Metaverse:
navigating digital frontiers

April 2025

table of contents

acknowledgements

Author

Ying Shaowei
Chief Scientist, NCS

Ying Shaowei coordinates the efforts of NCS' centres of innovation and centres of excellence, including leading one or more of these centres. He builds a global network of technology experts and research institutions which NCS leverages to accelerate client development and delivery work.

Shaowei champions selected innovation programmes or practices by providing executive sponsorship and directing investment funding. He also provides advice to the NCS corporate strategy on new potential market spaces and technology trends to invest and innovate in. Shaowei plays a key role in shaping the Voice of NCS on emerging technologies, amplifying long-term perspectives on important tech trends that impact businesses.

Contributors

APPS

Lyndy Ng Mui Yong
Practice Lead,
Xperience Works

Andros Lee Chueng
Lead IT Architect,
Xperience Works

Sowmiya Selvakumaraswamy
Metaverse Lead,
NCS Group Australia

NEXT

Damien Kopp
Partner,
NEXT Open Innovation

Gregory Wood
Practice Lead,
Digital Experience

Claris Zhou
SnrProductInnovator,
NEXT Gen Tech

Pey June Tan
Snr Consultant,
Digital Experience

Cyber

Lim Hoon Wei
Principal Director,
Cyber Special Ops
and R&D

Daniel Ong
Senior Consultant,
Cyber Management

Tech COE & Tesseract

Vijay Nayudu
AI Business Lead,
Tech CoE

Kangrui Ling
AI Business Lead,
Tech CoE

Editorial support

Georgia Swanson
Director of Strategy
& Growth, NCS NEXT
Global Innovation

Mark Addy
Insights Lead,
NCS NEXT,
Global Innovation

Deirdre Chong
Visual Designer,
NEXT Open Innovation

foreword

Despite a significant increase in both awareness and adoption of the Metaverse, and the extraordinary advancements in the underlying technologies that power it, for many, the Metaverse remains an esoteric concept of interest primarily to gamers. Yet even at this relatively early stage of what NCS believes the Metaverse will ultimately become, the technology already offers very real opportunities to significantly increase engagement and productivity across consumer, industrial, and enterprise use cases. And while there are still challenges to be resolved, the benefits of the immersive experiences Metaverse solutions enable are essentially limitless.

NCS has invested extensively in the human and technological capabilities required to envision and create Metaverse environments and experiences that will captivate users. Through our shared experience conducting research, developing and testing models, collaborating with industry peers and partners, and building solutions, we've developed a level of expertise and understanding of the Metaverse that we share with you in this report. The content of the report is organised as follows:

explaining the Metaverse

Asking the Right Questions (ARQ) about the Metaverse: Provides an overview of the current state of Metaverse development and answers why and how companies should develop a presence in the Metaverse.

A practitioner's guide to the different Metaverse tech layers: Explains the technologies that underpin each layer of the Metaverse tech stack and how those technologies work in conjunction to deliver holistic Metaverse experiences.

practical Metaverse use cases

Training Metaverse: Gen AI avatars in virtual roleplay training–Explains how digital avatars in a Metaverse environment can be used for remote employee training.

Consumer Metaverse: Mixed Reality in a museum setting–Attracting new audiences and generating interest in art through Metaverse-based interactive exhibits.

Enterprise Metaverse: Reinventing work–Details how companies can take a gradual approach to Metaverse inclusion in the overall digital strategy, explains the stages of immersion and the impact of Metaverse solutions on user experience for a financial services provider.

Industrial Metaverse: The power of immersive mission rooms–Explains how immersive 3D mission rooms can be effectively used for incident management.

Whether you are just starting to explore or how to include Metaverse solutions as part of your overall internal or external digital strategy, or you already view the Metaverse as a serious competitive differentiation tool, we hope that you find the information contained in this report useful.

NCS welcomes the opportunity to further explain how we are using the Metaverse to transform how we interact, both internally and externally, and to discuss how we might assist you on your Metaverse journey.

Shaowei Ying,
Chief Scientist, NCS

introduction

The Metaverse and Digital Spaces signify the fusion of virtually enhanced physical reality and physically persistent virtual reality, coalescing into a collective online realm. As a vital step in the next generation of digital evolution, the Metaverse is a progressive leap towards a future where the borders between our physical world and the virtual domain are seamlessly blurred.

The Metaverse has the potential to reshape large-scale engineering, manufacturing, government, and industrial applications. It can unlock new dimensions for interactive, immersive experiences and enable more realistic simulations, the creation and managerial operations of large-scale digital twins, the enhancement of public safety protocols and big data visualisation, and the inception of truly smart cities.

Yet, this is merely the starting point. Future iterations of the Metaverse are set to redefine our concept of reality, with developments like holographic communication, hyper-realistic virtual experiences, AI-assisted virtual identities, and interconnected global Metaverses on the horizon.

Moreover, as we progressively move towards a more digital society, the Metaverse will become a cornerstone for Industry 4.0, sustainable development, and digital governance, contributing to a more interconnected, integrated, and intelligent future.

At NCS, we stand at the forefront of this revolution, exploring the uncharted territories of the Consumer Metaverse, Industrial Metaverse, Enterprise Metaverse, and Training Metaverse. Just as Generative AI (Gen AI) has reshaped the landscape of artificial intelligence, the Metaverse is reshaping the way we perceive and engage with reality. In fact, the Metaverse will likely become the UI (User Interface) layer for all Gen AI applications.

The realm of the Metaverse is vast and its possibilities are limitless. Our mission is to continually innovate to pioneer new applications and frameworks that will redefine the boundaries of this digital space. From hyper realistic virtual experiences to AI-assisted virtual identities and interconnected global Metaverses, our roadmap is ambitious and far-reaching.

get involved

The NCS TechCoE is working across the NCS Innovation House to develop our approach to the Metaverse, including teams from Tesseract, Xperience Works, NEXT Open Innovations, NEXT Digital Experience and NEXT Growth. As we journey into this exciting future, we invite you to stay engaged with NCS.

Follow our latest work in the Metaverse, learn from NCS thought leaders, contribute your unique insights, and be a part of the future we're building together.

Stay connected with us as we navigate the frontiers of the Metaverse and co-create a future beyond imagination.

Asking the Right Questions (ARQ) about the Metaverse

Kangrui Ling, Andros Lee Chueng

Asking the Right Questions (ARQ) about the Metaverse

Executive summary

In the age of hype surrounding the Metaverse, NCS presents an exploration of its potential and practical implications as part of our ARQ Series. The Metaverse, perceived as the next evolution of the Internet, holds the promise to reshape how we live, work, and interact. NCS believes that significant advancements in technology, such as 3D modelling, blockchain, Artificial Intelligence (AI), and 5G, will unlock the true potential of the Metaverse. While challenges related to security and privacy persist, companies are actively pursuing business-driven use cases within this space. NCS introduces eight crucial questions as guiding principles that enterprises aiming to derive maximum value from the Metaverse should ask.

The momentum behind Metaverse technologies remains strong, fuelled by interoperability standards, technological advancements, and the commercialisation of immersive reality wearables. Established technology providers such as Amazon Web Services (AWS) are contributing with cloud-based spatial simulations. The Metaverse Standards Forum, comprising major technology industry players including Meta, Microsoft, and Huawei, aims to formulate global interoperability standards. NCS identifies four key domains (Consumer, Training, Enterprise, and Industrial) where businesses should target their Metaverse initiatives. Young people, including a significant number below the age of thirteen, are increasingly engaging in immersive experiences (on platforms such as Roblox) and reshaping digital engagement norms.

NCS has worked with multiple clients on innovative Metaverse projects, including the creation of virtual transportation stations for accessibility testing for an Australian transport authority, and the creation of an immersive artistic environment for a national art gallery. Businesses are encouraged to repurpose existing resources and to gradually adopt the Metaverse. While Metaverse security remains a concern, stateless transactions and persistent spaces offer ways to mitigate risks. The emergence of the Darkverse and unique attack vectors necessitate comprehensive security measures.

NCS emphasises that Metaverse success should be measured by aligning key performance indicators with business goals across various deployment complexities. The potential for profit improvement and operational efficiencies is vast, as even simple deployments can yield substantial benefits. Businesses are urged to identify and measure tangible business outcomes from their Metaverse projects, and to adopt a balanced approach that encompasses user experience, security, and privacy. The Metaverse can have a transformative impact, and a thoughtful approach will determine its successful integration into a company's digital landscape.

Introduction

NCS believes that the Metaverse is the next generation of the Internet. It represents a new paradigm of interconnectivity, where multiple virtual worlds exist. As such, the potential of the Metaverse to revolutionise the way we live, work, and play is tremendous. According to McKinsey's 2022 Value creation in the Metaverse report, the Metaverse is expected to unlock an estimated USD 5 trillion in value globally by 2030.

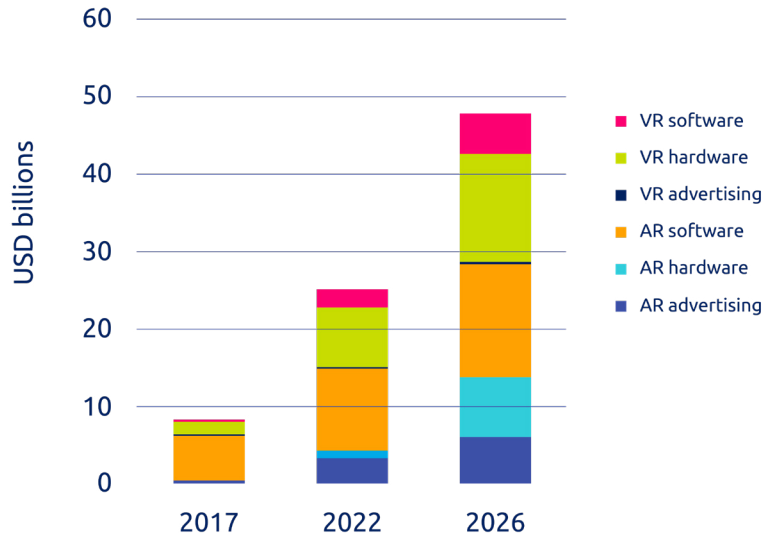
"The potential of Metaverse technology is immense and not to be underestimated. While the concept has existed since the early 90s, it is only with recent advancements in areas such as 3D modelling, blockchain, AI, and 5G that the full potential of the Metaverse has been unlocked. Despite ongoing concerns around security and privacy, companies are not deterred from exploring business-driven use cases for the Metaverse. While not all business Metaverse initiatives will be successful, those that are will offer tremendous opportunities for sustainability and growth. Furthermore, business applications of Metaverse technology will play an increasingly significant role in managing complex operations, making it a key area for businesses to focus on." – Lyndy Ng, Xperience Works Practice Lead

With this perspective in mind, NCS outlines a set of seven pivotal questions to serve as guiding beacons for enterprises. These queries will aid in helping businesses to realise the most value from the Metaverse.

Is it still worth paying attention to the Metaverse?

NCS believes that there is strong momentum in underlying Metaverse technologies.

Immersive reality revenue has grown CAGR 25% (2017 to 2022) …



…while blockchain, dApps, and DeFi technologies have continued to show significant expansion

Comparing previous crypto winter (Jan '18) to Jan '23:

- 3x growth in Bitcoin monthly developers
- 5x growth in Ethereum monthly developers
- Over 5x growth for other chains e.g. Polkadot, Polygon

Figure 1: Immersive reality market projected to reach over USD 45 billion by 2026. Source: NCS, Statista

Interoperability standards, technological advancements, and the commercialisation of immersive reality wearables are driving increased relevance and adoption of the Metaverse. For example:

Advancements by prominent hyperscale technology providers such as Amazon Web Services (AWS), which introduced the AWS SimSpace Weaver in November 2022, facilitate extensive cloud-based spatial simulations.

The Metaverse Standards Forum, established in June 2022 to formulate interoperability standards, currently boasts participation from over 2,400 organisations, including notable companies such as Meta, Microsoft, Huawei, China Telecom, Nvidia, and Qualcomm.

The introduction of Apple Vision Pro has invigorated both enterprise and developer enthusiasm for spatial interactions.

Generative AI (Gen AI) is playing a synergistic role by enabling the creation of virtual interactive avatars and the dynamic generation of scenarios. (NCS has worked with a large Singapore labour union to deploy virtual avatars as career counsellors using Gen AI on a Metaverse platform).

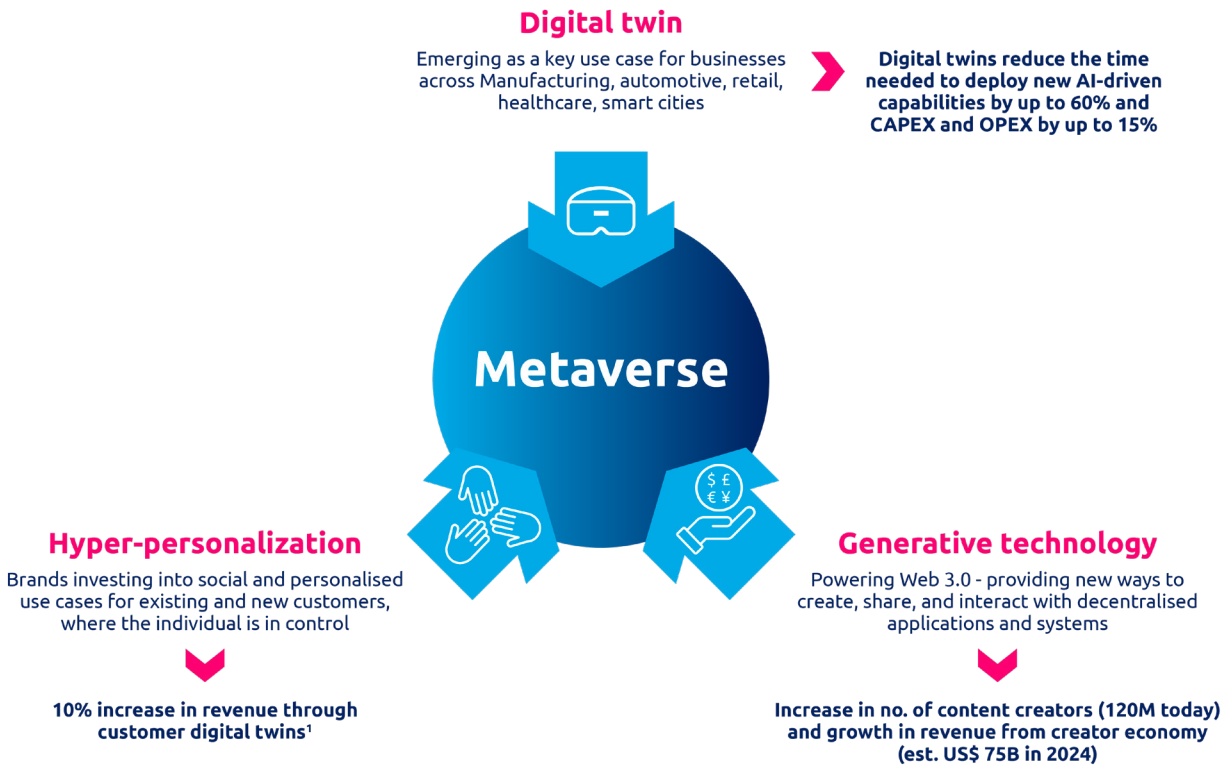


Figure 2: The three driving forces of the Metaverse

Business interest in the Metaverse is steadily growing and first movers around the globe are laying the groundwork to cater to anticipated future demand from consumers.

Which use cases for the Metaverse are most relevant to my business?

NCS highlights four key Metaverse domains that businesses should consider. A comprehensive study of existing Metaverse-related case studies and the Return on Investment (ROI) for each use case was conducted by NCS Tesseract to determine the key value propositions and ROI metrics.

Figure 3: Key Metaverse use cases and ROI. Source: Tesseract

Who are the prospective customers for Metaverse offerings?

A key question for businesses is: who are the right audiences for the Metaverse?

Metaverse users encompass a diverse range of individuals and groups, and while the specific demographics may vary based on platforms and experiences, businesses can generally target the following audiences:

- **Consumers:** Virtual experiences in the Metaverse are becoming more prevalent, offering unique engagement opportunities. Brands can attract consumers looking for immersive interactions and entertainment. Tech giants such as Microsoft and Apple and brands including Nike and Coca-Cola are already leveraging the Metaverse to connect with their audiences.

- **Professionals:** The Metaverse also serves as a platform for networking, business events, and training. Professionals seeking innovative ways to collaborate, learn, and showcase their expertise can benefit from Metaverse engagement.

- **Gamers and entertainment enthusiasts:** The gaming industry has been an early adopter of the Metaverse concept, attracting gamers and entertainment enthusiasts. Brands can tap into this segment by providing in-game experiences, events, and products.

- **Innovators and developers:** Developers and creators are fundamental to the Metaverse's growth. Businesses catering to this audience with tools, platforms, and resources can foster the Metaverse's expansion and innovation.

- **Industrial and skilled workers:** Employees working in harsh and dangerous industrial environments and in the Architecture, Engineering, and Construction (AEC) business segment will be key beneficiaries of the Metaverse. Businesses can improve safety and training effectiveness, and potentially enable cyber-physical augmentation whereby users can affect the real world through a virtual interface.

In essence, the users of the Metaverse span a broad spectrum of interests ranging from consumers seeking entertainment to professionals exploring networking and collaboration opportunities. To effectively engage these audiences, businesses must tailor their Metaverse strategies to align with the unique expectations and needs of each group.

Embracing shifting trends to reach new audiences

The ability to adapt to changing consumer behaviour is paramount for businesses that seek to avoid being disintermediated. Tesseract has found that young people are flocking to immersive experiences. The growth of platforms such Roblox, which saw its monthly active user base increase from nine million in 2016 to 200 million in 2023, underscores this fact. Supporting the fact that the digital demographic is changing is Tesseract's finding that more than half of current Metaverse users are aged thirteen or younger.

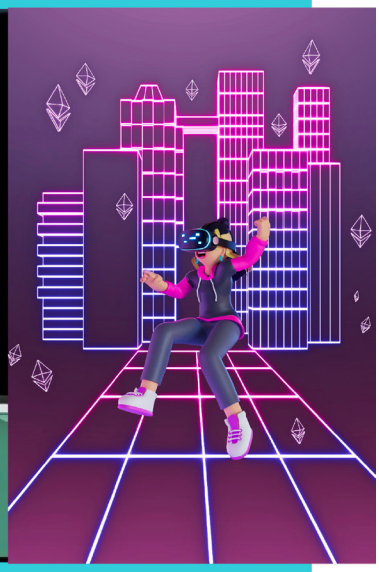
Metaverse case study

How NCS helped a Singapore Labour Union improve membership rates, reaching a younger demographic

Business goals and challenges

For a prominent Singaporean Labour Union, the focal points of their business strategy involve boosting membership, curbing member attrition, and improving member engagement.

To meet these objectives, they are concentrating on the younger demographic (ages 35 and below), characterised by their proactive information-seeking behaviour and familiarity with Web 3.0 ways of engagements.



Solution

A Metaverse platform, powered by generative AI and immersive tech, for members, job seekers, and interest groups connect, explore, and access services.

- Social interaction: Metaverse adds missing social element from Web 2.0.
- Engagement: Organic member interactions and friend invitations for product exploration.
- Integration: Metaverse ties multiple union products and services, breaking silos for cross-selling.
- Career counseling: 3D immersive career exploration, generative AI-powered job matching.
- Quality of life: Personal AI assistants, immersive facility tours with 360-degree views.
- Community building: User-generated content, special interest groups, avatar personalisation.

What experiences should be new or recreated for the Metaverse?

Not all Metaverse experiences are created equally. The right Metaverse experiences must be clearly identified. The following experiences offer great opportunity for creation or re-creation in the Metaverse:

- **Immersive work environments:** Reimagine work environments by creating virtual offices, collaborative spaces, and tools that enhance productivity and teamwork.
- **Entertainment and gaming:** Develop interactive and immersive games, concerts, and events that allow users to engage with their favourite content in unprecedented ways.
- **Social interaction:** Facilitate meaningful connections through virtual social platforms that enable people to socialise, attend events, and share experiences.
- **Education and training:** Offer interactive educational experiences, training simulations, and skill-building opportunities within a virtual setting.
- **Healthcare and therapy:** Provide virtual healthcare services, therapy sessions, and wellness activities that leverage the unique capabilities of the Metaverse.
- **Art and creativity:** Enable artists to create and showcase their work in new mediums that foster innovative forms of expression.
- **Retail and commerce:** Build immersive shopping experiences, allowing users to explore virtual stores and products before making purchases.
- **Travel and exploration:** Allow users to explore virtual destinations, historical landmarks, and fictional worlds to open new areas for exploration.

NCS reimagines experiences through Innovative Metaverse simulations

NCS collaborated with an Australian transport authority to reimagine virtual bus and train stations within the Metaverse. Using Virtual Reality (VR), individuals access a simulated environment, and the transport authority assesses user interactions with Passenger Information Display Systems (PIDS) and navigation throughout the environment. The VR settings allow for adjustments in user height to mirror the experience of individuals with disabilities. Additionally, the environment's lighting can be manipulated so that observations can be made about individual responses to PIDs in darkness. Moreover, the inclusion of Non-Player Characters (NPCs) to simulate fellow commuters provides insight into commuter situational reactions.

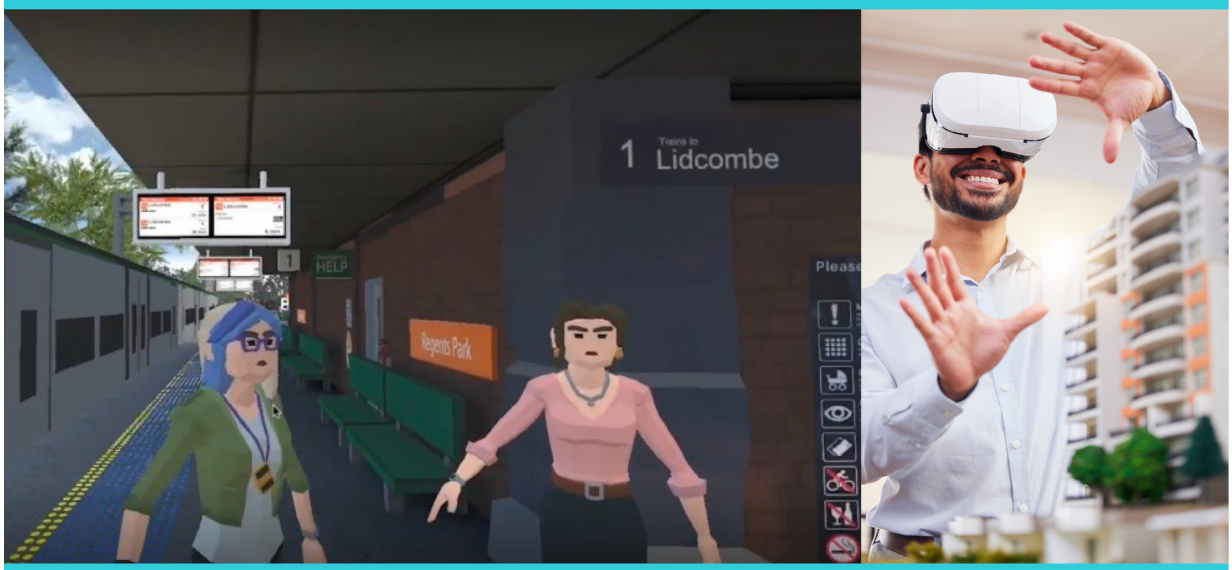
Metaverse case study

How NCS revolutionised infrastructure design

Business goals and challenges

An Australian transportation authority partnered with NCS for an innovation challenge to improve Passenger Information Display (PID) design for transport precincts.

Traditional methods were costly and insufficient to understand user responses on-site, considering factors like visibility, accessibility, and noise. NCS introduced a Metaverse platform for users to test infrastructure design in a Virtual Reality (VR) environment.



Solution

NCS tackled the challenges by creating a 3D transport precinct within the Metaverse using Unity, combining static and real-time data.

- Oculus Quest was used to implement a virtual reality testing environment with dynamic maps and mock-ups of PIDs.
- The VR system uncovered valuable insights leading to improvements in PID system design and user experience.
- The VR approach provided insights into the commuter's perspective and improved inclusivity for individuals with disabilities.
- The VR system allowed data collection, crowd simulations, scalability, and code reuse for efficient experimentation.

In an example of using innovative experiences to reach new audiences, NCS partnered with the National Gallery of Singapore to revolutionise artistic involvement through the Metaverse. The core challenge was to effectively captivate and engage individuals who do not typically identify as art enthusiasts. These individuals often perceive art as daunting, or distant, and struggle to navigate gallery spaces. NCS took a three-pronged approach that focused on entertaining, educating, and engaging the target audience. Fusing 3D audio/visual components with a dynamic mixed reality Metaverse experience, NCS enabled users to delve into the profound histories and inspiring narratives behind each work of art.

A trial centred around Raden Saleh's artwork, "Boschbrand", serves as an example of how the Metaverse can be used to enhance engagement. Using Augmented Reality technology (AR), users are immersed in a narrated video of the artwork where elements of the piece spring to life, exhibit movement, and even venture beyond the confines of the artwork itself to interact with the user's surroundings.

How can existing technologies enhance the Metaverse?

Businesses should contemplate repurposing existing resources for a gradual introduction of their Metaverse strategy. These resources can encompass various elements like 3D models, animations, 2D graphics, as well as ancillary systems such as Internet of Things (IoT) platforms and Geographical Information Systems (GIS).

Crafting Metaverse environments does not necessarily require substantial investments in external Metaverse service providers or platforms. Instead, companies can leverage low-code Metaverse development platforms, such as COMICOMI, which permit the reuse of pre-existing business assets. Alternatively, they can opt for platforms offering a repository of curated assets for swift deployment. Numerous avenues exist for accessing the Metaverse, including AR, VR, PCs, mobile devices, and image-tracking apparatuses for generating holographic avatars. AR serves as a valuable tool for navigation and can seamlessly integrate into an employee's daily tasks. Conversely, VR is better suited for simulations and training purposes. PCs or personal/business-grade mobile devices represent the most straightforward entry points.

However, it is vital for businesses to comprehend that the foundational technological layer of the Metaverse is essentially multi-platform. This includes platforms for managing 3D assets and content, payment systems, identity management, and backend development for the Metaverse, among other platforms. Moreover, ensuring compute and networking resources across on-premises and cloud infrastructure, and wireless configurations on end-user devices requires meticulous provisioning and management. Thus, identifying an appropriate integration partner with suitable alliances or solutions capability to provision the foundational Metaverse technology layer is of utmost importance.

How can one get started on the Metaverse journey?

Less intricate Metaverse solution deployments generally don't demand extensive modelling and have minimal data prerequisites. As such, there is no necessity to acquire or provision high-end GPUs or robust processing capabilities and storage solutions from external cloud providers to facilitate the setup. Moreover, these solutions exhibit moderate levels of interaction complexity, rely on straightforward programmed logic, and do not necessarily mandate data integration.

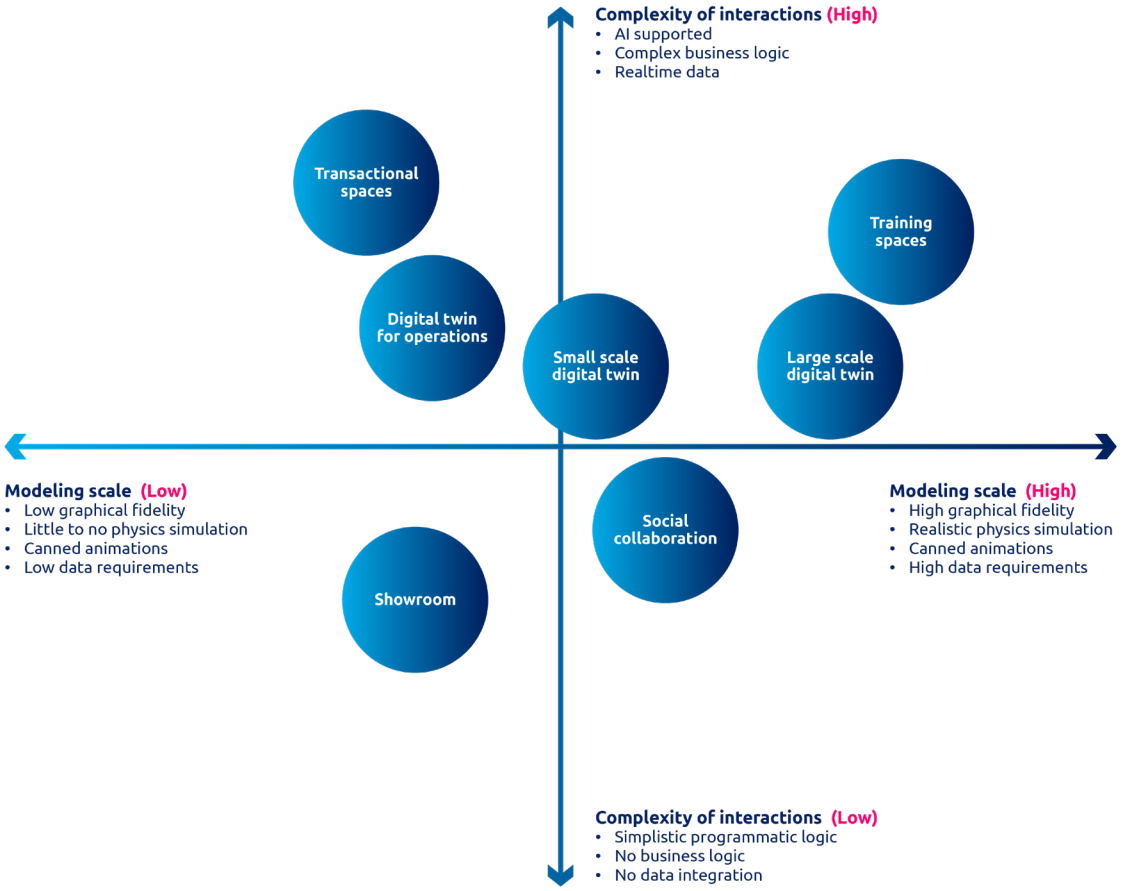


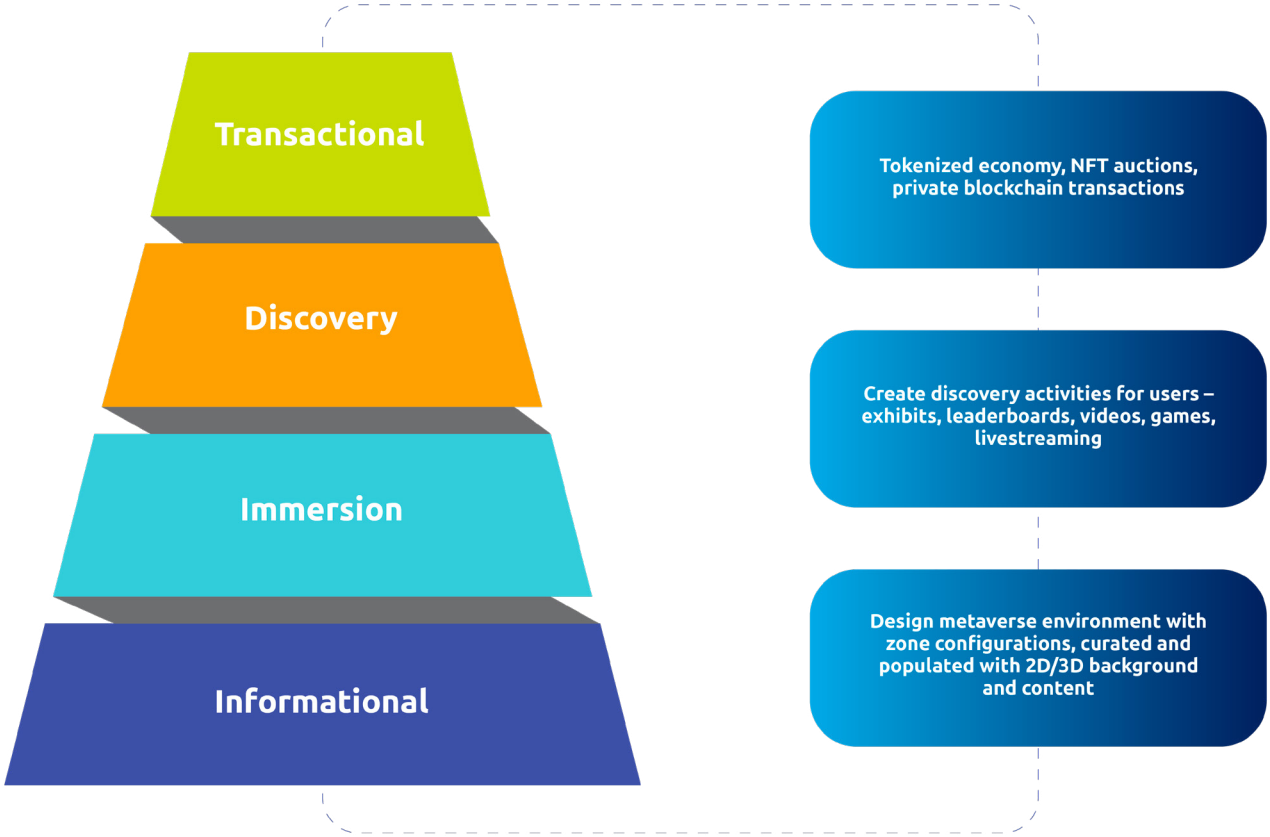
Figure 4: Metaverse Complexity Matrix. Source: NCS Xperience Works

As businesses progress along the complexity spectrum and expand their scope, the applications they deploy can adopt a more real-time nature and integrate with a greater number of components such as IoT sensors embedded in equipment and personal wearables.

This data stream can then be visualised in greater detail in a 3D Metaverse space to allow operations managers to have better situational awareness without having to be physically present.

Furthermore, the pursuit of more precise, physics-incorporated, and authentic simulations would elevate the scale of modelling, subsequently demanding heightened data prerequisites and enhance graphical realism. At the pinnacle of complexity, there exist transactional Metaverse archetypes which facilitate secure transactions and communication within a multiplayer environment.

NCS strategically enables gradual adoption of the Metaverse for a client



Through a collaborative effort, NCS orchestrated the progressive establishment of a Metaverse platform for a leading financial services provider in Asia. The journey began with a foundational, simplistic archetype situated at the base level, that was primarily designed for information dissemination.

No one has yet taken a 'big bang' approach when implementing Metaverse applications, especially in the enterprise space. Through a series of iterative events, NCS helped the client transition up the value chain from simple informational transactions, like town hall meetings, to the point where secured transactions like NFT trading were enabled in the Metaverse.

A notable outcome of the transactional stage was the ability of users to engage in a tokenised economy where users earned more than 1 million virtual coins that were subsequently converted into charitable contributions.

How can one mitigate security risks and enable secure commercial transactions?

How can security risks be addressed, and secure commercial transactions be enabled in the Metaverse? Stateless transactions can be implemented within the Metaverse, or traditional backend transaction systems can be utilised. While regulations for financial transactions within the Metaverse have not yet been fully established, businesses should not be discouraged from introducing payment solutions and transactional spaces in this environment. One way to overcome the absence of regulations is to initially avoid integrating payment solutions into Metaverse platforms. Instead, let the existing payment system handle transactions, while users engage in activities within the Metaverse.

In terms of security, persistent spaces in the Metaverse do not compromise safety since they are stateless. This means they do not retain information about their state from one runtime to the next. Employing a stateless approach enables businesses to conduct transactions or private meetings in the Metaverse, with a continuous environment, while sensitive details such as transaction records and passwords remain temporary. Additionally, a variety of security layers can be implemented across different points in the Metaverse, spanning from a device's hardware layer to the Metaverse platform and third-party applications.

New threats arise from the Metaverse

Within the ever-expanding domain of the Metaverse, several distinct attack vectors have emerged that present notable security and privacy challenges. Foremost, cyber-physical systems have become vulnerable targets in this virtual realm. The integration of physical devices with interconnected systems introduces opportunities for malicious actors to exploit vulnerabilities and cause real-world damage. Furthermore, AR and VR tools offer fresh avenues for attacks. Given their immersive nature, these technologies can be manipulated to deceive users or to compromise their personal information. NFTs and blockchain, which have gained substantial popularity, are also susceptible to threats. The decentralised nature of blockchain technology makes it an attractive target for hackers seeking financial gain or disruption. As the Metaverse continues to rapidly evolve, addressing these unique attack vectors becomes imperative.

The rise of the Metaverse introduces a new realm known as the Darkverse that is akin to the dark web in traditional cyberspace. This concealed underbelly of the Metaverse presents numerous security threats and challenges that users must be conscious of. The Darkverse serves as a breeding ground for illicit activities including the manipulation of cyber-physical systems, exploitation of AR and VR tools, and fraudulent practices involving NFTs and blockchain technology.

NCS's response to maintaining security in the Metaverse

NCS recognises the swiftly evolving nature of the Metaverse, and our viewpoint is shaped by the need to find equilibrium among user experience, security, and privacy. As users immerse themselves in this virtual realm, their interactions become more complex, necessitating robust measures to protect personal data and ensure a secure atmosphere. While user experience is central to the Metaverse's allure, it should not come at the expense of security or privacy.

Striking a balance between user experience and security involves implementing fundamental cyber hygiene practices, such as authentication protocols that verify user identities, without hindering the immersive experience. Access control mechanisms must be put in place to regulate permission within the Metaverse, while maintaining user autonomy. Safeguarding sensitive data within the Metaverse is pivotal for upholding trust among users. The integration of encryption techniques and data protection frameworks into the infrastructure is vital to preventing unauthorised access or breaches. Concurrently, continuous security monitoring must be adopted to swiftly detect and respond to potential threats.

NCS believes in collaborative endeavours to both secure the Metaverse and preserve privacy. Given the diverse array of virtual experiences and interactions that occur within this immersive digital realm, protecting sensitive information and averting cyber threats becomes a collective duty. Securing the Metaverse necessitates a multifaceted approach that calls for collaboration among diverse stakeholders including technology firms, developers, users, and regulatory bodies.

How should businesses measure success?

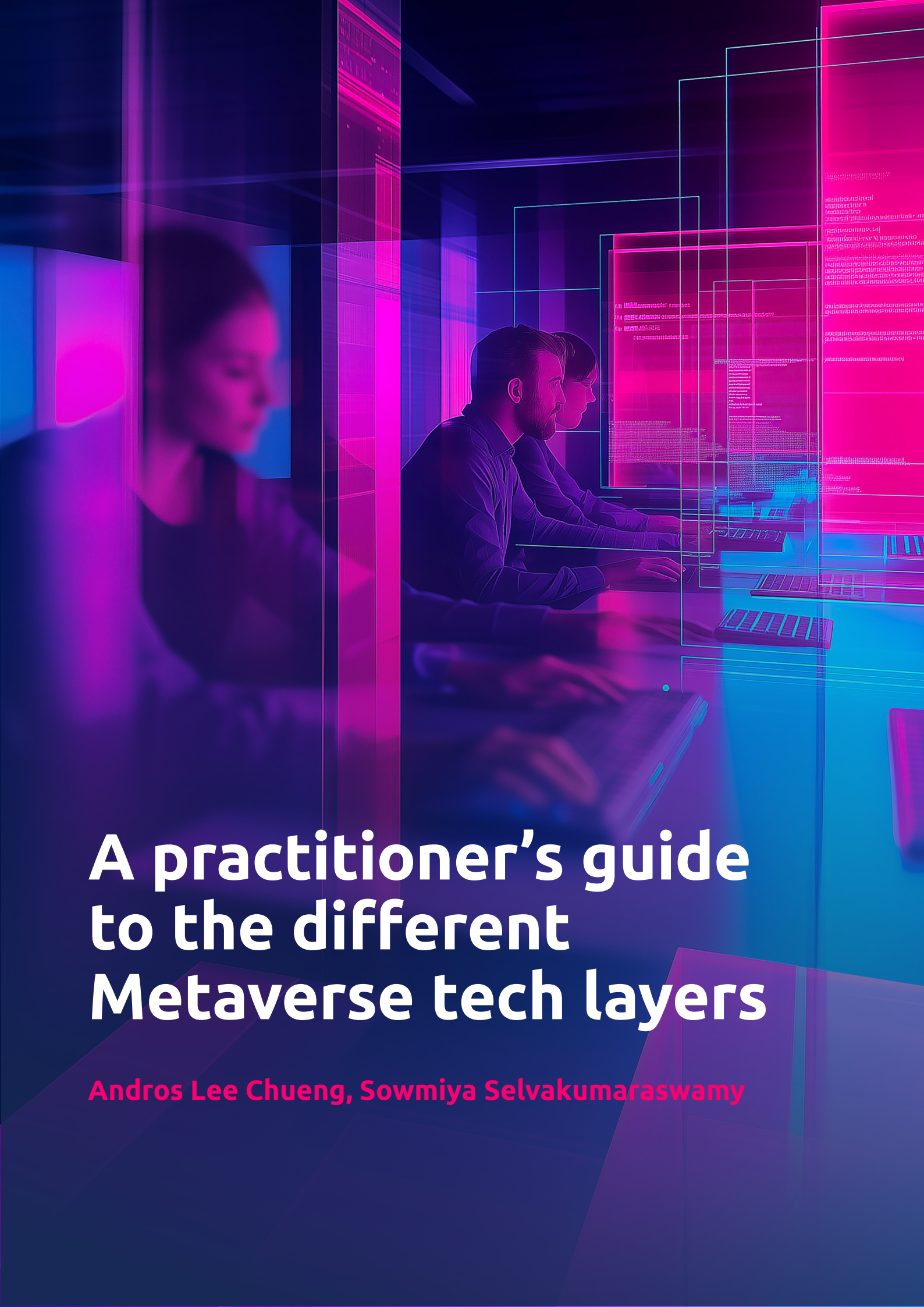
How should the measurement of success be approached? Key performance indicators (KPIs) should be established that align with business goals including user engagement, client contentment, and operational efficiency. While transactional capability in the Metaverse may be complex to deploy, it is not the only archetype that can help drive profits for businesses. Metaverse deployments with much lower levels of complexity, such as for showrooms or social collaboration, can deliver immediate efficiency gains and positive business outcomes. NCS has found that some Metaverse-related social collaboration use cases for the real estate industry have helped employees work faster and have increased collaboration among remote employees by 30%.

Businesses do not need to deploy all archetypes or a Metaverse transaction level of complexity to see improvement in the bottom line. Solutions such as AI can be applied across the entire spectrum of Metaverse archetypes to improve profit margins. For example, a retailer might create special interest groups in the Metaverse to understand its customers better. Secure methods can then be used to track online behaviour and interactions in these Metaverse groups, which can present upsell opportunities. Businesses must thus be observant and hawkish in identifying and measuring business outcomes from their Metaverse deployments.

About Tesseract:

Tesseract is NCS's Innovation Center and is focused on helping clients use technology to address market challenges and opportunities. Our extensive team of researchers and practitioners helps clients to experience cutting-edge technology, in an immersive manner, at our 4,500 square foot facility.

Through *Design Thinking* workshops, our innovation team leads clients through a proof of value process for the evaluation of leading technologies and the identification of market gaps. Tesseract has extensive APAC-focused research capability to assist clients with white papers and points-of-view on the impact of technology to specific industries and business functions, as well as consultative capabilities to identify promising innovative start-up companies globally.

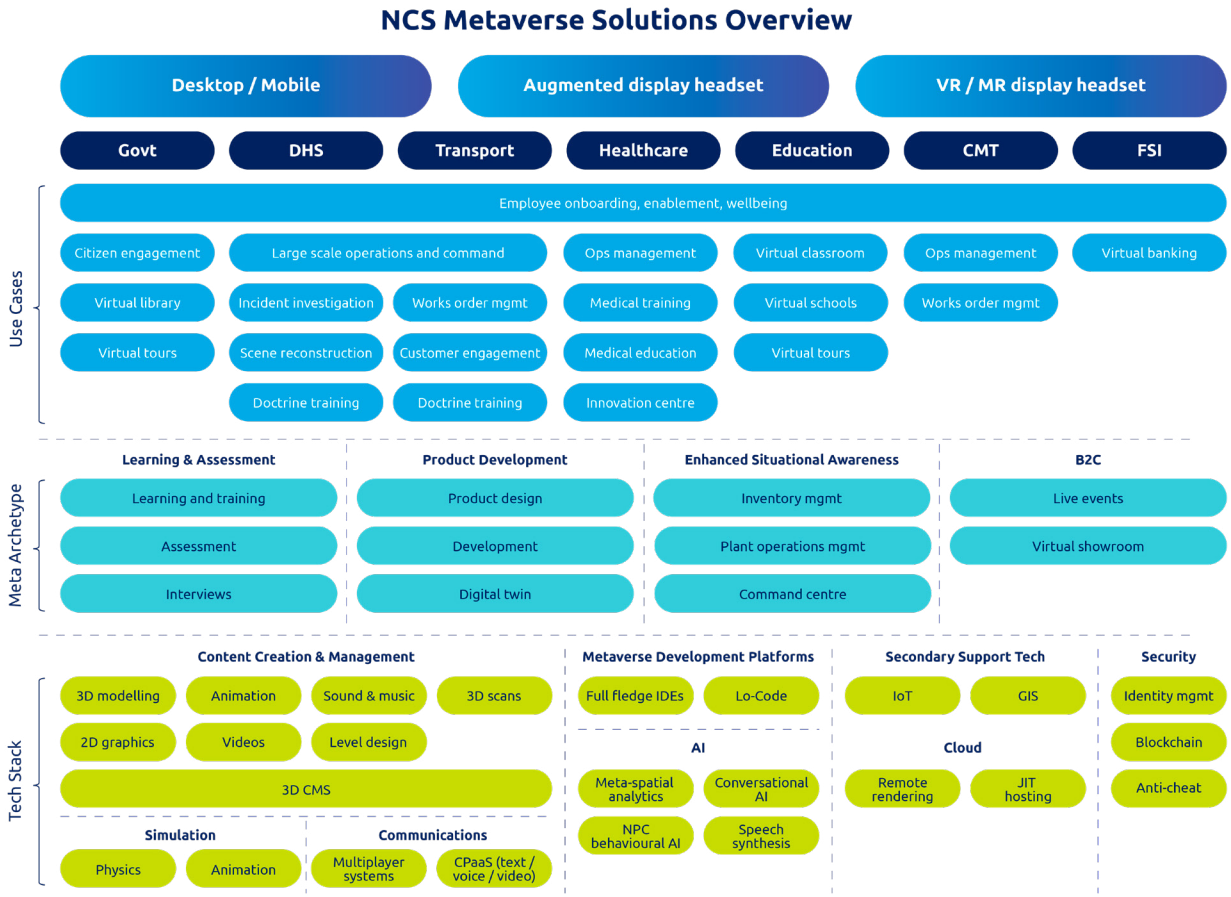


A practitioner's guide to the different Metaverse tech layers

Andros Lee Chueng, Sowmiya Selvakumaraswamy

A practitioner's guide to the different Metaverse tech layers

The Metaverse technology stack encompasses a diverse array of technologies and components across multiple domains, including content creation and management, Metaverse development and coding platforms, security, simulation engines, communications, Artificial Intelligence (AI), cloud computing, and auxiliary technologies such as Geographic Information Systems (GIS) and the Internet of Things (IoT).



This paper provides an overview of the fundamental elements within each layer of the tech stack.

Content creation and management

This layer encompasses the tools and platforms for creating, sharing, and curating digital assets which can include anything from virtual fashion to virtual real estate. Practitioners can play a significant role in fostering creativity and ensuring content quality by developing user-friendly creation tools and AI-driven content recommendation systems.

3D modelling and animation tools: These software applications, including Blender, Maya, and 3ds Max, serve as essential tools for crafting intricate 3D assets, characters, and animations that form the core of the Metaverse's immersive experience.

Digital art and design tools: Tools such as those found in Adobe Creative Suite enable the creation of 2D assets and textures that are indispensable in constructing virtual environments.

Asset libraries: These repositories are dedicated to storing and efficiently managing a variety of 3D models, textures, and other reusable assets that are vital to Metaverse content creation. For instance, Unity Asset Store serves as a repository for game developers to access and share 3D models, textures, and scripts. Game developers can purchase or upload their assets for reuse.

Asset optimisation tools: These specialised tools are used to optimise 3D assets, to reduce file sizes and enhance overall performance within virtual environments. Tools such as Simplygon and SpeedTree focus on optimising 3D assets. In a virtual world, these tools can optimise high-polygon count 3D models for better performance while maintaining visual fidelity.

Content Management Systems (CMS): CMS platforms are used for the systematic organisation, categorisation, and distribution of digital assets within the Metaverse to facilitate seamless access and utilisation. Contentful and Strapi are examples of CMS platforms for organising digital assets within the Metaverse. These platforms allow content creators to easily manage and distribute digital content such as virtual clothing, accessories, or 3D art.

Simulation engines

Physics Engines: Software such as NVIDIA PhysX and Bullet Physics simulate real-world physics within the metaverse, enhancing the realism of the virtual environment.

AI-Driven Simulations: AI and machine learning algorithms are leveraged to create dynamic and realistic simulations of virtual environments, including behaviour modelling, which enhances user immersion. Engines such as SpeechGraphics bring AI-powered Non-Player Characters (NPCs) into the 3D world to give it a layer of immersion and create a diverse experience rather than a scripted one, ensuring a unique experience each time a player enters the virtual space. Nvidia's Omniverse platform also provides a new simulation engine called Audio2Face which provides AI-generated facial expressions for 3D avatars.

- NCS recently made use of the Audio2face module from Nvidia Omniverse to animate a digital human for a digital concierge project. The animation of the avatar was accomplished by simply passing an audio stream through the module and letting Audio2face decide how to animate the avatar's facial expressions.

Communications

- Effective communication is essential in the Metaverse. This layer includes technologies for voice and text chat, virtual meetings, and social interaction. Practitioners should stay updated on platforms like VRChat, Horizon Workrooms, and emerging protocols for cross-platform communication.

- Voice and video chat: Real-time voice and video communication tools are integrated to facilitate social interactions within the Metaverse, enabling users to engage in meaningful conversations.

- Text chat: In-game text chat and messaging systems provide avenues for both one-on-one and group communication, enhancing the social aspects of metaverse experiences.

- Social media Integration: Metaverse experiences are linked to social media platforms, allowing users to share their experiences and connect with a broader audience.

Metaverse development/coding platforms

These platforms serve as the technological bedrock upon which the Metaverse is constructed. They provide the tools, frameworks, and environments for developers to create, build, and innovate within the Metaverse.

Game engines: Engines such as Unity and Unreal Engine have been widely adopted for Metaverse application development due to their capabilities in handling complex 3D environments and interactive elements.

- NCS has developed a project with a web-optimised games engine, Playcanvas, to create an engagement platform for a banking customer, serving both internal and external stakeholders.

Web-based frameworks: Frameworks such as WebVR, A-Frame, and Babylon.js enable web-based Metaverse development and ensure accessibility via web browsers.

- NCS has used FrameVR to deliver ad hoc projects, including a virtual town hall for a banking customer and an annual event for a networking client. Web-based framework tools that support many users and allow for 3D editing online enable NCS to develop and deploy solutions quickly and easily.

AR/VR development kits: Software Development Kits (SDKs) such as Oculus SDK and ARKit/ARCore are instrumental for Augmented Reality (AR) and Virtual Reality (VR) Metaverse development.

- NCS has built immersive digital twins and sandboxes using these frameworks for investigation and operational uses cases that require Extended Reality (XR) simulations. Those solutions make use of Hololens and Oculus to provide an immersive view of an incident area and allow users to use hand gestures to manipulate the environment, to issue commands, and to gather data.

Artificial Intelligence (AI)

Artificial intelligence and automation play a crucial role in shaping user experiences and managing the vastness of the Metaverse. AI-powered virtual assistants, content moderation, and predictive algorithms enhance engagement and safety within virtual worlds.

AI chatbots: AI-driven chatbots serve as NPCs and virtual assistants within the Metaverse, helping and enhancing user engagement.

Behaviour modelling: AI is utilised to simulate lifelike behaviours and the interactions of virtual entities, significantly augmenting the immersive quality of the Metaverse.

Speech synthesis: Creates natural sounding voices for NPCs and for any form of narration that is key to the overall experience for users. Fortunately, there are many solutions in the market to enhance the naturalness of speech, and the latest trend is to clone the voices of celebrities and other influential people to lend credence to narratives within the Metaverse environment. Creating a voice clone with just 45 seconds of real audio recording is already possible using platforms such as PlayHT.

Meta-spatial analysis: Users interacting within the Metaverse space present new data collection points (e.g., where users are located in the Metaverse and how users are navigating the space). These data sets allow content designers to strategically position content to achieve the best user engagement outcomes.

Secondary technologies (GIS and IoT)

The Metaverse's success depends on interoperability between platforms and technologies. Open standards and protocols are vital to ensure seamless cross-platform experiences. Practitioners should advocate for, and contribute to, the development of these standards.

GIS integration: Geographic data from GIS systems is incorporated into the Metaverse to provide location-based experiences and navigation capabilities.

IoT integration: IoT devices are connected to the Metaverse, enabling real-time data collection and interaction, including smart home integration and environmental sensor data acquisition.

Security

Security in the Metaverse presents a unique set of challenges as it needs to combine game-like features that traditionally prioritise speed and responsiveness over security. Fortunately, there are already existing technologies in place to meet these challenges.

Anti-cheat: This is a unique mechanism that governs behaviours and interactions of all players in the Metaverse environment. This is especially important when there are rewards and achievements that tie in with some monetary value. Having a robust anti-cheat mechanism in place becomes extremely important to ensure fair play.

Blockchain platforms: Platforms such as Ethereum, Flow, and Binance Smart Chain are leveraged for the development of blockchain-based Metaverse applications and the establishment of digital asset ownership.

Cloud computing

Cloud computing is crucial to the Metaverse as it provides scalable and cost-effective infrastructure for processing vast amounts of data, hosting virtual environments, and powering immersive experiences.

Server hosting: Leading cloud providers such as AWS (Amazon Web Services), Azure, and Google Cloud offer server infrastructure to host Metaverse services and applications, ensuring scalability and reliability.

Content delivery: Content Delivery Networks (CDNs) guarantee low-latency content delivery to users across the globe and contribute to a seamless user experience.

Additional security

As the Metaverse expands, security and privacy concerns intensify. Practitioners must prioritise cybersecurity, including identity protection, data encryption, and anti-phishing measures. Awareness of privacy regulations and ethical considerations is equally important.

Encryption: Encryption protocols are employed to safeguard data transfer and communications within virtual environments, protecting sensitive information from unauthorised access. Using encryption protocols, such as SSL/TLS to secure data transfer and communications within virtual environments is crucial for security. For example, SSL encryption ensures that user information remains confidential during in-game chats or with financial transactions.

- NCS implemented a Metaverse platform that uses Colyseus to handle multiplayer networking, which works on UDP, and is inherently insecure. But through a unique architecture design, we created a secured connection to the customer's secure backend while still allowing a gamified frontend.

Access control and authentication: Identity verification and access control mechanisms are implemented to ensure that only authorised users can access specific areas or perform designated actions within the Metaverse.

Cybersecurity tools: Utilising a range of cybersecurity tools and best practices is essential to defend against potential threats such as hacking, data breaches, and other cyberattacks.

Conclusion

The Metaverse technology stack is a dynamic and continuously evolving ecosystem. Successful Metaverse development often requires a multidisciplinary approach, bringing together expertise in various domains to create immersive and interconnected virtual worlds. Going forward, interoperability and adherence to standards will remain pivotal to ensuring the seamless integration of differing Metaverse platforms and experiences.

NCS training Metaverse case study – Virtual roleplay

Andros Lee Chueng

NCS training Metaverse case study – Virtual roleplay

Generative AI avatars in virtual roleplay training

Introduction

Generative AI (Gen AI) and 3D avatars can play a pivotal role in creating realistic roleplay training for the healthcare industry. Healthcare professionals often face complex and highly stressful situations and effective training can make a significant difference in their ability to respond to real-life scenarios. The benefits of Gen AI and 3D avatars for roleplay training in the healthcare industry include:

Scenario generation

Gen AI can be employed to create a wide range of realistic healthcare scenarios. This technology can simulate various medical conditions, patient interactions, and emergency situations, providing a diverse training experience. For instance, it can generate scenarios involving patient assessments, surgical procedures, diagnostic challenges, and critical care interventions.

Realistic avatars

3D avatars are a key element in creating lifelike interactions. These avatars can represent patients, colleagues, and other stakeholders in the healthcare setting. They can exhibit realistic facial expressions, body language, and vocal cues, enhancing the immersive nature of the training. The avatars can also be customised to simulate different ages, genders, and ethnicities, promoting diversity and inclusivity in training.

Communication and soft skills

Healthcare professionals require excellent communication and soft skills to interact with patients, families, and team members effectively. 3D avatars can provide opportunities for learners to practice these skills in realistic scenarios. Avatars can respond to verbal and non-verbal cues, allowing trainees to practice empathy, active listening, and delivering bad news, among other vital communication skills.

Decision-making training

Healthcare often involves making critical decisions under pressure. Gen AI can create branching scenarios, where the outcome depends on the choices made by the trainee. This can help in assessing the trainee’s decision-making abilities and when providing feedback on different courses of action. The AI can also adapt the scenario based on the trainee's responses to provide a dynamic and tailored learning experience.

Repetitive practice

Training in healthcare requires repetitive practice to build muscle memory and decision-making skills. Gen AI can be used to create an almost infinite number of scenarios that provide trainees with the opportunity to practice frequently, without the risk of patient harm. This is especially valuable for procedures like CPR, intubation, and surgical techniques.

Feedback and assessment

AI can provide real-time feedback and assessment, helping trainees to understand their strengths and areas for improvement based on both clinical and soft skills. It can also be used to track a trainee's progress over time and serve as the basis for personalised development plans.

Remote training

Virtual roleplay technologies allow for remote training, which can be especially valuable during times of pandemic or when it is challenging for learners to be physically present for the training. The technology enhances accessibility and is flexible as healthcare professionals can access training modules from anywhere.

Data-driven improvements

AI can be used to collect data on trainee performance, allowing institutions to make data-driven improvements to training programs. It can identify common areas where trainees struggle and adjust training accordingly.

Conclusion

Gen AI and 3D avatars make virtual roleplay realistic and scalable, which is important when healthcare practitioners require complex training scenarios to equip them to deal with unpredictable situations.

NCS consumer Metaverse case study – Mixed Reality in a museum setting

Pey June Tan, Gregory Wood
Credits: Janice Ooi, Selvi, Tianjiao Ji, Anastasia Evelyn Yeo

NCS consumer Metaverse case study – Mixed Reality in a museum setting

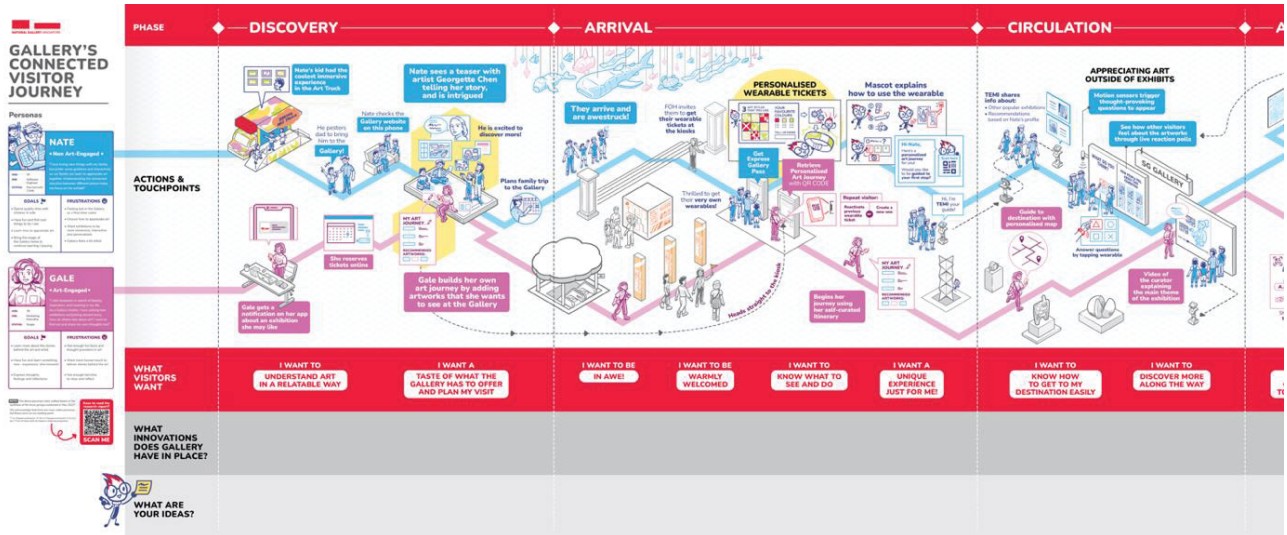
Breaking boundaries in art engagement: Step into the canvas with Mixed Reality

Overview

The growing desire among consumers for novel and realistic experiences has driven the continuous growth and advancement of immersive technologies, particularly within the gaming and entertainment sectors. However, these technologies are still in the early stages of adoption in the realm of the arts. Museums, traditionally focused on preserving history and maintaining a sense of tradition, now face the challenge of engaging a growing generation of digital natives. It is therefore crucial for us to pioneer innovative experiences that can attract a wider and more diverse audience and foster a renewed appreciation for the arts.

To achieve this, a deep understanding of the needs and motivations of individuals who may be less appreciative of the arts is paramount. NCS, in partnership with the National Gallery of Singapore, has developed a mixed reality experience that is tailored to meet the preferences and expectations of this target audience. This proof of concept leverages the advanced mixed reality capabilities of Meta Quest Pro to seamlessly blend virtual and augmented realities in a physical museum space.

How it began: The visitor journey map



In 2021, NCS became the official innovation partner of the National Gallery of Singapore. The NCS NEXT Digital Experience team collaborated with the Gallery to understand the then current visitor challenges so that a 'user-first' approach could be taken to co-create an immersive visitor journey. The Gallery's Visitor Journey Map served as a foundation for crafting connected, immersive, and innovative next-generation experiences.

One of the key challenges identified to ensuring broader appeal of the museum experience was making art more accessible to visitors who may not be familiar with art appreciation. To elevate the visitor experience using innovative technology, a holist approach that considered customer/user experience, and included behavioural science, was adopted.

Critical challenges

NCS' initial research revealed challenges faced by individuals less familiar with appreciating the arts, including:

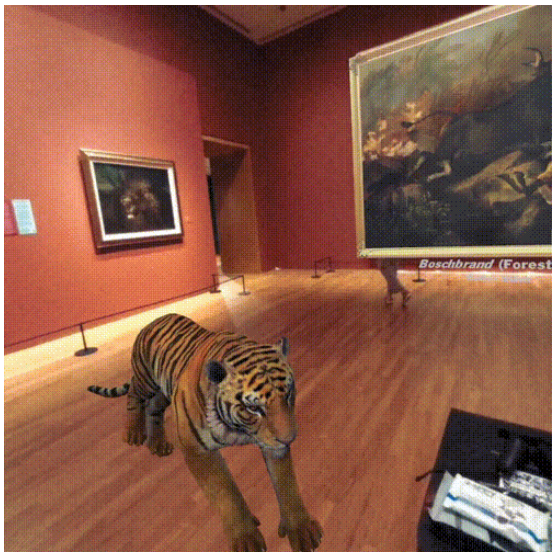
- Limited ways to access and understand the stories behind works of art: Visitors who were unfamiliar with art had a strong desire to understand the reasons that a piece of art had been created. However, the existing written captions below the static paintings fell short of capturing that essence of creation and limited the opportunities for visitors to develop meaningful connections with both the art and the artists.

- Lack of guidance about how to appreciate art: Visitors who were unfamiliar with art felt discouraged and excluded as they believed they required knowledge of art techniques and context to appreciate the work. They desired more guidance, and a barrier-free way to experience, consume, and appreciate the art.

Based on those findings, a team comprised of designers, developers, product managers, and UI/UX (User Interface/User Experience) experts from NCS NEXT Digital Experience and NCS Xperience Works was formed to create a mixed reality immersive experience that would bring the artworks to life for visitors.

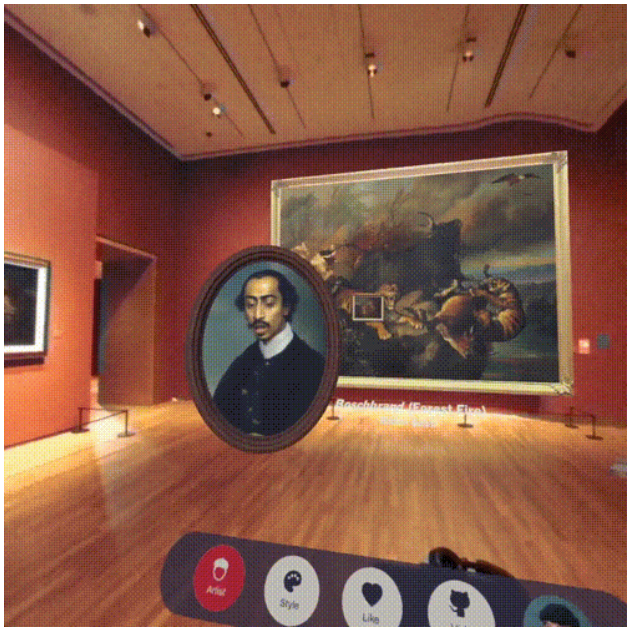
The experience

In the Gallery, visitors don a mixed reality headset while seated in a physical space. Using hand gestures, visitors can interact with the art and learn about context and back stories in an intuitive and engaging way. The novel and immersive nature of this mixed reality experience appeals to visitors, creates excitement, and increases engagement with Gallery exhibits.



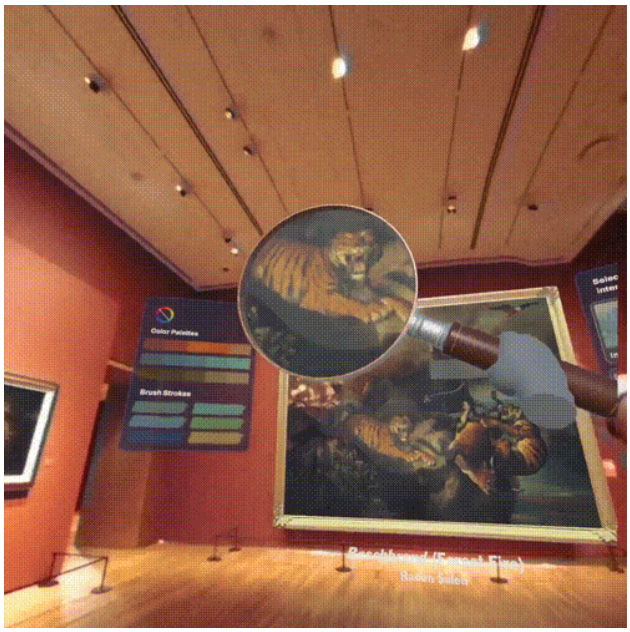
Immersion-realistic environments:

Through an immersive encounter, a life-sized adult tiger moves in close proximity, roars, and transports the visitor into the heart of the artwork. This realistic spatial experience, enriched with spatial sound and 3D elements, serves as a pivotal factor in elevating the perceived value of the visit and increases the visitor's willingness to pay.



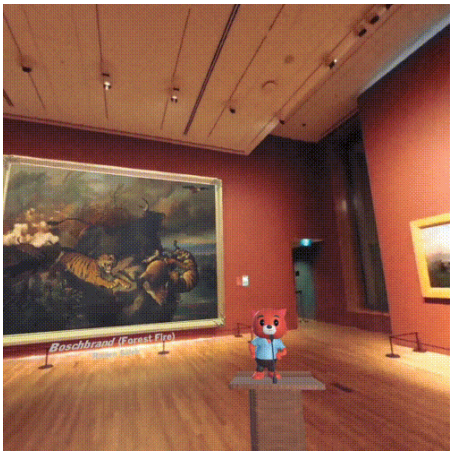
Narration delivered by the artist:

Through an animated portrait, the artist unfolds his past, leading visitors on a visual journey, while sharing his influences, and explaining his artistic process. With narratives about the artist and his inspirations, and information about the meaning of the artwork, the immersive experience allows visitors to develop a deeper emotional connection with both the art and the artist.



Interactive artwork:

The user interface style is in keeping with that of the artwork and the magnifying glass feature allows visitors to explore the painting and to zoom in. The ability to highlight elements of the artwork in greater detail helps visitors make sense of what they are seeing and enriches their overall engagement with the artistic content.



Gale' the Gen AI guide:

A friendly guide, powered by Gen AI, helps to answer any questions visitors may have when viewing the artwork, personalising the visit.

The technology

The mixed reality immersive experience focuses on a few key components:

- **Animation of the artwork:**

The focal point of Raden Saleh's "Forest Fire" has been given a new dimension through animation overlaid on the actual artwork. The previously static figures of the tiger, ox, and deer are animated, moving as if truly alive. The effect is heightened by a dynamic visual portrayal of the blazing fire, and the accompanying crackling sound effects, paired with a voiceover of the forest fire background story. The addition of motion and sound transforms the scene into a lifelike spectacle. The result is a more immersive and engaging viewing experience of "Forest Fire," as the animation breathes new life into the classic piece.

- **Spatial design:**

The spatial design of the mixed reality environment has been carefully crafted to ensure seamless interaction between the virtual elements and the physical space. Bezel, a collaborative spatial design platform for teams, was used for advanced mapping. This tool accurately measures and recreates the dimensions and features of the physical room within the virtual environment. This method guarantees a coherent experience, where virtual and real elements coexist naturally, preserving depth perception and spatial awareness for the user.

- **Development of realistic 3D models:**

The creation of realistic 3D models is crucial for an immersive experience. High-quality 3D models of key elements, such as the forest fire, tiger, and Gale, the docent ambassador, were developed with an emphasis on detail and realism. Techniques were used to deliver intricate details and lifelike realism, including realistic lighting and shadows, to enhance the authenticity of these characters. Additionally, photogrammetry techniques were utilised to capture textures and details from real-world objects. These elements were meticulously refined and optimised for rendering in the mixed reality environment, to ensure that the models are visually compelling and true to life.

- **Interactive elements:**

Interactive elements in our mixed reality environment were designed to enable natural and intuitive user engagement. During the development process, focus was put on selecting user-friendly gestures and commands. The interactive design was built on a blend of touch controls, eye tracking, and gestures. An iterative approach was taken to identify the most effective 'tappable' buttons for the menu panel to ensure realistic interactions with virtual objects. Additionally, eye tracking technology intuitively follows the user's gaze, enhancing interactions with Gale, the ambassador. The combination of eye tracking with touch and gesture-based interactive methods was designed to produce experiences that feel natural and responsive, while also being deeply immersive. The aim was to enhance the overall user experience and reduce any frustration that might result from elements that fail to respond in a realistic manner.

User testing: Paving the way to the future of museum visits

The team conducted iterative user testing where we went through a series of in-person sessions. The team spoke to eight users directly within the exhibition spaces, where users interacted with a prototype designed to immerse them in the authentic gallery environment.

The primary objective was to assess the appeal and desirability of an immersive mixed reality experience for individuals who were new to art appreciation. Testing focused on the extent to which the incorporation of innovative immersive technologies increased users' appreciation for art and had a positive impact on their overall gallery experience.

The user testing phase spanned a comprehensive two-week period and resulted in the following findings:

- **Strong positive sentiment to the Mixed Reality (MR) immersive experience:**
  - Average score of 80% for user intent to revisit the gallery
  - Average score of 90% for user intent to recommend the MR Immersive to others
  - Average score of 71% for ease-of-use of the MR immersive headset
- **Novelty of immersive experiences in museums is a strong pull factor:** Users noted the unique appeal of an experience that is not yet widely available in traditional art settings in Singapore. User sentiment reflected excitement with the ability to interact with immersive elements, such as the virtual tiger, outside of real-world constraints. The willingness of users to pay up to SG$10 for such engaging encounters underscores the strong attraction and perceived value of the mixed reality experience.
- **Sensorial experiences increase accessibility to the arts:** The sensorial, immersive experience, from the collective of 3D interactive elements, to the spatial surround sounds, was noted as an effortlessly enjoyable entry point by users who are new to art appreciation.
- **Narration of the artwork increases emotional connection:** The introduction of narration as well as information pertaining to the meaning of the artwork deepens user engagement. The animated talking paintings and interactive art controls contribute to a richer understanding and make the art more accessible and meaningful for users.
- **Gen AI guide helps personalise museum visits:** Users commented that, while still conceptual, the Gen AI guide's ability to answer questions and assist with navigation helped to personalise their museum visit.

These findings not only affirm the revolutionary potential of the MR experience but also highlight the ability to redefine how individuals connect with, and enjoy, cultural narratives within a museum setting with the addition of mixed reality elements. This phase has opened a pathway to a more immersive journey through art and history.

NCS enterprise Metaverse case study – Reinventing work

Kangrui Ling, Andros Lee Chueng

NCS enterprise Metaverse case study – Reinventing work

Reinventing work with the Metaverse

The four pillars of NCS's Metaverse strategy – An enterprise Metaverse perspective

NCS's Metaverse strategy is a comprehensive one. It is comprised of four key Metaverse archetypes, namely:

- **Consumer Metaverse:** Consumer-centric Metaverse experiences centred around retail, lifestyle, media, and entertainment. This includes elements of Web 3.0 and is a new phygital (physical plus digital) channel of engagement for businesses.
- **Enterprise Metaverse:** Centred around collaboration and productivity, it is where businesses engage with stakeholders in persistent virtual spaces and shared experiences such as town hall meetings and collaborative workspaces.
- **Industrial Metaverse:** Revolves around enabling operational excellence with tools such as Extended Reality (XR), digital twins, and smart wearables. It is enhanced by the latest developments in digital connectivity, networking, and visual rendering.
- **Training Metaverse:** Centred around safe and efficient training, and customised training scenarios, delivered in the Metaverse. Generative AI plays a synergistic role by enabling virtual interactive avatars or by dynamically creating scenarios.

These archetypes relate closely to existing and maturing technologies, including digital twins and immersive headsets, but are also intertwined with emerging concepts, including Web 3.0 and Generative AI.

With the launch of Apple Vision Pro and the visionOS software development kit (SDK) in June 2023, developer interest in spatial computing has increased. The further development of display technology, coupled with more tactile control, will allow businesses to leverage the Enterprise Metaverse to better enable immersive remote work, collaboration, and stakeholder engagement.

Spotlight: NCS pushing the cutting edge for financial service digital transformation

Challenges

In the rapidly-evolving digital financial services space, innovation is not just a buzzword – it's a necessity. Our client, a prominent regional financial service provider based in Asia, has consistently embraced innovation to enhance customer experience. Known for its pioneering use of technology, the financial service provider has earned accolades for its digital transformation efforts and has cemented its position as a digital leader in the industry. Its next challenge? The Metaverse.

Recognising the unprecedented opportunity the Metaverse presented to engage customers in a novel, immersive way, in May of 2022 the company began its journey to leverage the Metaverse's potential. However, while the Metaverse promised innovation, the security risks it presented could not be ignored. With a vision that transcended mere banking services, the company aimed to shape the Metaverse to cater to present and future generations of Small and Medium Enterprise (SME) customers. But the challenge lay in gradually adopting a Metaverse platform while maintaining the highest level of security at every step.

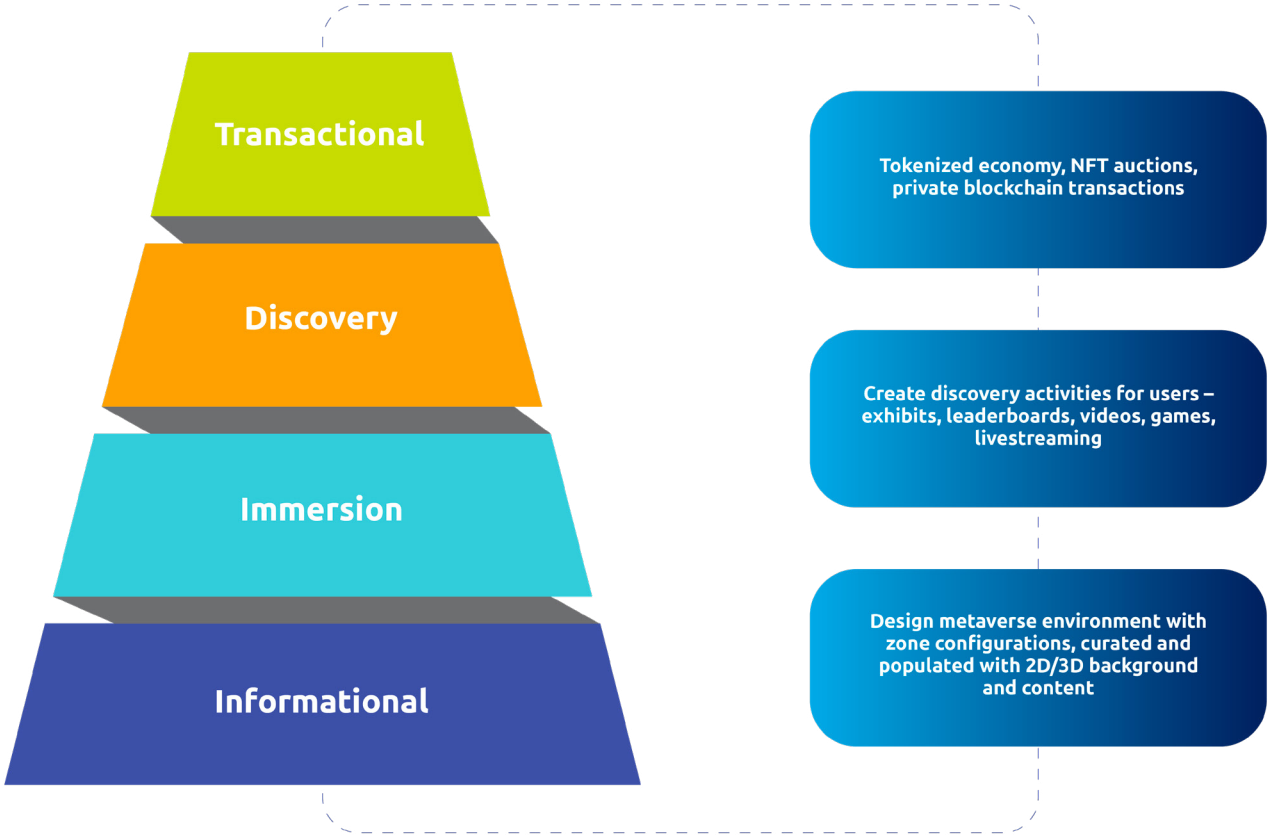
NCS's solution

To address these challenges head on, the financial service provider sought a partner with expertise in the Metaverse landscape. Their choice was clear: NCS. Collaborating closely, NCS developed a customised Metaverse solution that aligned with the service provider’s goals.

The cornerstone of this solution was day one security – a non-negotiable requirement for any platform that involves financial transactions. This foundation was built on a dynamic multi-room hub and spoke architecture, a setup that allowed each Metaverse "room" to function as an individual application. This architecture ensured that the platform was scalable and could be adapted to meet fluctuating demands.

A critical aspect was the inclusion of an orchestrator that managed the orchestration of rooms. In addition to providing for scalability, the orchestrator maintains end-to-end security and manages the spin-up and spin-down of rooms in strict compliance with security protocols.

But security wasn't the only focus. The solution also included a set of features that governed interactions within the Metaverse. These features, seemingly minor but pivotal, prevented any inconsistencies, hacking, or cheating within the virtual realm. For instance, imagine a player trying to move at the speed of 100 metres per second (m/s) – a scenario the platform was designed to prevent. This attention to detail underscored the solution's robustness.



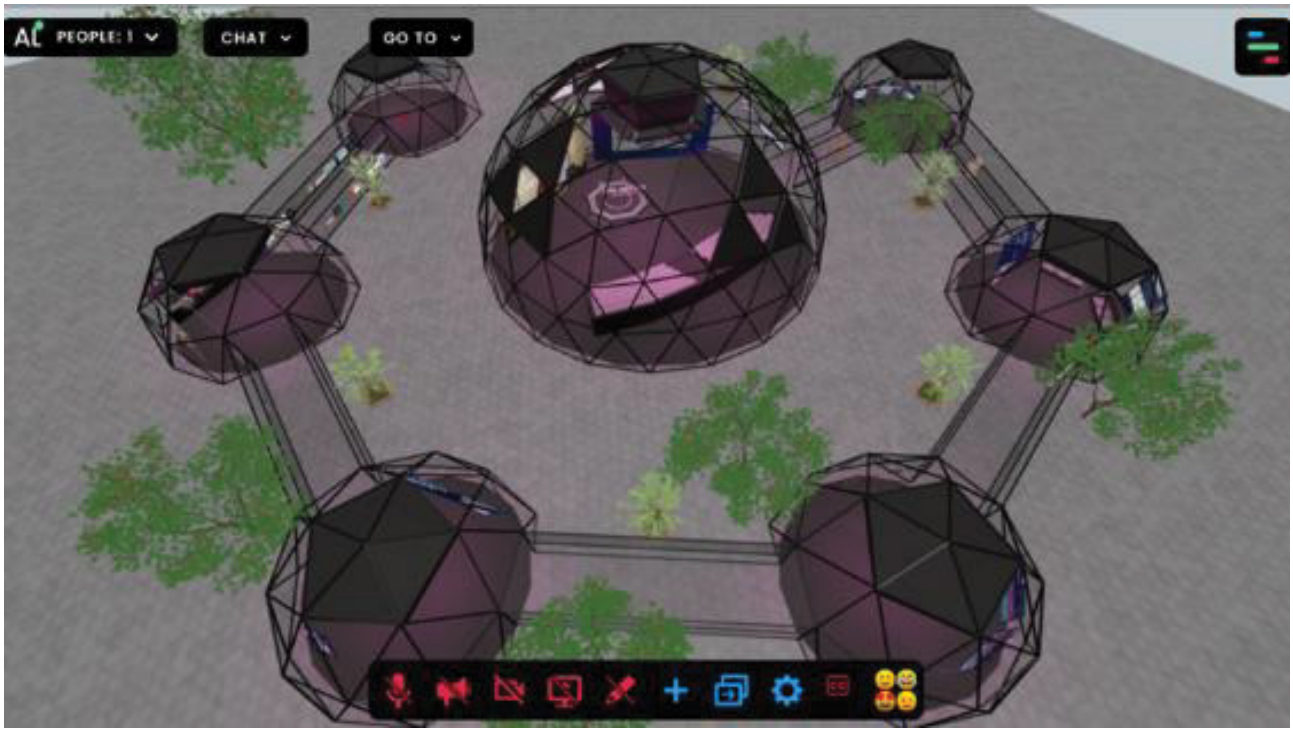
Ultimately, the collaboration resulted in a four-tiered approach to the Metaverse. That approach starts with a basic "Informational" layer, where a Metaverse environment is created for professionals to retrieve information. It then scales to a "Discovery" layer where more immersive, interactive, and engaging programs are available. The final, most complex and secure layer is the "Transactional" layer where commercial transactions occur.

This multi-layered approach allowed the financial service provider to gradually onboard users and to test effectiveness at each layer. Beginning with a few hundred users, the platform was efficiently scaled to accommodate more than one thousand users. This progression was a testament to the solution's adaptability and effectiveness.

Results

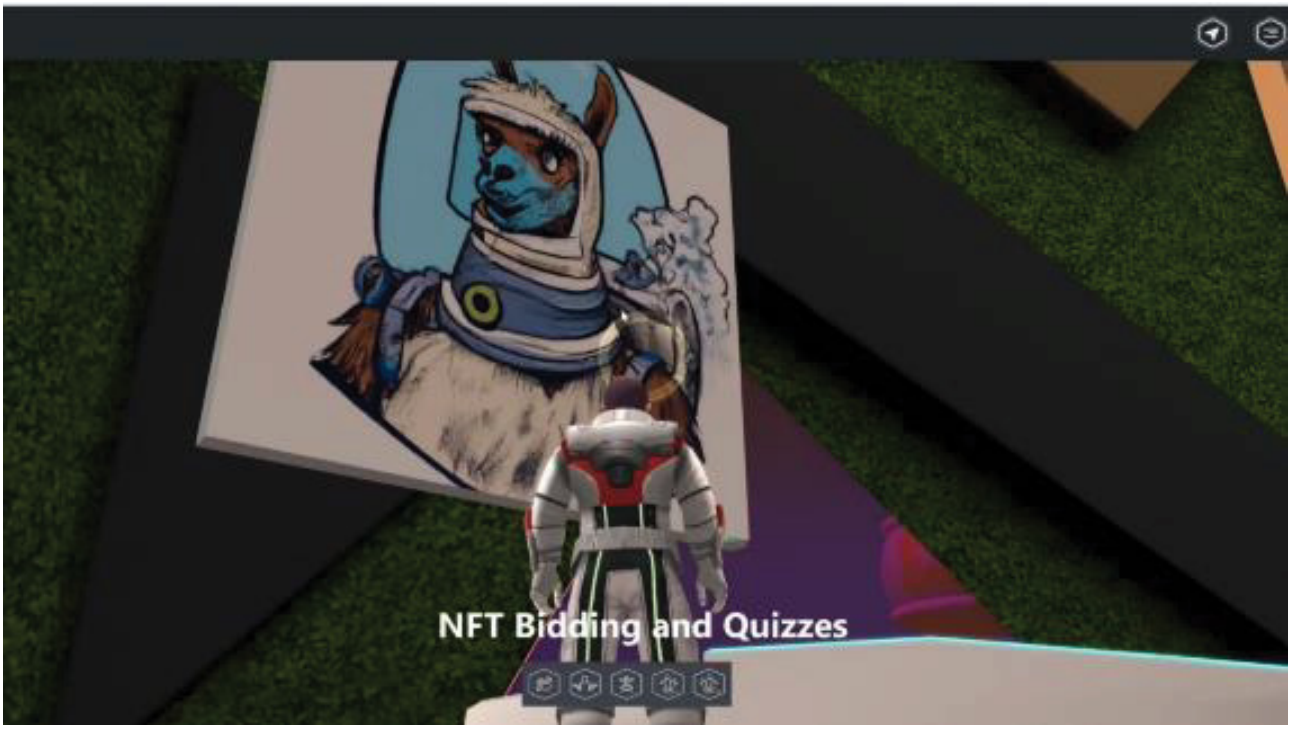
The collaboration between NCS and the financial service provider was successful at every stage of implementation:

Informational stage: At this stage, NCS created a Technology and Operations Town Hall meeting. With a focus on laying an initial foundation, the meeting allowed one hundred of the financial service provider's staff members to experience Metaverse platform zones, entrances, meeting halls, games rooms, and lounges, as the initial step toward full immersion.



Immersion stage: A *Future Operations Festival* was organised that allowed two hundred company employees to glimpse the Metaverse's immersive potential through digital twins of physical booths. This immersion experience fuelled creative re-engineering ideas for future customer and employee interactions.

Discovery stage: Going a step further, NCS built a *Customer Experience Day* for the client. This stage involved the financial service provider's Customer Experience (CX) team members who were physically located across eighteen different markets. Hosted in a "resort" environment that included seven separate zones, the experience combined exhibits, livestreamed sessions with company leaders, external speakers, and panellists to enrich both learning and collaboration among the CX team.



Transactional stage: The final stage was the Tokenisation Metaverse. This pinnacle stage tested the integration of the gamified elements and NFTs available on the platform. Staff earned over 1 million coins while bidding translated into charitable donations. With 500 staff participants, this finale showcased the platform's multi-dimensional capabilities.

The Metaverse platform offers an immersive alternative that bridges geographical gaps, enhances interaction, and fosters productivity through personalised real-world experiences. By systematically onboarding both employees and customers, the financial service provider was able to execute controlled experiments with new technologies and experiences while managing risks. This strategic approach allowed the service provider to shape its own version of the Metaverse by leveraging the customer solution that was developed by NCS.

Metaverse platforms that incorporate transactional capabilities offer huge promise to increase user engagement. Decentraland, a 3D virtual world where users can buy virtual land and trade in NFTs had eight thousand active users as of October 2022, and more than SGD 2 million worth of virtual land was sold in just last two months of 2022 on The Sandbox, a similar Metaverse platform. While full metrics are incomplete for its pilot phase, the financial service provider's Metaverse proof of concept demonstrated promising results in increasing user interest and engagement.

The partnership between the financial service provider and NCS exemplifies the balance between innovation and the careful planning/and adoption of the Metaverse. The financial service provider is exploring how to increase customer value through additional Metaverse use cases, including the provision of advisory services, delivery of master classes, creation of new networking channels, and IT technology onboarding services. As this financial service provider continues on its journey, the Metaverse stands as a gateway to unprecedented opportunities to redefine the way it engages with customers and employees alike.

NCS Industrial Metaverse case study – Immersive mission rooms

Kangrui Ling, Andros Lee Chueng

NCS industrial Metaverse case study – Immersive mission rooms

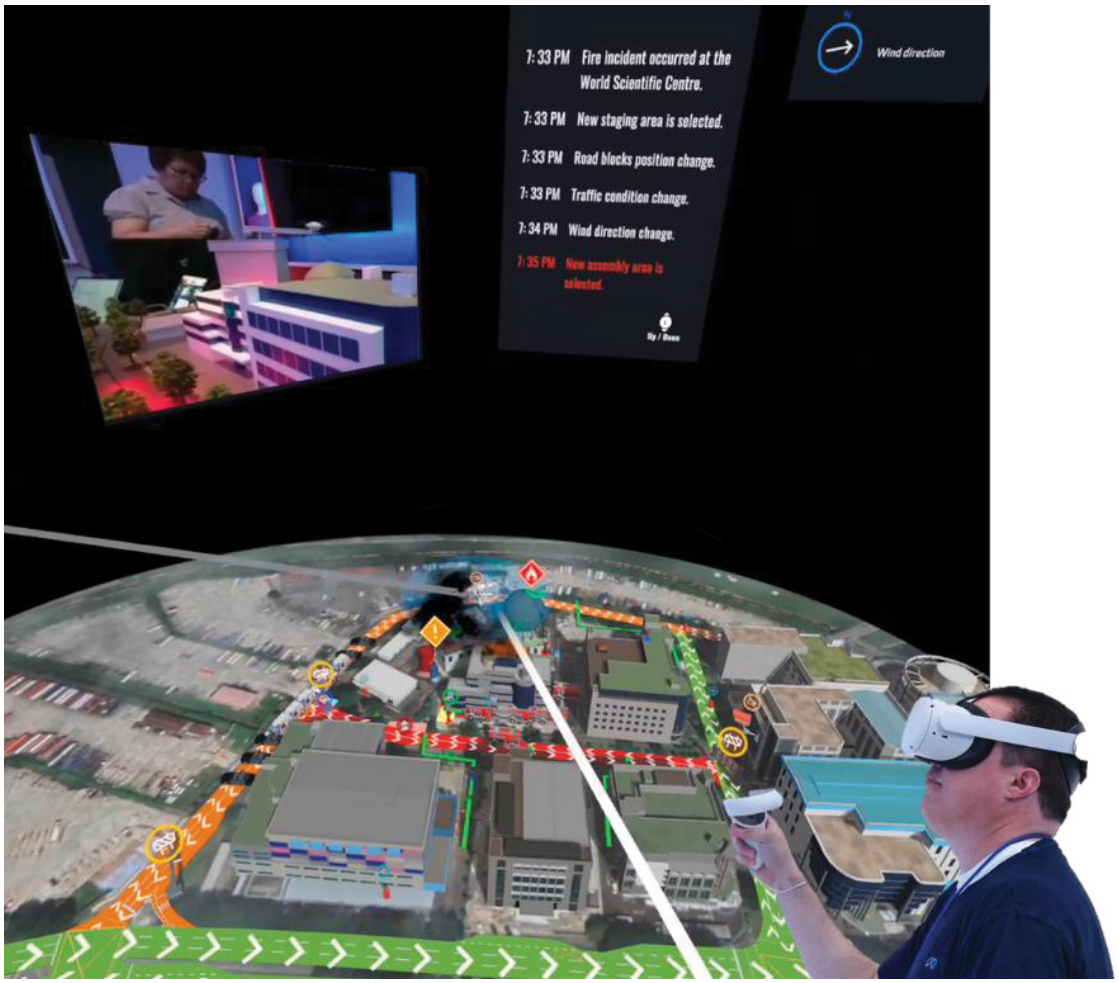
Revolutionising incident management: The power of immersive mission rooms

Introduction

In the ever-evolving landscape of incident management, organisations are constantly seeking innovative solutions to enhance their capabilities. One ground-breaking approach that has gained traction is the integration of immersive technology into mission rooms. This is a concept that was developed collaboratively with both the Singapore Civil Defence Force (SCDF) and Singapore Police Force (SPF) personnel to make the use case realistic. This article explores the transformative potential of combining a virtual immersive sandbox for incident managers and a 3D mission room for stakeholders to create a seamless and comprehensive incident management experience.

The virtual immersive sandbox for incident managers

Incident managers play a crucial role in responding to and mitigating emergencies. The virtual immersive sandbox is designed to empower incident managers by providing them with a dynamic and interactive platform to manage and monitor incidents in real time.



Here's how it works:

- **Real-time incident visualisation:** The sandbox leverages cutting-edge virtual reality (VR) technology to create a lifelike representation of the incident scene. Incident Managers can explore the virtual environment to gain a deeper understanding of the situation and make more informed decisions.

- **Data integration and dashboard access:** The sandbox seamlessly integrates with operational data sources and consolidates information on a centralised dashboard. Incident managers have access to real-time data, including sensor feeds, communication logs, and resource allocation information, enhancing their ability to assess and respond to incidents promptly.

- **Simulation and training:** Incident managers can conduct realistic simulations within the virtual sandbox to prepare for a wide range of potential scenarios. Training in a virtual environment allows for better decision-making under pressure and ensures that incident managers are well prepared for any situation.

The virtual 3D mission room for stakeholders

Collaboration among stakeholders is paramount in incident management. The virtual 3D mission room serves as a ground-breaking solution for stakeholders to collaborate, investigate, and strategise effectively.

- **Immersive teleportation:** Stakeholders can 'teleport' into the virtual 3D mission room from different locations, eliminating the constraints of physical presence. This teleportation feature facilitates quick and effective communication, enabling stakeholders to coordinate their efforts seamlessly.

- **Access to operational data dashboards:** The mission room is equipped with integrated dashboards that provide stakeholders with a comprehensive view of operational data. Collaborators can analyse real-time data, share insights, and make collective decisions to address the incident of focus.

- **Interactive investigation:** Stakeholders can engage in interactive investigations within the virtual environment, reconstruct events, and explore potential solutions collaboratively. The 3D mission room enhances communication and fosters a sense of shared responsibility among stakeholders.

Conclusion

The integration of a virtual immersive sandbox for incident managers and a 3D mission room for stakeholders represents a paradigm shift in incident management. With the power of immersive technology, organisations can elevate their response capabilities, improve decision-making, and foster enhanced collaboration among stakeholders. As technology continues to advance, the potential for immersive mission rooms to become standard in incident management is an exciting prospect that promises a safer and more resilient future.

ncs.co