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Information technology — Metaverse —

Part 1: Concepts, characteristics and technology

Technologies de l'information — Métavers —

Partie 1: Concepts, caractéristiques et technologie

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Introduction

The metaverse is a conceptual extension of the internet envisioned as a persistent, universal, immersive, interactive and socially engaging virtual environment that can be facilitated by virtual reality (VR) and augmented reality (AR)[1]. The term metaverse was first introduced in the 1992 science fiction novel Snow Crash[2] where people access a virtual urban environment from VR goggles or public terminals.

The metaverse comprises a set of digitally-constructed virtual worlds that can be accessed via various modalities. The metaverse is intended to be a decentralized 3D virtual environment, in contrast to the current predominantly 2D internet. Similar to the internet, it is always operational even though some parts can be non-operational for maintenance reasons.

VR provides immersion into the metaverse while AR enables metaverse elements to be layered onto the real world. In addition to these immersive technologies, access can also be achieved using conventional devices like keyboards, mice and screens to provide a less immersive and interactive experience.

Numerous organizations are actively engaged in shaping and establishing the metaverse. This document is intended to provide a general overview of the metaverse and define the foundational terms and concepts. It is intended to be the first of a series on aspects of the metaverse. Future parts are planned for framework and architecture, use cases, reference model, information model and governance.

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Information technology — Metaverse —

Part 1:
Concepts, characteristics and technology

1 Scope

This document provides an overview and defines fundamental terms and concepts for the metaverse.

This document specifies the following functionalities:

a) overview of the metaverse with description of its characteristics and technologies;

b) fundamental concepts;

c) terminology and definitions;

d) participation and oversight.

2 Normative references

There are no normative references in this document.

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3 Terms, definitions and abbreviated terms

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3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
reality
set of facts, beliefs and rules that are accepted as true

[SOURCE: ISO 9241-820:2024, 3.2.1]

3.1.2
real world
physical world
natural world as experienced by the user

[SOURCE: ISO 9241-820:2024, 3.2.3]

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3.1.3
virtual world
virtual environment
spatial organization of multiple *virtual objects* (3.1.5), potentially including global behaviour

Note 1 to entry: The simulated environments are often interactive and can be accessed by multiple users through online interfaces.

Note 2 to entry: The physical world in which people live and its related characteristics is referred to as the *real world* (3.1.2) to differentiate it from a virtual world.

[SOURCE: ISO/IEC 18039:2019, 3.1.25]

3.1.4
virtual space
any digital environment or interface, whether interactive or non-interactive

Note 1 to entry: A virtual space is a broader concept than a *virtual world* (3.1.3). It can refer to any computer-generated setting.

3.1.5
virtual object
computer-generated entity that is designated for augmentation in association with a *physical object* (3.1.6) data representation

Note 1 to entry: In the context of MAR, it usually has perceptual (e.g. visual, aural) characteristics and, optionally, dynamic reactive behaviour.

[SOURCE: ISO/IEC 18039:2019, 3.1.24]

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3.1.6
physical object
real object
object that exists in the *real world* (3.1.2)

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[SOURCE: ISO/IEC 18039:2019, 3.1.15]

3.1.7
virtual reality
VR
set of artificial conditions created by computer and dedicated electronic devices that simulate visual images and possibly other sensory information of a user's surroundings with which the user is allowed to interact

Note 1 to entry: The artificial conditions do not reflect a user's real-time physical environment.

[SOURCE: ISO 9241-394:2020, 3.8]

3.1.8
augmented reality
AR
interactive experience of a *real world* (3.1.2) environment whereby the objects that reside in the *real world* (3.1.2) are augmented by computer-generated perceptual information

[SOURCE: ISO/IEC 18038:2020, 3.2]

3.1.9
mixed and augmented reality
MAR
integration of *real world* (3.1.2) and *virtual worlds* (3.1.3) including *mixed reality* (3.1.10) and *augmented reality* (3.1.8)

Note 1 to entry: MAR is often used interchangeably with *MR* (3.1.10).

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[SOURCE: ISO/IEC 18038:2020, 3.13]

3.1.10
mixed reality
MR
display continuum in which both real and virtual images are combined in some way and in some proportion

Note 1 to entry: *Augmented reality (AR)* (3.1.8) and *virtual reality (VR)* (3.1.7) are considered to be on the mixed reality continuum[7].

[SOURCE: ISO/IEC TR 23843:2020, 3.4]

3.1.11
XR
real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables

Note 1 to entry: Within this document, XR is used as an umbrella term encapsulating *AR* (3.1.8), *VR* (3.1.7), *MR* (3.1.10) and other environments.

[SOURCE: ISO/IEC 5927:2024, 3.1.5]

3.1.12
simulation
use of a similar or equivalent system to imitate a real system, so that it behaves like or appears to be the real system

[SOURCE: ISO 16781:2021, 3.1.9]

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3.1.13
physics engine
software component that models the laws of physics inside a digital environment so objects behave in a way that feels physically plausible

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3.1.14
presentation engine
real time rendering component or components of a game, rendering, or other software engine relevant for creating the visual, audio and/or tactile representations of the media on behalf of the system

Note 1 to entry: The presentation engine is especially relevant for immersive display processing systems that leverage the capabilities of the engine to provide visual rendering capabilities of an immersive display.

[SOURCE: ISO/IEC TR 23090-27:2025, 3.17]

3.1.15
game engine
relevant libraries for functions such as a *physics engine* (3.1.13) and *presentation engine* (3.1.14) for the presentation of visual, audio and or haptic aspects of the media comprising the games

[SOURCE: ISO/IEC TR 23090-27:2025, 3.10]

3.1.16
presence
psychological sense of being in a particular environment

Note 1 to entry: Presence is about physical engagement, while *virtual presence* (3.1.17) is about engaging with others via digital *interaction* (3.1.57).

[SOURCE: ISO 9241-820:2024, 3.1.2, modified — Note 1 to entry has been added]

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3.1.17
virtual presence
ability of a user to feel that they are present in a virtual location such as an immersive simulation using technologies such as *virtual reality (VR)* (3.1.7) or *augmented reality (AR)* (3.1.8)

Note 1 to entry: Refer to *presence* (3.1.16) for the distinction between presence and virtual presence.

3.1.18
telepresence
set of technologies that allows a person to feel as if they are present at a place other than their true location

Note 1 to entry: Telepresence typically involves technologies such as video conferencing and *VR* (3.1.7) to create a realistic experience for users interacting with remote locations or other users. These remote locations and users are generally real environments and people, in contrast to *virtual presence* (3.1.17) where simulated environments are involved.

3.1.19
immersion
<metaverse> experience and participation in a particular environment

[SOURCE: ISO 9241-820:2024, 3.1.1]

3.1.20
agent
entity that takes programmed actions, such as software or a device

Note 1 to entry: Agents can provide recommendations, help with tasks, or facilitate *interactions* (3.1.57). Agents operate behind the scenes, unlike *avatars* (3.1.23), using *AI* (3.1.42) to analyse user behaviour and preferences [see *AI agent* (3.1.22)]. They can also manage environments and automate processes, making the *metaverse* (3.1.29) more dynamic.

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Note 2 to entry: A *chatbot* (3.1.25) is an example of an agent.

Note 3 to entry: *Software agent* (3.1.21) is an example of an agent.

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[SOURCE: ISO 27789:2021, 3.4, modified — Notes to entry added.]

3.1.21
software agent
agent (3.1.20) that perceives its environment and takes actions that maximise its chance of successfully achieving its goals

[SOURCE: ISO/IEC TR 29119-11:2020, 3.1.73, modified — "Digital entity" replaced with agent.]

3.1.22
AI agent
automated entity that senses and responds to its environment and takes actions to achieve its goals

Note 1 to entry: A *chatbot* (3.1.25) is an example of an AI agent.

[SOURCE: ISO/IEC 22989:2022, 3.1.1, modified — Note 1 to entry added.]

3.1.23
avatar
entity that can be used as a (visual) representation of the user inside the virtual environments

EXAMPLE A player's representation in a video game and human or fantastic representation of a person's self in online worlds.

Note 1 to entry: Avatars may represent humans, non-humans (aliens) and other living creatures (e.g. animals including pets).

[SOURCE: ISO/IEC 23005-4:2018, 3.1.1, modified — Note 1 to entry added.]

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3.1.24
AI avatar
avatar (3.1.23) controlled by an *AI system* (3.1.43)

Note 1 to entry: AI avatars are interactive, personalised and adaptable, making them suitable for a variety of applications whereas *NPCs* (3.1.26) are primarily designed to enrich the gaming experience with fixed roles and behaviours.

3.1.25
chatbot
software application that is designed to mimic human conversation through text or voice *interactions* (3.1.57)

3.1.26
non-player character
NPC
digital character controlled by software, sometimes including *AI* (3.1.42), and not by a human

Note 1 to entry: NPCs are designed to populate the *metaverse* (3.1.29) and engage users in various ways. They can serve specific roles to enrich the narrative.

Note 2 to entry: NPCs often have scripted behaviours.

3.1.27
hologram
three-dimensional photographic representation produced by an arranged interference between coherent light beams

[SOURCE: ISO 5127:2017, 3.3.3.23]

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3.1.28
holographic display
three-dimensional display that renders a complex optical wavefront

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Note 1 to entry: A holographic display can use a *hologram* (3.1.27).

[SOURCE: ISO/IEC 21794-1:2020, 3.15]

3.1.29
metaverse
set of universal, immersive *virtual worlds* (3.1.3) that can be enhanced by *virtual reality (VR)* (3.1.7) and *augmented reality (AR)* (3.1.8)

Note 1 to entry: As the metaverse concept continues to evolve, a range of definitions has emerged across different domains and stakeholder communities[18].

Note 2 to entry: Common metaverse themes are industrial, commercial, gaming, education and enterprise. A metaverse *virtual world* (3.1.3) can combine several of these themes.

Note 3 to entry: *VR* (3.1.7) and *AR* (3.1.8) offer novel interaction modalities, however their adoption has been constrained by user comfort, accessibility and physiological factors. Accordingly, anchoring metaverse implementations to 3D vision — rather than supporting inclusive 2D renderings of 3D environments — can limit accessibility and market viability.

3.1.30
metaverse system
group of interacting or interrelated elements that act according to a set of rules to form a unified whole within the *metaverse* (3.1.29)

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3.1.31
metaverse platform
persistent, real-time rendered 3D world and simulation that supports continuity of identity, objects, history, payments, and entitlements, and can be experienced synchronously by an effectively unlimited number of users, each with an individual sense of *presence* (3.1.16)

Note 1 to entry: There are many prototype metaverse platforms.

3.1.32
digital twin
DTw
digital representation of a target entity with data connections that enable convergence between the physical and digital states at an appropriate rate of synchronization

Note 1 to entry: Digital twin has some or all of the capabilities of connection, integration, analysis, simulation, visualization, optimization and collaboration.

Note 2 to entry: A digital twin can provide an integrated view of the target entity throughout its life cycle.

Note 3 to entry: A digital twin manifests when data is exchanged between an existing *physical object* (3.1.6) and its digital model in both directions and is fully integrated. The digital model acts as a controlling representation of the *physical object* (3.1.6). Within the *physical object* (3.1.6) or digital model, there can be objects, real or virtual, that induce changes of state. Hence, a change in the *physical object* (3.1.6) immediately leads to a change in the digital model or *virtual environment* (3.1.3), and vice versa[19].

[SOURCE: ISO/IEC 30173:2023, 3.1.1, modified — Note 1 to entry added collaboration, Note 2 to entry modified, Note 3 to entry added.]

3.1.33
liminal space
boundary between two points in time, space, or both

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Note 1 to entry: In the *metaverse* (3.1.29), liminal spaces will be required to enable users to transition smoothly between *virtual spaces* (3.1.4) without experiencing psychological issues such as anxiety.

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3.1.34
walled garden
closed ecosystem in which only a limited set of users have access to their software or hardware technology

Note 1 to entry: Most current social media platforms can be considered walled gardens since users are restricted to the specific platform's environment.

3.1.35
Web 1.0
first version of the internet mainly serving the use of e-mail and the posting and consultation of static HTML pages

[SOURCE: ISO 5127:2017, 3.1.9.04]

3.1.36
Web 2.0
loosely defined model of interactive internet services and information sharing

Note 1 to entry: See *Web 1.0* (3.1.35).

[SOURCE: ISO 5127:2017, 3.1.9.05, modified — Note 1 to entry added.]

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