METAVERSE FINLAND ECOSYSTEM White Paper

The Metaverse Definition 2026

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Executive Summary

The Metaverse is the totality of digital information connected to the physical world, human activity, and human imagination. It is a persistent, shared layer that reflects, simulates, augments, and interacts with reality."

The Metaverse is entering a phase where clarity matters more than hype. This document provides a stable, human-centric definition intended to align decision-makers, industries, academia, and citizens around a shared conceptual foundation. It frames the Metaverse as the next evolutionary phase of the Internet: a persistent and shared digital layer interwoven with the physical world, human activity, and human imagination. The definition presented here is intentionally foundational and non-technical, designed to remain relevant across industries, technologies, and generations of implementation.

The Metaverse is not a single platform, device, or virtual world. It is an emerging reality layer formed as data, digital twins, intelligent agents, and spatial interfaces become part of everyday life across work, industry, public services, and society at large.

A central claim of this document is that Artificial Intelligence (AI) is both an enabling technology and the native intelligence of the Metaverse. Without AI, the Metaverse cannot scale, adapt, or remain usable. AI transforms raw data into interpretable environments, actionable digital twins, context-aware interactions, and human-scale experiences. Through generative and agentic capabilities, AI removes traditional bottlenecks in content creation and operational complexity, enabling broad and inclusive adoption beyond isolated pilots and niche use cases.

This definition is grounded in Finland's Metaverse Strategy and its ongoing national implementation ecosystem. It is intended as a living reference point: stable enough to guide action today, yet flexible enough to evolve as technologies, societal expectations, and real-world usage mature. Its authority comes from clarity, shared values, and continuous collective development.

Acronyms and Terminology

AGI (Artificial General Intelligence)
A form of Artificial Intelligence with general-purpose cognitive capabilities comparable to those of humans, enabling flexible learning and problem-solving across a wide range of domains.

AI (Artificial Intelligence)
Computational systems capable of perceiving data, learning from experience, reasoning, and acting toward defined goals within digital or cyber-physical environments.

AI Avatar
An AI-driven digital agent with a representational form—often humanoid—that interacts with humans and other systems on behalf of an individual, organization, or service. AI avatars serve as perceptible interfaces to AI capabilities within the Metaverse.

Agentic AI / AI Agent
An AI system capable of autonomous or semi-autonomous action, goal pursuit, and interaction with other agents, systems, or humans. AI agents operate persistently over time and can plan, execute, and adapt actions within defined constraints.

AR (Augmented Reality)
Technology that overlays digital information and content onto the physical world, enhancing perception without fully replacing the real environment [4, Milgram 1994].

ASI (Artificial Super Intelligence)
A hypothetical form of Artificial Intelligence that surpasses human intelligence across all cognitive domains, including reasoning, creativity, and strategic decision-making.

Digital Twin
A digital representation of a physical entity, system, or process that is linked to real-world data and can be used for monitoring, simulation, analysis, and decision-making [5, NVIDIA 2022].

MEFI (Metaverse Ecosystem Finland)
Industrial ecosystem based on the Finnish Metaverse Strategy. The ecosystem is hosted and run by Dimecc Oy [7, MEFI 2025–2026].

Acronyms and Terminology

Metaverse
The collective, persistent, and evolving digital layer of reality, interconnected with the physical world and human activity, and shared across people, organizations, and intelligent systems (defined in detail in this document) [3, Ball 2024].

MR (Mixed Reality)
Interactive environments where physical and digital elements are spatially aligned and can influence each other in real time [4, Milgram 1994].

OSI Model
The Open Systems Interconnection (OSI) model is a conceptual, seven-layer framework developed by the International Organization for Standardization (ISO) that standardizes how computing systems communicate across networks, regardless of their underlying technology. It acts as a universal, 7-layer language for networking, providing a structured approach for troubleshooting, designing, and understanding network protocols.

Telepresence
Technologies and experiences that enable individuals to perceive, interact, and participate in remote environments as if physically present, with increasing fidelity of sensory, spatial, and social cues [3, Ball 2024].

VR (Virtual Reality)
Fully immersive digital environments that replace physical surroundings with computer-generated spaces, typically experienced through head-mounted displays [4, Milgram 1994].

XR (Extended Reality)
An umbrella term encompassing Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), covering the spectrum of immersive and spatial computing technologies [4, Milgram 1994].

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Challenge: ambiguity and hype

The concept of the Metaverse has, over the past years, become increasingly fragmented, politicized, and misunderstood. The term has been stretched to cover almost anything digital, from isolated virtual reality applications to marketing campaigns, platform roadmaps, and speculative future visions. As a result, "the Metaverse" has often meant very different things to different audiences, leading to confusion rather than shared understanding [3, Ball 2024].

Part of this ambiguity is rooted in the origin of the term itself. Coined by Neal Stephenson in his dystopian novel Snow Crash, the Metaverse was originally a fictional construct, designed to critique social and technological trajectories rather than to serve as a precise technical or societal blueprint [1, Stephenson 1992]. While the novel has been inspirational, its dystopian framing has also burdened the term with negative and misleading connotations. Combined with aggressive marketing hype and platform-centric narratives, this has made it difficult to arrive at a definition that is both broadly accepted and practically useful [3, Ball 2024].

This document is intentionally positioned as a corrective to that trajectory. It is not marketing-driven, not tied to any single platform, vendor, or technology stack, and not built on speculative hype. Instead, its purpose is to make the Metaverse understandable as a societal and technological phenomenon, and to provide a clear conceptual foundation that supports informed discussion, responsible development, and long-term decision-making [6, Business Finland 2023]. The aim is not to "own" the definition, but to offer a stable reference point that others can build upon, challenge, and refine [3, Ball 2024].

The perspective presented here is grounded in real-world experience. This document draws directly from the extensive, collaborative work carried out during the creation of Finland's Metaverse Strategy in 2023. That process brought together public institutions, companies, researchers, artists, and individuals across disciplines, and resulted in a shared national vision rooted in Finnish values [6, Business Finland 2023]. The collaboration initiated during that strategy work did not end with its publication; it continues today through Metaverse Ecosystem Finland (MEFI), which serves as an open, evolving forum for implementation, experimentation, and international engagement [7, MEFI 2023–2026].

At the same time, this document openly acknowledges that any definition of the Metaverse must remain iterative. The Metaverse itself is not a finished system, and neither is its definition. In a very real sense, the Metaverse will only be "fully defined" once it is fully in use as part of everyday life.

For this reason, the document is deliberately foundational and non-technical. Technologies, platforms, and interfaces will continue to change rapidly, and anchoring a definition too tightly to any of them would make it obsolete

Challenge: ambiguity and hype

almost immediately. Thinking, principles, and values, however, are far more durable. By focusing on conceptual clarity, human-centric values, and long-term structures rather than implementation details, this document aims to enable broad adoption across governments, industries, academia, and civil society, both in Finland and internationally [6, Business Finland 2023].

Background of the Metaverse

The roots of the Metaverse reach much further back than the term itself. Long before immersive graphics or head-mounted displays existed, humans were already building digital alternative realities through text. Early text-based adventure games and interactive fiction created shared imagined spaces where users navigated worlds described entirely through language. These experiences evolved further with the emergence of Multi-User Dungeons (MUDs), which introduced persistent, shared environments inhabited simultaneously by multiple participants. For the first time, people were not merely interacting with a computer, but with each other inside a common digital space [3, Ball 2024].

As computing capabilities expanded during the 1990s, these imaginary worlds gradually transformed from text into graphics. Two-dimensional and later three-dimensional computer games introduced spatiality, perspective, and embodiment into digital experiences. Massively Multiplayer Online Role-Playing Games (MMORPGs) extended these ideas by combining persistent worlds, social structures, economies, and identity. Players became inhabitants of digital worlds. Today's leading game titles offer visually stunning, richly interactive environments that already resemble parts of what is often labeled as "the Metaverse." With the introduction of Virtual Reality (VR), these experiences have become immersive in a literal sense, surrounding the user perceptually and creating a strong sense of presence [3, Ball 2024; 4, Milgram 1994]. While such environments are sometimes called "a metaverse," they are better understood as precursors or partial realizations rather than the Metaverse in its full sense [3, Ball 2024].

Cultural works have played a crucial role in accelerating the conceptual development of the Metaverse. Neal Stephenson's Snow Crash articulated the term and presented a powerful vision of a shared virtual space connected to identity, economy, and power. Importantly, this vision was not a technical specification but a narrative exploration of possible futures [1, Stephenson 1992]. Later works, such as Ready Player One, further popularized the idea by making the Metaverse more tangible and accessible to a broad audience [2, Cline 2011]. However, it is notable that many of these influential narratives were dystopian in nature. While effective as warnings and thought experiments, they have also shaped public perception in ways that can make the concept awkward or overly charged when applied to present-day societal development [3, Ball 2024]. These works should therefore be understood as conceptual accelerators rather than blueprints for implementation [3, Ball 2024].

In parallel with virtual worlds, the Internet itself has followed a clear evolutionary trajectory toward increasing fidelity of presence. Human communication has progressed from symbolic signals and written text to telegraphy, voice calls, and eventually video

Background of the Metaverse

conferencing. Each step has reduced the gap between remote interaction and physical co-presence. This trajectory makes it evident that the next logical step is spatial, shared, and embodied communication, where distance matters less and presence is experienced rather than merely observed [3, Ball 2024]. The Metaverse can be seen as a continuation of this long arc, extending telepresence from flat media into shared spatial experiences involving many, and ultimately potentially unlimited, participants [3, Ball 2024].

Despite decades of conceptual development, the Metaverse has only recently become feasible at a meaningful scale. The vision requires a convergence of several technological capabilities: massive computing power, advanced GPUs for real-time 3D graphics, high-bandwidth and low-latency networks, dense arrays of sensors and cameras, and the ability to produce vast amounts of digital content. Until recently, these requirements made large-scale immersive environments economically and technically prohibitive [3, Ball 2024; 5, NVIDIA 2022].

AI has fundamentally changed this equation. AI can reduce bandwidth needs through intelligent compression and prediction, generate and enhance content automatically, and manage complexity that would otherwise require extensive human labor [5, NVIDIA 2022]. At the same time, AI introduces its own computational demands, further increasing the need for advanced infrastructure [5, NVIDIA 2022].

Crucially, however, AI lowers the cost threshold for creating immersive experiences. With AI-assisted content creation and adaptation, it becomes feasible to build high-quality immersive experiences even for small groups or even individual users [3, Ball 2024; 5, NVIDIA 2022].

The Metaverse: new view to the reality

"The Metaverse is the totality of digital information connected to the physical world, human activity, and human imagination. It is a persistent, shared layer that reflects, simulates, augments, and interacts with reality."
This definition reflects a systemic and ecosystem-based perspective developed through collaborative work within the Metaverse Ecosystem Finland (MEFI) during 2025–2026. [7]
This definition intentionally frames the Metaverse not as a product, platform, or destination, but as an emergent layer of reality. The Metaverse is not something we "enter" from the outside; it is something that gradually forms as digital information becomes increasingly intertwined with the physical world and with human life itself [3, Ball 2024]. It encompasses data generated by physical environments, machines, organizations, and people, as well as information created purely through imagination, culture, art, and storytelling [3, Ball 2024].
At its core, the Metaverse is persistent and shared. It exists independently of individual users and continues to evolve over time, while being accessible and meaningful to many simultaneously [3, Ball 2024]. It reflects reality by mirroring the state of the physical world through data and digital twins [5, NVIDIA 2022]. It simulates reality by allowing scenarios, alternatives, and futures to be explored safely and efficiently [5, NVIDIA 2022]. It augments reality by adding digital meaning, context, and capabilities to physical environments [4, Milgram 1994]. And it interacts with reality by influencing decisions, actions, and systems in the physical world through feedback loops, automation, and human agency [6, Business Finland 2023]. By leveraging emerging technologies such as AI, AR, XR and VR, metaverse solutions deliver highly engaging, multi-sensory experiences that foster deep immersion and real-time collaboration [9, Mystakidis, 2022][10, Cheng, 2023].
It is equally important to clarify what the Metaverse is not. The Metaverse is not a single platform, company, ecosystem, or proprietary environment, regardless of how large or technologically advanced. Nor is it synonymous with a specific device such as a VR headset, or with a single application domain such as gaming [3, Ball 2024]. While virtual reality and games have played an important historical role in shaping immersive digital experiences, they represent only a subset of what the Metaverse encompasses [3, Ball 2024; 4, Milgram 1994].
Access to the Metaverse takes place through multiple modalities, reflecting its layered and evolving nature. Today, interaction may occur through traditional screens, mobile devices, and web interfaces. Increasingly, it also takes place through augmented reality glasses, virtual reality headsets, and mixed reality systems [4, Milgram 1994]. In parallel, many interactions happen indirectly through embedded systems, sensors, and autonomous agents that act on behalf of humans or organizations

The Metaverse: new view to the reality

[3, Ball 2024]. No single interface defines the Metaverse; rather, it is characterized by its ability to be accessed through many forms, depending on context, purpose, and capability [3, Ball 2024].

Figure 1. The Metaverse Stack follows the OSI model concept.

A useful way to understand the Metaverse is through the concept of a Metaverse stack (see Figure 1 above). At its foundation lies the physical world: environments, objects, infrastructure, and living beings. Sensors and actuators connect this physical layer to the digital realm by capturing signals and enabling action. These signals form data, which accumulates into vast, dynamic representations of reality [5, NVIDIA 2022]. AI operates on this data, interpreting, generating, optimizing, and acting within it [5, NVIDIA 2022]. Visual, auditory, spatial, and conversational interfaces translate this intelligence into forms humans can perceive and interact with [4, Milgram 1994]. At the top of the stack lies human experience: meaning, decision-making, creativity, collaboration, and ultimate agency.

Crucially, the Metaverse is not about replacing the physical world with a digital one. Instead, it is about coexistence. Physical and digital realities enhance each other, each compen-

The Metaverse: new view to the reality

sating for the limitations of the other. The physical world provides grounding, embodiment, and meaning; the digital layer provides scale, memory, simulation, and adaptability [3, Ball 2024; 5, NVIDIA 2022]. When designed responsibly and aligned with human values, the Metaverse strengthens reality rather than escaping from it [6, Business Finland 2023].

AI as the Metaverse's native intelligence

Within the Metaverse, AI increasingly functions as an intermediary and active agent between humans and digital information, dynamically generating, contextualizing, and personalizing views into the shared digital layer according to situational needs. From a systemic perspective, AI can be seen as a native inhabitant of the Metaverse: an entity born from accumulated digital data, trained within digital environments, and operating most naturally within the persistent digital layer that constitutes the Metaverse.[1.1]

Without AI, the Metaverse cannot scale, adapt, or remain usable. A world-sized digital layer which is continuously updated by sensors, systems, organizations, and people, would exceed human cognitive and operational capacity. Manual creation, maintenance, moderation, and interpretation would be economically and practically impossible at the required scale [5, NVIDIA 2022; 3, Ball 2024]. AI is therefore a structural condition for viability [3, Ball 2024].

More fundamentally, AI is "native" to digital reality. AI systems are trained on digital representations: text, images, video, and increasingly sensor streams and simulations. They do not experience the physical world directly; they operate through data. This makes AI uniquely capable of working inside the Metaverse's core material, information, at a scale and speed humans cannot match [5, NVIDIA 2022].

AI turns raw data into usable reality in four practical ways:

1. Interpreting and operationalizing data

AI transforms sensor streams, logs, and measurements into interpretable system states and actionable insights. [5, NVIDIA 2022].

2. Making digital twins intelligent

Digital twins become more than static models: they can update continuously, predict behavior, explain what is happening, and support operational decision-making [5, NVIDIA 2022].

3. Generating and adapting content at scale

One historic bottleneck of immersive environments has been content production. AI reduces this bottleneck by generating, refining, and adapting 3D environments and behaviors, enabling smaller teams and smaller user groups to benefit from high-quality immersive capabilities [5, NVIDIA 2022; 3, Ball 2024; 8, Williams 1996-2001].

4. Reducing complexity through agent-mediated interaction

As the Metaverse grows, humans cannot navigate every interface, dataset, or system directly. AI agents and avatars increasingly mediate the complexity,- filtering, summarizing, translating, and acting, so humans can remain in control without being overwhelmed [3, Ball 2024].

AI as the Metaverse's native intelligence

In short: the Metaverse is the world of digital information; AI is the form of intelligence that naturally operates in that world. Through AI, humans gain the ability to perceive, understand, and influence digital reality at human scale without losing agency or values [6, Business Finland 2023; 7, MEFI 2023–2026].

Practical steps ahead

The transition toward the Metaverse is not a single project, platform launch, or technology rollout. It is a long-term structural shift that requires coordinated action, shared understanding, and continuous learning and systematic evaluation [6, Business Finland 2023].
The following steps outline a pragmatic path forward for governments, organizations, and ecosystems seeking to act responsibly and effectively.
The first prerequisite is the establishment of shared definition and language across organizations, sectors, and borders. Without a common conceptual foundation, collaboration becomes fragmented and progress slows. A shared vocabulary does not eliminate disagreement, but it enables constructive dialogue and interoperability. Additionally, it may enable the creation of new metaverse-related innovations across various sectors. This document is intended to serve as one such reference point, supporting alignment while remaining open to iteration [7, MEFI 2023–2026].
All Metaverse development must be anchored in explicit, human-centric values. Technology alone does not determine outcomes; values do. Issues such as security, well-being, health, privacy, agency, inclusion, freedom, and trust must be defined upfront and treated as design constraints rather than afterthoughts [6, Business Finland 2023].
Progress should begin with real, meaningful and need-based use cases rather than abstract visions. Industry, education, healthcare, and public services offer concrete contexts where Metaverse-enabled approaches can demonstrably improve productivity, quality, accessibility, or resilience [6, Business Finland 2023].
Data must be treated as strategic infrastructure, and AI as a core capability. Without high-quality data, the Metaverse remains shallow; without AI, it becomes unmanageable [5, NVIDIA 2022; 3, Ball 2024]. Organizations should inventory, govern, and invest in their data assets deliberately, while developing internal competence in AI systems and deployment. This is not an IT concern alone, but a leadership-level responsibility [6, Business Finland 2023].
To navigate uncertainty, an iterative strategy model is essential. One proven approach is the MATRIX model [7, MEFI 2023–2026]:

- Map opportunities to understand where value and risk lie
- Align values to set ethical and strategic direction
- Team up to bring diverse perspectives and capabilities together
- Roadmap to translate vision into phased action
- Implement through pilots and concrete initiatives
- eXpand by scaling what works and adapting to new realities

Metaverse development should be ecosys-

Practical steps ahead

tem-driven rather than siloed. Public, private, academic, and civil actors all bring essential capabilities, and no single organization can address the full scope alone. Open collaboration, multidisciplinarity, shared experimentation, and interoperable approaches increase resilience and reduce duplication of effort. Ecosystems outperform isolated excellence [6, Business Finland 2023; 7, MEFI 2023–2026].

Finally, continuous change must be accepted as a structural condition. Definitions, technologies, assumptions, and even goals will evolve. Attempts to freeze the Metaverse into a fixed model will fail. Success lies in building adaptive capacity: the ability to revise definition, update strategies, and learn collectively as reality unfolds [7, MEFI 2023–2026].

The Metaverse is not something that will simply arrive. It is something that will be built, step by step, through deliberate choices. The practical steps outlined here are not exhaustive, but they provide a grounded starting point for action today while remaining open to tomorrow [6, Business Finland 2023; 7, MEFI 2023–2026].

This document is intended as a living reference point. Its authority comes not from rigidity, but from clarity, values, and continuous collective iteration [7, MEFI 2023–2026].

References

[1] Stephenson, 1992, Neal Stephenson. Snow Crash. Bantam Books.
[2] Cline, 2011, Ernest Cline. Ready Player One. Crown Publishing Group.
[3] Ball, 2024, Matthew Ball. "The Metaverse: Building the Spatial Internet" (Fully Revised & Updated Edition). Liveright / W. W. Norton & Company.
[4] Milgram, 1994, Paul Milgram & Fumio Kishino. "A Taxonomy of Mixed Reality Visual Displays." IEICE Transactions on Information and Systems.
[5] NVIDIA, 2022, NVIDIA. Omniverse and digital twin foundations (concepts and technical background).
[6] Business Finland, 2023, Business Finland. Metaverse Initiative by the Finnish Ecosystem (Digital Finland). https://digitalfinland.fi/
[7] MEFI, 2025–2026, Metaverse Ecosystem Finland (MEFI). Ecosystem materials, workshops, and collaborative outputs.
[8] Williams, 1996–2001, Tad Williams. Otherland series (City of Golden Shadow; River of Blue Fire; Mountain of Black Glass; Sea of Silver Light). DAW Books.
[9] Mystakidis, 2022, Stylianos Mystakidis. "Metaverse." Encyclopedia, 2(1), 486–497. https://doi.org/10.3390/encyclopedia2010031
[10] Cheng, 2023, Shih-Cheng Cheng. "Metaverse." In Metaverse: Concept, Content and Context. Springer, Cham. https://doi.org/10.1007/978-3-031-24359-2_1