Welcome to the metaverse

A toolkit for the next 24 months

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“Welcome to the metaverse”: déjà vu anyone?

For the media and entertainment industry the dawn of the metaverse, and the word soup of acronyms that accompanies it, is the latest high-profile technology wave that threatens to simultaneously upend established distribution models and reinvent both the experience and relationship with the audience.

Many companies will feel they have been here before.

The last 25 years have seen digital distribution relegate physical content formats to history. Likewise search and on-demand services have transformed audiences’ ability to find the content they want when they want it. Device types have changed from fixed, heavy boxes, to always connected mobile-first form factors.

What is forgotten is how many companies never recovered from these changes, never adapted and never took a positive approach to the advance of new technology until it was too late. Change was forced on them, and new companies rose where others failed: Netflix, Spotify, Amazon.

2022?

1994?

Our definition of the metaverse

- **A combination of physical and digital worlds—embodying a unified digital presence into physical and virtual lives**
- **Fully formed high fidelity 3D worlds that embrace mixed reality via AR/VR**
- **Always on, persistent, and real time**
- **Unlimited immersive and social interaction that can occur at any scale**
- **A seamless digital economy delivering creation and marketplace opportunity**
- **An advanced workspace with new forms of collaboration, productivity and communications**

It is clear that a fully realised, *fully optimised* metaverse is many years away. There will also be multiple metaverses which will have varying degrees of interconnectedness. As such, the broad sweep of its capabilities will result in usage and experiences that we cannot foresee.

Our working definition of the metaverse is therefore focused on the broad components *and their utility* that will redefine the global digital experience in the future.

Immersive virtual worlds

The metaverse will rely heavily on the development of immersive virtual worlds: fully realised digital environments that enable a so-called "digital twin" to exist, interact, create, be entertained and work in a virtual space. The concept itself is not new—environments such as this have existed in the games industry for years and have had early instances in online services such as "Second Life". The metaverse will see new worlds created that fundamentally alter the perception of immersion via VR or mixed reality: either overlaying digital experiences in the physical world or allowing for full realisation in a digital space.

We expect the transition between physical and digital spaces will become routine, as highly advanced and technically complex environments are constructed with smoother transitions into everyday activities such as communications and work. It will take years for this to occur, and its complexity shouldn't be underestimated—with new design languages and interaction models combined with quantum improvements in compute and network capabilities still to be developed.

High fidelity 3D environments

The creation of new immersive digital worlds will be reliant on extensive use of 3D design and rendering, mostly a domain of expertise of the games industry for the last quarter century. The requirements themselves are complex, not least in terms of understanding 3D design fundamentals but also in the creation of vast amounts of 3D digital assets (models, environments, and other elements).

Rendering these environments on vast scale will require substantial improvements to the software engines that are currently available in the game space—be it Unity, Unreal, O3DE, Godot etc.—with completely new architecture and efficiency beyond which exists today.

To achieve a goal of high fidelity (high pixel count, photorealism, low latency to the end user) the underlying architecture of the internet itself will need to evolve to handle the vast quantity of computational complexity and network traffic that will result. Enormous sustained investment will be required.

At the current early-stage of development, 3D environments will have to negotiate trade-offs in density and design complexity to achieve reliability and latency targets—expect constrained and highly focused experiences for specific use cases for the foreseeable future.

"Stray", Annapurna Interactive

Always on, persistent, real time...

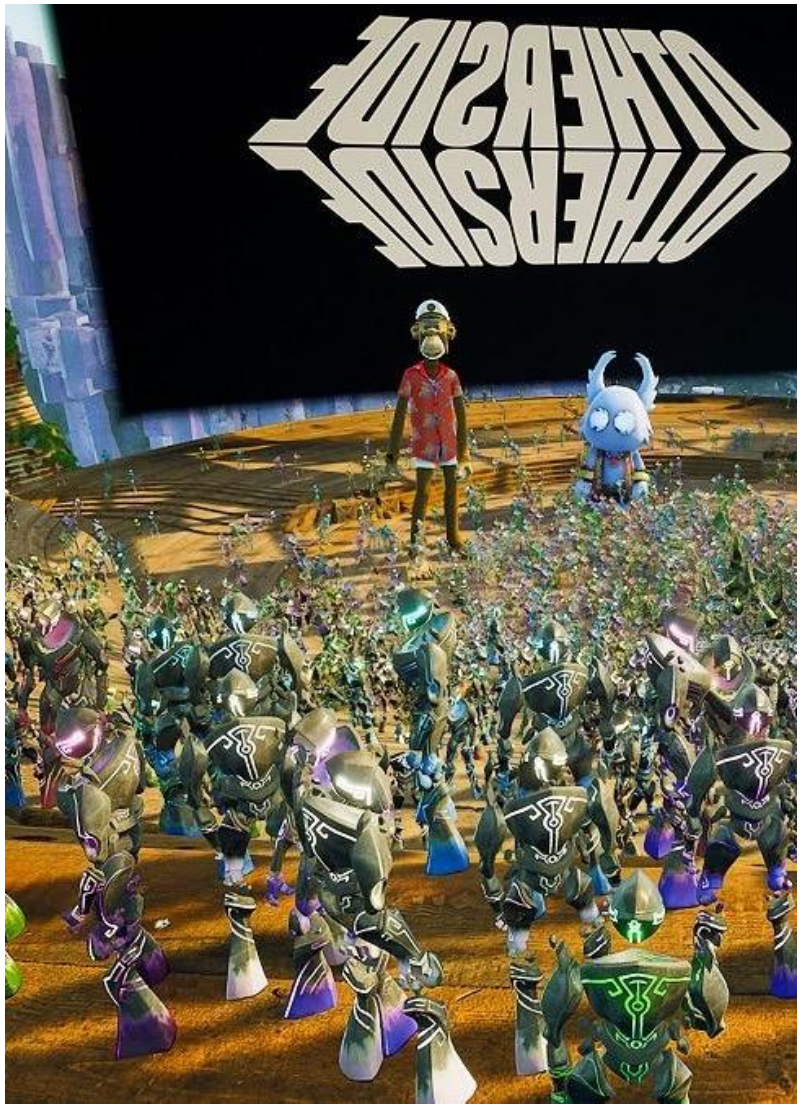
While early metaverse experiences will be focused on specific utility (communications) or events (mostly entertainment), the longer-term goal will be for persistent, always on, virtual worlds to develop and render in real time.

Minecraft and Roblox already exist in this form—albeit with regimented and tightly controlled universes that focus on creation and play models, and effectively "reset" on an ongoing basis. The blocky aesthetic that both use are a means to an end—lowering the demands on players, but also the complexity required across their services.

The fully realised metaverse, with its complex 3D environments and high-fidelity visual experience, will be accessible across multiple devices, and able to respond dynamically to user interaction and be situationally appropriate and aware. This will be even more challenging with a need to render the metaverse at scale in real time—something that cannot be achieved today. The metaverse will not be an application to be downloaded—it will be present and accessible everywhere.

To achieve a persistent metaverse, underlying services will have to create an enormous pipeline of content, moving beyond asset creation to also include AI and data-driven experiences that autonomously react to metaverse participants.

Unlimited interaction



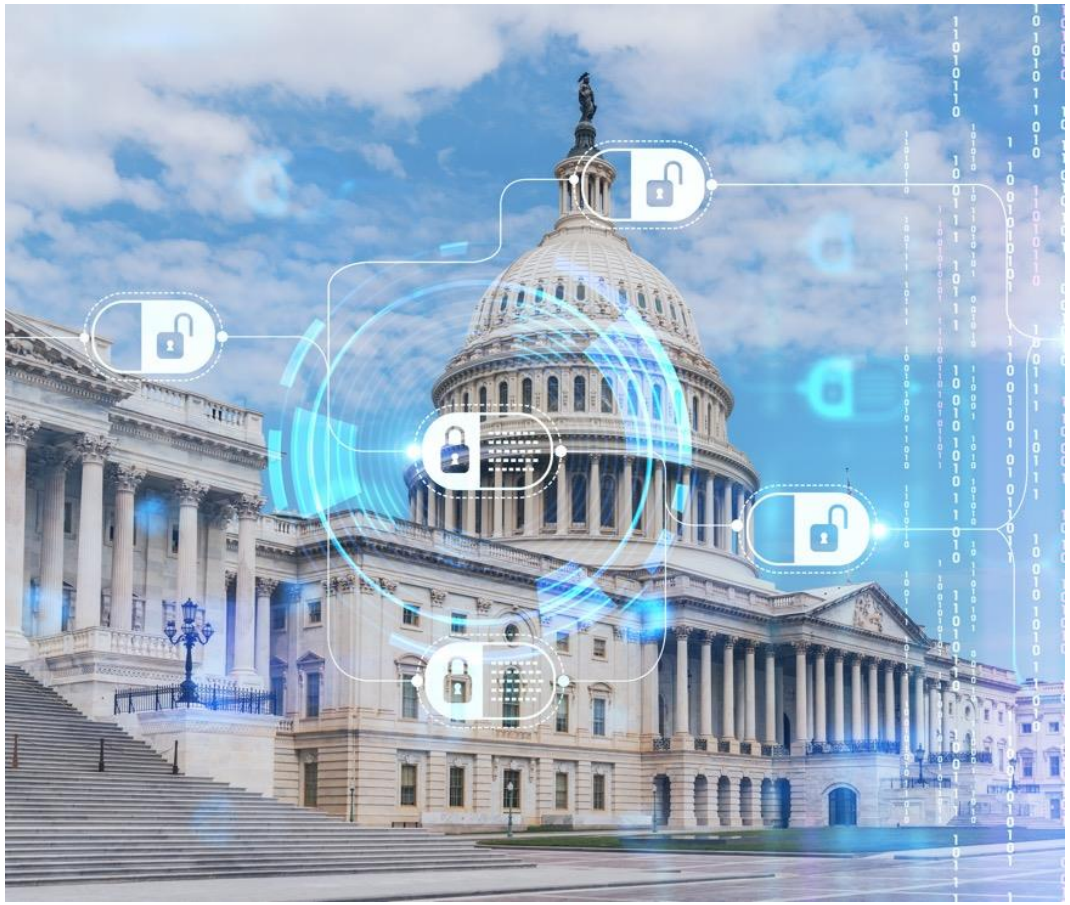
The current internet provides limited options for interaction on a massive scale. Already, Zoom calls and other video conferencing environments hit capacity quickly—with quality of service levelled to the most basic requirements and capabilities of user hardware and network. The many online events that are claimed to have millions of viewers are always asymmetric—delivering one-to-many experiences like traditional broadcasting. Most large-scale events are usually small groups of users (up to 100 or so) that are then replicated thousands of times over. There is also a fixed sense of place—with a user tied to a webcam and keyboard.

The metaverse will be unlimited in terms of its interaction model—particularly when combined with representation as a virtual avatar allowing movement and expression as well as communication. Thousands of users will be able to be present in shared spaces and to interact directly, bringing a new sense of immersion, particularly to live events. While unlimited in design, and theoretically without guardrails, successfully bringing that scale will not only require leaps in compute and network capabilities, but a new perspective on design and interaction mechanics, singularly and en masse. Ensuring that users have quality and safe experiences will be an ongoing, iterative process for years to come.

The other interaction mode of note will be the option of entering and leaving shared spaces at will—for example virtual offices and workspaces, accessing services, and attending live events. With spaces always accessible in a persistent metaverse, the opportunity for organic and unscheduled interaction will be a defining feature.

Yuga Labs, Otherside

A digital economy reliant on new standards and interoperability



It is entirely predictable that, much like today's internet, the metaverse will provide vast new environments to attract audiences, and allow for creators to build and sell services and products on a new scale. The metaverse economy is however being defined *inaccurately* as requiring the deployment of "Web3" technologies, particularly cryptocurrencies and blockchain-dependent digital assets such as NFTs. While the metaverse may use such devices, it is not dependent on them, nor are they part of our metaverse definition.

The inherent nature of the metaverse, involving new levels of interaction and immersive 3D worlds, will alone be enough to drive a robust and wide-ranging new wave of innovative digital products and services—be they assets, tools, or experiences. In addition, the creator economy is likely to supercharged—moving beyond dependence on performance broadcast mediums such as YouTube, TikTok and Instagram, into virtual (and digital) versions of Etsy and other craft environments. This will broaden the base for the metaverse into a wide-ranging digital economy.

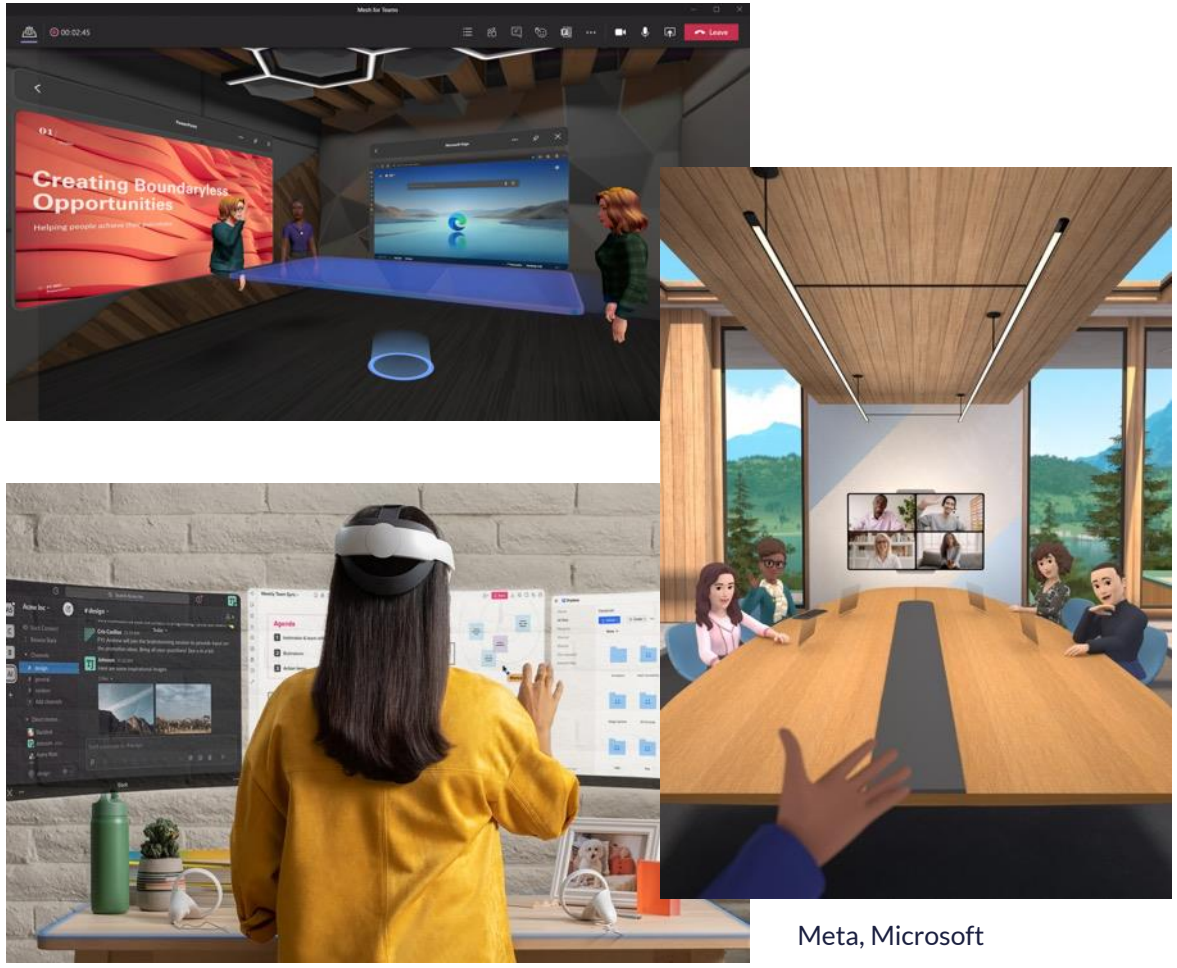
Key to the success of the digital economy will be the development of appropriate interoperability mechanics and standards—already underway with the formation of the "Metaverse Standards Forum", amongst other initiatives. Key to driving value in the metaverse will be the interoperability of assets between metaverses, as well as consistent and recognised design languages that allow seamless migration between experiences. Interoperability will always be an inherent design issue—some metaverses may never allow wider integration (Minecraft will not allow NFTs or Blockchain). Momentum in the standards space over the next 24 months will be a bigger driver of the digital economy than any other initiative.

A workspace for productivity, collaboration, and communication

Enterprise is already an early mover in the metaverse, with significant investment underway by Microsoft and Meta to shape the next generation of communication, collaboration and productivity tools. Apple is likely to be an entrant soon. Demand for VR headsets by enterprise currently outstrips supply, as companies deploy new immersive experiences to achieve better outcomes with remote working and other pandemic-driven limitations, such as on business travel.

Enterprise deployment will be an important foundation for getting new VR/AR hardware into the hands of consumers, bringing costs down by stimulating demand, and importantly mandating usage where necessary. This will drive familiarity and trust in services and experiences—and also build an ecosystem of development talent to support enterprise scenarios through live services.

The metaverse is driving a fundamental overhaul of communication and collaboration experiences in the near term, delivering more immersive and "present" interpretations of virtual meetings and events even with early-stage products. In conjunction with this, new collaboration tools will be the next phase of development—representing a more dynamic and efficient version of traditional desktop applications and static office environments.



Meta, Microsoft

How the games industry is leading the way

The games industry can legitimately be called a prototype for future metaverse development, and already has multiple instances of metaverse-like worlds operational. From its earliest attempts at building virtual worlds (Second Life 2.0 started in the mid-noughts) through to its huge entertainment franchises with explorable worlds (GTA, Roblox, Minecraft) the games industry will retain an outsized influence across the wider metaverse, not just media and entertainment, for the years ahead.

There are four critical pillars which the games industry is leading for the wider metaverse, with dependencies and connections across each: technology, design, economics and virtual lives. From both an engineering and creative viewpoint they represent the core framework for both experiences and platform development, with capabilities having originated from gameplay requirements and an insight as to what players require in their respective game space. This is an important point—the games industry has practical rather than theoretical expertise.

The impact for the wider media and entertainment industry will be ongoing demand for specialist talent with expertise in these areas that has been forged in games and their development.

Talent and expertise

Technology

- 3D world development and rendering specialisation
- Engine development (Unity/Unreal/O3DE) that will power the delivery of metaverse experiences
- Global live digital service expertise
- Development of AR/VR hardware and applications
- Large-scale cloud compute and network development

Design

- Narrative and interaction design of open worlds
- Specialisation that scales from journeys in fully realised worlds through to individual character interaction
- Understanding of large-scale events with thousands of players
- Increasingly data-driven based on live service gaming

Economics

- Development of in-game economies, marketplaces, currencies and digital assets that can be bought, sold and traded
- Closely aligned with real-world currencies, along with integration of crypto and blockchain "Web3" tech such as NFTs
- Specialisation in digital asset and service creation and management—revenue models based around forward bookings and future engagement

Virtual Lives

- Development of long-term engagement with digital worlds
- Expertise in physical and digital product cross-over—via merchandising and retail channels
- Interaction between services and players, and between players and players
- AI-driven methodologies and ecosystem management

Building strong metaverse communities with dedicated audiences

One of the games industry's biggest successes has been the creation, and nurture, of dedicated communities around key game IP. This has been achieved with a combination of technology-driven innovation in-game, deep and immersive worlds with strong narratives and experiences, and key partnerships outside the game (particularly with YouTube and Twitch delivering huge audiences) that allow for audience interaction in addition to virtual immersion.

The "gamification of content experiences", for lack of a better description, will be directly transferrable into other content sectors, with sports and music innately well-suited to super-serving fan experiences. Dedicated and immersive fan environments in the metaverse will be a natural evolution from forums and websites, and wider communication and discussion services such as Reddit and Discord.

Building out community-centred metaverses will therefore likely be a combination of unique content and interaction, but with additional game-centric techniques such as awards and achievements, timed events, single and multi-user focused experiences.

Rewards and achievements: borrowing from games

Incentivisation structures and techniques (using rewards and achievements) have been signature features of gameplay for many years, and one of the most transferable models into apps and services, particularly those requiring high engagement. The success of fitness and learning-based apps, such as Apple Fitness and Duolingo, shows that the same underlying structure used in games, of targeting regular play and stretch goals, increases repeat usage and engagement and can rely on zero-cost and basic rewards (e.g. digital items that unlock, such as badges).

These simple incentivisation structures build community, but also the opportunity to differentiate users based on loyalty and engagement, and therefore can be expected to be a core component of immersive metaverse worlds in the future. This is particularly important in the case of digital twins and avatars—a fundamental element of the metaverse—where there will be a requirement to build a unique profile not just based on appearance, but also on experience and capabilities. As interoperability between metaverses improves, the recognition of experience through rewards and achievements will become more coveted and therefore valuable.

The games industry has also built robust revenue models, particularly in the free-to-play game space, that enable rewards and achievements to be unlocked through payment (usually by accelerators, new tools, or direct upskilling). This will be a core feature in many metaverse experiences, and provide a wider and more creative range of monetisation methods beyond advertising, subscription and paid access.

Challenges ahead: new technology will need to be developed

The metaverse is not without its challenges, conceptually as well as practically. It will take years, and billions of dollars of sustained investment, to fully leap all the technological hurdles that currently present themselves. Many of those hurdles are related to operating at scale and will develop in similar ways to the current internet—sustaining ever larger audiences as they come online.

The metaverse, however, is profoundly different in its architecture—rather than the mostly asymmetric design (one-to-many) that we have today with the current internet, the metaverse will require significant compute and network capacity for every user. Each user will need to be able to seamlessly interact and create in real time and will export vast amounts of data in addition to receiving complex inbound data streams.

Uneven implementation speed will occur, particularly as new hardware with longer lead times will be required. But the metaverse will be a software- and services-first experience—with perpetual iteration and development.

There will be three major design pillars—compute, network, and devices—to support the metaverse. Network is likely to be the slowest and most difficult to solve—particularly in reducing latency and supporting services at scale.

The media and entertainment industry need not wait until all these issues are resolved. There will never be a better time for experimentation and early-stage development of new experiences and services.

Compute

- Real-time mass-scale rendering—improvements globally and at the edge
- Compute capacity for thousands of simultaneous experiences in one event
- Significant compute capability at home and on end-point devices

Network

- Ultra low latency home networking between end-points and home compute
- Low latency symmetrical bandwidth from home to edge
- Replication of huge datasets globally and synchronously
- Capacity improvement and low latency mobile networks

Devices

- Home "end-point" devices (glasses/AR/MR) become more capable and powerful—but smaller & lighter
- Metaverse integration on all device types
- Low-cost devices expand reach—esp. for AR
- Hologram projection devices will be developed

Design challenges

How good does connectivity have to be?

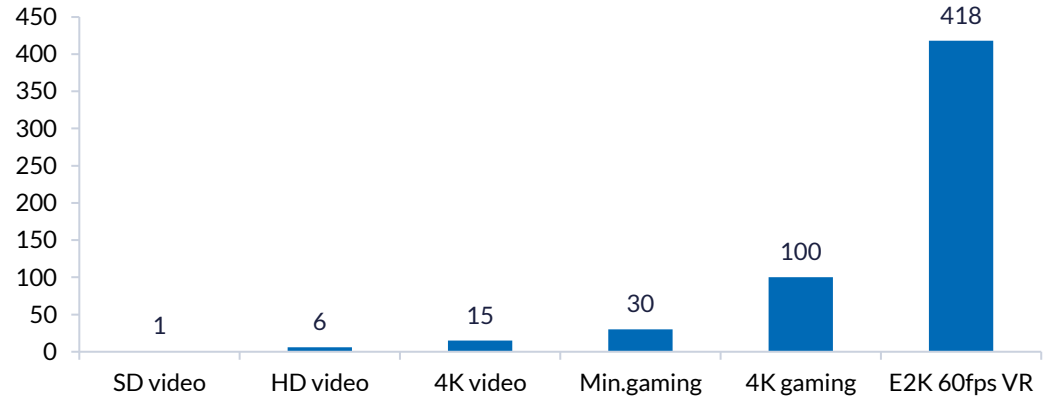
Metaverse-type applications put pressure on networks in a number of ways:

- **Bandwidth:** Providing the experience of 'being there' requires higher resolution and refresh rates, and a much wider field of view, and aggressive compression is difficult to provide in real time. There is a broad consensus of around 100-900Mbps being required, and we look later at 300Mbps as a minimum requirement
- Having more rendering on the end-user device via dedicated applications can reduce the live bandwidth requirement, but this means that all graphic elements have to be downloaded at some point, so high bandwidth is still required for a rich experience
- **Latency**: High levels of interactivity require low levels of latency, especially if the application is responsive to subtle movement, e.g. eyeball tracking. The level of responsiveness can be layered to some extent (e.g. some response from the device, some from an edge server, and some from a central server), but low latency in the network is still required
- **The messy details**: Other factors such as upload speed, capacity, in-home connectivity, and the issue of end-to-end reliability would also impact the user experience

As we go on to discuss, current networks are sufficient to support metaverse services on a one-to-one basis for early adopters with very high-speed connections and high-end home equipment, but any multi-user application is quite vulnerable to the weakest link in the chain, and therefore has to be quite forgiving.

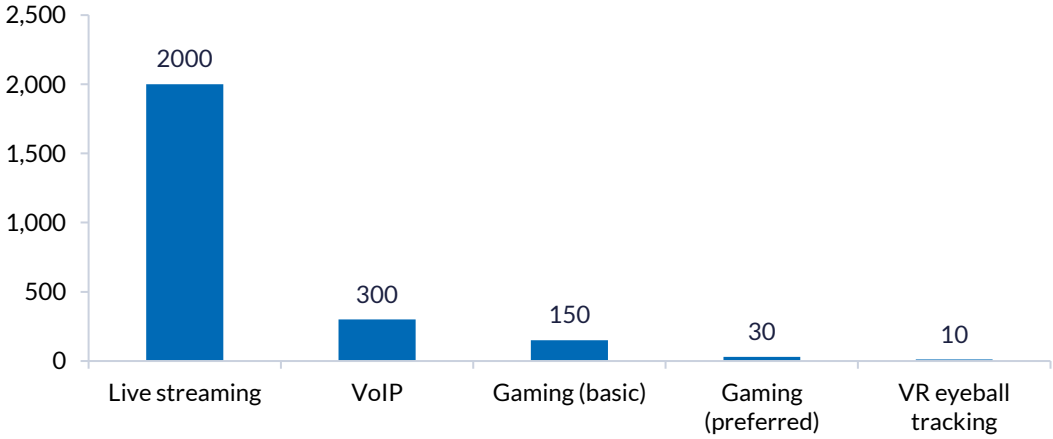
All of the current issues are soluble in time, however, with the telcos (and others) perhaps needing to see evidence of early adopters to adapt their networks and services appropriately.

Network bandwidth requirements (Mbps)



[Source: Enders Analysis]

Network latency requirements (ms)



[Source: Enders Analysis]

Connection bandwidth

Roll-outs of full fibre and cable upgrades have resulted in most developed nations now having speeds of over 300Mbps available to most households.

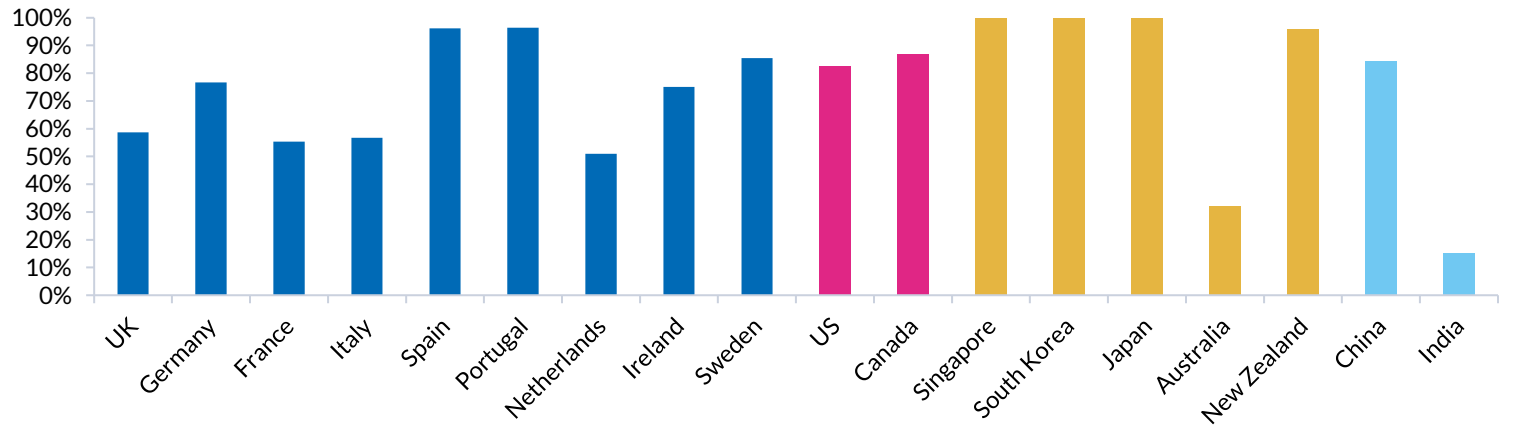
The laggards are mostly catching up within a few short years, with the UK scheduled to hit 85% by 2025, and roll-outs/upgrades progressing in Germany, France, Italy and the Netherlands.

Availability does not however necessarily translate into take-up, with average fixed broadbands speeds significantly lagging availability.

This is not generally for cost reasons but more just inertia/apathy: with broadband churn rates at 10-15% per annum many households just do not bother to upgrade if their current speeds are sufficient. Compelling metaverse applications could therefore drive a wave of upgrades.

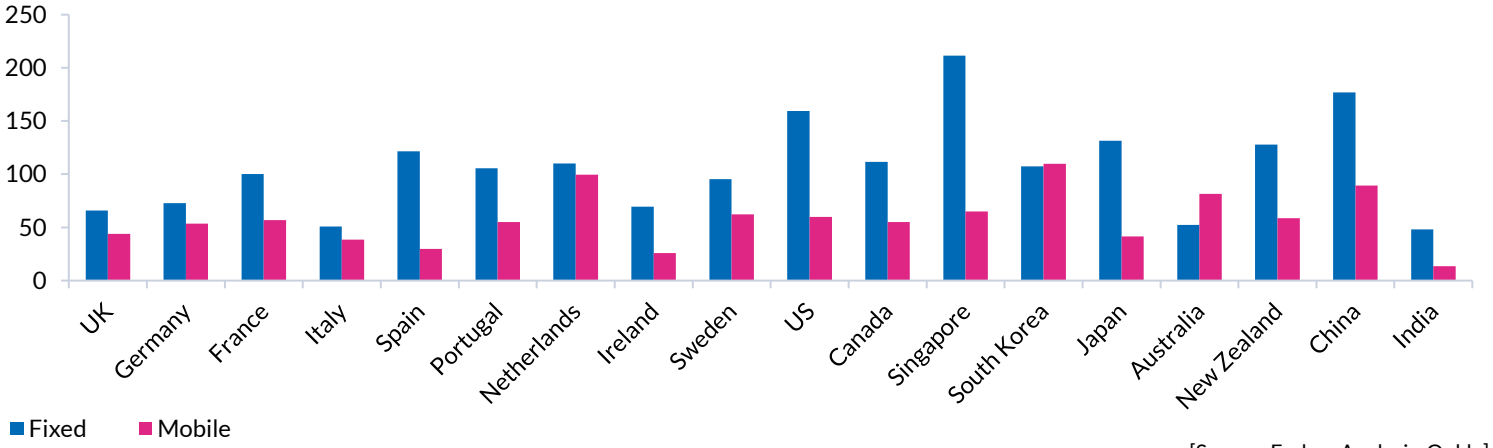
Mobile speeds still lag those of fixed; 5G should in theory provide average speeds of around 300Mbps, but 5G roll-outs have been fairly slow in most markets. We would expect near-complete 5G roll-outs by the late 2020s.

Availability of >300Mbps bandwidth (% households)



[Source: Ofcom, Enders Analysis]

Fixed and mobile download speeds (Mbps)



[Source: Enders Analysis, Ookla]

Latency

Fixed broadband network latency is already fairly low at close to 10ms, and is decreasing as more advanced technologies are rolled out and adopted.

Mobile latencies are much higher, but reducing latency has been a major focus of 5G, and thus we would expect major drops as 5G is rolled out.

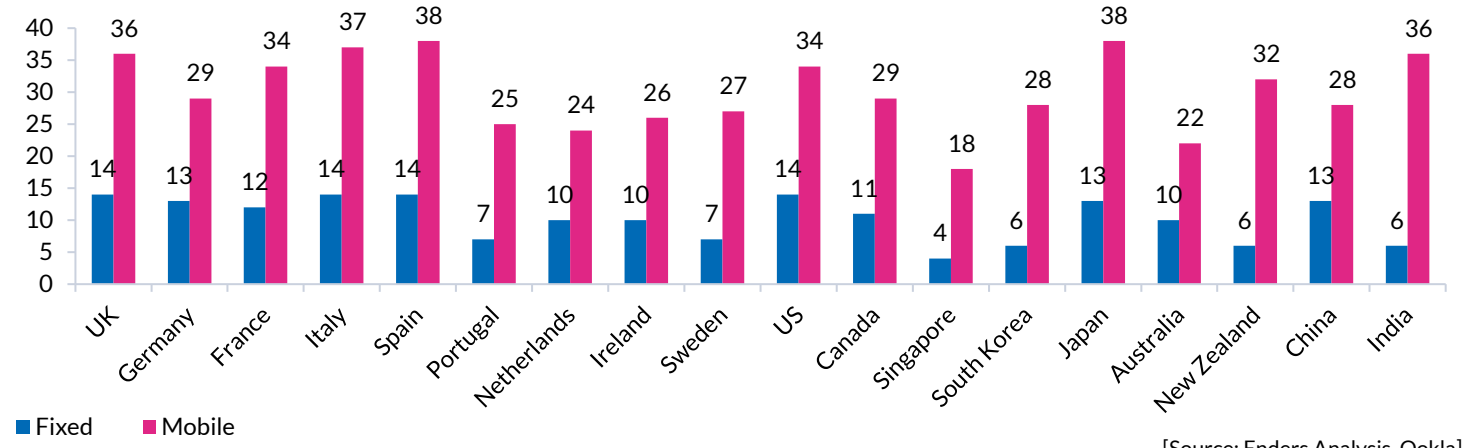
These are median average latencies, and latencies can be much higher if there is network congestion.

With network latencies dropping to c.10ms and below, the bigger issue with latency is the distance from the server to the end user, both due to the speed of light (which adds 4ms per 1,000km) and the number of router hops (which can add c.1ms per hop).

Thus, for very low latency requirements, compute infrastructure needs to be deployed close to end users, either at the (outer) edge of ISP networks or actually within them in many cases (if not within end-user equipment), which also reduces the risk of network congestion.

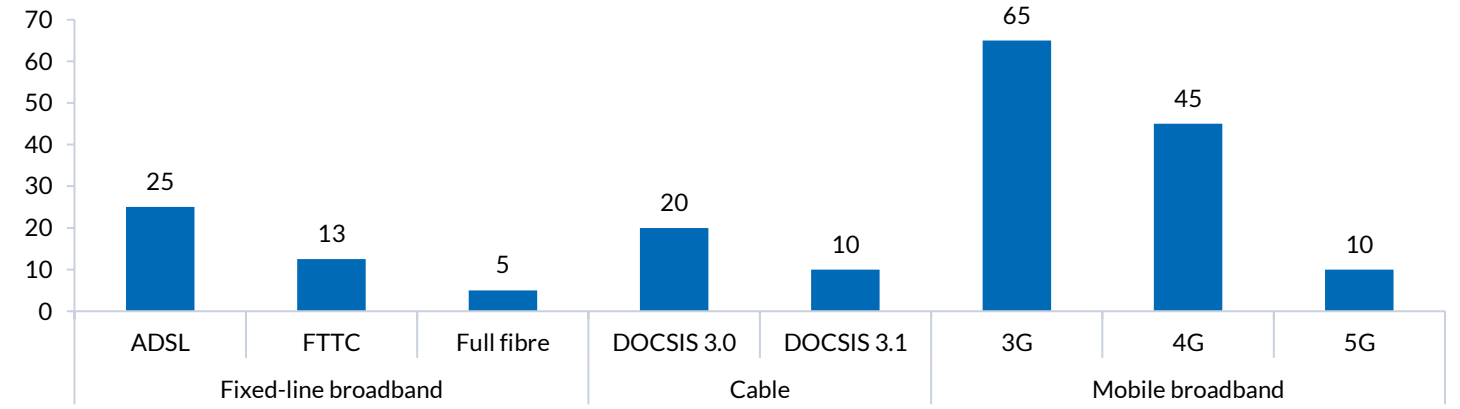
The large internet content companies (Google, Facebook, Netflix, Amazon, Akamai etc.) already have distributed content servers, although these will not be close enough in some or all cases.

Fixed and mobile latency (ms)



[Source: Enders Analysis, Ookla]

Typical telecoms access technology latency (ms)



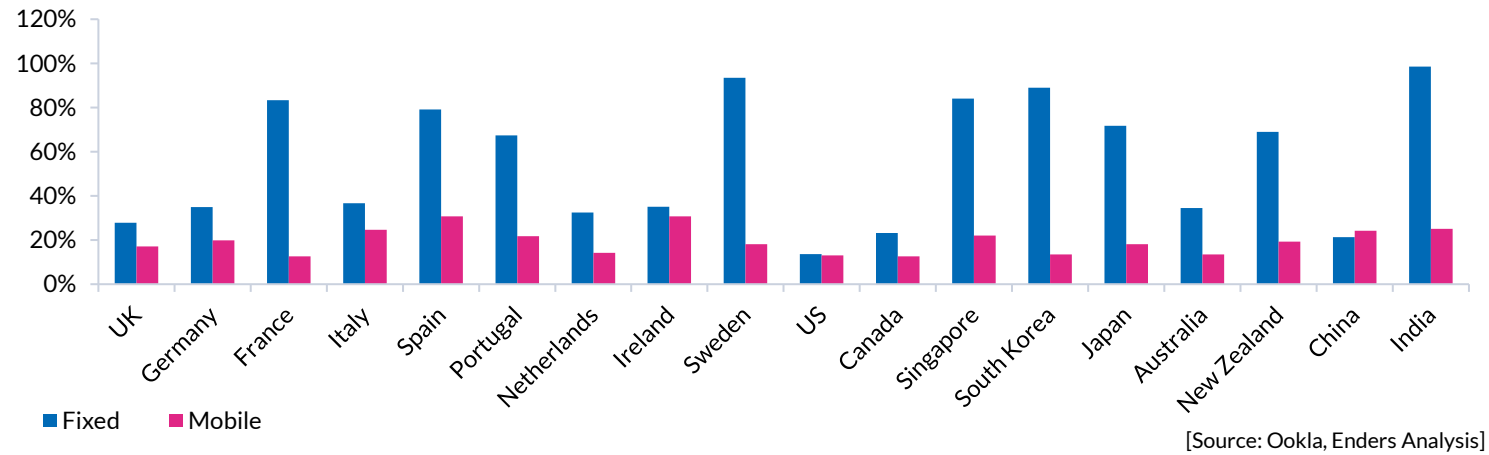
[Source: Enders Analysis, Ofcom, Ookla]

The messy details: symmetry/capacity/in-home/end-to-end reliability

While telecoms networks are theoretically good enough for many metaverse applications, there are a number of practical drawbacks that limit the universality of availability:

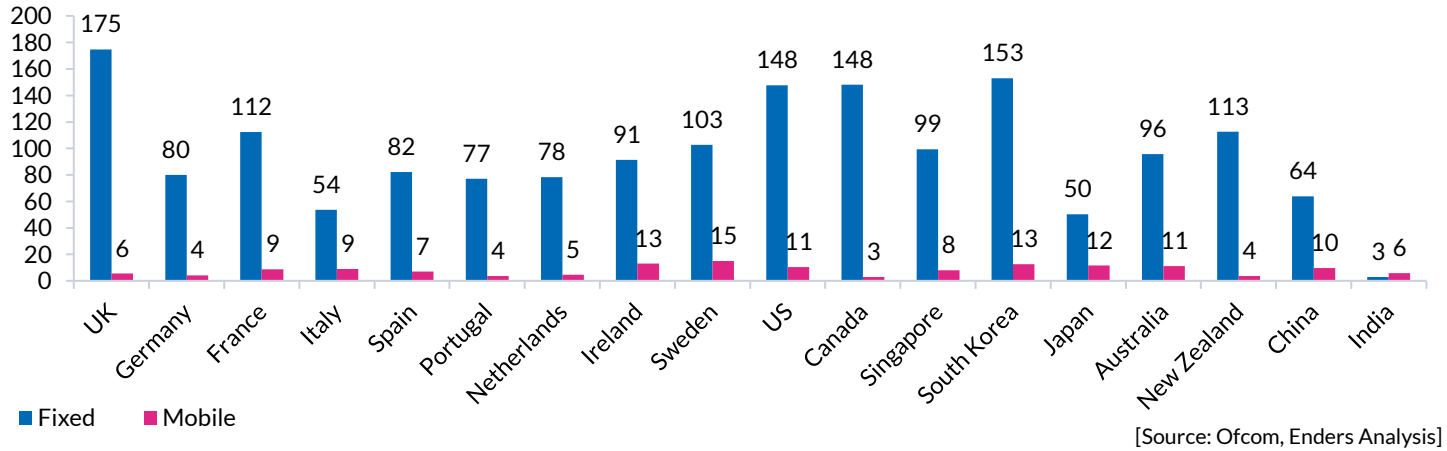
- **Symmetry**: telecoms networks are generally configured to have far more downlink than uplink speed, especially in mobile networks, which limits some applications
- **Capacity**: metaverse applications will significantly challenge existing network capacity, with (say) an hour a day use at 400Mbps being over 30 times current average usage. Rapid mass adoption would thus rapidly result in congestion, slowing speeds and increasing latency. Fixed networks are relatively cheap to upgrade, but it would take time; mobile networks are prohibitively expensive
- **In-home**: modern Wi-Fi networks are capable of delivering 400Mbps+, but most households have aged equipment which would need to be updated, and the Wi-Fi equipment will need to be correctly placed
- **End-to-end reliability**: in delivering a metaverse service, there are many elements which may degrade the overall experience—device performance, in-home Wi-Fi, connection speed, network congestion, server performance etc. It may be hard to identify the culprit if the experience is flawed

Upload speed as a % of download speed



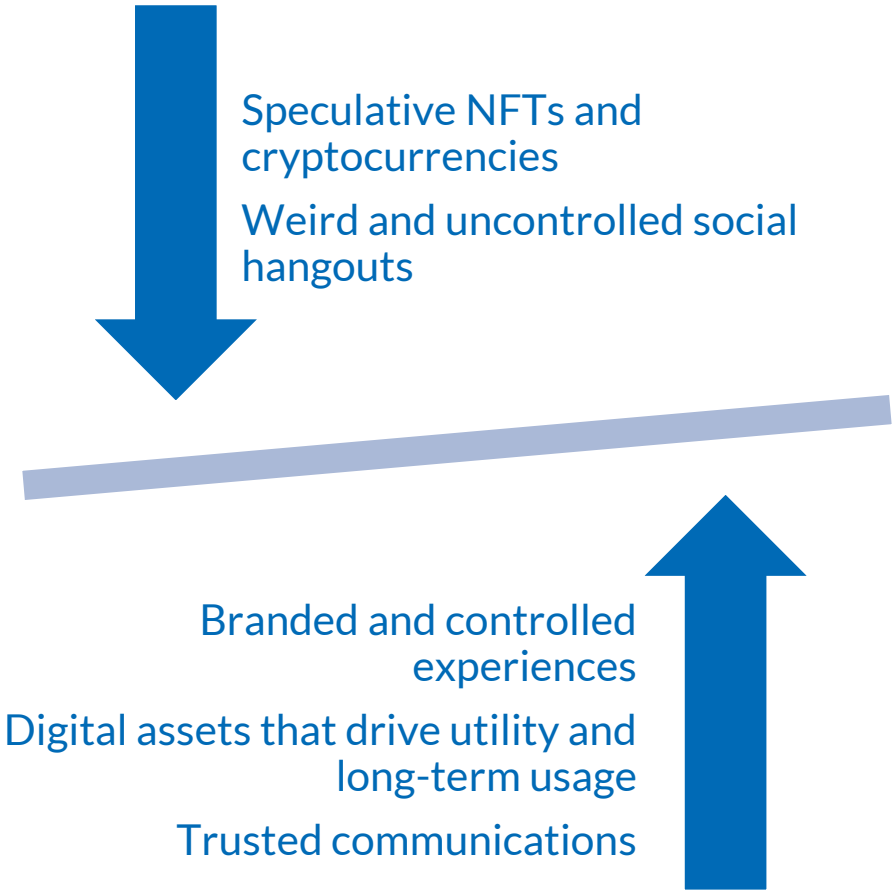
[Source: Ookla, Enders Analysis]

Data usage (GB/month per capita)



[Source: Ofcom, Enders Analysis]

Noise and distractions to avoid



Since the renaming of Facebook to Meta in 2021, the metaverse has swept into the mainstream discourse and bought with it a pioneer "wild west" spirit. There is a rush to claim leadership, with a large portion of FOMO. Many companies have reacted reflexively and mostly speculatively, without a longer-term strategy for building audiences and developing long term assets.

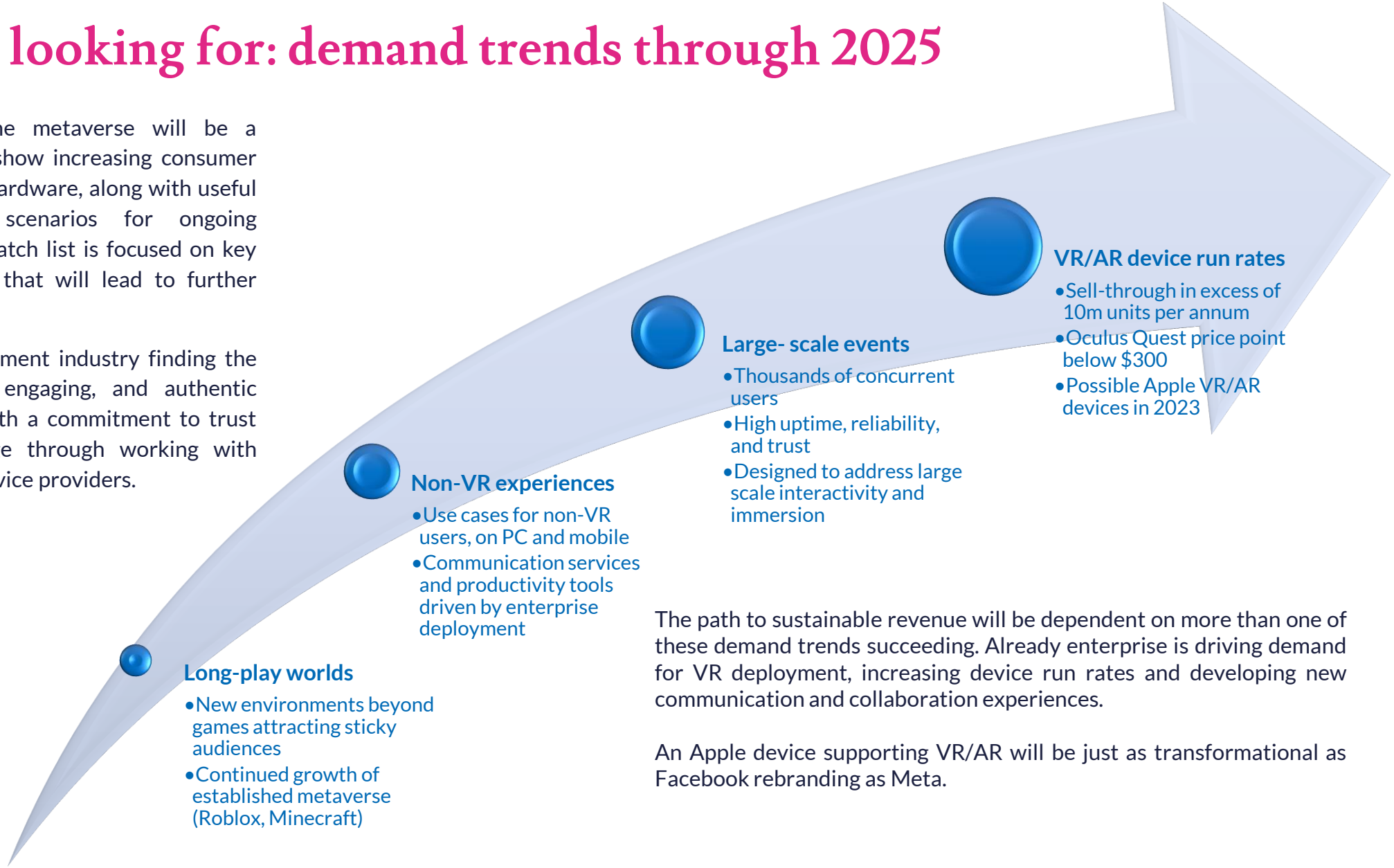
The metaverse is also used as a term to describe the rise of "Web3"—blockchain technologies, cryptocurrencies, and persistent identities being the core elements. While the metaverse will use Web3 technologies extensively in conjunction with existing capabilities, it's not a requirement that current metaverse experiences adopt any elements related to Web3.

There are two significant risk areas at present: uncontrolled social interaction spaces and rampant speculation related to digital assets, specifically NFTs. Uncontrolled social space and weird online hangouts raise the risk of damage related to nefarious activity—companies should control the spaces where they present. Meanwhile digital assets that provide utility and value through long-term usage don't necessarily have to be NFTs. Companies should think clearly about the design and usage of digital assets in their initial metaverse experiences.

What we are looking for: demand trends through 2025

Key to the success of the metaverse will be a combination of trends that show increasing consumer interest in experiences and hardware, along with useful test cases that prove scenarios for ongoing development. Our current watch list is focused on key elements of the metaverse that will lead to further growth and investment.

For the media and entertainment industry finding the combination between fun, engaging, and authentic experiences must be met with a commitment to trust and reliability—at this stage through working with experienced partners and service providers.



The path to sustainable revenue will be dependent on more than one of these demand trends succeeding. Already enterprise is driving demand for VR deployment, increasing device run rates and developing new communication and collaboration experiences.

An Apple device supporting VR/AR will be just as transformational as Facebook rebranding as Meta.

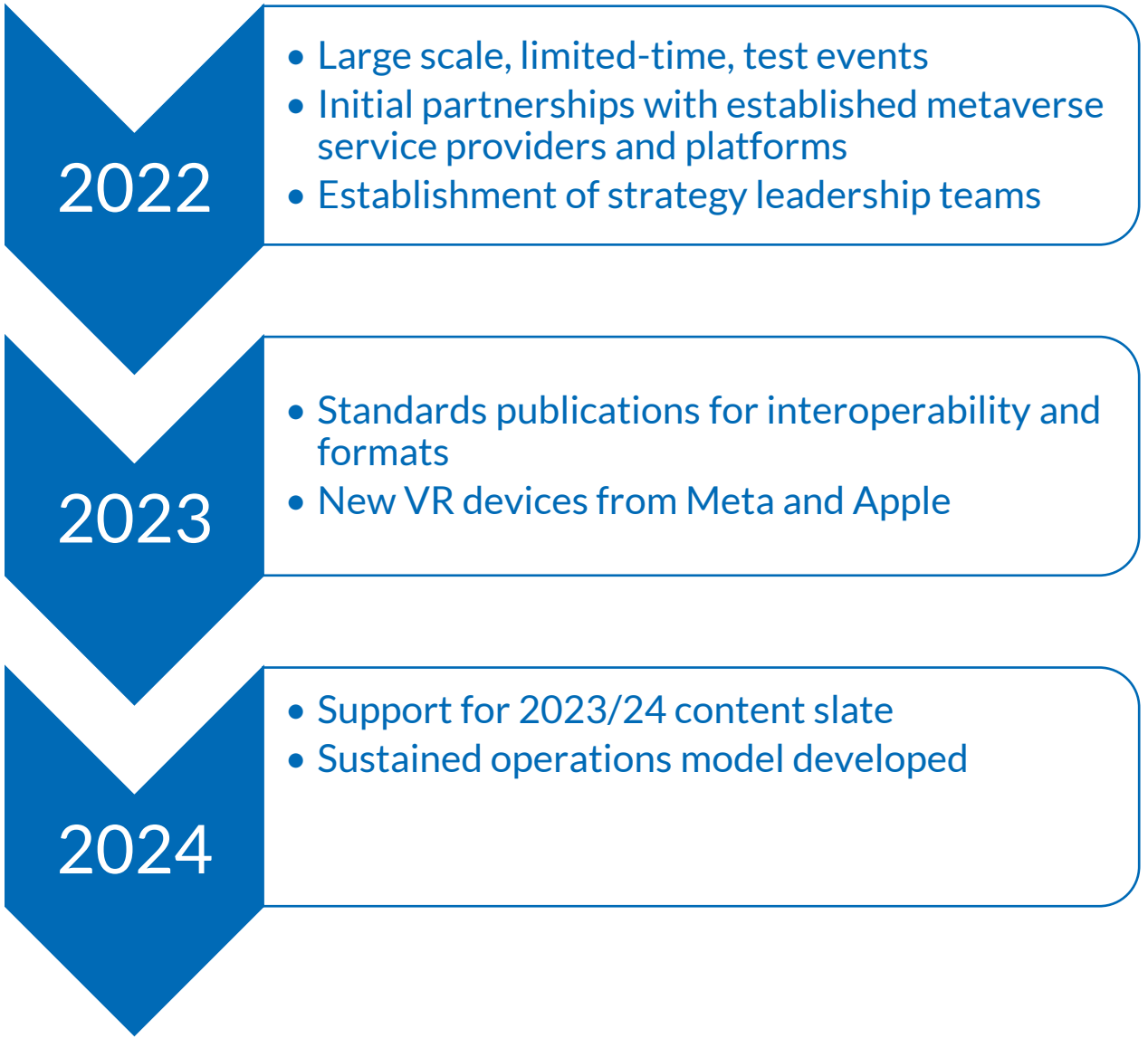
The 24 months ahead

The next 24 months will see the foundations of the metaverse evolve, allowing new entrants to pursue their first forays into the metaverse with less risk and wastage, largely as result of published technology standards and new hardware in the hands of consumers.

For the media and entertainment industry this is a particularly useful window to invest at small scale with limited downside risk. With audiences small but influential, there is opportunity to start early, develop robust test cases and build expertise in conjunction with the right service providers and partners. Existing assets and content can be utilised in new ways, and a metaverse-centric design ethos can be developed.

There will be specific opportunities that well-prepared companies will be able to take advantage of by starting now:

- New device hardware from Apple and Meta
- 2023/24 content slate and talent support
- Integration and asset exploitation with other metaverse platforms



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