Revolutionizing Metaverse

Delve into the building blocks of Metaverse Commerce

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Acknowledgement

Books are rolling accumulations of debt – some to the living, some to those without breath.

Since this is a book about technology, let us first thank those without breath: the technologies that made the manuscript possible.

Most of the content ideas of the book were found by the extensive research efforts and profound interest in the subject of the authors, which has resulted in the creation of an architecture and engineering structure of the book and its content.

It is also due to the expert sessions taken by the authors on the subject, to sensitise students and faculty members, making the experiences live and engrossing, in order to ensure that value is found all across for academia and corporate. Thanks to all the students and faculty members for the dialogue.

Our fingers are crossed that this will be a living book as well.

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We sincerely hope that this book will meet the desired demands of all our valuable readers.

Amit Johri | Dr. Kalpesh Parikh

Preface

The next generation does not find this physical world sufficient, as the speed at which they can wander in the physical world constrains and restricts them and they feel as if they are in a virtual cage.

They need a technology that can break all barriers of the physical world and enable them to execute what they want, at whirlwind speed without moving from their physical location. This is expected to happen at their own time and disposition.

Virtual reality and augmented reality have been present for quite some time; however, they could not create a virtual/alternate world which is now offered by the Metaverse. Metaverse has become an extended world to this physical world, and offers bi-directional transactions, leading to an immersive world to a level from which one cannot distinguish whether it is happening in the physical world or virtual world or both.

Socialization has become a reality, without moving from your own couch. Meeting compatible people in no time is a dream that has come true, and engaging with them has become a new way of life.

A world without commerce is not thoughtful, and the same is true about Metaverse. The money of the physical world is not accepted here and hence blockchain based crypto token and currency comes to the rescue, for commercial transactions and identity of each entity in the virtual world.

With this cryptocurrency, NFT, shapes, collectibles, and avatars become indispensable and it is the right time for a company to engage with Metaverse Business.

Metaverse represents a $800 billion market opportunity, according to Bloomberg's Intelligence, thus creating a new economy in which wealth will be generated, traded, and increased with a different currency, yet connected to the real-world money. We will see businesses formed, office buildings built, meeting for remote workers held, and job interviews conducted in the Metaverse world.

The Metaverse will see a surge in digital commerce, primarily as big-box retailers aim to sell things there.

The IT industry is particular about the Metaverse, which is predicted to be worth $800 billion by 2024 and have a community of one billion by 2030.

The metaverse has rapidly found itself a topic of discussion by the world's most influential newspapers, companies, governments and academia.

This book examines what technology advances must be secured in order to realise the metaverse, ranging from latency to interoperability challenges.

There is also a pertinent discussion about open standards and their particular importance in the metaverse. At present, tech giants are in the process of closing their ecosystems to secure their user and developer bases, prophesising a fragmented 'Corporate Internet', although 'economic gravity' could force rival metaverse companies towards standardisation.

The book also examines the potential of the metaverse: what it could look like, and its applications in business and commerce.

The book is divided into **three sections** and **eight chapters**, whose descriptions are as follows:

SECTION - I: Foundations of Metaverse

Chapter 1: Introduction to Metaverse includes information about Metaverse transformers, what the Metaverse is and what can be done with it, Metaverse vs. Multiverse, stages of the Metaverse, its layers, and the most popular and promising games on Metaverse. It also discusses Metaverse real estate, along with a deep dive into Metaverse technology, Open Standards and Interchange Formats, and Metaverse positioning.

Chapter 2: Enabling Metaverse includes the technical aspects, including a low-latency environment, presence via haptics and the Internet of Things. It also discusses Metaverse Technology Shapes including VR, AR, MR, XR, interfaces, blockchain protocols, NFT, Web 3.0, gaming technology, and tokens. The chapter then moves on to Metaverse Elements such as digital currency, digital assets, online shopping, device independence, social media, gaming, **Natural Language Processing (NLP)**, digital humans, NFT, workplaces, marketplaces, concerts, and other social and entertainment events. It introduces you to Unity, UWP, Solidity, C# and .net.

SECTION - II: Enabling Commerce in Metaverse with Trust using Blockchain

Chapter 3: Blockchain in Metaverse discusses Money in Metaverse, the role of Blockchain, Web 3.0, Crypto and NFTs, as well as the integration of blockchain in the metaverse, blockchain technological architecture, and the immutability of

blockchain for the metaverse. The chapter then delves into the data security design of blockchain for Metaverse, interoperability of blockchain with other Metaverse technologies and Blockchain as the Metaverse's backbone for eCommerce.

Chapter 4: Non-Fungible Tokens (NFTs) covers topics including tokens, ERC-20, Ethereum request for comments, and describes ERC 223, ERC 621, ERC 827, and ERC 721. Then, it moves on to topics such as Ethereum token standards, security token versus utility token. The chapter also picks up the topics of Non-Fungible Tokens, and their workings, types, popular ones as well as the differences between Fungible and Non-Fungible tokens. The chapter wraps up with a discussion on Metaverse tokens, Games-Game Engine, Metaverse and play-to-earn games, and Risk User NFT asset.

Chapter 5: Decentralized Autonomous Organization discusses the concept of **Decentralized Autonomous Organization (DAO)**, its architecture, the Compound DeFi protocol, trade-offs of different decentralized governance architecture as well as the tools used to build DAOs – Coding solutions and No-Coding solutions.

Chapter 6: Cryptocurrency and Wallet introduces you to Cryptocurrency and the internet of money, working of cryptocurrency, future of cryptocurrency, and **Central Bank Digital Currency (CBDC).** It further explains cryptocurrency as a metaverse pillar, the working of crypto exchange, and the Ethereum wallet. It further illustrates a betting contract with an account interaction example, and then compares centralized vs. decentralized metaverse and explains the relationship between metaverse and cryptocurrencies.

SECTION - III: Developing Metaverse with Web 3.0

Chapter 7: Web 3.0 Business Opportunities, Ideas, and Expectations covers topics including the core principles of Web 3.0, the web's progression from Web 1.0 to Web 2.0 and then to Web 3.0; the Web 3.0 Stack as well as its architecture layers. It then discusses the Web 3.0 technology layer, its development from apps of Web 2.0 to dApps of Web 3.0, and Web 3.0 dApp (decentralized Applications). The chapter wraps up with a discussion on Metaverse and Web 3.0.

Chapter 8: Decentralized Applications (dApps) provides an understanding of dApps, differences between centralized and decentralized apps, dApps usage, the future of dApps, Ethereum dApps, dApp features, and enabling technologies.

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Chapter 1
Introduction to Metaverse

Introduction

At large, a 3D version of the Internet and Computing is the Metaverse. There are two ways to place this in the current context.

On the first emergence of the two technologies of the Internet and Computing, all user interactions were primarily text-based, including e-mails, messages, usernames, passwords, and e-mail addresses. Gradually, they included livestreams, photos, and videos and became more media-based. Going further, they elevated into 3D for **user interface** (**UI**) and **user experience** (**UX**).

Second, if a cell phone can be thought of as a computer with the Internet being available in it at all times, the Metaverse can be thought of as being inside the Internet and always within a computer.

The experts look at the Metaverse as a 3D model of the Internet, as the Metaverse is seen as the logical next stage of development that would ideally be accessed through a single gateway. The Metaverse would basically be a place parallel to the physical world where you spend your digital life. It would be a place where you and other people have an avatar, and you interact with them through their avatars.

An equivalent to the real world will be had by Metaverse as it develops, and it will be much more distributed, democratic, fluid, and varied.

The virtual reality experience will be taken by the Metaverse to the next level, according to technologists, allowing the users to float into the virtual world to do everything from playing games, performing financial transactions, hosting parties, and buying land.

A new digital economy where users can involve themselves in creating, buying, and selling goods is envisioned by many companies.

There are some new building blocks in place with the Metaverse: the ability to host hundreds of people in a single instance of a server or motion-tracking tools that can distinguish where a person is looking or where his hands are. These new technologies are very exciting and feel futuristic.

The foundations of Metaverse commerce are NFT, Web 3.0, DAO, dApps, Blockchain, and Cryptocurrency. The metaverse technology shapes, elements of the Metaverse, and the enabling tools and technologies, including Unity, **Universal Windows Platform** (**UWP**), Solidity, C#, and .net, will be discussed.

Structure

In this chapter, the following topics will be covered:

- Metaverse transformers
- Metaverse—what it is and what can be done with it
- Metaverse versus Multiverse
- Layers of Metaverse
- Stages of Metaverse
- Feel the Metaverse
- Most popular and promising games
- Metaverse real estate
- A deep dive into Metaverse technology
- Open standards and interchange formats
- Metaverse positioning

Objectives

The chapter's objectives include explaining the Metaverse Transformers, the technologies that Metaverse takes the help of and which are expected to play distinct and vital roles in the development of Metaverse as a viable business force in the

coming years—AI, IoT, Extended Reality, Brain-Computer Interfaces, 3D Modelling and Reconstruction, Spatial and Edge Computing, and Blockchain. Next, we explain what Metaverse is and what you can do with it, comparing Metaverse and Multiverse, and an understanding of the seven layers of Metaverse—Experience, Discovery, Creative economy, Spatial computing, Decentralization, Human interface, and Infrastructure is provided. We further discuss the four stages of Metaverse from Virtual Reality technology to Haptic to Advanced Virtual Reality—Neuro tech to Advance Neuro technology, where the Metaverse and the real world become totally indistinguishable.

We also explain the techniques/tools to use for feeling the Metaverse. We list the most popular and promising games and also discuss Metaverse real estate. Furthermore, a deep dive into Metaverse technology is made, together with the discussion on open standards and interchange formats. We next discuss Metaverse positioning, which not only empowers the consumer but also gives companies a greater opportunity to get creative with their branding.

After reading this chapter, you will be thorough with the knowledge of the Metaverse, its transforming technologies, its layers, its stages, Metaverse feel, Metaverse real estate, Games, Metaverse technology, Multiverse, Open standards and interchange formats, and Metaverse positioning.

Metaverse transformers

The technologies that will have the biggest impact on metaverse development over the coming years are as follows:

- **Artificial Intelligence**: To create avatars, digital humans, and spontaneous conversation
- **Internet of Things**: To seamlessly connect 3D virtual spaces with the real world
- **Extended Reality**: In the form of AR, VR, and MR to visualize and use data in 3D
- **Brain-Computer Interfaces**: To replace traditional computer control screens and hardware
- **3D Modelling and Reconstruction**: To capture real objects and provide 3D prototypes
- **Spatial and Edge Computing**: To quickly respond to user actions that mimic reality
- **Blockchain**: to decentralize the Metaverse, secure digital content, and avoid delays

These dynamic technologies are expected to play distinct and vital roles in the development of the Metaverse as a viable business force during the next several years.

The Metaverse and the Internet are different, and the differences are as follows:

The Internet is a network of billions of computers, millions of servers, and other electronic devices. Once online, Internet users can communicate with each other, view and interact with websites and buy and sell goods and services.

The Metaverse does not compete with the Internet—it builds on it. The Internet is something that people "browse," but people can "live" in the Metaverse to a degree. The growth of the Internet has spawned many services that are leading the way to the creation of the Metaverse.

NFTs in the Metaverse

In the usefulness and popularity of the Metaverse, NFTs figure to play a big role. A secure digital asset based on blockchain technology used by cryptocurrency is NFT. An NFT can represent a piece of art, a song, or digital real estate instead of currency. In the Metaverse, an NFT gives the owner a digital deed or proof of ownership that can be bought or sold.

NFTs and Blockchain lay the groundwork for digital ownership. The ownership of one's real-world identity will carry over to the Metaverse, and NFTs will be this vehicle.

DAOs for governance

A DAO is a governance body that uses Blockchain and smart contracts to reach a consensus for various decisions. To ensure that everyone in the organization has the opportunity to participate in the governance process, all decisions in DAOs continue to be governed by proposals and voting processes. The procedure is vital for assisting participants in casting ballots on significant decisions on managing Metaverse resources.

Web 3.0 support

The idea behind Web 3.0 is the progression of user ownership and control over their online material, digital assets, and online personas. Web 3.0 and Metaverse technologies work in perfect harmony with one another. The foundation for connectivity in the Metaverse may be provided by Web 3.0 as the Metaverse is a virtual environment that prefers a decentralized web.

Web 3.0 is the term used to denote a new Blockchain-based version of the Internet.

Blockchain and cryptocurrency

Blockchain technology provides a decentralized and transparent solution for digital proof of ownership, digital collectability, transfer of value, governance, accessibility, and interoperability. Cryptocurrencies enable users to transfer value while they work and socialize in the 3D world. Crypto can potentially incentivize people to actually work in the Metaverse.

The Metaverse's interconnectivity with the natural world is increasing through blockchain technology, with cryptocurrencies and Non-fungible tokens becoming a staple of a Web 3.0 future.

Who owns the Metaverse, if anyone. The short answer: No one and Everyone! The tool builders, software developers, world builders, artists, 3D modelers, game developers, users, and investors, are the proverbial owners of the Metaverse.

And if we look at it from a business perspective, in that case, the companies that own the tools that allow for all the activities mentioned previously indeed hold sway over the future of Metaverse for the coming times.

Metaverse: What it is and what can be done with it

A virtual world in which the users, businesses, and digital platforms can exist and interact with each other, including everything from virtual, social, and gaming platforms to NFTs, is the Metaverse.

- **Network**: First and foremost, Metaverse involves socializing in a more classic sense and is going to be a social platform as it also applies to crypto exchanges and NFT purchases.
- **Invest and Do Business**: In the Metaverse, NFT, and cryptocurrency are great ways for users and businesses to invest in the platform and are important building blocks.
- **Shop**: In real life, you can use cryptocurrency to buy just about anything. Endless are the shopping possibilities in that corner of the Metaverse.

There is a form of shopping that relates far more directly to the Metaverse. In this new virtual space, whether you are building out your avatar's world on a platform or building up your inventory of NFTs, there is plenty of shopping to do.

Technologies of software, hardware devices, and also the varied realities, including augmented, virtual, and mixed, are extended together with special sound and geospatial capabilities combined to form the Metaverse. The digital spaces, objects, identities, and activities are the computing technologies that are used to build and access digital systems that can mimic the real world in the Metaverse.

A few of the popular definitions of Metaverse are as follows:

"A shared virtual space that is interactive, immersive, and hyper-realistic that includes your own customized avatar and digital assets which will be recorded on a blockchain."

"You with other people, who are not in the same physical space as you, can create and explore in the Metaverse which is a set of virtual spaces"—Definition as per Meta.

"It is a place in a virtual, online environment will able to work, create, learn, play, shop, and also interact with friends"—Definition as per Meta.

"A shared, realistic, and immersive computer simulation of the real-world or other possible worlds, in which people participate as digital avatars."

"Mimicking the real world for creating spaces for rich user interaction in a simulated digital environment the Metaverse uses virtual reality, augmented reality, and blockchain, as well as the concepts from social media."

"A massively scaled and interoperable network of real-time rendered 3D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence and with continuity of data, such as identity, history, entitlements, objects, communications and payments"—Matthew Ball, Author of The Metaverse and How it will Revolutionize Everything

The following are set of technologies that are included in Metaverse:

- A combination of varied realities *vis-à-vis* augmented, virtual, and mixed is **Extended Reality (XR)**. To access the Metaverse, one or more of these XR devices are used by Metaverse users. These devices not only capture geospatial data and the voice of the player but also provide a virtual world to them.
- **People and their Digital Avatars**: Representing real people and their activities like working, conversing, walking, dancing, and playing, the users in the Metaverse are represented in the form of 3D avatars. Via the XR devices, there will also be the possibility of applying touch, sense, and smell in the future.
- **Connection and collaboration**: Connecting and creating collaboration among real-world people in the virtual world is the main function of Metaverse. Not only can people connect and collaborate in the real world, but they can also do business in the virtual world. In the virtual world, real people can party, conduct a meeting, attend a virtual conference, or show via their avatars.

- **In a virtual world, the real-world representation**: Representing real-world economies, making transactions in the virtual world, and buying them back into the real world is the key concept of the Metaverse. People learn and use the skill sets they have learnt in the real world and get trained in a virtual world. Players can earn digital currencies and cash them out in the real world in real currencies through digital assets and NFTs, which are used in games by players.
- **Computing with high performance**: A necessity to support all of the above to build and run Metaverse is computing with high performance. The infrastructure that includes faster processing, storage, and high-speed Internet is the focus of Metaverse companies that are building their systems using computing with high performance.
- **Developing applications in Metaverse**: A 3D gaming engine such as Unity or Unreal, a programming language, and an app/game development platform are required in the Metaverse for developing applications. Unity, **Universal Windows Platform** (**UWP**), C#, and .net will be needed by you to build Microsoft Holographic apps.

The main way to invest in the Metaverse is through investing in digital assets. Digital tokens that can be used in gaming and other apps are being created by several innovative companies and start-ups in the blockchain and cryptocurrency world. The Metaverse and 3D objects and real-world representation in virtual worlds are being used by many of these games. To use in Metaverse based games and apps, cryptocurrencies are developed. One of the first major apps of cryptocurrencies being used in the Metaverse is NFTs.

Metaverse versus Multiverse

Multiverse and Metaverse are both online virtual worlds that allow users to interact with each other in a 3D environment. However, there are some key differences between the two platforms. Multiverse is designed for developers who want to create their own virtual world, whereas Metaverse is a more general-purpose platform that anyone can use. In addition, Metaverse offers a wider range of features than Multiverse, including the ability to create avatars, build 3D objects, and script interactions between users.

Metaverse is an integrated network of 3D virtual worlds where users have access to digital avatars that let them live in a digital world.

Multiverse is a hypothetical collection of identical or diverse universes with distinct traits and features.

The incorporation of Blockchain into its underlying technology with Blockchain-powered assets like NFTs and cryptocurrencies is done in the Metaverse. The value of the real-world assets, interactions made, and experiences earned has started to be demonstrated in the digital arena while the Metaverse environment has existed in online games, which are massively multiplayer, incorporating Blockchain, smart contracts, crypto, and virtual reality in the sector. Also, users can interact with each other in the Multiverse with a digital space for them with one basic distinction that, at any particular time, they can perform only one task.

The Multiverse can be defined as a set of different virtual universes where to do different things, and you can switch in between the universes. Thus, within the framework of their ecosystems, the Multiverse projects such as game platforms are ideal virtual worlds, but they lack convergence with the real world. Furthermore, as they are mostly isolated ecosystems, their interconnectivity with other Multiverse projects is limited.

As suggested by Metaverse, in the future, based on our necessities, we may have a related digital world, and the users can seamlessly transition between the two different areas of Metaverse.

An extra ecosystem of digital worlds is presented by the Multiverse that is disconnected. The digital ecosystems that are different within the Multiverse would not allow the users to seamlessly switch between the digital worlds.

The key differences between the Metaverse and the Multiverse are summarized in the following table:

Criterion	Metaverse	Multiverse
Definition	Allows users to perform their work, watch movies, play games, visit the library, and also offers other services; it is a shared digital environment.	A collection of different virtual worlds, which are hypothetical with unique traits and features.
Ecosystems—their number	Among different platforms of the Metaverse, endless movements of users are allowed by only one shared universe.	Existing in a hypothetical pool, different ecosystems are created through multiple virtual worlds.
Provision of connection	For the flow of information, the Metaverse is highly connected with a specific order.	Without any particular order for information flow, the Multiverse is highly random, containing different virtual worlds.

Criterion	Metaverse	Multiverse
Property	In the Metaverse, the users can have ownership of their digital assets and experiences.	In the Multiverse, the users cannot have ownership over the assets in the separate virtual worlds.
Entities	Different entities such as AI, robots, digital avatars, and human Metaverse participants are included in the Metaverse.	Included in the Multiverse are the distinct virtual worlds as its entities.

***Table 1.1**: Key differences between the Metaverse and Multiverse*

The distinction as observed between Metaverse and Multiverse from the preceding table is that a pool of multiple virtual worlds is a Multiverse, whereas a common holistic shared place where all digital actions can occur is a Metaverse.

The Metaverse to work for everyone must be decentralized; however, one line of thinking is the centralized Metaverse. The multiple Metaverse projects that exist cannot be accommodated in the one-universe approach of decentralized Metaverse. In creating a unified experience for Metaverse development, we need to adopt the Multiverse approach to accommodate multiple decentralized Metaverse projects. The idea of decentralization, unified experience, and democracy is well aligned with the approach of Multiverse.

The idea of a unified decentralized Metaverse is a way to build decentralized Metaverse projects, which is Multiverse.

Adopting a Multiverse approach to Metaverse development

Multiple creators are allowed to contribute with the Multiverse approach to Metaverse development. Like Multiverse worlds, with this approach, decentralized Metaverse projects can be designed and developed as individual projects. To achieve a unified Metaverse experience, however, these Multiverse worlds should co-exist and be interoperable.

Multiple Metaverse projects would always be created by multiple creators.

We already have multiple blockchain technologies, and more will emerge in the future is another thing to consider. As it will allow the diversity in blockchains and creators' concepts and digital experiences to co-exist and become connected, a Multiverse approach to Metaverse development is more sustainable. Refer to