NTT DATA

The journey into building the **XR & Metaverse** economy: challenges and opportunities

Index

Welcome to the unlimited future, welcome to the XR & Metaverse era

How should we define this complex and ever-evolving concept: Metaverse? And how does it relate to those (better known) concepts Extended Reality (XR) and Augmented Reality (AR)?

At NTT DATA we think that Metaverse is more than a new type of interfacing technology, more than a 3D social media platform and much more than an extension of gaming, web 3.0 and the growing NFT market.

In reality Metaverse, like internet, is just the next term for future business as usual, for the way we will all operate in the near future and the (virtual) space we will all inhabit, for business use, fun: in fact, just about all forms of interaction.

The best description of Metaverse is probably this: the internet mostly in 3D and real time, interoperable, interactive, persistent, secure, unlimited supported by the "real economy" and directly connected to the "real life".

From where we stand today, we can identify a series of new opportunities for businesses of every kind for B2B and B2C:

- New ways to interact with complex systems and machinery, replacing conventional GUI with immersive haptics, enabling operators and collaborators to inhabit a space perhaps thousands of kilometers from where they are based.
- Added dimensions to essential systems we now take for granted, from navigation to education to entertainment to training and far beyond.
- Virtual environments in which people and organizations can live, work, interact, play, exchange ideas and, most important perhaps, buy and sell virtual goods and real estate.
- Entertainment centers so sophisticated in their immersive capabilities that concerts, debates, forums and all aspects of normal interaction will take place here as a matter of course. These are in addition to the new channels and new ways to interact with clients that we know creative minds across the industry are now developing.
- In other words, this is not something outside of our normal lives, this is a concept that will in the next 10 years (at most) become an intimate, integral part of our normal lives.
- Once we talked about online channels as forming a distinct, even separate, added value business location. Now it's where we live and work. The same will be sooner rather than later true of Metaverse.

We are not there yet, of course, although a roadmap to that destination is appearing. For the early movers and enablers, the opportunities are significant.

- There will be 1.7 billion mobile AR users worldwide by 2024
- Open Metaverse standards are now under development on a cross-industry basis to simplify and accelerate transition.
- Metaverse as a B2B and H2H (Human to Human) channel to market has an estimated potential value of $1.3 trillion by 2030
- Data usage is expected to grow 1000% in the next 10 years
- Major corporations (Nike, Gucci…) are already selling virtual products in virtual outlets based on Metaverse platforms, in some cases for more than the cost of the "real" products concerned.

Whether a business is in the B2B, B2C or B2B2C markets, Metaverse cannot be ignored. The rewards and opportunities are too great for that, but there are challenges on the way.

What's taking so long? Challenges and barriers for XR adoption

If everyone is convinced Metaverse will be a normal part of everyday life in the near future, why exactly is it taking so long to become reality?

There are obstacles to the take up of any new technology: that's normal, but with a concept as demanding and complex as Metaverse, those barriers to adoption tend to be higher and wider than in the past.

At NTT DATA, we have been monitoring development of XR and related concepts with Metaverse, not least because we are acknowledged leaders in high-performing, business strategy capabilities, integrating solutions, intelligent networks and XR-related interfaces. We therefore occupy two of the most strategic locations for making XR and Metaverse happen. We have a grandstand view of developments and are constantly analyzing the situation, while also playing an active part in enabling developments.

Our assessment is this:

Mass adoption still has some way to go. Attempts to push people to Metaverse have not been very successful to date, and the reasons are almost certainly generational. Younger people, who treat gaming platforms as a "normal habitat" are already mentally in the Metaverse. The problem lies with established technology players, which may simply be too conservative in learning how to connect with this younger age group and ensure recurrence for the mass market. The secret is to improve the quality of content available, develop higher impact features and build the most valuable use cases we can. Adoption will speed up once these improvements are in place.

ID/IP/Compatibility. We can see a combination of problems here, as industries and businesses that are very different from each other need to agree on new legal and technological frameworks to enable traceability of users and interconnection between their own environments. This has to be done in a way that provides seamless experiences for users (as easy as walking from one shop to another on a high street) but that preserves the rights and IP of each participant. There is still work to do in this particular space and we are working to build the partnerships needed to make these changes happen.

Digital identity, standards and interoperability ID. This may be the biggest issue of all, as large players try to own different parts of what logically should be an open and immersive environment. They all have their own ways of doing managing or charging for access: a % surcharge on in-app purchases, refusal to allow transfer of IDs across different proprietary platforms, and there are other restrictions currently in place. Again, agreement is required on how to deal with these essential commercial conflicts.

Security. Metaverse is ultimately about data. We've already noted that the amount of data to be processed is likely to increase by a factor of ten in the next decade as Metaverse takes off. This concept cannot exist without the ability to process vast amounts of data. And it´s not only the amont but the kind of data. All our biometric data will be there, including how many times our eyes blink in one specific moment, and what we felt. How to keep that secure? To be compliant? To safeguard the interests of individuals and companies? We all understand that there are security issues in the Cloud and other forms of online IT. In Metaverse these same issues exist, but on a larger scale. This is a major issue.

The regulatory framework, the social impact and web 3. The greatest strength of Metaverse is also its greatest weakness, because it creates an online, immersive, 3D environment which can be inhabited as if it were the real world. In that environment we bring together the interests not just of commercial bodies and individuals, but also of governments, their agencies and regulatory bodies. Within Metaverse the issues are all about privacy, shaping new social habits, compliance, taxation, and defining which national/trans-national bodies are accountable in a world without borders.

None of these challenges are easy to define, analyze and manage, and this is not the only set of issues facing us. We also need to overcome some technology challenges, although these are not as tough as the economic and political problems above.

The Metaverse environment must be Ubiquitous, which means it should be accessible to every user with approximately the same level of quality. That requires high bandwidth and intelligent networking, enabled without doubt by 5G and Edge computing. This is a problem we at NTT DATA are solving and we can talk to you about that in as much detail as you require at any time.

Now we have to ensure outstanding graphic quality and mostly in 3D, right across the environment. This means that computing power has to be available for fast and high-resolution rendering, advanced graphic engines and rendering will be essential, while low and no code environments will become more available than ever so that everyone can be an active participant, whatever their skills (or lack of them).

There is also a new requirement for interaction and situational awareness in the Metaverse environment. To achieve this, we will need machine learning and eventually a form of emergent AI to provide simulation and modelling at very high speed and quality. We need IoT to ensure that the virtual and real worlds can be interconnected at a very granular level, synchronizing real and virtual data perfectly. In the Metaverse, users must not only be accurately oriented in the virtual world but also in the real-world locations that may be represented by Metaverse. The level of detail and dynamism in models for Metaverse is on a higher level than ever achieved in “normal” interfaces and environments.

The content we capture, and model will not be conventional data, either, but volumetric in nature: 3D objects that must be captured, modelled and manipulated across different platforms and environments.

For Metaverse we also need an environment in which identity can be assured and no single party can claim ownership. That means we will be using Blockchain and NFTs to safeguard digital assets and uphold the rights of participants (corporate and individual), while providing for secure transactions of every kind.

To achieve the levels of detail and agility required for Metaverse, we will need new methods for Mapping, outdoors and indoors, enabling objects of every kind (real and virtual) to be accurately positioned in the Metaverse environment. Space occupied and relationships between bodies in 3D space must be mapped with real precision, but also capable of rapid movement, ensuring that changes in virtual space are accurately displayed and related to what is also happening in “real world” space.

This is a technology requirement that the industry is currently addressing to a limited extend through the application of AR in a wide and growing range of use cases. In Metaverse, the task and the benefits delivered will be orders of magnitude greater.

Finally, Metaverse will be experienced in most cases through a combination of technologies that are already well established: XR and Cloud. Capacity and capability in each case will expand considerably to support the growing needs of Metaverse-based interaction. Intelligent, networked cloud, enabled by Multi-Access Edge Computing (MEC) will have a transformational impact on Cloud and XR performance, but much work still needs to be done in order to deliver as required.

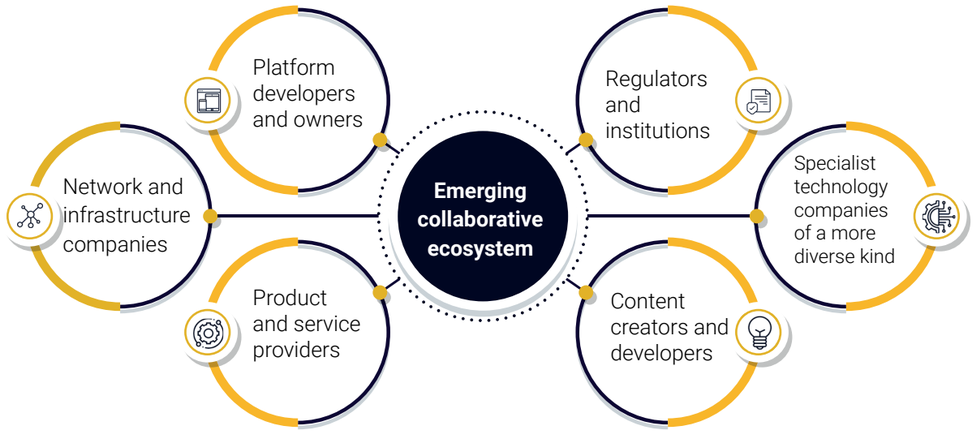
These technology issues are well known across the IT world and are subject to much investment and joint working. All of them are capable of resolution. None of them are easy and the industry as a whole needs to invest time and effort to deliver acceptable solutions, available to all.

Who are the players enabling XR and Metaverse?

So far, we have been dealing with theoretical constructs, but now we need to look at the market and how it is likely to evolve. This is a complex landscape in which different participants can come together in a huge variety of different ways to create markets, solutions, offers, concepts, marketable ideas of every kind.

Open ecosystems and collaborative models have already become an increasingly important trend and a living reality for innovation teams and content or service developers. As we work together in bringing Metaverse and its XR interfaces to life, we will need to make dynamic collaboration a normal way of how we work and do business.

This emerging collaborative ecosystem contains a lot of different players, all of them with their own different capabilities to offer. The six most important of these are:



Here's how we see them operating together to build a rich, evolving virtual environment in the Metaverse.

Content Creators will adapt or specially develop materials for sharing and sale to virtual audiences. This content can range from immersive "films" or "tv" to events (music concerts, for example), games, fantasy experiences (sporting, D&D, extensions of multi-party gaming or magic card games). We may also see news kind of content creator and "meta-influencers" emerging in the years ahead as creative people explore the full potential metaverse offers.

Content creators will need to team up with platform providers, specialist technology developers and IT consultancies/integrators to make their offers fit for purpose in this new environment. Once in the Metaverse we expect content to develop a life of its own and start to evolve in ways we might find surprising.

In other words, we will not just adapt existing models for immersive reality environments: we will see completely new concepts appearing, which will no doubt drive Metaverse into new directions that we cannot guess at right now. Lines between collaborators may begin to blur and new teams will surely emerge.

Product and service providers will see Metaverse as a new channel, sales and consumption environment for their core business- in fact, evidence from the market suggests they already do. Providers are seeing metaverse as a natural home for anything from branding to virtual retailing, while also being capable of expansion to include pure B2B activities, like managing complex assets within an extended manufacturing network. We expect there to be great variety in this area of the market, with different players bringing specific skills in key market segments (smart cities, transportation, healthcare, leisure, manufacturing and more) but with solutions that broadly follow similar paths, no matter how differently they are branded and structured. You may now buy a virtual product in a virtual shop, talking to a virtual adviser at an online bank, or work closely with an expert engineer to solve a machinery problem in a difficult environment against the clock. The outcomes may seem different, but the components are very much the same.

Platform developers and owners will provide the environments in which XR and Metaverse offers are both developed and taken to market. In this way we will see a similar division of responsibilities to that happening in Cloud. The players, however, and the technologies used will be different. In particular, we see a stronger and more central role for collaboration platforms, as creative teams from many different businesses, large and sometimes very small and specialized, learn to work in highly flexible (yet secure) ways. Platform design, development and management may come to be a discipline of compelling importance in the future of Metaverse.

Network and infrastructure companies will be critical to making Metaverse a practical proposition. This is supremely a matter of broad bandwidth data transfer, very low latency and intelligence at the Edge, ensuring the performance and delivery of the entire CDN (Content Delivery Network). The effectiveness of Metaverse depends, in other words, on intelligent networks. This is likely to offer a once only growth opportunity to Telcos and CSPs, which have often been left behind by the OTT (streaming) boom enabled by 4G and the explosion in mobile smart devices. XR is more demanding in terms of data transfer, resolution and intelligence close to the user. The intelligent network is the key to fast transition to Metaverse, so the businesses most adept at managing such networks have a built-in advantage- if they know how to use it. Besides this, Telco companies can leverage a key role in extending Metaverse as a secure and reliable service in a massive way

Specialist technology companies, however, will be critical to fast development and maintenance of Metaverse environments. And we do not think this will be an "in-house" affair. The efforts of some major players (Meta, Google, even Apple) to "own" this space will not and cannot work. No business, however large and capable, can define and develop something as huge, global and complex as this.

We expect to see a boom in virtual collaboration, with secure platforms used for “variable geometry” projects, in which teams come together to swarm around one task and then reconfigure to deal with another, very different need. Developers, creative teams, systems engineers, technology integrators will all have a part to play, we just doubt that many of the key specialists will be long-term employees of any major player. The age of flexible collaboration may take a big and rapid step forward precisely because the complexity of Metaverse is too great for any one company to handle. It has to be collaborative.

Regulators and institutions create the context in which this entire collaborative ecosystem operates. Their role will evolve in the future and will certainly become higher profile and more important. Right now, regulation is defined in terms of restrictions (at least to many members of the technology community), but we expect there to be growing dialogue, with an increased ability to inform and influence regulations. The other side of this will be a growing need for the industry to prove compliance, to manage rights more effectively across multiple jurisdictions and to embrace the goals and requirements of the regulators more clearly. A change in attitudes and culture may be needed.

Building the XR & Metaverse economy: Requirements and key features

At NTT DATA, we have been looking at this issue for some years and have been very actively involved in some of the key developments. In particular, as one of the world’s leading network operators and owners, with a global research effort focused on intelligent network innovations, we have a clear and strong point of view on next steps.

We have defined eight main levels of interconnected activity required to build a viable, constantly evolving Metaverse economy. These are:

- Infrastructure
- Spatial computing
- Creator economy
- Payments
- Experiences and platforms
- Human interface
- Use cases deployer
- Consulting and Integrator

As we have already seen, there is a great deal of work to do at all these levels, and in the connections between them, to make the Metaverse a reality. In practice, we and many other players will be working together, either deliberately or simply by operating in the same space at the same time, to build a collaborative environment in which creative co-evolution is the norm.

Key requirements at each level are:

Infrastructure. This is the foundation of the entire concept, where intelligent, high bandwidth, low latency networks provide the operating environment in which all other capabilities and services can thrive and grow.

Spatial computing. Mapping platforms replicate real spaces and accurately geolocate them in the Metaverse, while content developers use low code tools advanced graphics engines to build the virtual “buildings”, cities, shopping centres and other parts of the Metaverse environment, ready to be inhabited and expanded by the other participants.

Creator economy. Creators are already engaged in conceptualising and building components for services, entertainment and other elements of the Metaverse. Those of us engaged in enabling development of this new environment need to provide a true marketplace, where creators and service providers can meet, engage and collaborate to build Metaverse components, while safeguarding their commercial interests.

Payments. Metaverse services must be paid for, just like all others, so the ability to make secure payments in ways that allocate funds to each IP and component owner is a key enabling factor. Digital wallets and currencies will be a major part of this new environment.

Experiences and platforms. Immersive experiences are the key distinguishing characteristic of the Metaverse and these will be developed and managed at the platform level. We expect that most of these will require collaborative working of considerable complexity and depth, which is why secure environments for ideation, conception, development, testing, modelling, revising and completing will be perhaps the most important part of this activity.

Human interface. At the external layer of the architecture we describe is the point of contact for individual humans and wider groups of participants. Uniquely, this layer has both virtual (avatars, Metaverse identities…) and physical (Haptics, devices…) characteristics. Here we create the doors into the new world that Metaverse presents to its users, bringing together 3D interfaces, the operational rules (unique to each user) and the virtual space, itself.

Use case deployer. Metaverse, as we have seen, represents a major new commercial and creative opportunity for most industry sectors. To achieve take-off and build critical mass, however, each commercial player must design and deploy new use cases into this environment, and to make sure these are seen as offering true added value to users.

We believe this may become a distinctive discipline of its own, with consultancy required to build concepts into solid propositions, then to ensure that the full potential of each concept can be realized in Metaverse, before successful taking the use case to market and monetizing it. Although major players (banks, large consumer goods businesses, for example…) will certainly wish to have these capabilities in house, we have no doubt that a strong focus will be given to everything in this value chain: concept to outline use case, to design, model and test, right through to commercial profiling and marketing.

Consulting and Integrator. Moving into this new world of Metaverse and XR is challenging but ultimately we expect it to be highly rewarding. Businesses that want to profit from Metaverse will certainly need specialist help- and we have already outlined ways in which new players and combinations of capabilities can deliver added value. To minimize the potential for failure and maximize the potential for success, we have no doubt that early consulting support is essential.

This is where blind alleys can be avoided and new ideas identified. Consulting in this space is likely to be targeted, pragmatic and measured according to positive business outcomes. Consulting will naturally lead into the role of integration, which will be vital to the success of Metaverse simply because the requirements are so varied and levels of collaboration so intense. Integration of ecosystem members, creative ideas, technologies, platforms, processes and methodologies, smoothly and efficiently, is the key to success in Metaverse. Having this capability available will be extremely important.

Why NTT DATA?

NTT DATA has a strong presence at every level of the Metaverse technology architecture and commercial landscape. In particular:

- We are key enablers of the infrastructure through our leadership in all aspects of intelligent networking. From our MEC architecture to our role in 5G roll-out, to our work in defining intelligent networked cloud, the next stage of development in what some players call “distributed cloud”: we are leaders in creating the IP for future Metaverse infrastructure.
- In XR and other forms of 3D interfacing, we have been leaders in practical applications across industries as diverse as energy, automotive, retail, port management and smart cities. We have built a strong position in bringing XR to the point where it delivers practical advantages to users today.

In establishing a development platform, we have created Naka, a part of Syntphony, based on the Japanese term that means “at the heart”, or “in the center” ("中"). The NAKA concept comprises three main elements:

- **Interaction.** This is the capability to render and display the complete virtual environment that you need to manage or with which you may need to interact.
- **Composition.** This is the ability to combine multiple sources that together help produce a rich, complex, realistic context. NAKA will connect multiple systems, including both internal systems of record and external sources, while also creating new scenarios by blending components into new forms.
- **Scalability.** The capacity to grow and evolve in capacity, capability and performance, by scaling to cover hundreds of users, scenarios and use cases.

This ensures that our presence in the Metaverse goes from top to bottom, from human experience to basic infrastructure, while enabling rapid, secure development of the most complex applications and services.

The Metaverse is still in the early stages of its development, but we think there is a clear roadmap into the future. The time to start the journey is now.

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