KAIST)
 |  | Technical Report[*Approved at the seventh FG-MV meeting*] | [Challenges to achieving trustworthy metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-45.pdf) | Gyu Myoung LEE (KAIST)Woojoo PARK (ETRI (Republic of))Xiaojia SONG (China Mobile) Xiongwei JIA (China Unicom) | June 2024 |
| ​​Technical Report | The framework of building a trustworthy digital human​​ | Naying HU (CAICT, China)Sumin GUO (Beijing Normal University, China) | Not completed[FGMV-I-852](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-852.docx) |
| Technical Report[*Approved at the seventh FG-MV meeting*] | [The essential components of trusted data use in building a trustworthy metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-46.pdf) | Xiaoshuang JIA, Xiaomi AN, Jinfa LI (Renmin University of China)Gyu Myoung LEE (KAIST) | June 2024 |
| **WG 7** | [**Economic, regulatory & competition aspects**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-7.aspx) | Co-Chairs:* Mr Andrey PEREZ (Anatel, Brazil)
* Mr Okan GERAY (Digital Dubai, UAE)

Vice-Chair:* Mr Ahmed SAID (Egypt)
 | * Economic aspects and competition
* Metaverse value chain: main agents' role and interactions
* Impacts on revenues and investments, with a focus on the telecom sector
* Main competitive dynamics: scale and scope economies
* Metaverse potential market failures and regulatory remedies
* Public sector value models
 | Technical Report[*Approved at the seventh FG-MV meeting*] | [Economic Value Creation and Competition in metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-47.pdf) | Okan GERAY (Digital Dubai, UAE) | June 2024 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Regulatory and economic aspects in the metaverse: Data protection](http://handle.itu.int/11.1002/pub/822f50ea-en) | Ahmed SAID (MCIT, Egypt)Hedaia NABIL (MCIT, Egypt) | December 2023 |
| Technical Report[*Approved at the third FG-MV meeting*] | [Policy and regulation opportunities and challenges in the metaverse](http://handle.itu.int/11.1002/pub/822f50e7-en) | Andrey PEREZ (Anatel, Brazil)Okan GERAY (Digital Dubai, UAE) | October 2023 |
| **WG 8** | [**Sustainability, Accessibility & Inclusion**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-8.aspx) | Co-Chairs:* Ms Nevine TEWFIK (Egypt)
* Ms Pilar ORERO (UAB, Spain)

Vice-Chairs:* Mr Manuel BARREIRO, (Aston Group, Mexico)
* Ms Christina Yan ZHANG, (The Metaverse Institute)
* Mr Khaled KOUBAA, (Medeverse)
* Ms Wendy Teresa GOICO CAMPAGNA (Dominican Republic)
 | * Impact on the climate changes (e.g., Green and low carbon issues, etc.)
* Environmental Sustainability related issues
* Accessibility related issues
* Social considerations
* Diversity, equity and inclusion
* Circular economy related issues
 |   |   |  |  |
| **TG-sustainability** | Chair:* Ms Shuguang QI (CAICT, China)
 | * Use cases, requirements, and technical solutions related to climate changes and environmental sustainability
 | Technical Report[*Approved at the seventh FG-MV meeting*] | [Metaverse Sustainability: Driving energy efficiency and GHG emissions reduction](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-49.pdf) | Shuguang QI, Mengdi WANG (CAICT, China) | June 2024 |
| Technical Specification[*Approved at the seventh FG-MV meeting*] | [Methodology on assessment of GHG emissions of metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-50.pdf) | Shuguang QI, Mengdi WANG (CAICT, China)Anders ANDRAE, Paolo GEMMA (Huawei, China) | June 2024 |
| **TG-accessibility & inclusion** | Co-Chairs:* Ms Paola CECCHI-DIMEGLIO (Harvard University)
* Mr Yong Jick LEE (Center for Accessible ICT, Korea (Republic of))
 | * Use cases, requirements, and technical solutions related to accessibility
 | Technical Specification[*Approved at the fourth FG-MV meeting*] | [Accessibility requirements for metaverse services supporting IoT](http://handle.itu.int/11.1002/pub/822f50eb-en) | Yong Jick LEE (Center for Accessible ICT, Korea (Republic of))Hark SOHN (SCE Korea, Inc., Korea (Republic of))  Jee-In KIM (Konkuk University, Korea (Republic of)) | December 2023 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Guidelines and requirements on interpreting in the metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-17.pdf) | Binhua WANG (University of Leeds)Yong Jick LEE (Center for Accessible ICT, Rep. of Korea)Fei GAO (Chongqing University of Posts and Communications)Lihong PAN (University of Leeds) | December 2023 |
| Technical Report[*Approved at the third FG-MV meeting*] | [Guidelines to assess inclusion and accessibility in metaverse standard development](https://www.itu.int/pub/T-FG-MV-2023-03) | Gayoung PARK (The State University of New York, Korea (Republic of))Neal DREAMSON (The State University of New York, Korea (Republic of)) | October 2023 |
| Technical Specification[*Approved at the third FG-MV meeting*] | [Requirements of accessible products and services in the metaverse: Part I – System design perspective](http://handle.itu.int/11.1002/pub/822e20cf-en) | Estella ONCINS (UAB, Spain)Carlo EUGENI (University of Leeds)Anna Matamala(UAB, Spain) | October 2023 |
| Technical Specification[*Approved at the third FG-MV meeting*] | [Requirements of accessible products and services in the metaverse: Part II – User perspective](http://handle.itu.int/11.1002/pub/822e20f7-en) | Estella ONCINS (UAB, Spain)Carlo EUGENI (University of Leeds)Anna Matamala (UAB, Spain)Paola Cecchi Dimeglio (Harvard University) | October 2023 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Accessibility in a sustainable metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-16.pdf) | Sarah Anne MCDONAGH (UAB, Spain) | December 2023 |
| Technical Report[*Approved at the fourth FG-MV meeting*] | [Guidance on how to build a metaverse for all: Part I – Legal framework](http://handle.itu.int/11.1002/pub/822f50ee-en) | Christina Yan ZHANG (The Metaverse Institute)Pilar ORERO (UAB, Spain) | December 2023 |
| Technical Report[*Approved at the seventh FG-MV meeting*] | [Guidance on how to build a metaverse for all: Part II - Survey](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-48.pdf)  | Christina Yan ZHANG (The Metaverse Institute)Pilar ORERO (UAB, Spain) | June 2024 |
| Technical Specification[*Approved at the fifth FG-MV meeting*] | [Requirements for communication between human-avatar languages in the metaverse](https://staging.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-26.pdf) | Pilar ORERO (UAB, Spain)Rahel LUDER, Louis AMARA (SwissTxt) | March 2024 |
| **TG-sustainable metaverse design** | Chair:* Ms Daniela TULONE (CNIT, Italy)
 |  | Technical Specification[*Approved at the third FG-MV meeting*] | [Design criteria and technical requirements for sustainable metaverse ecosystems](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-08.pdf) | Daniela TULONE (CNIT, Italy) | October 2023 |
| ​Technical Specification | Incentive strategies to boost high-impact sustainable metaverse applications​​ | Daniela TULONE (CNIT, Italy) | Not completed[FGMV-WG8-I-017](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/wg8_input/FGMV-WG8-I-017.docx) |
| ​Technical Specification | ​Metrics and indicators to drive the design of sustainable metaverse applications | Daniela TULONE (CNIT, Italy) | Not completed[FGMV-WG8-I-016](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/wg8_input/FGMV-WG8-I-016.zip) |
| **TG-metaverse social safety** | Chair:* Ms Gabrielle PANTERA (Heroic Robots)
 |  | ​Technical Report | Metaverse social safety: mitigating harassment in the metaverse​ | Gabrielle PANTERA (Heroic Robots)​​ | Not completed[FGMV-I-712](https://extranet.itu.int/sites/itu-t/focusgroups/mv/input/FGMV-I-712.docx) |
| **WG 9** | [**Collaboration**](https://extranet.itu.int/sites/itu-t/focusgroups/mv/wg/SitePages/Working-Group-9.aspx) | Co-Chairs:* Ms Stella KIPSAITA (Communications Authority, Kenya)
* Mr Ziqin SANG (CICT, China)
 | * Promote more active collaboration with other SDOs by setting up a close liaison relationship, including the appointment of an FG-MV liaison rapporteur to other relevant SDOs
* Focal point on collaboration issues, including coordination of incoming and outgoing Liaison Statements in FG-MV
* Develop deliverable on gap analysis, in collaboration with other SDOs
* Develop deliverable on standardization roadmap on metaverse, in collaboration with other SDOs
* Other collaboration-related issues of FG-MV
 | Technical Report[*Approved at the seventh FG-MV meeting*] | [Standardization roadmap for metaverse](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-51.pdf) | Ziqin SANG, Hao WU (CICT, China) | June 2024 |
| **TG-gap analysis** | Co-Chairs:* Mr Leonidas ANTHOPOULOS (University of Thessaly, Greece)
* Ms Jungha HONG (ETRI, Korea (Republic of))
 |  | Technical Report[*Approved at the seventh FG-MV meeting*] | [Metaverse standardization landscape for gap analyses](https://www.itu.int/en/ITU-T/focusgroups/mv/Documents/List%20of%20FG-MV%20deliverables/FGMV-52.pdf) | Jungha HONG (ETRI, Korea (Republic of)) | June 2024 |

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