

ITU-T 디지털 트윈 기반 메타버스 가상-현실 연동 표준화 동향

2024. 10. 30.

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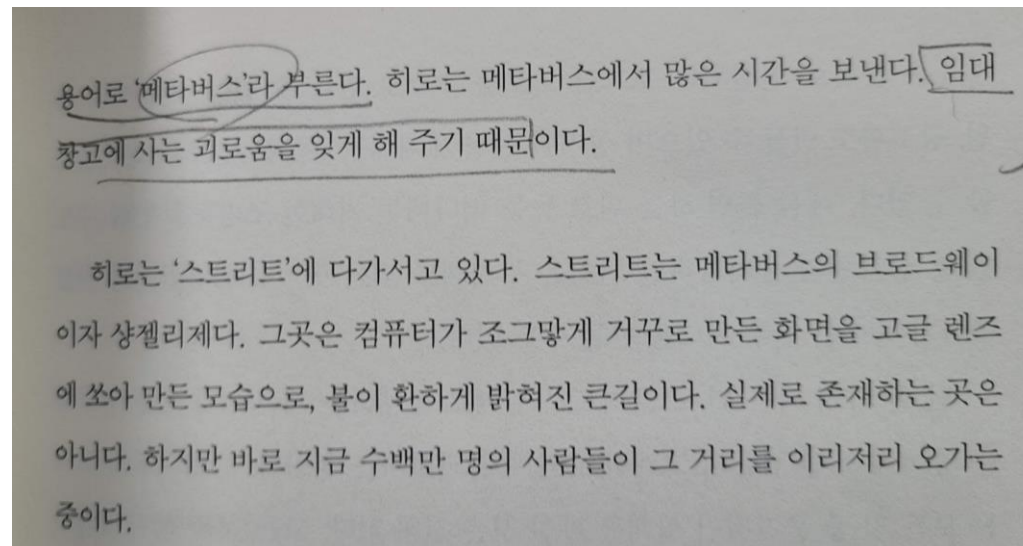
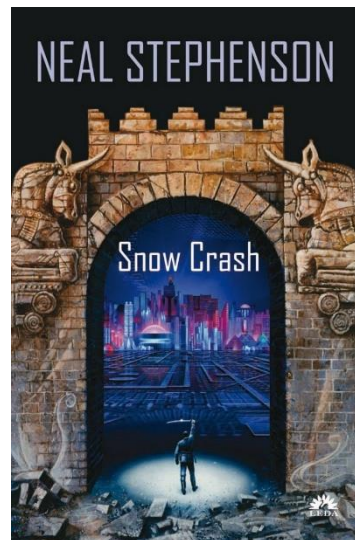
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메타버스란 무엇인가?

■ 정의

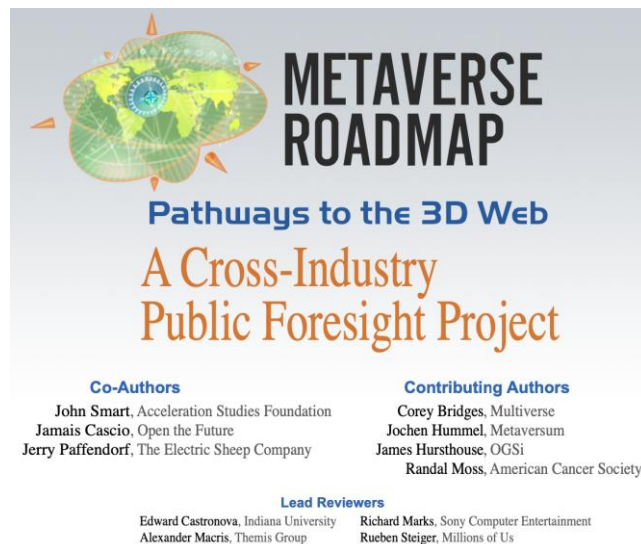
- 메타버스(metaverse) = 가상, 초월을 의미하는 “메타(meta)”+ 현실세계를 의미하는 “유니버스(universe)”
- SF 작가 윌리엄 깁슨(William Gibson)은 「Newromancer」(‘82) 통해 무한한 크기의 3차원 관계형 데이터베이스로 구축된 **사이버 공간**(Cyberspace)이라는 개념 정립
- ‘92년 닐 스티븐슨(Neal Stephenson)의 소설 「Snow Crash」에서 **메타버스**라는 용어를 사용
✓ 고글(3D영상), 이어폰(디지털 스테레오)을 통해 <메타버스>라 불리는 세계로 들어간다.



메타버스란 무엇인가?

■ 개념

- 미국의 비영리 연구 그룹 ‘가속연구재단(ASF, Acceleration Studies Foundation)’는 「메타버스 로드맵」 보고서('07)에서 개념 구성 및 특성 분류 시도
- 기술의 **사적 활용 수준**(외적-내적)와 **디지털전환** 강도(시뮬레이션-증강)라는 두 개의 축을 교차하여 **메타버스의 개념 구성**
 - ✓ 두 축의 교차를 통해 ‘증강현실(augmented reality)’, ‘라이프로깅(life logging)’, ‘미러월드(mirror world)’, ‘가상세계(virtual reality)’로 분류
- ASF는 ‘메타버스’는 현실의 단순한 가상화, 혹은 현실과 완벽히 반대되는 개념이 아니라 현실-가상 세계 간 **교차(junction)·결합(nexus)·수렴(convergence)**되는 관계로 정의



메타버스란 무엇인가?

- 메타버스와 디지털 트윈 비교
 - 디지털 트윈과 개념적으로 유사 (현실세계와 연결)
 - 메타버스는 완전한 가상의 객체도 가능
 - 메타버스가 새로운 형태의 매체로 발전 가능성 존재
 - 멀티버스 형태의 메타버스
 - ✓ 개인마다 다른 메타버스
 - 메타버스 안에서 경제 활동 가능



출처: https://www.hdec.kr/kr/newsroom/news_view.aspx?NewsSeq=696&NewsType=BRAND&NewsListType=news_clist

구분	디지털 트윈	메타버스
목적	가상모델과 물리적 자산의 센싱정보를 연동하여 현실에서 발생하는 상황 예측 및 최적화 등 관리에 활용	물리적 시공간의 제약에서 벗어나 언제 어디서든 사회 활동을 할 수 있도록 하기 위한 도구로 활용
주 적용대상	부품, 제품, 시스템, 공정, 공급망 등 제조 전반	SNS, 게임, 공연 등 영상 기반 콘텐츠 및 미디어 서비스 전반
핵심기술	센싱, 모델링 및 시뮬레이션, IoT, Cloud 등	XR, CG(Computer Graphic), 라이프 로그, Computing, Cloud, Network 등
주 응용분야	스마트공장(설계, 제조), 항공, 전력(진단, 예측), 자동차(설계) 등	게임, 비대면공연, SNS, XR, 방송, 교육 등



출처: 산업경제리서치, 2022년 국내외 메타버스 산업 및 시장분석과 비즈니스 전략

메타버스에서 표준의 중요성

**Support a safe, secure,
and regulated metaverse**

**Allow for interoperability
within the metaverse**



**Ensure that the metaverse
is open and accessible to all**

**Ensure that technologies
can work together
seamlessly in the metaverse**

메타버스 관련 표준화 동향

- 여러 표준화 기구별로 메타버스 플랫폼의 요소 기술 및 도메인에 해당하는 애플리케이션의 표준화 추진 중

표준화 기구	내용
ITU-T SG 16	Multimedia, Digital human, Immersive systems and Services, Blockchain, AI, etc.
ITU-T SG 17	Security aspects related to metaverse
ITU-T SG 20	IoT and smart city aspects related to metaverse
ISO/IEC Joint SEG 15 on Metaverse	Definition, needs and initial roadmap for standardization activities, etc.
ISO/IEC JTC 1/SC 29	Media-oriented virtual-reality media interworking format, compression, etc.
ISO/IEC JTC 1/SC 24	3D Computer Graphics, Mixed Reality, Augmented Reality, etc.
ISO TC 172/SC 9	Laser and electro-optical systems
ISO TC 133	Clothing sizing systems - size designation, size measurement methods and digital fittings
ISO TC 133/WG 2	Digital Fitting
IEC TC 110/WG 6	3D Display Devices
IEEE 2888 WG	Interface for Cyber and Physical World, Orchestration of Digital Synchronization between Cyber and Physical World, Holographic Visualization, etc.
IEEE 3079 WG	HMD based VR Sickness Reducing, Mixed Reality for Motion Learning, etc.

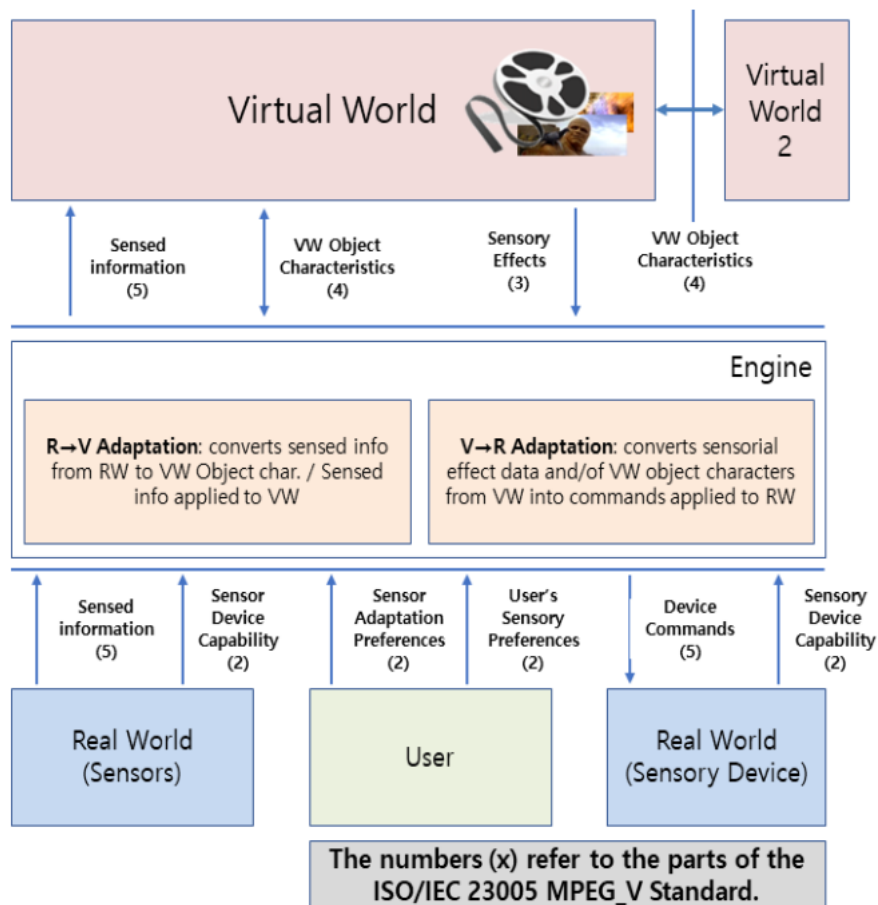
메타버스 관련 표준화 동향

- 여러 표준화 기구별로 메타버스 플랫폼의 요소 기술 및 도메인에 해당하는 애플리케이션의 표준화 추진 중

표준화 기구	내용
3GPP	5G/6G standards have been evolving to support XR and multimedia services with immersive user experiences - Local Metaverse Study Item has been approved in Feb. 2022. in 3GPP SA1(Services WG) - Providing timely media to multiple users with sufficiently low latency and synchronization to enable services based on rapid interaction with virtual objects
IETF	Side meetings on Metaverse
Khronos Group	Computer graphics acceleration technology, VR. AR. MR device interface, etc.
W3C	MICG(Metaverse Interoperability Community Group): Bridge virtual worlds by designing and promoting protocols for identity, social graphs, inventory, etc.
OpenHMD project	provide a Free and Open Source API and drivers for immersive tech., such as HMDs
Open Metaverse Operating System	providing a common and open source OS for the Metaverse
METaverse STANDARDS FORUM	A Venue for cooperation between Standards Organizations and Companies to foster the development of interoperability standards for an Open and Inclusive Metaverse
Open Metaverse Foundation	creating open standards and software to support the open, global, scalable Metaverse
Open Metaverse Alliance for Web3	ensure virtual land, digital assets, ideas, and services are highly interoperable between platforms and transparent to all communities

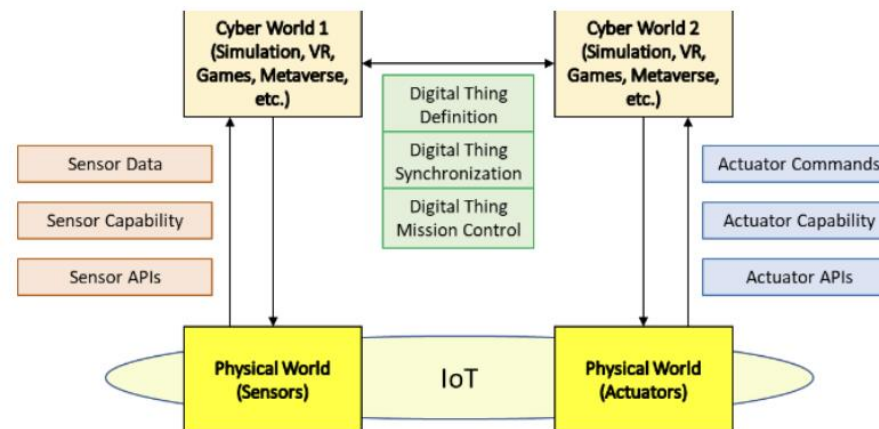
메타버스 관련 표준화 동향

- ISO/IEC 23005-4:2018 Information technology — Media context and control — Part 4: Virtual world object characteristics

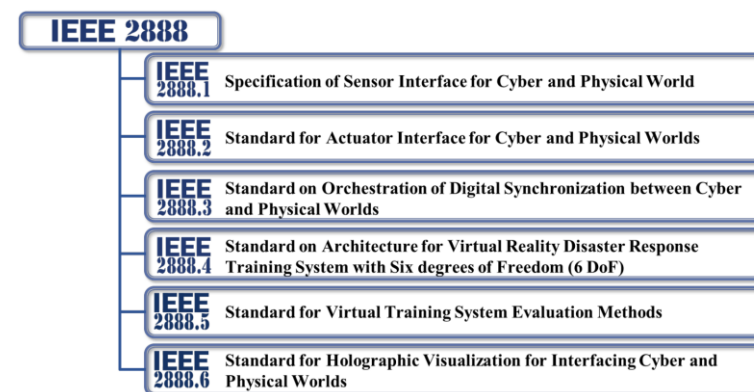


< MPEG-V System Architecture >

- IEEE 2888 Working Group - Interfacing Cyber and Physical World Working Group



< IEEE 2888 Overall Architecture >



< IEEE 2888 표준 구성 >

ITU FG-MV의 설립 배경

- ITU-T SG 16 (Multimedia and related digital technologies)
 - The necessity of standardization work on multimedia related metaverse issues was discussed at the SG 16 meeting in January 2022
 - ✓ Correspondence Group on Metaverse (**CG-Metaverse**) was established with ToR
 - Co-Chairman : Shin-Gak KANG (ETRI/Korea), Kepeng LI (Tencent/China)
 - ToR of CG-Metaverse
 - ✓ carry out the preliminary standardization analysis to help SG16 effectively make decision on appropriate standardization issues and work method in the next SG16 meeting
 - ✓ to discuss technical aspects leading to a SG16 analysis of future standardization directions, potential work items and future coordination needs
 - CG-Metaverse discussed standardization issues and the **need for FG establishment** through three e-meetings
 - ✓ First (06 July 2022), Second (10 August 2022), Third (8 September 2022)

ITU FG-MV의 설립 배경

- ITU-T SG 16 (Multimedia and related digital technologies)
 - **Decided to establish a Focus Group** through discussions on metaverse standardization issues and working methods at the SG 16 meeting in October 2022
 - Proposed to ITU-T TSAG(Telecommunication Standardization Advisory Group) for approval of establishment of FG-MV

- ITU-T TSAG meeting (December 2022)
 - **Decided to establish the Focus Group on metaverse (FG-MV)** under TSAG
 - ✓ Scope of the FG-MV covers more than a single Study Group of ITU-T
 - ✓ Most of the ITU-T SGs expressed their interest and willingness to participate in FG-MV
 - Access link for ITU-T FG-MV
 - ✓ <https://www.itu.int/en/ITU-T/focusgroups/mv/Pages/default.aspx>

ITU FG-MV의 역할

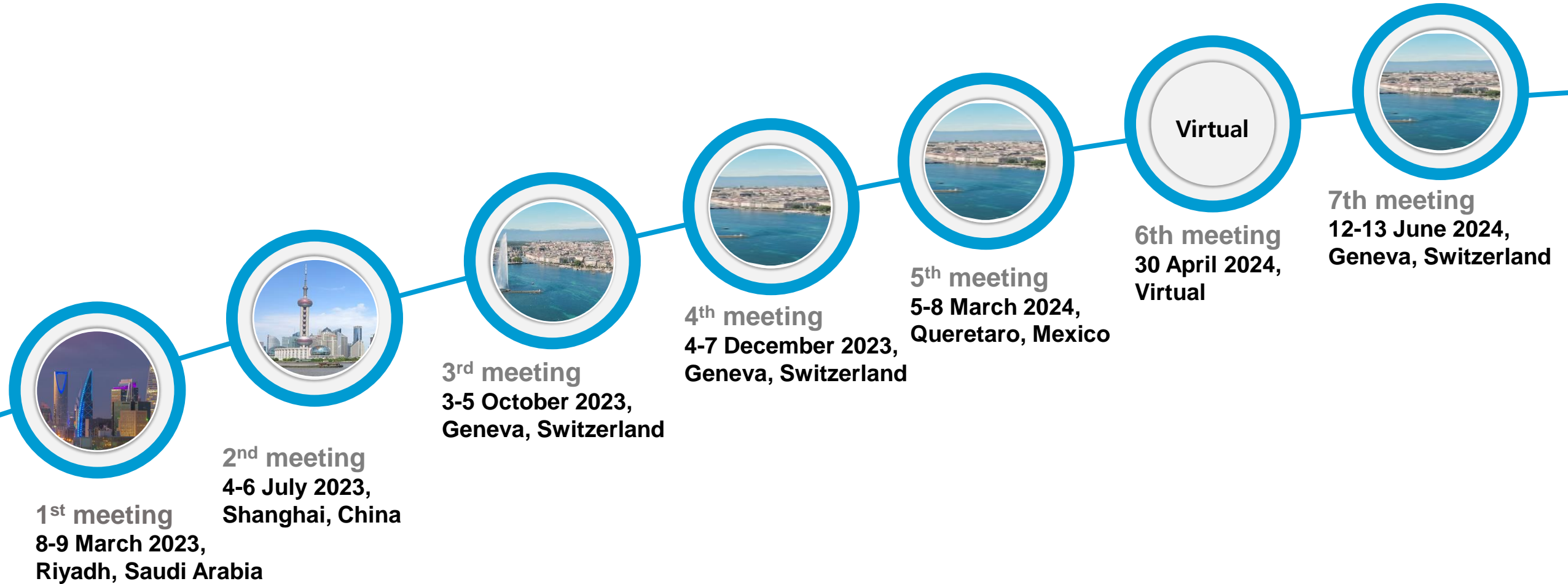
■ Objectives

- To study **terminology, concepts**, vision and ecosystem.
- To identify and study the **enabling technologies**, their evolution and key tasks for standardization purposes,
 - including multimedia, network optimization, connectivity, interoperability of services and applications, security, protection of personally identifiable information, quality (including bandwidth), digital assets (e.g., digital currencies), IoT, accessibility, digital twin and environmental sustainability
- To study and gather information to develop a pre-standardization roadmap.
- To build a community of experts and practitioners to unify the concepts, develop common understandings, so that it be benefiting the global community.
- To identify stakeholders with whom ITU-T could collaborate and establish liaisons and relationships.
- To stimulate international collaboration, to share knowledge and best practices, and to explore the opportunities and challenges related to interoperability.
- To provide a platform to share findings and for dialogue on economic, policy and regulatory implications of metaverse related to telecommunication/ICT.

ITU FG-MV의 역할

- Specific tasks and deliverables
 - To develop deliverables related to working definitions and terminology, use cases, and requirements.
 - To develop deliverables with guidelines and collection of best practices, including a gap analysis and a pre-standardization roadmap.
 - To develop deliverables related to technical frameworks, and architecture, taking into consideration security requirements and approaches, PII protection and design principles to meet accessibility requirements.
 - To organize and participate in workshops to share and collect knowledge and experience from a wide range of expert community and stakeholders.
 - Upon completion of its lifetime, to provide the final report and a complete set of deliverables to TSAG.

ITU FG-MV 회의 이력



FG-MV 구조



WORKING GROUP 1

General



WORKING GROUP 2

Applications
& Services



WORKING GROUP 3

Architecture &
Infrastructure



WORKING GROUP 4

Virtual/Real World
Integration



WORKING GROUP 5

Interoperability



WORKING GROUP 6

Security, Data &
PII Protection



WORKING GROUP 7

Economic,
Regulatory &
Competition Aspects



WORKING GROUP 8

Sustainability,
Accessibility &
Inclusion



WORKING GROUP 9

Collaboration

ITU FG-MV WG4

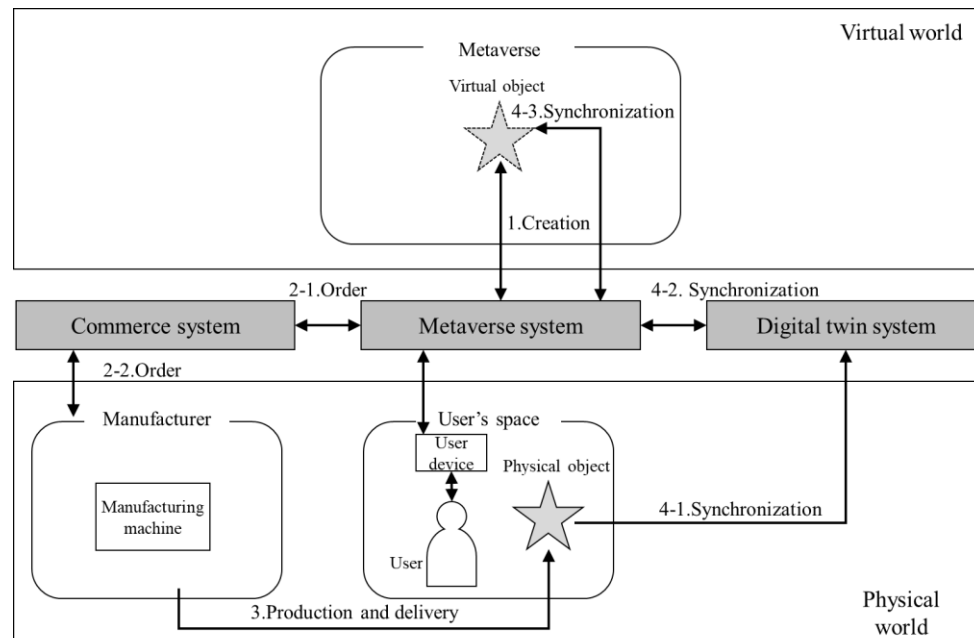
- 물리 세계와 가상 세계의 통합을 위한 기술 문서 개발 주도
- FG-MV Working Group 4: Virtual/Real World Integration
 - Interoperable technologies, including use cases and requirements, to enable the integration of virtual world with real world, and to enable the convergence between virtual world and real world (e.g., Mechanisms for synchronization)
 - Structured data models for virtual and real worlds mapping
 - Applications and services integration between virtual and real worlds
- WG4 결과물
 - Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds
 - Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds

ITU FG-MV WG4 – FGMV-28

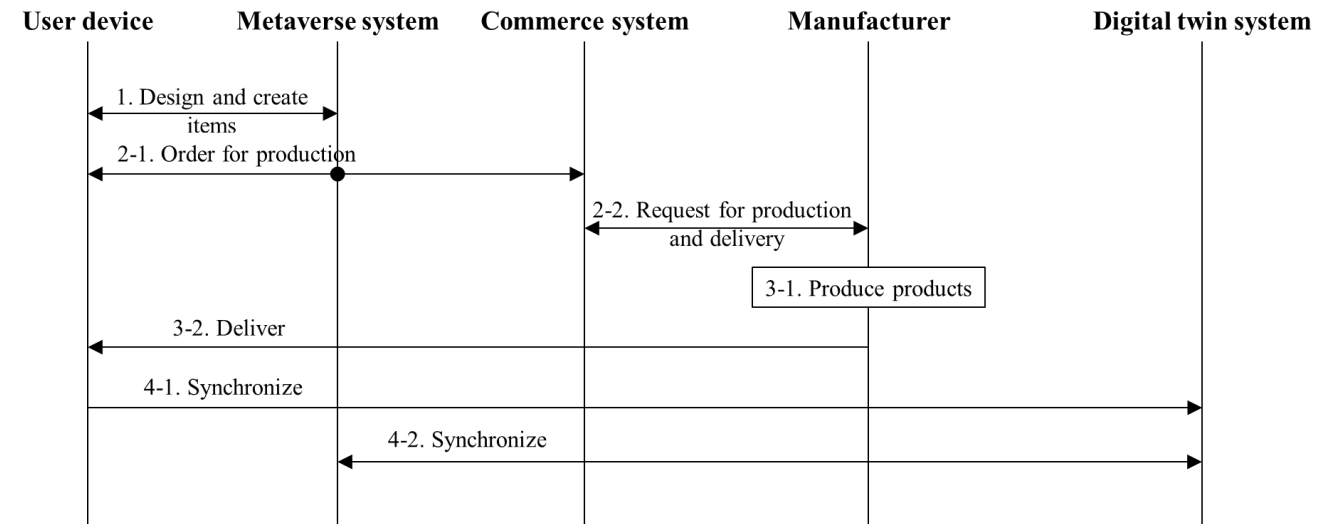
- Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds
 - Service scenarios of the metaverse based on digital twins
 - Requirements for the metaverse based on digital twins

ITU FG-MV WG4 – FGMV-28

- Service scenarios of the metaverse based on digital twins
 - Interaction initiated from the virtual world
 - Interaction initiated from a physical world
 - Synchronization between virtual and physical worlds



Conceptual diagram for delivering products generated in the virtual world to the physical world



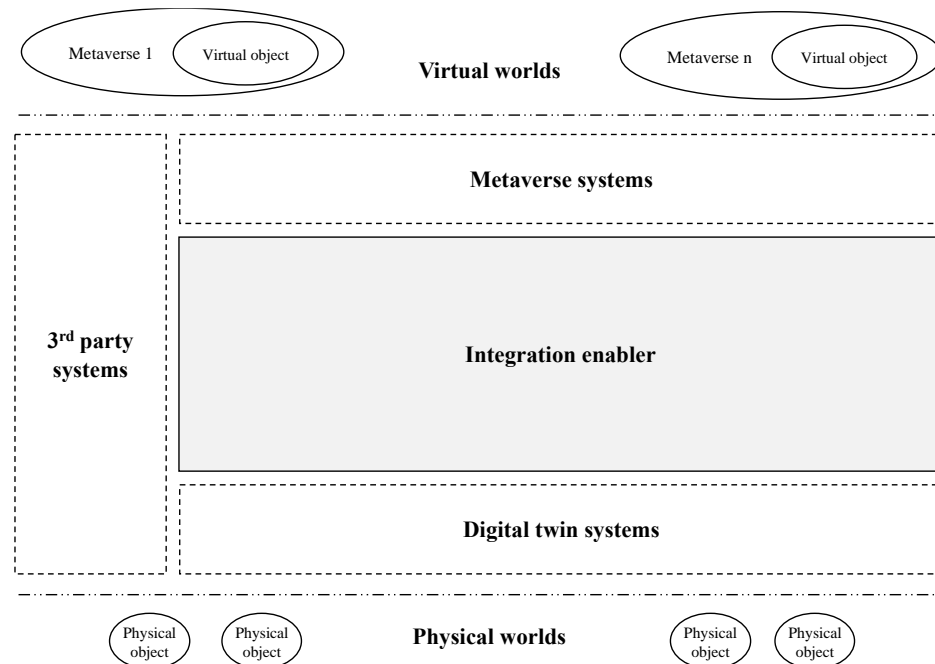
Operation flows for delivering products generated in the virtual world to the physical world

ITU FG-MV WG4 – FGMV-28

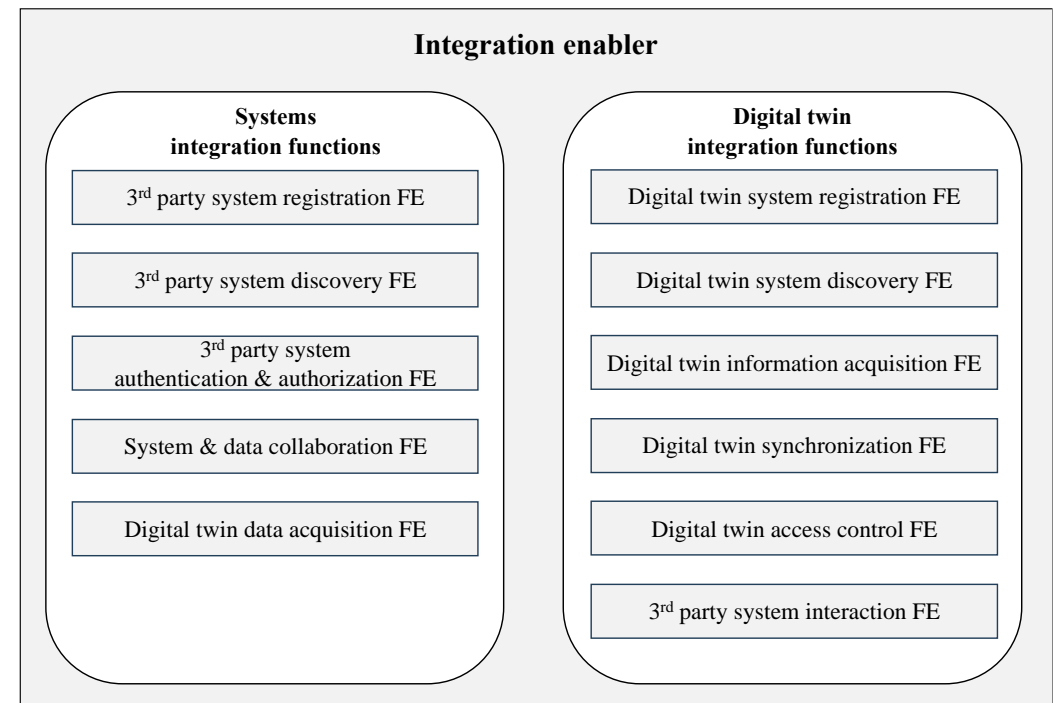
- Requirements for the metaverse based on digital twins
 - Requirements related to digital twin
 - Requirements related to metaverse
 - Requirements related to system interaction

ITU FG-MV WG4 – FGMV-29

- Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds
 - Reference model to integrate the metaverse based on digital twins to physical world applications
 - Functional entities of the reference model for the metaverse based on digital twins



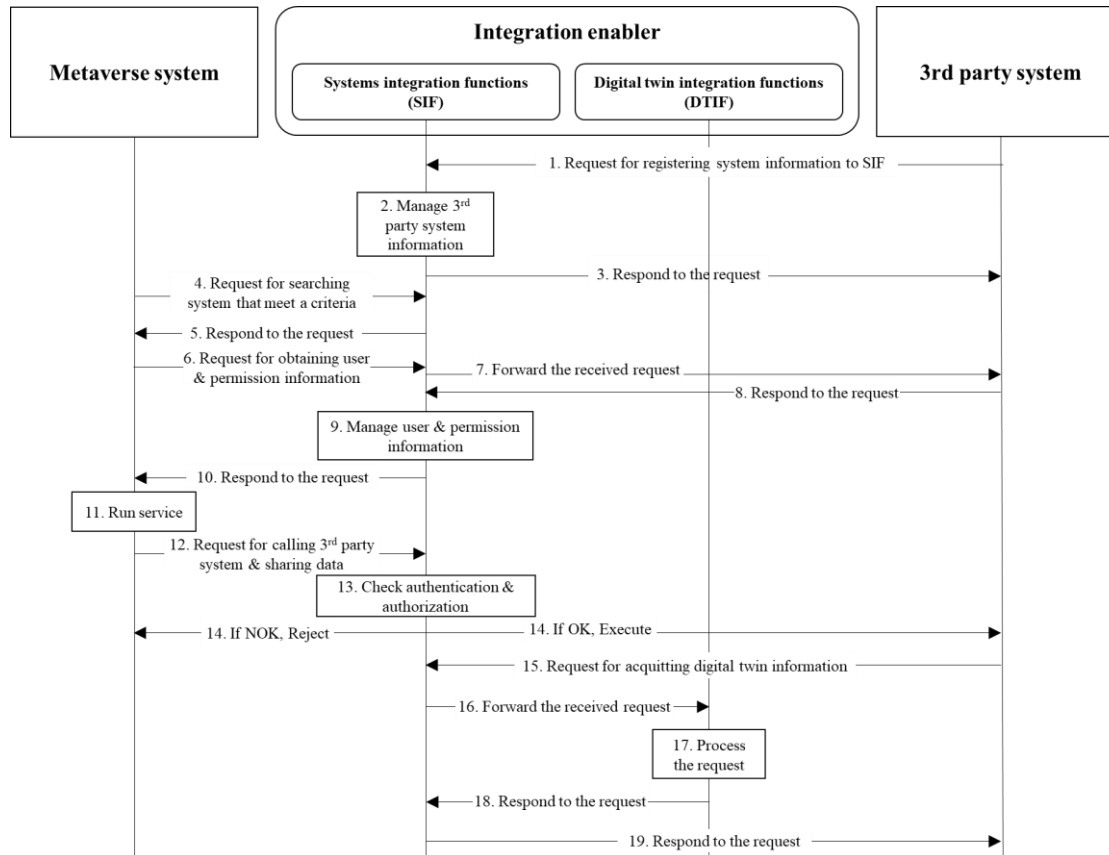
< Reference model >



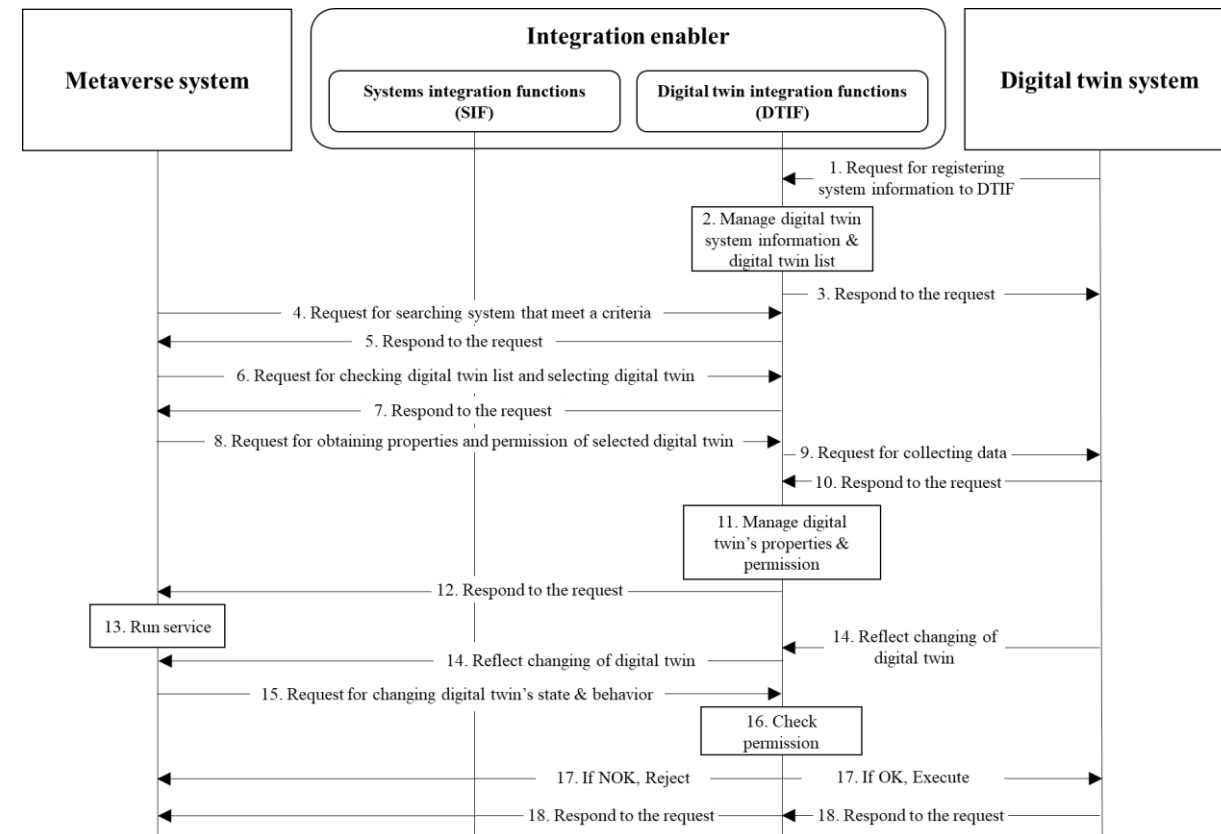
< Functional entities >

ITU FG-MV WG4 – FGMV-29

Operational flow



< Operational procedures of integrating 3rd party systems >



< Operational procedures of integrating digital twin systems >

ITU-T SG20에서의 표준화

Work item: [Y.dtmv-reqts](#)

Subject/title: Requirements of integrating virtual and physical worlds through digital twins for the metaverse

Status: [Under study](#)

Approval process: AAP

Type of work item: Recommendation

Work item: [Y.dtmv-ref](#)

Subject/title: Reference model of integrating virtual and physical worlds through digital twins for the metaverse

Status: [Under study](#)

Approval process: AAP

Type of work item: Recommendation

Work item: [Y.dtmv-if](#)

Subject/title: Interface model and its requirements of integrating virtual and physical worlds through digital twins for the metaverse

Status: [Under study](#)

Approval process: AAP

Type of work item: Recommendation

맺음말

- 메타버스를 통해서 물리 세계와 가상 세계가 통합된 서비스 가능
- 물리 세계로의 반영을 위하여 성숙된 디지털 트윈 기술이 필요
- ITU FG-MV 의 결과물을 기반으로 ITU-T SG20에서 권고안 개발 중

감사합니다