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| | INTERNATIONAL TELECOMMUNICATION UNION | **FG-MV-O-006-R1** |
| | **TELECOMMUNICATION STANDARDIZATION SECTOR** | **Focus Group on metaverse** |
| | STUDY PERIOD 2022–2024 | **Original: English** |

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| **WG(s):** | N/A | Riyadh, 8–9 March 2023 |

## OUTPUT DOCUMENT

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| **Source:** | FG-MV Chairman |
| **Title:** | Draft Report of the first meeting of the Focus Group on metaverse (FG-MV), Riyadh, 8–9 March 2023 |
| **Contact:** | Shin-Gak Kang     E-mail:sgkang@etri.re.kr<br>ETRI<br>Rep. of Korea |

**Abstract:** This document contains the draft report of the first meeting of ITU-T Focus Group on metaverse (FG-MV), which was held on 8–9 March 2023 in Riyadh, Kingdom of Saudi Arabia.

Please see below.

**Draft Report of the first meeting of the Focus Group on metaverse (FG-MV), Riyadh, 8–9 March 2023**

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# 1 Introduction

The Focus Group on metaverse (FG-MV) was established by the ITU-T Telecommunication Standardization Advisory Group (TSAG) on 16 December 2022. FG-MV aims to lay the groundwork for international standards that can help create an underlying technology and business ecosystem. The group analyses 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 provides 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 technical pre-standardization work.

The first meeting of FG-MV was held from 8–9 March 2023 in Riyadh, Kingdom of Saudi Arabia. It was preceded by the first ITU Forum on Embracing the metaverse (co-organized by ITU and the National Cybersecurity Authority (NCA) of the Kingdom of Saudi Arabia), held on 7 March 2023, at the same venue. The Forum was attended by more than 600 participants.

Mr Shin-Gak Kang (FG-MV Chairman) chaired the first meeting of FG-MV (8–9 March 2023) with the support of Ms Cristina Bueti (FG-MV Counsellor, ITU), and Ms Yining Zhao and Ms Chiara Co (FG-MV Secretariat, ITU). The meeting was attended by more than 650 participants. A total of **58** input documents were submitted, see ANNEX 1; the list of input documents is available in FGMV-I-055-R1. Seven output documents were produced; see ANNEX 2. The complete FG-MV documentation is available on the FG-MV SharePoint site.

# 2 FG-MV Opening plenary

The FG-MV meeting opened on 8 March 2023, at 0900 hours, KSA.

Mr Shin-Gak Kang, FG-MV Chairman opened the meeting by welcoming the participants and thanking them for their contributions to the first meeting of the Focus Group.

Mr Seizo Onoe, ITU Telecommunication Standardization Bureau (TSB) Director, delivered the opening remarks and highlighted the importance of the activities of the new Focus Group on metaverse (FG-MV) and the improvements being made in TSB staff in achieving a greater gender balance to recognize the International Women's Day.

The agenda of the meeting, along with the document allocation, was approved with modifications as the meeting proceeded. The final version of the agenda is posted as FGMV-I-001-R11.

## 2.1 Overview of the 1st ITU Forum on Embracing the metaverse (7 March 2023)

The first ITU Forum on Embracing the metaverse was held on 7 March 2023, from 0930–1605 hours, KSA.

The forum brought together more than 600 experts from around the world to start a global conversation on the metaverse. More than thirty speakers shared their expertise across eight different sessions, covering topics such as interoperability, security, regulation, and future use cases. The insights and recommendations generated by the forum are contained in the Outcome Document and will be an important resource for policymakers, industry leaders, and other stakeholders, including experts of the ITU-T Focus Group on metaverse.

Detailed information, including the programme, the presentations delivered during the forum, is available at: https://www.itu.int/en/ITU-T/ssc/Pages/1st-forum-metaverse.aspx.

Find the video highlights available here.

Find the outcome document available here.

Find the photos available here.

## 2.2    Appointment of FG-MV vice-chairmen

The FG-MV Chairman presented the list of proposed FG-MV vice-chairmen [FGMV-I-051-R2]. The following proposed FG-MV vice-chairmen have been officially additionally appointed during the opening plenary:

- Mr Leonidas Anthopoulos, Professor, University of Thessaly, Greece
- Mr Manuel Barreiro, Founder and Chairman, Aston Group, Mexico
- Ms Cristina Martinez, Deputy Head for Smart Technologies for Communities, European Commission
- Ms Stella Kipsaita, Deputy Director of Standards and Type Approval, Communications Authority, Kenya
- Ms Natalia Bayona, Director, Innovation, Education, Investments, World Tourism Organization (UNWTO)

## 2.3    IPR roll call

An IPR call was made at the opening plenary – anyone having knowledge of intellectual property rights issues, including patents, copyright for software or text, marks, the use of which may be required to implement or publish the Technical Specifications or Recommendation being considered, was asked to inform the meeting.

## 3    Overview of ITU-T Focus Group working methods and additional information

Ms Cristina Bueti, FG-MV Counsellor, provided an overview of the ITU Focus Group Working Methods, including the following elements [as contained in FGMV-I-047] for the benefit of new participants:

- Objectives of Focus Groups
- Background information on the standardization work conducted by ITU-T Study Groups
- How Focus Groups are created
- How to participate in Focus Groups and eligibility to do so
- Contributive process to Focus Group deliverables
- Collaborative tools for FG-MV

Furthermore, the ITU IPR Policy [FGMV-I-045] along with Recommendation ITU-T A.7 on Focus groups: Establishment and working procedures [FGMV-I-046] were presented.

In addition, a briefing on ITU Kaleidoscope 2022 papers of relevance to the FG-MV [FGMV-I-048] was presented.

## 4    Envisioning the way forward: Focus Group management, structure and list of documents

Before commencing the core meeting discussion, the FG-MV Counsellor presented the Terms of reference of the FG-MV [FGMV-I-054] as approved by TSAG and the list of Documents for the first FG-MV meeting and their abstracts [FGMV-I-055-R1].

During the meeting, the FG-MV Chairman presented the structure for FG-MV proposed by the FG-MV management team as contained in FGMV-I-053-R1. After lengthy discussions, the approved FG-MV structure is contained as FGMV-I-053-R2.

In addition, a Proposal to set up a working group (WG) on AI technology in metaverse [FGMV-I-009] and a Proposal to create a WG to discuss network aspects of Metaverse [FGMV-I-024] were noted.

In accordance with the agreed FG-MV structure, Chairmen and Vice-Chairmen for the WGs and task groups (TGs) have been appointed (as contained in FGMV-I-052-R5).

**Table 1 – Chairmen and Vice-chairmen for the working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV)**

| FG/WGs | Subgroup | ToR | Leadership positions |
|---|---|---|---|
| **FG** | **metaverse** | | |
| | **TG-collaboration** | - Collaboration and coordination with other groups inside and outside ITU-T | Chairman:<br>- Ms **Cristina MARTINEZ** (European Commission) [Vice-chairman of FG-MV]<br>Vice-chairman<br>- Ms **Stella KIPSAITA** (Communications Authority, Kenya) [Vice-chairman of FG-MV] |
| **WG 1** | **General** | - Business ecosystem<br>- Collection of best practices, including a gap analysis<br>- Roadmap for setting technical standards<br>- Overall concepts, service model, related technologies of metaverse platforms and services<br>- Issues outside the scope of other WGs | Chairman:<br>- Mr **Leonidas ANTHOPOULOS** (University of Thessaly, Greece) [Vice-chairman of FG-MV]<br>Vice chairman:<br>- Mr **Younghwan CHOI** (ETRI, Korea) |
| | **TG-terminology & definitions** | - Definition and terminology | Chairman:<br>- Ms **Xiaomi AN** (Renmin University, China) |
| | **TG-gap analysis** | | Chairman:<br>- Mr **Leonidas ANTHOPOULOS** (University of Thessaly, Greece) [Vice-chairman of FG-MV] |
| **WG 2** | **Applications & Services** | - 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 | Chairman:<br>- Mr **Yuntao WANG** (CAICT, China) [Vice-chairman of FG-MV]<br>Vice-chairmen:<br>- Mr **Ismael ARRIBAS** (Spain)<br>- Mr **James Kunle OLORUNDARE** (Nigeria) |

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| | | interactions, health care, tourism, art and culture, etc.)<br>- High-level requirements for supporting related use cases for specific applications and services | |
| | **TG-media coding** | - | Co-chairmen:<br>- Mr **Zekun WANG**, (China Telecom)<br>- Mr **Marcelo MORENO**, (Fraunhofer IIS, Germany) |
| **WG 3** | **Architecture & Infrastructure** | - 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.)<br>- Architectures, their functionalities, interfaces, intelligent management mechanisms, connectivity technologies, APIs, and QoS/QoE, performance, minimum requirements for infrastructure requirements, etc. | Chairman:<br>- Mr **Hideki YAMAMOTO** (OKI, Japan)<br>Vice-chairmen:<br>- Ms **Yuan ZHANG** (China Telecom, China)<br>- Mr **Wilmer AZURZA NEYRA** (Ministry of Transport and Communications of the Administration, Peru) |
| | **TG-xxxxx** | | |
| **WG 4** | **Virtual/Real World Integration** | - 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)<br>- Structured data models for virtual and real | Chairman:<br>- Ms **Shane HE** (Nokia, Finland) [Vice-chairman of FG-MV] |

| | | worlds mapping<br>- Applications and services integration between virtual and real worlds | |
|---|---|---|---|
| | **TG-xxxxx** | - | |
| **WG 5** | **Interoperability** | - Use cases and requirements for cross-platform interoperability<br>- Functional enablers for interoperability of services and applications<br>- Functional architecture and interfaces for cross-platform interoperability<br>- Interfaces amongst platform, users and devices | Chairman:<br>- Mr **Hideo IMANAKA** (NICT, Japan) [Vice-chairman of FG-MV]<br>Vice-chairman:<br>- Mr **Wook HYUN** (ETRI, Korea) |
| | **TG-xxxxx** | | |
| **WG 6** | **Security, Data & Personally Identifiable Information (PII) Protection** | - Use cases and requirements related to security and PII protection aspects<br>- Security of networks and technology underpinning the metaverse platform, including cybersecurity and identity management<br>- Building confidence and security including Personally identifiable information (PII) protection-related aspects plus preventing online and offline harm and considering ethical issues and standards<br>- Consider the issues on trustworthiness related to the metaverse<br>- Child online protection<br>- Data ownership and protection<br>- Digital asset ownership | Chairman:<br>- Mr **Vincent AFFLECK**, (UK) [Vice-chairman of FG-MV]<br>Vice-chairmen:<br>- Ms **Naying HU** (CAICT, China)<br>- Ms **Radia FUNNA** (Build n Blaze) |
| | **TG-child online protection** | | Chairman<br>- Mr **Muhammad KHURRAM** (King Saud University, Kingdom of Saudi Arabia) |

| | | TG-cybersecurity | | TBC |
| --- | --- | --- | --- | --- |
| | | **TG-building confidence and security in the metaverse** | | TBC |
| **WG 7** | | **Economic, regulatory & competition aspects** | - Economic aspects and competition<br>- Metaverse value chain: main agents' role and interactions<br>- Impacts on revenues and investments, with a focus on the telecom sector<br>- Main competitive dynamics: scale and scope economies<br>- Metaverse potential market failures and regulatory remedies<br>- Public sector value models | Co-chairmen:<br> - Mr **Andrey PEREZ** (Anatel, Brazil) [Vice-chairman of FG-MV]<br> - Mr **Okan GERAY** (Digital Dubai, UAE)<br>Vice-chairman:<br> - Mr **Ahmed SAID** (Egypt) |
| **WG 8** | | **Sustainability, Accessibility & Inclusion** | - Impact on the climate changes (e.g., Green and low carbon issues, etc.)<br>- Environmental Sustainability related issues<br>- Accessibility related issues<br>- Social considerations<br>- Diversity, equity and inclusion<br>- Circular economy related issues | Co-Chairmen:<br> - Ms **Nevine TEWFIK** (Egypt)<br> - TBC<br>Vice-chairmen:<br> - Mr **Manuel BARREIRO**, (Aston Group, Mexico) [Vice-chairman of FG-MV]<br> - Ms **Christina Yan ZHANG**, (The Metaverse Institute)<br> - Mr **Khaled KOUBAA**, (Medeverse) |
| | | **TG-sustainability** | - Use cases, requirements, and technical solutions related to climate changes and environmental sustainability | Chairman:<br> - Ms **Shuguang QI** (CAICT, China) |
| | | **TG-accessibility & inclusion** | - Use cases, requirements, and technical solutions related to accessibility | Chairman:<br> - TBC |

## 5    FG-MV Contributions

### 5.1    Contributions (Topic: Focus Group)

−    FGMV-I-027: Proposed allocation of metaverse key technical factors for ITU-T SGs and FG-MV
(ZTE Corporation (China), China Telecommunications Corporation)

Abstract: This document describes a metaverse industry map based on the current metaverse use cases from CG-metaverse report and proposes to allocate the corresponded key technical factors into ITU-T Study Groups for future study of new work items.

Outcome: The contribution was noted, and the contributors were encouraged to send specific contributions to the next Focus Group meeting in accordance with the approved structure.

−    FGMV-I-009: Proposal to set up a working group on AI technology in metaverse
(Sberbank of Russia)

Abstract: This document contains the proposal to set up a working group on AI technology in metaverse.

Outcome: This contribution was presented and it was noted that AI will be addressed in all WGs.

−    FGMV-I-043: Proposal for the establishment of two working groups within the FG on Metaverse
(Egypt, Sudan)

Abstract: This contribution aims to propose the creation of two working groups within the structure of the FG-MV in order to study critical issues of high priority, which are the following: Working group on Economic and Regulatory aspects; Working group on Environmental sustainability.

Outcome: This contribution has been noted.

−    FGMV-I-033: Focus Group on metaverse Work Group on sustainability
(China, Orange, Huawei, China Telecom, China Unicom)

Abstract: The development of the metaverse is getting faster. Due to its energy consumption and GHG emissions, the sustainability of metaverse is proposed to be considered with the creation of a working group.

Outcome: This contribution has been noted.

−    FGMV-I-031: Focus Group on metaverse Work Group on sustainability
(China; Egypt; Sudan; Uganda; Universitat Politècnica de Catalunya (UPC) (Spain))

Abstract: This contribution proposes the creation of a working group on sustainability.

Outcome: This contribution has been noted.

−    FGMV-I-024: Proposal to create a WG to discuss network aspects of metaverse
(China Mobile Communications Co. Ltd.)

Abstract: This document proposes to establish a working group on network aspects of metaverse, in which existing work related to key technology enabling metaverse was

introduced, and provides potential future work related to network aspects of metaverse, as well as the future work plan.

Outcome: This contribution has been noted.

## 5.2 Contributions (Topic: TG on Collaboration and coordination with other groups inside and outside ITU-T)

– FGMV-I-026: Proposal for collaboration with the metaverse-related SDOs
(National Institute of Information and Communications Technology (NICT) (Japan), Oki Electric Industry Company Ltd. (OKI) (Japan))

Abstract: This contribution proposes to send a Liaison Statement to several standards developing organizations (SDOs) for metaverse, to collaborate with them for accelerating FG-metaverse work. The Annex of this contribution provides the draft liaison statement to the metaverse-related SDOs.

Outcome: It was agreed to prepare an outgoing Liaison Statement on "requesting collaboration on metaverse standardization work" to be sent to relevant Standards Developing Organizations (SDOs).

– FGMV-I-015: Introduction to World Metaverse Council
(World Metaverse Council, UAE)

Abstract: This contribution contains information on the World Metaverse Council.

Outcome: This contribution was noted and FG-MV was encouraged to collaborate with World Metaverse Council.

## 5.3 Contributions (Topic: WG1 on General)

– FGMV-I-029: Draft initial gap analysis on metaverse standardization
(Nokia Corporation (Finland))

Abstract: This document provides a standardization gap analysis of metaverse, as a pre-standardization work of ITU-T Focus Group on metaverse (FG-MV). In this document, a five-element model of metaverse is introduced, and a roadmap to FG-MV standardization work is provided. Moreover, an incomplete set of existing standards and current standardization work related to metaverse is presented. Based on this, a brief summary is offered for each technical field of standardization bodies.

Outcome: The contribution was presented, and it was agreed to prepare the gap analysis on metaverse standardization under a Task Group on Gap Analysis in Working Group 1.

– FGMV-I-025: Proposal for initial gap analysis on metaverse
(National Institute of Information and Communications Technology (NICT) (Japan), Oki Electric Industry Company Ltd. (OKI) (Japan))

Abstract: This contribution briefly summarizes several standard development organizations (SDOs) for metaverse, and proposes to include content into a deliverable on gap analysis. For accelerating work in FG metaverse, it suggests collaborating with them.

Outcome: The contribution was presented, and it was agreed to prepare the gap analysis on metaverse standardization under a Task Group on Gap Analysis in Working Group 1.

–  FGMV-I-013: FGMV-overview: a proposal for a new work item on "Metaverse overview and ecosystems"
(Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of))

Abstract: One of the most important and urgent issues in metaverse standardization is that overall aspects of metaverse platform, services, and its ecosystem model. It is very important to establish a general concept of metaverse because the definition, concepts and models of metaverse may be different depending on the viewpoint of each SDO or expert. This document proposes a new work item to develop a deliverable on "Metaverse overview and ecosystems" that describes definitions, overall concepts and technical matters, related standardization issues, and ecosystem models of metaverse.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Metaverse overview" in Working Group 1.

–  FGMV-I-040: Defining the Business Ecosystem and the value sources of metaverse
(Ministry of Digital Governance (Greece), University of Thessaly (Greece))

Abstract: The aim of this document is to propose the development of a Technical Report that will define the business ecosystem and the value sources of metaverse. It will examine how metaverse can create economic value for businesses and consumers and social value to citizens, as well as how it will provide new opportunities for economic development and innovation and its relation to the physical economy.

Outcome: The contribution was presented, and it was agreed that this contribution will be discussed in Working Group 7.

–  FGMV-I-028-R1: Technical Report on a New Standard Work Item on the Power Metaverse Terminology
(State Grid Corporation of China)

Abstract: This Technical Report proposes to initiate a new standard work item on the power metaverse terminology. The concept of the power metaverse (PM) is introduced, which is fundamental to promoting the flexibility, reliability and intelligence of the power system operation. Standardizing the terminology in the PM creates a unified foundation for further exploration, allowing scholars to discuss and work efficiently, although currently there is lack of terminology standard. The background, ecosystem, components, functions, use cases of the PM, and examples of terminology that require standardized are provided.

Outcome: The contribution was presented. It was agreed to develop a deliverable on "Vocabulary for Metaverse", which will take into consideration contribution FGMV-I-028-R1 and contribution FGMV-I-019  in the task group on terminology and definitions in Working Group 1.

–  FGMV-I-019: Vocabulary for Metaverse
(Renmin University of China, China)

Abstract: This document proposes a draft new Technical Specification on Vocabulary for Metaverse. This draft new Technical Specification contains metaverse-related vocabulary to be used for metaverse.

Outcome: The contribution was presented. It was agreed to develop a deliverable on "Vocabulary for Metaverse", which will take into consideration contribution FGMV-I-028-R1 and contribution FGMV-I-019 in the task group on terminology and definitions in Working Group 1.

– FGMV-I-038: Metaverse: an analysis of definitions
(Ministry of Digital Governance (Greece), University of Thessaly (Greece))

Abstract: The aim of this document is to propose the development of a Technical Report that will contain a detailed gap analysis in literature and provide "Metaverse" with a definition and an explained terminology.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Metaverse: an analysis of definitions" in the task group on terminology and definitions in Working Group 1.

## 5.4   Contributions (Topic: WG2 on Applications & Services)

– FGMV-I-030: Proposal for two typical use cases in power metaverse
(ZTE Corporation (China), China Telecommunications Corporation)

Abstract: This proposal proposes several use cases of power metaverse, which is an important part of metaverse use case. It includes virtual power plant and digital twin of power grid system.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Use cases on power metaverse" in WG2.

– FGMV-I-021: Proposed new work item on ITU-T FGMV-AEP "Guidelines for metaverse application in energy power"
(State Grid Corporation of China, Ministry of Industry and Information Technology (MIIT) (China))

Abstract: This document contains a proposal for a new study on draft new Technical Specification "Guidelines for metaverse application in energy power". It outlines the basic connotation of energy power metaverse, gives the mapping mode between the real and virtual power system. It summarizes the application architecture and general technical requirements of energy power metaverse, and lists four application scenarios.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Guidelines for metaverse application in energy power" in WG2.

– FGMV-I-017: Proposal for characteristics, codec requirements and one use case of metaverse applications
(China Telecommunications Corporation)

Abstract: This contribution suggests to define the characteristics, requirements for virtual and real fusion coding and proposes one use case in metaverse application.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Use cases and requirements for virtual and real fusion coding in metaverse applications" in the task group on media coding of Working Group 2.

– FGMV-I-032: Immersive media coding standardization for metaverse
(Fraunhofer IIS)

Abstract: Six Degrees of Freedom (6DoF) immersive audio rendering will be a critical component for metaverse. Currently, the ISO/MPEG Audio working group WG6 defines the upcoming MPEG-I Immersive Audio standard for VR/AR. Along with other parts of MPEG-I, the technology supports a complete audio-visual VR or AR presentation in which the user can navigate and interact with the simulated environment using 6DoF. Therefore, this

contribution draws the attention of the ITU-T Focus Group to the reported ISO/MPEG standardization activities, especially to MPEG-I Immersive Audio. This contribution proposes MPEG-I as a key technology for metaverse applications and their interoperability. It also proposes the creation of an FG-MV workgroup on immersive media coding.

Outcome: The contribution was presented, and it was agreed that this contribution will be discussed in the task group on media coding in Working Group 2.

– FGMV-I-035: Suitable standardization to achieve transcoding free operation for metaverse applications
(Fraunhofer IIS)

Abstract: One of the key elements for many envisioned metaverse use cases is immersive interaction and virtual meetings between humans. Due to the nature of limited network bandwidth, audio visual communication needs low-delay audio and video coding. On the other hand, independent vendors of metaverse applications might introduce different coding schemes due the lack of agreed guidelines. This contribution emphasizes the need for standardization of A/V codecs for metaverse applications considering the requirements for a transcoding-free operation.

Outcome: The contribution was presented, and it was agreed that this contribution will be discussed in the task group on media coding in Working Group 2.

## 5.5 Contributions (Topic: WG3 on Architecture & Infrastructure)

– FGMV-I-016: New requirements and challenge of network infrastructure for metaverse
(China Telecommunications Corporation)

Abstract: This contribution introduces current research directions for future network and the new requirements and challenge of network infrastructure for metaverse, and proposes to initiate a Technical Report on the network infrastructure of metaverse.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Requirements and challenge associated with network infrastructure to enable the metaverse" in WG3.

– FGMV-I-010: Decentralized Social Networking Protocol for the development of the Metaverses
(McCourt Institute, France)

Abstract: This contribution recommends the development of protocols such as the Decentralized Social Networking Protocol (DSNP), to allow users to control their data.

Outcome: This contribution was presented. The contributors were invited to submit a more elaborated proposal to Working Group 6.

– FGMV-I-008: Proposed new work item on "Requirements and functional architecture of IoT-based metaverse service"
(ZTE Corporation (China), China Telecommunications Corporation)

Abstract: This input document proposes to initiate a new work item on the Requirements and functional architecture of IoT-based metaverse service. This proposed draft new Technical Specification provides the requirements and functional architecture of IoT-based metaverse service, including general requirements, high-level functional architecture and use cases of IoT-based metaverse service.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Requirements and functional architecture of IoT- based metaverse service" in WG3.

–   FGMV-I-006: The Reference Architecture of Industrial Metaverse
    (China Academy of Information and Communications Technology (CAICT), China)

Abstract: This contribution focuses on the needs of industrial development, gives the overall reference framework for the construction of the industrial metauniverse, and clarifies the key technology system for the development of the industrial metaverse.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Reference architecture of industrial metaverse" in WG3.

–   FGMV-I-039: Setting the framework for an ICT architecture of Metaverse
    (Ministry of Digital Governance (Greece), University of Thessaly (Greece))

Abstract: The aim of this document is to propose the development of a Technical Specification that will contain the ICT architecture development framework of metaverse and will conclude on corresponding architecture views and guides.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Setting the framework for an ICT architecture to enable the metaverse" in WG3.

–   FGMV-I-042: A New Era of Metaverse: Conforming WiFi to Metaverse using Federated Machine Learning-Assisted Concurrent Transmission
    (Nahla Mustafa Ali (Independent Researcher))

Abstract: This presentation uses a multidisciplinary approach to engage with questions about ways wireless infrastructure may ensure immersion in metaverse: the next generation of the Internet that transcends videos to immersive experiences, metaverse will revolutionize games, education and social interaction. This presentation discusses factors that affect the deployment of Concurrent Transmission (CXMSN), which is a low-latency forwarding technique. The presentation offers insights regarding enhancing Concurrent Transmission by deploying Federated Machine Learning.

Outcome: This contribution was presented and the contributor was invited to contribute to the development of the deliverable on "Network infrastructure for metaverse", related to FGMV-I-016.

## 5.6    Contributions (Topic: WG4 on Virtual/Real World Integration)

–   FGMV-I-014: A proposed new work item on the use cases and requirements for metaverse based on digital twins enabling integration of virtual and physical worlds
    (Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of)))

Abstract: This contribution proposes a new work item on the use cases and requirements for metaverse based on digital twins enabling integration of virtual and physical worlds. This proposed draft new Technical Specification provides use cases and requirements for metaverse based on digital twins enabling integration of virtual and physical worlds.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Use cases and requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds" in WG4.

– FGMV-I-011: Digital Twin and Metaverse: bringing the operational and customer-centric side of immersive reality
(IDC (International Data Corporation) Government Insights)

Abstract: There are two trends that are converging in technology, metaverse and digital twins. They support slightly different use cases but could eventually converge into a continuum of data-to-information-to-insights-to-purpose, by creating the ultimate connection between the physical and virtual worlds through a panoramic multiverse. This contribution proposes the development of a Technical Report defining the reference capabilities for a digital multiverse and a policy guidance report.

Outcome: The contribution was noted.

## 5.7 Contributions (Topic: WG5 on Interoperability)

– FGMV-I-023: Standardization activities on metaverse interoperability
(Electronics and Telecommunications Research Institute (ETRI) (Korea, Rep. of))

Abstract: Interoperability is recognized as an important issue for realizing global-scale metaverse infrastructure, as seen in the legacy Internet. Recently, some notable activities have been observed to address the interoperability issue, especially in metaverse industries and open-source communities. This contribution briefly summarizes these activities.

Outcome: This contribution has been presented and is expected to be further discussed in the Task Group on collaboration and in Working Group 1.

– FGMV-I-022: A proposal for a new work item on the use cases and requirements for metaverse cross-platform interoperability
(Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of))

Abstract: This contribution proposes a new work item on the use cases and requirements for metaverse cross-platform interoperability. This proposed new work item aims to identify the different use cases and requirements for metaverse cross-platform interoperability, including avatar interoperability, asset interoperability, content interoperability, identity interoperability, communication interoperability, and protocol interoperability.

Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Use cases and requirements for metaverse cross-platform interoperability" in WG5.

– FGMV-I-020: Proposed template for a use case and requirements for the interoperable metaverse
(Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of))

Abstract: Since one of the primary roles of the Focus Group on metaverse is to develop deliverables related to metaverse use cases, this contribution proposes a use case template as a starting point for discussion to create a collection of use cases with a unified style.

Outcome: This contribution has been presented and it was agreed that the contributor, the FG-MV Chairman together with WG Chairmen will develop a template for use cases.

–   FGMV-I-012: A roadmap to Metaverse Interoperability
    (Moving Picture, Audio and Data Coding by Artificial Intelligence (MPAI) Switzerland)

    Abstract: Standards are important for the successful adoption of the metaverse proposition. This document reports the current results of an exploration that relies on: 1) an extensive collection of Functionalities that Metaverse Instances might be required to support; and 2) on the consideration of Functionality Profiles in preparation for a later phase when it will be possible to develop Technology Profiles. This is an alternative approach to entering into a proper standardization phase at this stage.

    Outcome: This contribution was presented and is expected to be discussed in the task group on collaboration.

–   FGMV-I-005: Proposal of a new study on draft new Technical Specification "Interoperability and migration of identity of things across metaverses"
    (China Unicom, China Information Communication Technologies Group)

    Abstract: This document contains a proposal for a new study on draft new Technical Specification "Interoperability and migration of identity of things across metaverses". This proposed draft new Technical Specification analyses, and provides solutions for, identity interoperability and migration for things across metaverses.

    Outcome: The contribution was presented, and it was agreed to approve the development of a work item on "Interoperability and migration of identity of things across metaverses" in WG5.

## 5.8   Contributions (Topic: WG6 on Security, Data & Personally Identifiable Information (PII) Protection)

–   FGMV-I-018: New Work Item on Requirements and Framework for Digital Identity System
    (China Mobile Communications Co. Ltd.)

    Abstract: This contribution contains a proposal of a new work item on requirements and framework for a digital identity system. The proposal includes the overview, concepts, use case, functional requirements and framework. It is submitted for discussion and approval at this FG-MV meeting.

    Outcome: The contribution was presented, and it was agreed to approve the development of a work item on "Requirements and framework for digital identity system" in WG6.

–   FGMV-I-004: Proposal of a new study on draft new Technical Specification "Data management and security for things across metaverses"
    (China Unicom, China Information Communication Technologies Group)

    Abstract: This document contains a proposal for a new study on a draft new Technical Specification "Data management and security for things across metaverses". This proposed draft new Technical Specification analyses and provides solutions for data management and security for things across metaverses.

    Outcome: The contribution was presented, and it was agreed to approve the development of a deliverable on "Data management and security for things across metaverses" in WG6.

– FGMV-I-036: Securing the development of Metaverse
(National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia))

Abstract: This contribution discusses the importance of security in the development of metaverse. Additionally, it highlights the importance of prioritizing user safety in metaverse, which includes users' personal data protection, identity management, and users' protection against meta harms. With the integration of these security considerations, metaverse can become a more trustworthy and safe virtual space for users to interact and conduct various activities.

Outcome: This contribution was presented. During the meeting, the Focus Group structure including the list of Working Groups and Task Groups has been approved, this includes the proposed Working Group on Security, Data and PII protection. The proponents were encouraged to send contributions related to Working Group 6 in the next Focus Group meeting.

– FGMV-I-037: Cyber risks, threats, and harms in the Metaverse
(National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia))

Abstract: The contribution discusses the various cyber risks and threats associated with the metaverse, with a focus on Non-fungible tokens (NFTs) and social engineering. It also highlights the emerging field of 'metacrimes,' which include the use of the Darkverse, the growing concerns of money laundering, and financial fraud in the metaverse. To address these risks, the contribution proposes the development of a detailed report on risks, threats, and potential harms with inputs from all stakeholders to inform the standardization roadmap for the metaverse.

Outcome: This contribution was presented and it was agreed to approve the development of a deliverable on "Risks, threats and potential harms in the metaverse" in WG6.

– FGMV-I-041: Children Cybersecurity in the Metaverse
(King Saud University (Kingdom of Saudi Arabia))

Abstract: The metaverse is becoming increasingly popular among everyone, including children. However, as it is still in its early development phase its parental control and safety measures are inconsistent for children. Hence, it is imperative to initiate discussion on building a set of common criteria and standards for metaverse for age-appropriate usage, child data governance, and risk mitigation procedures.

Outcome: The contribution was presented, and it was agreed to establish a Task Group on child online protection.

## 5.9 Contributions (Topic: WG7 on Economic, regulatory & competition aspects)

– FGMV-I-044: Legal and Regulatory Implications of Metaverse
(Egypt)

Abstract: This contribution aims to propose a kick off for the work of the suggested Economic and Regulatory working group by presenting some elements that can be studied in the framework of the legal implications of metaverse.

Outcome: The contribution was presented and noted. The contributor was encouraged to send contributions to WG7.

### 5.10 Contributions (Topic: WG8 on Sustainability, Accessibility & Inclusion)

– FGMV-I-034: Proposed new work item on Green Metaverse "Guidance on green and low carbon development of Metaverse"
(China, Huawei, Orange, China Telecom, China Unicom)

Abstract: This document contains a new work item proposal for "Guidance on green and low carbon development of Metaverse", which will be discussed at the first meeting of the ITU-T Focus Group on metaverse (Riyadh, 8–9 March 2023). The aim of this work item is to provide a clear picture on how metaverse is currently developing, what kind of application scenarios exist for metaverse, where the highest energy consumption and GHG emissions will be, and to elaborate possible green and low carbon development roadmaps for metaverse.

Outcome: This contribution was presented, and it was agreed to approve the development of a deliverable on "Guidance on green and low carbon development of metaverse" in the Task Group on Sustainability in WG8.

– FGMV-I-003: Metaverse for All
(Universitat Autònoma de Barcelona, Salford University, SWPS University, Clemson University, Universitat Autònoma de Barcelona)

Abstract: The European Commission has been financing research on accessibility for immersive environments (XR) since 2017. This has been regularly presented in the form of contributions to ITU IRG-AVA. This document suggests the creation of a sub-group on Immersive Accessibility with some objectives. The document also gives references to previous documents related to immersive accessibility services presented at ITU IRG-AVA.

Outcome: The presentation was noted and it is expected to be further discussed in the Task Group on Accessibility & Inclusion in WG8.

## 6 Incoming Liaison Statements

The following Liaison Statements were received for this meeting:

– FGMV-I-002: LS/i on Information about IPv6 Forum on IPv6-based metaverse and related PoCs [from IPv6 Forum]

Abstract: This LS/i informs about the IPv6 Forum activities on "IPv6-based Metaverse" and the wish to establish a collaboration with the ITU-T Focus Group on metaverse (FG-MV).

Outcome: This Liaison Statement was noted by the meeting and it was agreed to send an OLS.

– FGMV-I-007: LS/i on new work item proposal ITU-T Y.IoT-MVS "Requirements and functional architecture of IoT based metaverse service" [from ITU-T SG20]

Abstract: This Liaison Statement informs TSAG and FG-MV that the new work item proposal from Q3/20 has been transferred to FG-MV due to the scope of this proposal being related to metaverse.

Outcome: This Liaison Statement was noted by the meeting.

## 7 Outgoing Liaison Statements

The FG Chairman, Management and Secretariat continue efforts to establish and maintain liaison relationships with relevant bodies and groups. Two Liaison Statements were sent to several SDOs, ITU Groups and other consortia.

FGMV-O-001-R1: Draft LS/o on requesting collaboration on metaverse standardization work

Abstract: A new ITU-T Focus Group on metaverse (FG-MV) established in December 2022, would like to collaborate with SDOs on metaverse. For accelerating FG work, FG would like to request any information on metaverse standardization work, especially standardization roadmap, published specifications and reports.

Outcome: The OLS as approved during the meeting is given in FGMV-O-001-R1.

FGMV-O-002: Draft LS/o on audio/video media coding specifications for metaverse services and applications [to ISO/IEC JTC1/SC29]

Abstract: ITU-T Focus Group on metaverse (FG-MV) held its first meeting in Riyadh, Kingdom of Saudi Arabia, from 8–9 March 2023, and agreed on its initial structure. Working Group 2 on Applications & Services established a specific Task group on media coding (TG-media coding). FG-MV kindly requests MPEG (ISO/IEC JTC1/SC29) to share information related to immersive audio and video coding and other metaverse-related work items.

Outcome: The OLS as approved during the meeting is given in FGMV-O-002.

## 8    Future work

The following deliverables have been agreed as shown in Table 2 (FGMV-I-057-R4):

**Table 2 – List of agreed deliverables and editors**

| Working Group/ Focus Group | Task Group | Type | Title of deliverable | Related documents | Editors |
|---|---|---|---|---|---|
| FG-MV | TG-collaboration | | | FGMV-I-026 <br> FGMV-I-015 <br> FGMV-I-023 <br> FGMV-I-012 | |
| FG-MV | | Template | Use case template | FGMV-I-020 | Wook HYUN (ETRI, Korea (Republic of)), <br><br> FG Chairman and WG Chairmen |
| WG1 | TG-gap analysis | Technical Report | Gap analysis on metaverse standardization | FGMV-I-029 <br> FGMV-I-025 <br> FGMV-I-023 | Leonidas ANTHOPOULOS (University of Thessaly, Greece) |
| WG1 | - | Technical | Metaverse | FGMV-I- | Younghwan CHOI |

| | | Specifications | overview | 013 | (ETRI, Korea (Republic of)) |
|---|---|---|---|---|---|
| WG1 | TG-terminology and definitions | Technical Specifications | Vocabulary for Metaverse | FGMV-I-019  FGMV-I-028-R1 | Xiaomi AN (Renmin, University of China, China)  Jie SONG (State Grid Corporation of China) |
| WG1 | TG-terminology and definitions | Technical Report | An analysis of definitions | FGMV-I-038 | Leonidas ANTHOPOULOS (University of Thessaly, Greece) |
| WG2 | - | Technical Specifications | Use case on power metaverse | FGMV-I-028-R1  FGMV-I-030 | Jie SONG (State Grid Corporation of China, China) |
| WG2 | - | Technical Specifications | Guidelines for metaverse application in energy power | FGMV-I-021 | Dong WANG (State Grid Corporation of China, China) |
| WG2 | TG-media coding | | | FGMV-I-032  FGMV-I-035 | Yuan ZHANG (China Telecom, China)  Marcelo MORENO (Fraunhofer IIS, Germany) |
| WG2 | TG-media coding | Technical Specifications | Use case and requirements for virtual and real fusion coding in metaverse application | FGMV-I-017 | Zekun WANG (China Telecom, China) |
| WG3 | - | Technical Report | Requirements and challenge associated with network infrastructure to enable the metaverse | FGMV-I-016 | Jingwen LI (China Telecom, China) |
| WG3 | - | Technical Specifications | Requirements and functional architecture of IoT- based | FGMV-I-008 | Chao MA (CAICT, China) |

| | | | metaverse service | | |
|---|---|---|---|---|---|
| WG3 | - | Technical Specifications | Reference architecture of industrial metaverse | [FGMV-I-006](#) | Cheng CHI (CAICT, China) |
| WG3 | - | Technical Specifications | Setting the framework for an ICT architecture to enable the metaverse | [FGMV-I-039](#) | Leonidas ANTHOPOULOS (University of Thessaly, Greece) |
| WG4 | - | Technical Specifications | Use cases and requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds | [FGMV-I-014](#) | Sangkeun YOO (ETRI, Korea (Rep. of)) |
| WG5 | - | Technical Specifications | Use cases and requirements for metaverse cross-platform interoperability | [FGMV-I-022](#) | Jungha HONG (ETRI, Korea (Republic of)) |
| WG5 | - | Technical Specifications | Interoperability and migration of identity of things across metaverses | [FGMV-I-005](#) | Xiongwei JIA (China Unicom, China) |
| WG6 | - | Technical Specifications | Requirements and framework for digital identity system | [FGMV-I-018](#) | Jingwen LIU (China Mobile, China) |
| WG6 | - | Technical Specifications | Data management and security for things across metaverses | [FGMV-I-004](#) | Xiongwei JIA (China Unicom, China) |
| WG6 | - | Technical Report | Risks, threats and potential harms in the metaverse | [FGMV-I-037](#) | Sarah ABANUMAY (National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia)) Aljawharah |

| | | | | | ALSALEM (National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia)) |
|---|---|---|---|---|---|
| WG6 | TG-cybersecurity | | | FGMV-I-010 | |
| WG6 | - | | | FGMV-I-036 | |
| WG6 | TG-child online protection | | | FGMV-I-041 | Muhammad Khurram KHAN (King Saud University, Kingdom of Saudi Arabia) |
| WG6 | TG-building confidence and security in the metaverse | | | | |
| WG7 | - | | | FGMV-I-044 FGMV-I-040 | |
| WG8 | TG-sustainability | Technical Specifications | Guidance on green and low carbon development of Metaverse | FGMV-I-034 | Shuguang QI (CAICT, China) |
| WG8 | TG-accessibility & inclusion | | | FGMV-I-003 | |

## 9 Next Steps

The FG-MV Chairman emphasized the following for the next FG-MV meetings:
- Call for Contributions to advance the FG-MV deliverables/Task Groups

The next planned FG-MV meetings are as indicated (also contained in FGMV-I-050-R4 [1]):

- WGs-MV, 9-11 May 2023, Geneva and virtual
- 2nd meeting of FG-MV, June/July 2023, China
- 3rd meeting of FG-MV, 6-8 September 2023, Geneva
- Special Session on FG-MV, 12-13 September 2023, Arusha, Tanzania
- Special Session on FG-MV, 18-19 October 2023, Riga, Latvia

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[1] A revised FGMV-I-050-R4 will be posted in due course.

–  4th meeting of FG-MV, 4-7 December 2023, Geneva

Relevant information will be disseminated in due time through the mailing list.

## 10   AOB

### 10.1 List of FG-MV mailing lists

The Focus Group on metaverse (FG-MV) mailing lists are shown in the table below (also contained in FGMV-I-058).

Please see step-by-step guide on how to subscribe to the mailing lists available HERE.

| Description | Mailing list name |
|---|---|
| General mailing list for the FG on metaverse (FG-MV) | fgmv@lists.itu.int |
| Topic Group - Collaboration | fgmv-tg-collaboration@lists.itu.int |
| Working Group 1 - General | fgmv-wg1@lists.itu.int |
| Working Group 2 - Applications & Services | fgmv-wg2@lists.itu.int |
| Working Group 3 - Architecture & Infrastructure | fgmv-wg3@lists.itu.int |
| Working Group 4 - Virtual/Real World Integration | fgmv-wg4@lists.itu.int |
| Working Group 5 - Interoperability | fgmv-wg5@lists.itu.int |
| Working Group 6 - Security, Data & Personally Identifiable Information (PII) Protection | fgmv-wg6@lists.itu.int |
| Working Group 7- Economic, Regulatory & Competition Aspects | fgmv-wg7@lists.itu.int |
| Working Group 8 - Sustainability, Accessibility & Inclusion | fgmv-wg8@lists.itu.int |

### 10.2 FG-MV Workplan

The FG-MV Workplan document (FGMV-O-007) contains information on the FG-MV structure, the list of deliverables, and the list of Chairmen and Vice-Chairmen for the Working Groups (WGs) and Task Groups (TGs) in a single document.

## 11   Closing Plenary

Dr Shin-Gak Kang, the FG-MV Chairman, thanked the participants for their Contributions, and congratulated them for establishing the FG Structure and for the appointment of FG Vice-chairmen and WG/TG Chairmen and Vice-chairmen.

Ms Cristina Bueti (FG-MV Counsellor), Ms Yining Zhao and Ms Chiara Co (FG-MV Secretariat) and Mr Ilia Londo (IT Support Officer, ITU) were thanked for supporting the meeting by coordinating the required technical arrangements as well as for the guidance provided during the course of the FG-MV meeting.

The FG-MV meeting closed on 9 March 2023 at 1530, KSA.

**Annexes: 2**

–    ANNEX 1 – List of FG-MV Input Documents (8–9 March 2023)

# ANNEX 1 – List of FG-MV Input Documents (Riyadh, 8–9 March 2023)

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| FG-MV-I-001 | N/A | FG-MV Chairman | Draft Agenda of the first meeting of the Focus Group on metaverse (FG-MV) | This document contains a draft agenda of the first meeting of the ITU-T Focus Group on metaverse (Riyadh, 8–9 March 2023). |
| FG-MV-I-002 | N/A | IPv6 Forum | LS/i on Information about IPv6 Forum on IPv6-based Metaverse and related PoCs [from IPv6 Forum] | This LS/i informs about the IPv6 Forum activities on "IPv6-based Metaverse" and the wish to establish a collaboration with ITU-T Focus Group on metaverse (FG-MV). |
| FG-MV-I-003 | N/A | Universitat Autònoma de Barcelona, Salford University, SWPS University, Clemson University, Universitat Autònoma de Barcelona | Metaverse for All | The European Commission has been financing research on accessibility for immersive environments (XR) since 2017. This has been regularly presented in the form of contributions to ITU IRG-AVA. This document suggests the creation of a sub-group on Immersive Accessibility with some objectives. The document also gives references to previous documents related to immersive accessibility services presented at ITU IRG-AVA. |
| FG-MV-I-004 | N/A | China Unicom; China Information Communication Technologies Group | Proposal of a new study on draft new Technical Specification "Data management and security for things across metaverses" | This document contains a proposal for a new study on draft new Technical Specification "Data management and security for things across metaverses". This proposed draft new Technical Specification analyses and provides solutions about data management and security for things across metaverses. |
| FG-MV-I-005 | N/A | China Unicom; China Information Communication Technologies Group | Proposal of a new study on draft new Technical Specification "Interoperability and migration of identity of things across metaverses" | This document contains a proposal for a new study on draft new Technical Specification "Interoperability and migration of identity of things across metaverses". This proposed draft new Technical Specification analyses and provides solutions about identity interoperability and migration for things across metaverses. |
| FG-MV-I-006 | N/A | China Academy of Information and Communications Technology (CAICT), China | The Reference Architecture of Industrial Metaverse | This contribution focuses on the needs of industrial development, gives the overall reference framework for the construction of the industrial metauniverse, and clarifies the key technology system for the development of the industrial metaverse. |
| FG-MV-I-007 | N/A | ITU-T Study Group 20 | LS/i on new work item proposal ITU-T Y.IoT-MVS "Requirements and functional architecture of IoT based | This Liaison Statement informs TSAG and FG-MV that the new work item proposal from Q3/20 has been transferred to FG-MV |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| | | | metaverse service" [from ITU-T SG20] | due to the scope of this proposal being related to metaverse. |
| FG-MV-I-008 | N/A | Ministry of Industry and Information Technology (MIIT) (China), China Mobile | Proposed new work item on "Requirements and functional architecture of IoT based metaverse service" | This input document proposes to initiate a new work item on Requirements and functional architecture of IoT based metaverse service. This proposed draft new Technical Specification provides the requirements and functional architecture of IoT based metaverse service, including general requirements, high-level functional architecture and use cases of IoT based metaverse service. |
| FG-MV-I-009 | N/A | Sberbank of Russia | Proposal to set up a working group on AI technology in metaverse | This document contains the proposal to set up a working group on AI technology in metaverse. |
| FG-MV-I-010 | N/A | McCourt Institute, France | Decentralized Social Networking Protocol for the development of the Metaverses | This contribution recommends the development of protocols such as the Decentralized Social Networking Protocol (DSNP), to allow users to control their data. |
| FG-MV-I-011 | N/A | IDC (International Data Corporation) Government Insights | Digital Twin and Metaverse: bringing the operational and customer-centric side of immersive reality | There are two trends that are converging in technology, metaverse and digital twins. They support slightly different use cases but could eventually converge into a continuum of data-to-information-to-insights-to-purpose, by creating the ultimate connection between the physical and virtual worlds through a panoramic multiverse. This contribution proposes the development of a Technical Report defining the reference capabilities for a digital multiverse and a policy guidance report. |
| FG-MV-I-012 | N/A | Moving Picture, Audio and Data Coding by Artificial Intelligence (MPAI) Switzerland | A roadmap to Metaverse Interoperability | Standards are important for the successful adoption of the metaverse proposition. This document reports the current results of an exploration that relies on: 1) an extensive collection of Functionalities that Metaverse Instances might be required to support; and 2) on the consideration of Functionality Profiles in preparation for a later phase when it will be possible to develop Technology Profiles. This is an alternative approach to entering into a proper standardisation phase at this stage. |
| FG-MV-I-013 | N/A | Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of)) | FGMV-overview: a proposal for a new work item on "Metaverse overview and ecosystems" | One of the most important and urgent issues in metaverse standardization is that overall aspects of metaverse platform, services, and its ecosystem model. It is very important to establish a general concept of metaverse because the definition, concepts, and models of metaverse may be different depending on the |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| | | | | viewpoint of each SDO or expert. This document proposes a new work item to develop a deliverable on "Metaverse overview and ecosystems" that describes definitions, overall concepts and technical matters, related standardization issues, and ecosystem models of metaverse. |
| FG-MV-I-014 | N/A | Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of)) | A proposed new work item on the use cases and requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds | This contribution proposes a new work item on the use cases and requirements for metaverse based on digital twins enabling integration of virtual and physical worlds. This proposed draft new Technical Specification provides use cases and requirements for metaverse based on digital twins enabling integration of virtual and physical worlds. |
| FG-MV-I-015 | N/A | World Metaverse Council, UAE | Introduction to World Metaverse Council | This contribution contains information on the World Metaverse Council. |
| FG-MV-I-016 | N/A | China Telecommunications Corporation | New requirements and challenge of network infrastructure for Metaverse | This contribution introduces current research directions for future networks and the new requirements and challenge of network infrastructure for metaverse, and proposes to initiate a Technical Report on network infrastructure of metaverse. |
| FG-MV-I-017 | N/A | China Telecommunications Corporation | Proposal for characteristics, codec requirements and one use case of metaverse applications | This contribution suggests considering clearly defining the characteristics and requirements for virtual and real fusion coding, and one use case in metaverse application. |
| FG-MV-I-018 | N/A | China Mobile Communications Co. Ltd. | New Work Item on Requirements and Framework for Digital Identity System | This contribution contains a proposal of a new work item on requirements and framework for digital identity system. The proposal includes the overview, concepts, use case, functional requirements and framework. It is submitted for discussion and approval at this FG-MV meeting. |
| FG-MV-I-019 | N/A | Renmin University of China, China | Vocabulary for Metaverse | This document proposes a draft new Technical Specification on Vocabulary for metaverse. This draft new Technical Specification contains metaverse-related vocabulary to be used for metaverse. |
| FG-MV-I-020 | N/A | Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of)) | Proposed template for a use case and requirements for the interoperable metaverse | Since one of the primary roles of the Focus Group on metaverse is to develop deliverables related to metaverse use cases, this contribution proposes a use case template as a starting point for discussion to create a collection of use cases with a unified style. |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| FG-MV-I-021 | N/A | State Grid Corporation of China, Ministry of Industry and Information Technology (MIIT) (China) | Proposed new work item on ITU-T FGMV-AEP "Guidelines for metaverse application in energy power" | This document contains a proposal for a new study on draft new Technical Specification "Guidelines for metaverse application in energy power". It outlines the basic connotation of energy power metaverse, gives the mapping mode between the real and virtual power systems. It summarizes the application architecture and general technical requirements of energy power metaverse, and lists four application scenarios. |
| FG-MV-I-022 | N/A | Electronics and Telecommunications Research Institute (ETRI) (Korea (Rep. of)) | A proposal for a new work item on the use cases and requirements for metaverse cross-platform interoperability | This contribution proposes a new work item on the use cases and requirements for metaverse cross-platform interoperability. This proposed new work item aims to identify the different use cases and requirements for metaverse cross-platform interoperability, including avatar interoperability, asset interoperability, content interoperability, identity interoperability, communication interoperability, and protocol interoperability. |
| FG-MV-I-023 | N/A | Electronics and Telecommunications Research Institute (ETRI) (Korea, Rep. of) | Standardization activities on metaverse interoperability | Interoperability is recognized as an important issue for realizing global scale metaverse infrastructure, as seen in the legacy Internet. Recently, some notable activities have been observed to address the interoperability issue, especially in metaverse industries and open-source communities. This contribution briefly summarizes these activities. |
| FG-MV-I-024 | N/A | China Mobile Communications Co. Ltd. | Proposal to create a WG to discuss network aspects of Metaverse | This document proposes to establish a working group on network aspects of metaverse, in which existing work related to key technology enabling metaverse was introduced, and provides potential future work related to network aspects of metaverse, as well as the future work plan. |
| FG-MV-I-025 | N/A | National Institute of Information and Communications Technology (NICT) (Japan), Oki Electric Industry Company Ltd. (OKI) (Japan) | Proposal for initial gap analysis on metaverse | This contribution briefly summarizes several standard development organizations (SDOs) for metaverse, and proposes to include content into a deliverable on gap analysis. For accelerating work in FG metaverse, it suggests collaborating with them. |
| FG-MV-I-026 | N/A | National Institute of Information and | Proposal for collaboration with the metaverse related SDOs | This contribution proposes to send a Liaison Statement to several standards developing organizations (SDOs) for metaverse, to |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| | | Communications Technology (NICT) (Japan), Oki Electric Industry Company Ltd. (OKI) (Japan) | | collaborate with them for accelerating FG-metaverse work. The Annex of this contribution provides the draft Liaison Statement to the metaverse-related SDOs. |
| FG-MV-I-027 | N/A | ZTE Corporation (China), China Telecommunications Corporation | Proposed allocation of metaverse key technical factors for ITU-T SGs and FG-MV | This document describes a metaverse industry map based on the current metaverse use cases from CG-metaverse report, and proposes to allocate the corresponded key technical factors into ITU-T Study Groups for future study of new work items. |
| FG-MV-I-028-R1 | N/A | State Grid Corporation of China, Shanghai University, Shanghai Jiaotong University | Technical Report on a New Standard Work Item on the Power Metaverse Terminology | This Technical Report proposes to initiate a new standard work item on the power metaverse terminology. The concept of the power metaverse (PM) is introduced, which is fundamental to promote the flexibility, reliability and intelligence of the power system operation. Standardizing the terminology in the PM creates a unified foundation for further exploration, allowing scholars to discuss and work efficiently, although currently there is lack of terminology standard. The background, ecosystem, components, functions, use cases of the PM, and examples of terminology that require standardized are provided. |
| FG-MV-I-028 | N/A | State Grid Corporation of China | Technical Report on a New Standard Work Item on the Power Metaverse Terminology | This Technical Report proposes to initiate a new standard work item on the power metaverse terminology. The concept of the power metaverse (PM) is introduced, which is fundamental to promote the flexibility, reliability and intelligence of the power system operation. Standardizing the terminology in the PM creates a unified foundation for further exploration, allowing scholars to discuss and work efficiently, although currently there is lack of terminology standard. The background, ecosystem, components, functions, use cases of the PM, and examples of terminology that require standardized are provided. |
| FG-MV-I-029 | N/A | Nokia Corporation (Finland) | Draft initial gap analysis on metaverse standardization | This document provides a standardization gap analysis of metaverse, as a pre-standardization work of ITU-T Focus Group on metaverse (FG-MV). In this document, a five-element model of metaverse is introduced, and a roadmap to FG-MV standardization work is provided. Moreover, an incomplete set of existing standards and current standardization work related to |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| | | | | metaverse is presented. Based on this, a brief summary is offered for each technical field of standardization bodies. |
| FG-MV-I-030 | N/A | State Grid Corporation of China, China Telecommunications Corporation | Proposal for two typical use cases in power metaverse | This proposal proposes several use cases of power metaverse, which is an important part of metaverse use case. It includes virtual power plant and digital twin of power grid system. |
| FG-MV-I-031 | N/A | China; Egypt; Sudan; Uganda; Universitat Politècnica de Catalunya (UPC) (Spain) | Focus Group on metaverse Work Group on sustainability | This contribution proposes the creation of a working group on sustainability. |
| FG-MV-I-032 | N/A | Fraunhofer IIS | Immersive media coding standardization for metaverse | Six Degrees of Freedom (6DoF) immersive audio rendering will be a critical component for metaverse. Currently, the ISO/MPEG Audio working group WG6 defines the upcoming MPEG-I Immersive Audio standard for VR/AR. Along with other parts of MPEG-I, the technology supports a complete audio-visual VR or AR presentation in which the user can navigate and interact with the simulated environment using 6DoF. Therefore, this contribution draws the attention of the ITU-T Focus Group to the reported ISO/MPEG standardization activities, especially to MPEG-I Immersive Audio. This contribution proposes MPEG-I as a key technology for metaverse applications and their interoperability. It also proposes the creation of an FG-MV workgroup on immersive media coding. |
| FG-MV-I-033 | N/A | China, Orange, Huawei, China Telecom, China Unicom | Focus Group on metaverse Work Group on sustainability | The development of the metaverse is getting faster. Due to its energy consumption and GHG emissions, the sustainability of metaverse is proposed to be considered with the creation of a working group. |
| FG-MV-I-034 | N/A | China, Huawei, Orange, China Telecom, China Unicom | Proposed new work item on Green Metaverse "Guidance on green and low carbon development of Metaverse" | This document contains a new work item proposal for "Guidance on green and low carbon development of metaverse", which will be discussed at the first meeting of the ITU-T Focus Group on metaverse (Riyadh, 8–9 March 2023). The aim of this work item is to provide a clear picture on how metaverse is currently developing, what kind of application scenarios exist for |

| Doc. number | WG | Source | Title | Abstract |
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| | | | | metaverse, where the highest energy consumption and GHG emissions will be, and to elaborate possible green and low carbon development roadmaps for metaverse. |
| FG-MV-I-035 | N/A | Fraunhofer IIS | Suitable standardization to achieve transcoding free operation for metaverse applications | One of the key elements for many envisioned metaverse use cases is immersive interaction and virtual meetings between humans. Due to the nature of limited network bandwidth, audio visual communication needs low-delay audio and video coding. On the other hand, independent vendors of metaverse applications might introduce different coding schemes due to the lack of agreed guidelines. This contribution emphasizes the need for standardisation of A/V codecs for metaverse applications considering the requirements for a transcoding free operation. |
| FG-MV-I-036 | N/A | National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia) | Securing the development of Metaverse | This contribution discusses the importance of security in the development of metaverse. Additionally, it highlights the importance of prioritizing user safety in metaverse, which includes users' personal data protection, identity management, and users' protection against meta harms. With the integration of these security considerations, metaverse can become a more trustworthy and safe virtual space for users to interact and conduct various activities. |
| FG-MV-I-037 | N/A | National Cybersecurity Authority (NCA) (Kingdom of Saudi Arabia) | Cyber risks, threats, and harms in the Metaverse | The contribution discusses the various cyber-risks and threats associated with the metaverse, with a focus on non-fungible tokens (NFTs) and social engineering. It also highlights the emerging field of "metacrimes", which includes the use of the Darkverse, the growing concerns of money laundering, and financial fraud in the metaverse. To address these risks, the contribution proposes the development of a detailed report on risks, threats, and potential harms with inputs from all stakeholders to inform the standardization roadmap for the metaverse. |
| FG-MV-I-038 | N/A | Ministry of Digital Governance (Greece), University of Thessaly (Greece) | Metaverse: an analysis of definitions | The aim of this document is to propose the development of a Technical Report that will contain a detailed gap analysis in literature and provide "metaverse" with a definition and an explained terminology. |
| FG-MV-I-039 | N/A | Ministry of Digital | Setting the framework for an ICT architecture of | The aim of this document is to propose the development of a |

| Doc. number | WG | Source | Title | Abstract |
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| | | Governance (Greece), University of Thessaly (Greece) | Metaverse | Technical Specification that will contain the ICT architecture development framework of metaverse and will conclude on corresponding architecture views and guides. |
| FG-MV-I-040 | N/A | Ministry of Digital Governance (Greece), University of Thessaly (Greece) | Defining the Business Ecosystem and the value sources of metaverse | The aim of this document is to propose the development of a Technical Report that will define the business ecosystem and the value sources of metaverse. It will examine how metaverse can create economic value for businesses and consumers and social value to citizens, as well as how it will provide new opportunities for economic development and innovation and its relation to the physical economy. |
| FG-MV-I-041 | N/A | King Saud University (Kingdom of Saudi Arabia) | Children Cybersecurity in the Metaverse | The metaverse is becoming increasingly popular among everyone, including children. However, as it is still in its early development phase its parental control and safety measures are inconsistent for children. Hence, it is imperative to initiate discussion on building a set of common criteria and standards for metaverse for age-appropriate usage, child data governance, and risk mitigation procedures. |
| FG-MV-I-042 | N/A | Nahla Mustafa Ali (Independent Researcher) | A New Era of Metaverse: Conforming WiFi to Metaverse using Federated Machine Learning-Assisted Concurrent Transmission | This presentation uses a multidisciplinary approach to engage with questions about ways wireless infrastructure may ensure immersion in metaverse: the next generation of the Internet that transcends videos to immersive experiences. Metaverse will revolutionize games, education, and social interaction. The term originates in creative fiction. Novelist Neal Stephenson coined the term in 1992 in his novel *Snow Crash*, in which he envisioned a virtual world of socializing, work, art, and self-actualization. When Mark Zuckerberg announced "Meta" as an evolution of Facebook in October 2021, big companies like Microsoft, Google, Nvidia, and Qualcomm joined the race by investing in virtual reality. One of the main features of metaverse is ultimate immersion that is the seamless interaction between the users in diverse physical locations. Seamless interaction requires ultra-low latency. Wireless infrastructure is a main pillar to ensure full immersion in metaverse. WiFi is more affordable than other technologies due to a licensed-exempt spectrum. It also has a well-established infrastructure. Deploying WiFi thus encourages entrepreneurs and small businesses to invest in metaverse. This presentation |

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| | | | | discusses factors that affect the deployment of Concurrent Transmission (CXMSN) which is a low-latency forwarding technique. The presentation offers insights regarding enhancing Concurrent Transmission by deploying Federated Machine Learning. |
| FG-MV-I-043 | N/A | Egypt, Sudan | Proposal for the establishment of two working groups within the FG on Metaverse | This contribution aims to propose the creation of two working groups within the structure of the FG-MV in order to study critical issues of high priority, which are the following:<br>- Working group on Economic and Regulatory aspects<br>- Working group on Environmental sustainability |
| FG-MV-I-044 | N/A | Egypt | Legal and Regulatory Implications of Metaverse | This contribution aims to propose a kick off for the work of the suggested Economic and Regulatory working group by presenting some elements that can be studied in the framework of the legal implications of metaverse |
| FG-MV-I-045 | N/A | TSB | ITU IPR Policy | This document contains an overview of ITU's intellectual property policy applicable to FG-MV. |
| FG-MV-I-046 | N/A | TSB | Recommendation ITU-T A.7 | This document contains Recommendation ITU-T A.7 on "Focus groups: Establishment and working procedures". |
| FG-MV-I-047 | N/A | TSB | Tutorial on Focus Group working methods | This document contains a presentation providing a tutorial on Focus Group working methods. |
| FGMV-I-048 | N/A | TSB | ITU Kaleidoscope 2022 papers of relevance to Focus Group on metaverse | This document provides information on one keynote paper, two keynote summaries, and one invited paper from the Kaleidoscope 2022 academic conference (K-2022), published in the Conference Proceedings, which may be relevant to the work of the Focus Group on metaverse. The purpose of this document is to invite the FG to take into consideration these papers in its activities. Annex 1 provides K-2022 highlights.<br><br>An evaluation of all Kaleidoscope 2022 papers with respect to relevance in ITU activities was presented at TSAG, 12–16 December 2022. |
| FGMV-I-049 | N/A | FG-MV Management Team | List of Contributions allotted to the proposed working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV) | This document contains list of Contributions in accordance with the proposed working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV). |

| Doc. number | WG | Source | Title | Abstract |
|---|---|---|---|---|
| FGMV-I-050 | N/A | FG-MV Management Team | List of future physical and virtual meetings | This document contains a list of planned future physical meetings and a list of planned virtual meetings for the Focus Group on metaverse (FG-MV). |
| FGMV-I-051 | N/A | FG-MV Management Team | List of proposed candidate Vice-chairmen for the Focus Group on metaverse (FG-MV) | This document contains list of proposed candidate vice-chairmen for the Focus Group on metaverse (FG-MV). |
| FGMV-I-052 | N/A | FG-MV Management Team | Proposed candidate Chairmen and Vice-chairmen for the proposed working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV) | This document contains list of proposed candidate chairmen and vice-chairmen for the proposed working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV). Their expertise and standardization experience of each detailed technical area has been taken into consideration. |
| FGMV-I-053 | N/A | FG-MV Management Team | Proposed structure for the Focus Group on metaverse (FG-MV) | This document contains the proposed structure for the Focus Group on metaverse (FG-MV). |
| FGMV-I-054 | N/A | TSB | Terms of reference for the Focus Group on metaverse (FG-MV) | This document contains the Terms of reference for the Focus Group on metaverse (FG-MV). |
| FGMV-I-055 | N/A | FG-MV Management Team | List of Documents and their abstracts | This document contains the list of Documents and their abstracts. |
| FGMV-I-056 | N/A | ISO/IEC JTC1/SC43 | LS/i on Liaison statement from ISO/IEC JTC1/SC43 [from ISO/IEC JTC1/SC43] | This LS/i informs about the JTC1/SC43's first plenary and invites the liaison representative of the FG-MV to join the next plenary of JTC1/SC43 on 27–31 March 2023. |
| FGMV-I-057 | N/A | TSB | List of agreed deliverables and editors | This document contains the list of agreed deliverables and editors. |
| FGMV-I-058 | N/A | TSB | List of FG-MV mailing lists | This document contains a list of Focus Group on metaverse (FG-MV) mailing lists. |

## ANNEX 2 – List of FG-MV Output Documents (Riyadh, 8–9 March 2023)

| Doc. number | WG | Source | Title | Abstracts |
|---|---|---|---|---|
| FGMV-O-001 | N/A | FG-MV | Draft LS/o on requesting collaboration on metaverse standardization work [to various entities] | A new ITU-T Focus Group on metaverse (FG-MV) established in December 2022, would like to collaborate with SDOs on metaverse. For accelerating FG work, FG would like to request any information on metaverse standardization work, especially standardization roadmap, published specifications and reports. |
| FGMV-O-002 | WG2 | FG-MV | Draft LS/o on audio/video media coding specifications for metaverse services and applications [to ISO/IEC JTC1/SC29] | ITU-T Focus Group on metaverse (FG-MV) held its first meeting in Riyadh, Kingdom of Saudi Arabia, from 8–9 March 2023, and agreed on its initial structure. Working Group 2 on Applications & Services established a specific Task group on media coding (TG-media coding). FG-MV kindly requests MPEG (ISO/IEC JTC1/SC29) to share information related to immersive audio and video coding and other metaverse-related work items. |
| FGMV-O-003 | N/A | TSB | List of participants - First meeting of ITU Focus Group on metaverse | This document contains a list of participants of the first meeting of the ITU Focus Group on metaverse. |
| FGMV-O-004 | N/A | TSB | Chairmen and Vice-chairmen for the working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV) | This document contains list of chairmen and vice-chairmen for the working groups (WGs) and task groups (TGs) of the Focus Group on metaverse (FG-MV) as agreed on 9 March 2023. |
| FGMV-O-005 | N/A | TSB | List of agreed deliverables and editors | This document contains the list of agreed deliverables and editors. |
| FGMV-O-006 | N/A | FG-MV Chairman | Draft Report of the first meeting of the Focus Group on metaverse (FG-MV), Riyadh, 8–9 March 2023 | This document contains the draft report of the first meeting of the ITU-T Focus Group on metaverse (FG-MV), which was held on 8–9 March 2023 in Riyadh, Kingdom of Saudi Arabia. |
| FGMV-O-007 | N/A | TSB | FG-MV structure and workplan | This document contains agreed FG-MV structure, list of chairmen and vice-chairmen for the working groups (WGs) and task groups (TGs) of the FG-MV and list of deliverables. |

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