What is the metaverse?

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The metaverse is the superset of existing and future virtual spaces that either virtually enhance physical reality or are entirely virtual worlds. The idea of scalable, persistent, interconnected, interoperable virtual spaces between which digital assets are portable is at the core of the metaverse vision. The metaverse will need to be based on open standards and APIs that facilitate this interoperability.

Is the metaverse real yet?

The metaverse is not yet real, despite Meta's very active involvement in this space, along with Microsoft, NVIDIA, Unity and others. Even the definition will change as the technology and business models evolve. Indeed, various companies are interpreting the term differently to suit their own objectives and established strengths. The metaverse depends on an ecosystem of interconnected platforms; many current platforms contain metaverse-ready aspects, but the metaverse itself has not yet emerged, primarily because this interconnectedness has not yet happened.

At its simplest, the metaverse could be described as a future version of the internet in which users create and participate in a shared VR or AR environment that is highly immersive and has 'persistence' (that is, it has temporal continuity, even when no one is using it). This will not solely be 'in 3D'. The metaverse will incorporate existing '2D' applications, AR and other 'Internet of Senses' technology such as haptics that will be used separately from spatial rendering. The term 'internet' is shorthand to describe the interconnected, protocol-based nature of the metaverse, though the metaverse itself is unlikely to be IP-based, unless IP evolves significantly to support the necessary connectivity demands.

Many dependencies must be met to make the metaverse a reality. Meta's pivot to the metaverse in 2021 was the first of several catalyst events needed to initiate the convergence of disparate 'monoverses' (proprietary virtual spaces) into the metaverse, but the overall process will take many years.

Existing metaverse-type applications and monoverses can be grouped into three categories.

- **Consumer-centric applications** are primarily peer-to-peer in nature, such as those used for social, commerce, entertainment and gaming purposes.

- **Business-led applications** include applications that involve the interaction of people with businesses and institutions in sectors such as retail, education and health, as well as collaboration and productivity tools used for other enterprise applications. These applications often rely on the same platforms, engines and connectivity as the consumer-facing metaverse.

- **Industrial metaverse applications** are closed virtual systems or digital twin solutions that often do not run on common platforms and are not interconnected. AR/VR, sensors and AI and analytics are brought together to create a digital duplicate of industrial environments.

The term metaverse is also being less-rigorously applied to current-generation simulation technologies, from virtual environments used for gaming, entertainment and learning through to AI-based simulations and digital twins in industrial contexts. It is also being applied to all VR/AR applications. These applications will generally increase the demand for higher bandwidths, lower latency and reduced jitter. We loosely categorise this group of applications into 'metaverse-type applications' to separate them from the future metaverse. These applications exist today, unlike the metaverse itself.

When will the metaverse be launched?

There will not be a single point in time when the metaverse is suddenly 'turned on'. It will be dependent on the development and adoption of various technologies and standards, much like the internet and the world wide web. However, we are already seeing the beginnings of the metaverse in the form of growth in the number of metaverse-type applications and the increased use of VR and AR, as well as the development of technologies such as blockchain and AI. The results of our survey on the metaverse show that 10% of consumers are actively interested in using the metaverse; this proportion is very likely to increase, thereby further driving activity in this area. The following steps are necessary for the metaverse to become a reality.

- Advanced VR/AR platforms and devices that can create highly immersive environments that give a sense of presence must be developed.

- A robust network and distributed cloud infrastructure that can support the massive amounts of data and the low latencies that will be required to enable high-fidelity metaverse experiences must be created.

- The standards and protocols, such as blockchain and distributed ledgers, that will both enable users to securely and transparently exchange and purchase digital assets and make different virtual environments interoperable (that is, that enable the 'portability of assets') must be developed.

- AR/MR technologies that enable users to move seamlessly between different virtual environments and the real world must be developed.

- User-friendly interfaces and tools that allow people to create content within, and participate in, the metaverse must be developed.

- New business models and economic systems that can support the growth and sustainability of the metaverse must be developed.

- Mechanisms and regulations for protecting user privacy and security in the metaverse must be formulated.

- Compelling content and experiences that will attract users to the metaverse must be created.

The above eight points will encourage developers to buy into the metaverse and will drive a critical mass of users to adopt the metaverse, which in turn will help to create a vibrant and dynamic virtual space that is rather different to the lacklustre experiences that many users report today.

How can telecoms operators enable the metaverse?

In Analysys Mason's report, *Metaverse strategies: case studies and analysis*, we posit that the various aspects of the metaverse ecosystem can be grouped into ten sub-categories and three super-categories (Figure 1). No single

player needs to excel in all aspects in order to be successful; operators will more naturally succeed in some areas (such as connectivity), while hyperscalers will do better in others (such as central cloud).

Figure 1: Framework for considering approaches to the metaverse
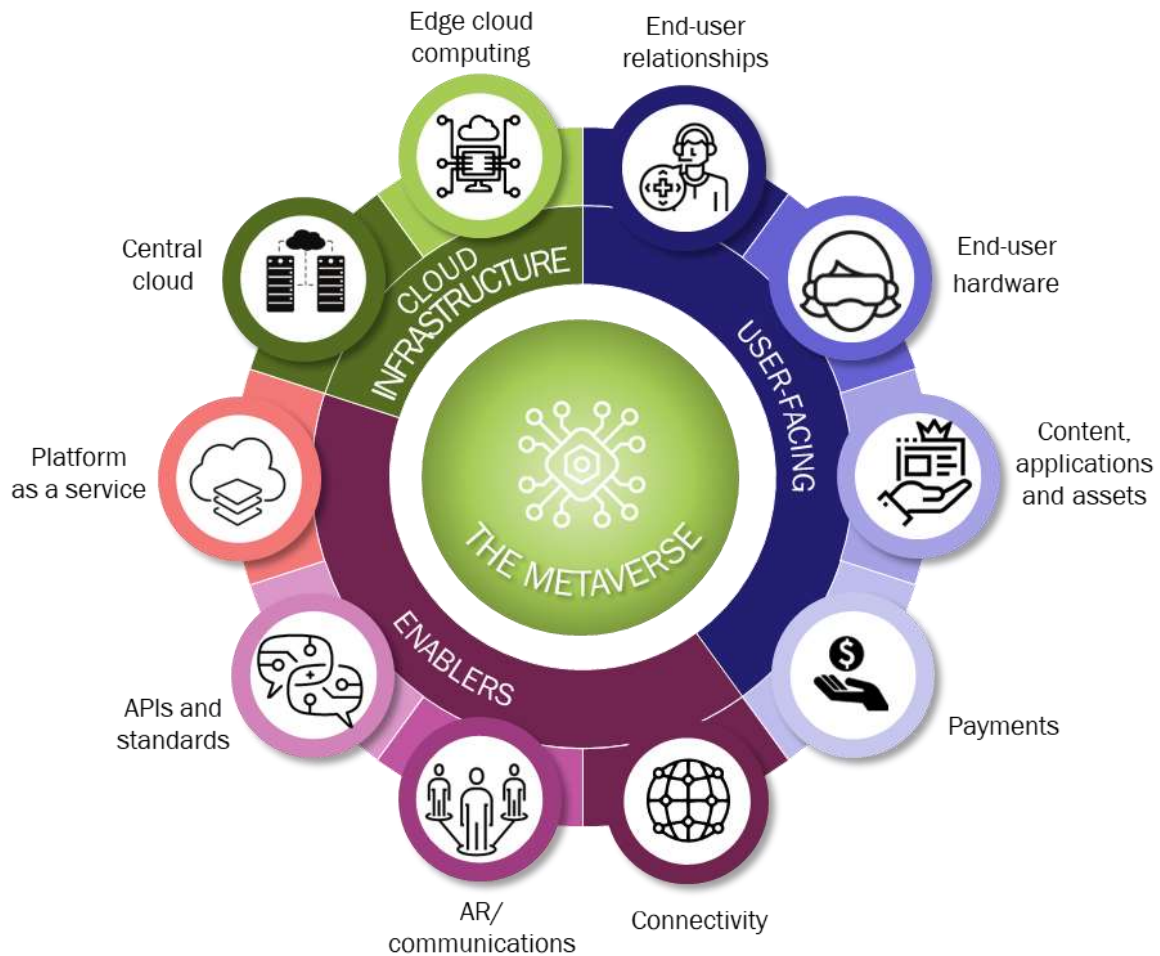
Source: Analysys Mason

Telecoms operators will play a crucial role in the metaverse because they are responsible for providing the network infrastructure that will be required for the metaverse to function. This will involve building out networks that can handle the real-time data transfer and end-to-end latency required to make metaverse experiences immersive and real-time. Telecoms operators may also provide the edge cloud infrastructure on which these software-defined and virtualised networks will depend and which can itself support metaverse platforms and applications. Furthermore, telecoms operators will need to develop new technologies that enable users to access the metaverse from a wide range of devices and locations. This is likely to precipitate a change in both network and cloud computing topology, which operators should be considering as part of their roadmap towards 6G.

Telecoms operators can promote the adoption of the metaverse by providing information and support to users, by acting as retail partners for equipment manufacturers and by partnering with other companies to develop compelling metaverse experiences. Telecoms operators are already aggregators of entertainment experiences; they frequently offer pay TV and other services, such as gaming, alongside their core telecoms offerings. Telecoms operators have relevant experience and established consumer relationships to extend this approach to metaverse contexts, thereby positioning themselves as curators of metaverse experiences.

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