Matrix World – A Programmable 3D Multichain Metaverse

1. Introduction

Matrix World is a decentralized open virtual world that lets users interact with immersive 3D applications simultaneously running on different blockchains. The world consists of Lands, issued as Non-Fungible Tokens (NFTs), which permanently persist on blockchain networks such as Ethereum and Flow. Thus, Matrix Lands are tradable and transferable via blockchain networks and their owners retain complete control over the creations on their Lands. These Lands can be bound to a sandbox in the Matrix Network which has its own compute and storage resources. These resources allow landowners and creators to govern the visual appearance, inner properties, and lifecycle logic of the Land's creations, ultimately resulting in the production of an immersive 3D application that can operate in perpetuity in the Matrix World cyberspace.

In Matrix World, users can take advantage of standard 3D open-world features such as building 3D architectures, hosting virtual meetings, exhibiting digital assets (e.g., NFTs), etc., along with more advanced functionality such as creating and hosting 3D decentralized applications (DApps) using Matrix's built-in creator services and computational resources. These DApps include 3D games and 3D marketplaces, among others. Our ultimate goal is to create unlimited possibilities and opportunities in the metaverse by eliminating the boundary between blockchains and building a next-generation 3D open-world DApp platform on top of Matrix World.

2. Background

Speaking of open-world games, it is always inevitable to mention Minecraft [1]. Minecraft offers the freedom for players to build a customized 3D world. Additionally, it exposes powerful and robust backend interfaces that enable users to implement their own game or application in that universe. More significantly, it introduces the Bring Your Own Device (BYOD) concept to the game. As a creator, you can purchase your own compute resources, namely a Minecraft server, to run your Minecraft-based mini-game.

The majority of blockchain-based 3D open-world platforms are inspired in some way by Minecraft, and we have already seen several well-implemented products. Some of these products have concentrated on gaming and game creation, others have focused on 3D social networking and showcasing assets (NFT), and some have offered a thin layer of 3D visualization while allowing the community to add additional extensions to enrich their ecosystems. However, no existing blockchain-based open worlds have demonstrated the same customization and user experience level as Minecraft. In other words, none of the current blockchain-based 3D open worlds have provided a Turing complete world capable of creating infinite possibilities. A 3D world built entirely on assets is not a real living Metaverse, but a new revolution is underway to enrich the community.

For three years, the Matrix World team has been developing blockchain infrastructure and development tools. We have extensive experience building multichain solutions and technology for decentralized applications (DApps). The next generation of blockchain-based 3D open-world platforms that we envision should have a dedicated computational layer that allows all platform users to build visualization and computation-intensive applications. As developers and creators we want such a platform in place which is why we are kicking off this project.

3. A Programmable Multichain Metaverse

3.1 Programmable Objects

We breathe life into Matrix World's objects by introducing the concept of programmable objects, known as Matrix Objects, that run on a canonical virtual machine called the Space Virtual Machine (SVM). The SVM keeps track of a group of Matrix Objects in one or more Lands and manages each object's attributes, appearance, and lifecycle. Meanwhile, users can define custom functionalities to customize the behavior of these Matrix Objects. Using the Matrix Object and Scene Editor, authorized creators can easily program the actions of their Matrix Objects and create complicated 3D applications by combining multiple programmed/scripted Matrix Objects which can then interact with one another. As illustrated in Figure 1, the ideal SVM enables hierarchical objects to operate jointly by following predetermined scripted operations. The requested SVM CPU and memory capacity dictate the number of objects and the complexity of application logic. At the same time, the Matrix Lands determine the virtual physical space in the Matrix World.

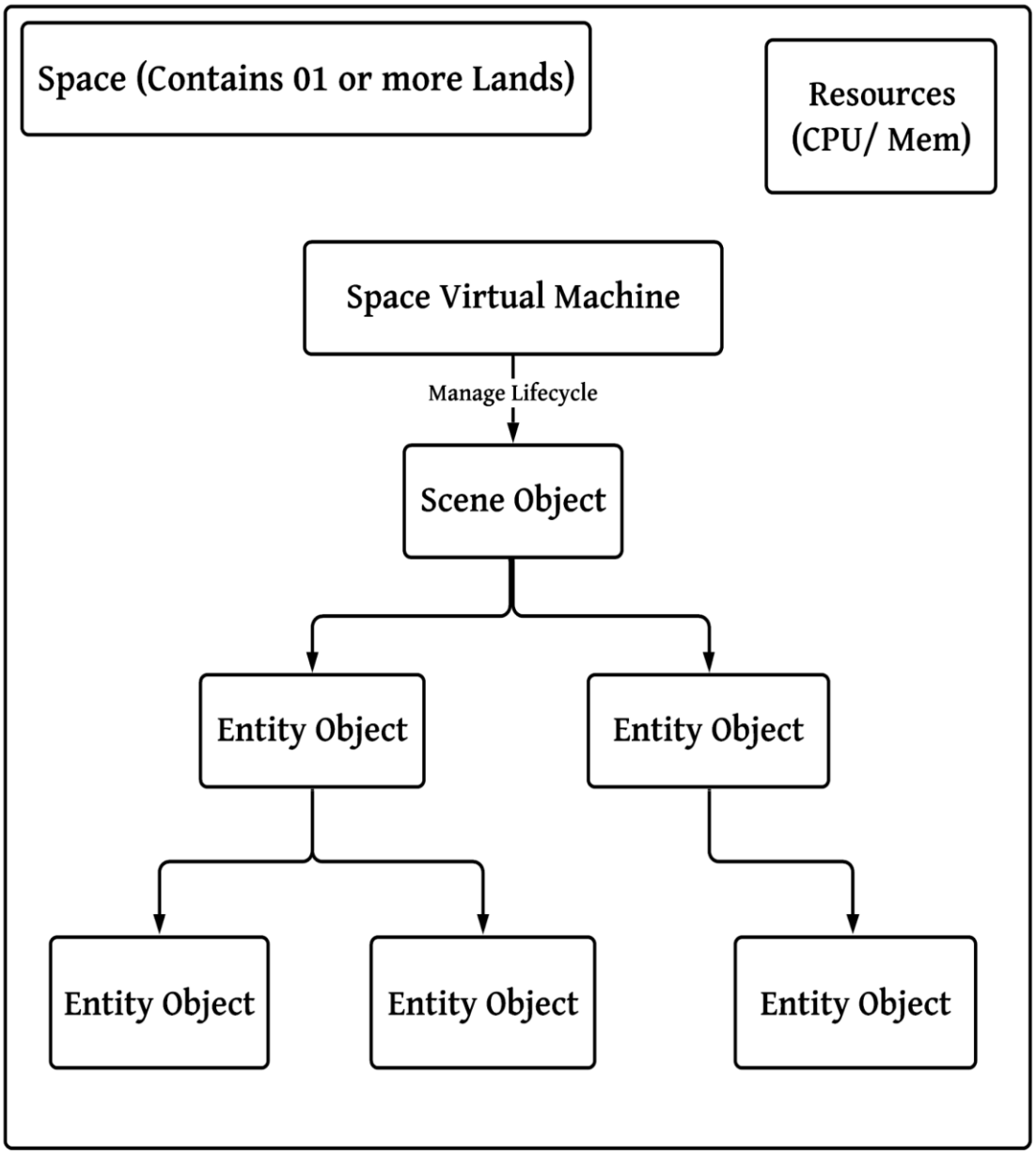


Figure 1. Space Virtual Machine and the hierarchy of Matrix Objects

Additionally, multiple SVMs can connect to form a Matrix Network, as shown in Figure 2. At the same time, each SVM is responsible for operating a Scene on a single Land or Space (a collection of merged Lands) that provides various features similar to a game server. Not only may creators construct 3D applications on a single SVM, but also cross-SVM for multiscene applications.

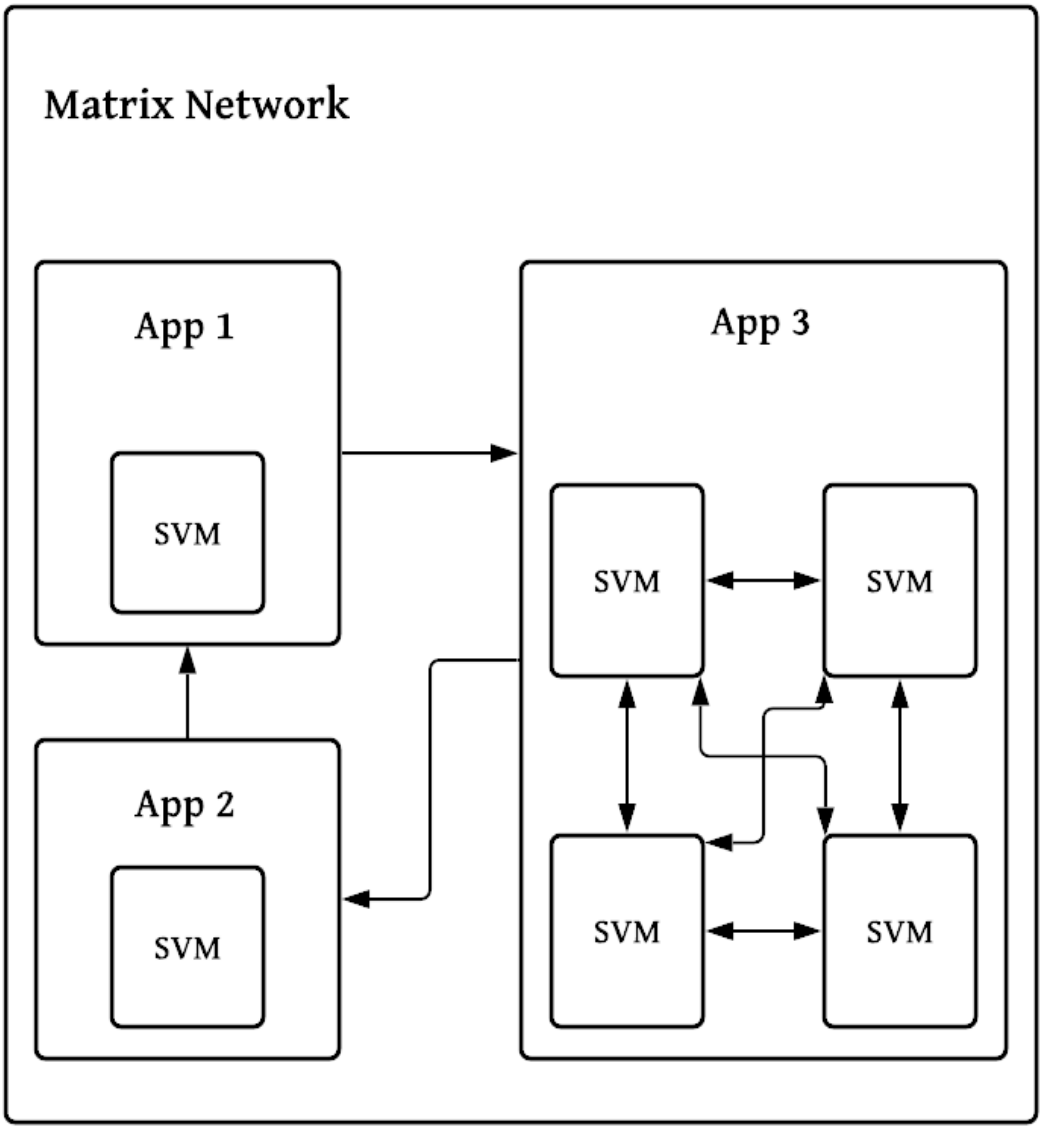


Figure 2. Applications in Matrix Network

As defined earlier, Matrix World is a Turing complete metaverse, which means that each object can be programmed as a living entity. Additionally, we provide developers and creators with tools and services to aid in the production of Scenes and DApps. Thousands of 3D applications will operate simultaneously in the form of fully programmable objects and will be decentralized. That is how Matrix World integrates apps into the actual metaverse.

3.2 Multichain Connectivity

The Matrix World technology facilitates the maintenance of identities across several blockchains. The system currently supports Ethereum and Flow, but it can easily be expanded to incorporate new blockchains as its persistent and consensus layers.

Moreover, creators can also connect Matrix Objects to external smart contracts running on multiple blockchain networks. For instance, game developers and content creators can build a 3D Uniswap ATM by crafting its appearance and defining the action that invokes Uniswap's swap function in Ethereum. Futhermore, they can place such an ATM in a virtual NBA Top Shot museum that features a 3D video gallery powered by the Flow network.

In addition to blockchain networks, Matrix World can also connect to external services. In the first instance, we propose integrating NFT marketplaces on multiple blockchains such as OpenSea, Rarible, MyNFT, as well as storage protocols like IPFS and Arweave, and streaming services such as Twitch and YouTube. To this end, creators can directly connect to the aforementioned services using both programmable 3D objects and API endpoints. Notably, the entire system is designed to be extensible, allowing for the continuous addition of new services to enrich the world.

Matrix World's multichain connectivity enables the creation of unique immersive social networks. Users can experience a world with unlimited possibilities by connecting to multichain DApps and other resources. Matrix World will bolster interoperability among multichain DApps and streamline communication across several metaverses.

3.3 Use Cases

Immersive 3D DApps

Matrix World's development tooling and programming language will allow users to develop immersive 3D applications. Creators can define 3D objects' shapes, attach materials and textures, create lighting, add transformation functions, attach scripted and AI-based behaviors, make payments, invoke external services, etc. The players can go into the 3D NFT buildings to check details such as textures. They can finish shopping in the immersive marketplace without external links, bring the NFT home, and use an auto construction code pack to see the NFT building auto-build on their Lands.

Programmable NFTs

Matrix World allows users to directly import 2D images, 3D models, videos, audios, and other multimedia NFTs into the 3D world with convenient functions. Each

imported NFT will be transformed into a Matrix Object with an original appearance (e.g., a 2D image will be transformed into a 3D picture with a frame). Since all of the NFTs imported into Matrix World become Matrix Objects, creators can program the loaded NFTs to make them more functional. For instance, if the creator is a game maker, he or she can construct playable characters for a mini-game using Loot NFTs and create a mini-game using these characters. On the other hand, if the creator is an artist that knows about programming, he or she can convert a static image into an animation by applying a dynamic animating filter.

Cross-Chain Socializing & Trading

Matrix World is a metaverse space that connects multiple blockchain networks and services. It provides a place for different players from various blockchain networks to gather and meet.

Cross-Chain Conferences & Meetings

Matrix World's public social facilities and buildings can authorize people with identities from different blockchain networks to attend meetings and conferences. We believe cross-chain communications will be more productive than single-chain ones.

Cross-Chain Advertising

Brands that want cross-chain influence will find Matrix World to be the best fit for them. They can attract potential customers from multiple blockchain networks by posting advertisements in Matrix World's multichain visible public area.

Cross-Chain Trading

The Matrix World team will develop a mechanism to allow cross-chain trading and payment to increase the liquidity of the assets (e.g., NFTs and in-game objects) in the Matrix World.

4. Services

4.1 Convenient Tooling for Creators

Object and Scene Editor

The Matrix World team intends to release a collection of tools that will enable anyone to construct 3D objects in the Matrix World. The first tool will be a cloud-based What You See Is What You Get (WYSIWYG) model editor that allows users to alter a 3D model's geometry, material, lighting, and shaders. Along with the model editor, we also plan to include a Scene editor, which will allow creators to import the numerous 3D

objects they have built into a Scene or directly use other external resources to ramp up and augment a Scene.

Create with Automation

Apart from handcrafting models from scratch, the Matrix World team is also working on an automated tool that will enable users to generate Scenes using pre-defined blueprint templates. Additionally, creators can offer their blueprints to Matrix World's marketplace to accelerate the building process for other players while also monetizing their works.

4.2 NFT Ecosystem

NFT Importing

Matrix World will offer users convenient functions to import NFTs into the metaverse. These functions will allow users to directly import 2D images, 3D models, videos, audios, and other multimedia NFTs into the 3D world. All imported NFTs will be transformed into Matrix Objects with original appearances (e.g., a 2D image will be transformed into a 3D picture with a frame).

Programmable NFT

Since each of the NFTs imported into Matrix World becomes a Matrix Object, creators can program the loaded NFTs to make them more functional. For instance, if the creator is a game maker, he or she can construct playable characters for a mini-game using Loot NFTs and create a mini-game using these characters. On the other hand, if the creator is an artist that knows about programming, he or she can convert a static image into animation by applying a dynamic animating filter.

NFT Creation from Objects

Apart from importing existing NFTs, Matrix World is capable of creating NFTs from Matrix Objects. As a result, Matrix World will have a first-party 3D marketplace that will connect to Ethereum and Flow marketplaces. With a few clicks, users can easily publish NFTs from Matrix Objects.

4.3 Space Name Server

Matrix Land is a beacon to the whole decentralized metaverse world. We will enable space name services for all builders. Users can construct their own Space and register it with its own name which represents the Lands and DApps within it. This will help the players easily get to accurate locations and enjoy DApps through short links.

5. Architecture

5.1 High-Level Architecture

The Matrix system consists of 3 layers: Frontend, Backend, and External Services.

5.1.1 Frontend

The frontend of Matrix World is a public-facing web or mobile client. It contains:

Identity Client

The Identity Client is a multichain identity client that users will use to log in and get authorized to access Matrix World's services via their blockchain credentials (cold wallet or hot-wallet services).

Content Rendering Client

The Content Rendering Client is a WebGL-based client that renders the visual appearances of 3D Matrix Objects in the browser.

Interaction Client

The Interaction Client is responsible for interacting with Matrix Object models managed by the Matrix Network. The Matrix Network routes the signal to a specific SVM to perform the update in the backend.

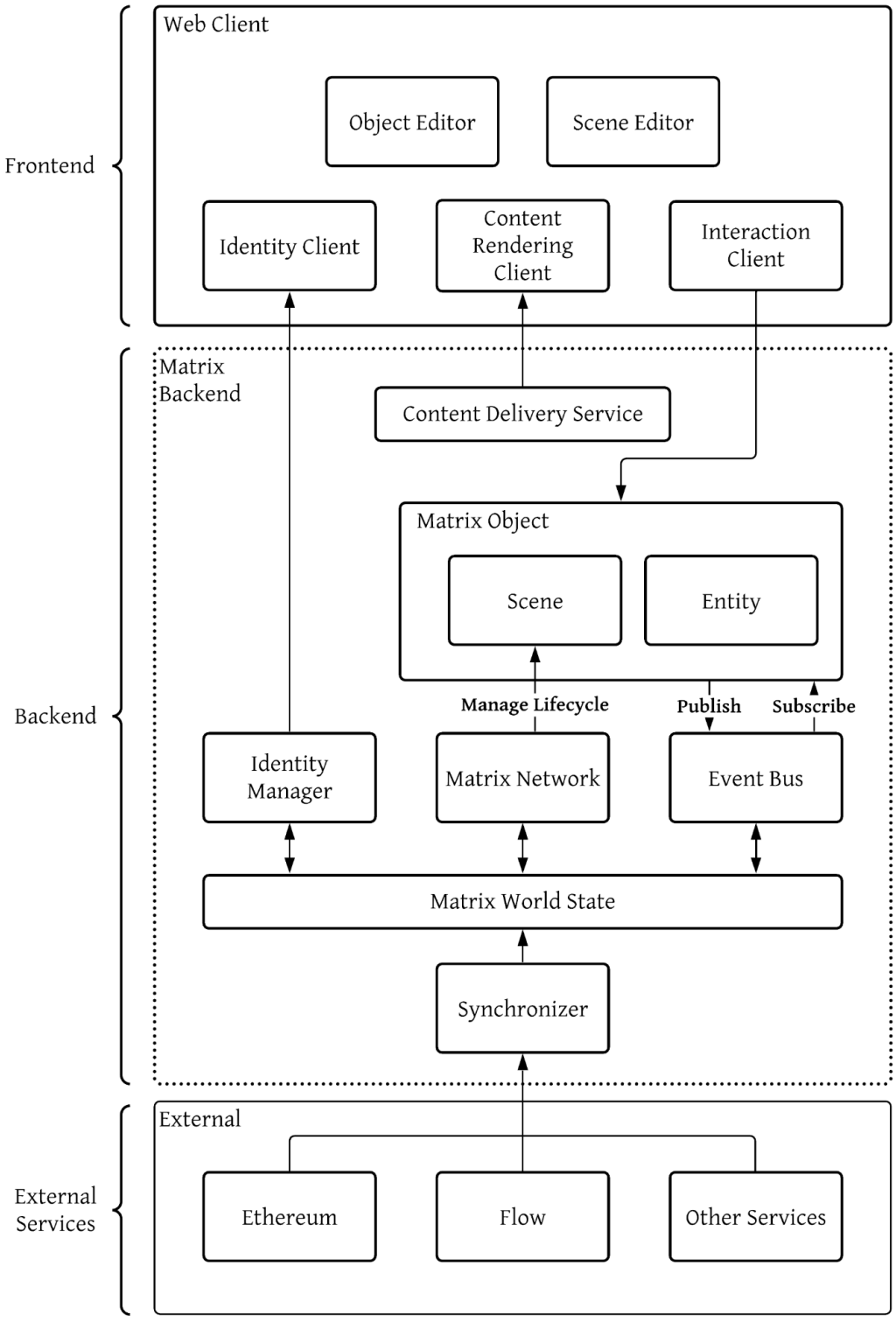


Figure 3. High-level architecture

Object Editor

The Object Editor is a 3D visual WYSIWYG editor that allows users to edit Matrix Objects' 3D models, texture, skeleton, animations, and program their action and lifecycle functions.

Scene Editor

The Scene Editor is a 3D visual WYSIWYG editor that allows users to edit a Scene. Users can import Matrix Objects and external 3D models to compose a Scene.

5.1.2 Backend

The backend is responsible for two major data workflows, as shown in Figure 3. The first is synchronizing the data from external services like blockchain networks (Ethereum and Flow) and other centralized services (e.g., OpenSea). These data will be collected in the Matrix World state and aggregated events will flow to the Event Bus and be subscribed to by the frontend clients. The second workflow consists of the instructions input from the frontend. These data will stream into the Matrix Network, update the world state, and trigger external service calls.

Matrix Object

A Matrix Object is the minimal unit of Matrix World. It has default properties, such as its physics, textures, 3D transformations, and attached NFT media. Creators can also define custom attributes for Matrix Objects via scripts or the Editor UI. Matrix Objects are programmable so that the user can define their lifecycles and action functions. Action functions will be triggered when an interaction signal is sent from the client and lifecycle functions will be triggered when the Matrix Object's state changes. These functions can have multiple purposes like updating the 3D visuals, transforming and making payments, invoking another Matrix Object's action, and performing external calls. Matrix Objects can also subscribe to events from the Event Bus.

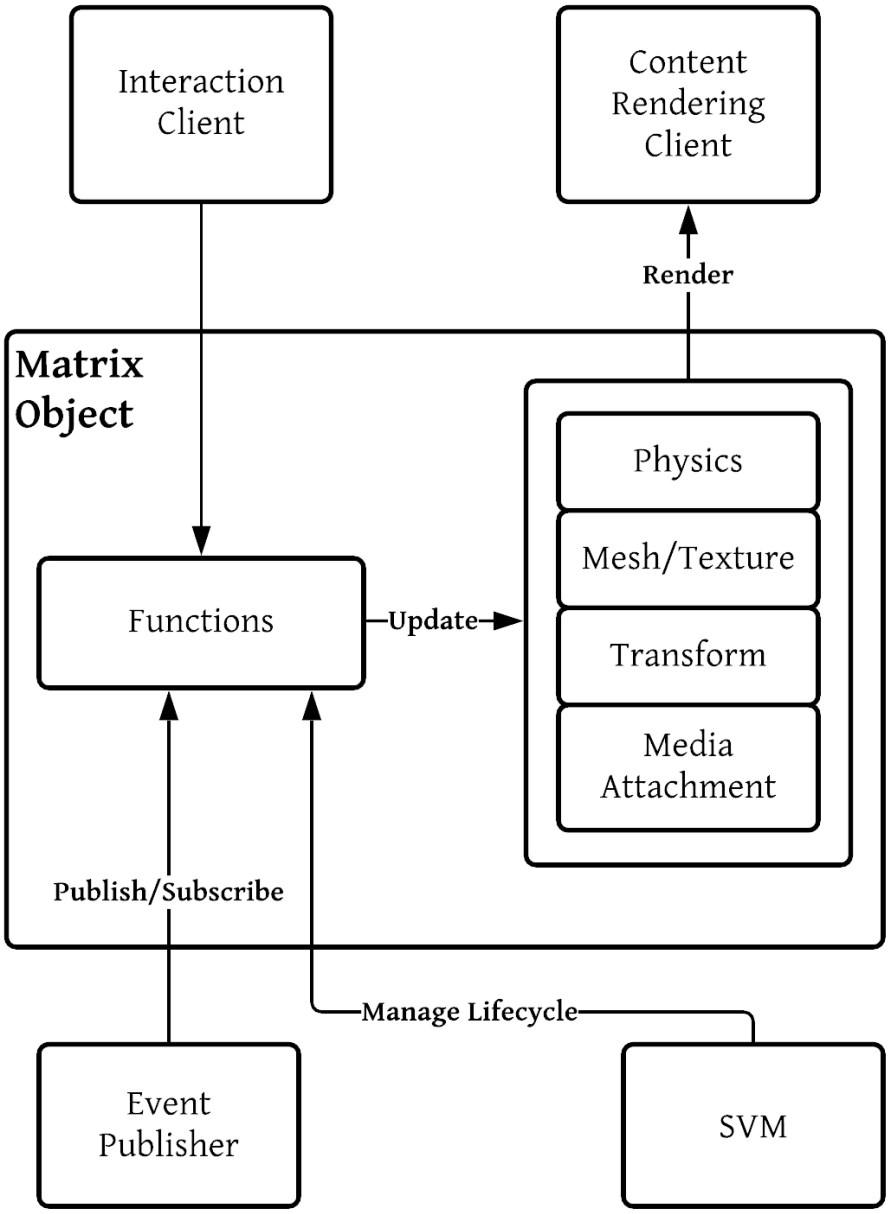


Figure 4. Matrix Object

Space Virtual Machine

The Space Virtual Machine (SVM) is a sandbox server that manages all of the Matrix Objects' states and lifecycles for a specific Matrix Space (Figure 1). Its computation and storage resources are equal to the sum of the resources of its Lands. Matrix is currently hosting all SVMs ourselves, but we plan to release self-hosted SVMs for landowners for decentralized land management and DApp hosting.

Matrix Network

The Matrix Network is a distributed network consisting of applications built on top of SVMs (Figure 2). Landowners can build their DApps by running SVMs bound to their Spaces. This design is inspired by Ethereum and allows all SVM public functions to call each other. Our goal is to make the Matrix Network a 3D DApp platform.

6. Road Map

2021 Oct 8th – 2021 Nov 8th

- Oct 10th: Community pre-sale starts
- Oct 15th: First wave community pre-sale of up to 2000 Lands on Ethereum
- Oct 26th: Second wave community pre-sale of up to 5000 Lands on Flow
- Nov 8th: Third wave community pre-sale of up to 3000 Lands on Ethereum

2021 Oct – 2022 May

- Development of Matrix World alpha version
- Development of low-code creation tools and Matrix Virtual Machine
- Development of public service buildings and sample 3D DApps
- Partnership with brands and events, build up demonstration projects
- Development of Matrix community in Facebook, Twitter, and Discord
- Joint-laboratories construction in metaverse with different universities and research institutions

2022 May – 2022 Dec

- Development of Matrix World beta version
- Open Matrix World to some public creators for early access
- Partnership with big brands and collaborate in stadium construction
- Metaverse Creator Meetups
- Rocket Project for Matrix creators

- Metaverse land pre-sale for media, ecosystem, and global community construction

2023 Jan – 2024 Dec

We plan to become one of the leading metaverse projects in the space of decentralized worlds, reaching over 10,000 DApps and 1,000,000 MAUs in Matrix World over the next five years. To achieve this, we will be working on:

- Global Creator Ecosystem Construction
- Metaverse Creator Conference
- Project Origin: AI Generate Metaverse
- Digital Twins of Earth, incentivize creators to migrate the physical world into Matrix World
- Metaverse space public release, build up Matrix World ecosystem and creator community.

7. FAQ

7.1 Matrix World Overview

What is Matrix World?

Matrix World is an open world that enables users to build immersive 3D applications on top of multiple blockchains. In Matrix World, users can take advantage of traditional 3D open-world features such as building 3D architectures, hosting virtual meetings, exhibiting NFTs, and more advanced functionality such as creating their own 3D decentralized applications (DApps) using the Matrix Network's built-in computational resources.

When will Matrix World be released?

Matrix World is currently in the pre-alpha version. We are currently constructing public tools，services, and buildings such as universities and headquarters for famous companies. This will make our metaverse energetic and provide fully functional support for the community. We set up joint laboratories with different partners and help them get connected to the decentralized world.

We plan to open up alpha testing of Matrix World to the community in 6 months, with more features and creator-friendly metaverse environment betas coming in 2023.

In Q2 2022, we will launch the alpha version of Matrix World along with a fundamental fast build toolbox and low code development platform to help users build the Matrix World metaverse. We will also present public service buildings for practical use, such as education, tourism, and social connection. The beta version is coming in 2023, and it will be officially launched in early 2024.

Which platform should I choose to participate in Matrix World?

Currently, we don't support mobile devices. Users can run Matrix World from a PC or Mac using Chrome or Firefox. While it may be technically possible for other browsers to work we highly recommend using Firefox or Chrome in order to ensure optimal performance.

Why should I participate in Matrix World? What are some highlights of Matrix World?

1. Matrix World is the first open virtual world project running on multiple blockchain networks simultaneously. The system now supports Ethereum and Flow, and we plan to incorporate more blockchain networks as its persistent and consensus layers.

2. The Matrix team has extensive experience with blockchain games, middleware, and the metaverse. Our game Cell Evolution won the Game Creativity Award at the First NEO Game Development Competition and successfully helped us establish close connections in the blockchain gaming world's first developer ecosystems. We also collaborated with ChainIDE, a cloud-based integrated development environment that provides online services in more than 185 countries. The Metaverse Bootcamp that we co-hosted incubated over 30 blockchain games and metaverse projects.

3. We are proud of the global developer ecosystem and partnerships that we have developed. Our official partnership with the Flow team makes Matrix World the first metaverse project in the Flow ecosystem. Furthermore, the Flow team plans to build a Flow headquarters in Matrix World. Many Flow blockchain projects, like CryptoKitties and NBA Top Shots, will eventually collaborate with Matrix World.

7.2 Matrix Land

What is a Matrix Land?

A Matrix Land is the smallest territorial unit in Matrix World and has finite computation and storage resources. A Land is represented on several blockchains as a tradable NFT token. For instance, it is an ERC-721 token on Ethereum, whereas on Flow it is an on-chain Flow resource.

What is a Matrix Land Voucher?

A Land Voucher is a certificate Non-Fungible Token (NFT) that proves your ownership of a square of Lands in the early stages of Matrix World. It can be freely traded in marketplaces in order to transfer ownership.

How large is a tile of Matrix Land?

A Land is 30m x 30m, or 99ft x 99ft. There will be a height limitation, which we are still deciding. However, our partners and community members can apply for extra height for special cases.

Can I merge or split Matrix Lands?

If owners buy more than one Land, they can split it and sell it in parts. When a group of Lands shares the same owner, the owner can choose to merge the Lands into a Space for larger construction and more complex application development. The computational resources and storage of the Lands will also be merged.

What can Landowners do?

Matrix Lands are tradable and transferable via blockchain networks, and their owners retain complete control over the creations on their Lands in Matrix World. Users can take advantage of traditional 3D open-world features such as building 3D architectures, hosting virtual meetings, exhibiting NFTs, and more advanced functionality such as creating their own 3D decentralized Applications (DApps) using Matrix World's built-in computational resources. These DApps include 3D games and 3D marketplaces, among others.

Can I resell my Land in the pre-alpha phase?

Yes. Matrix Lands are tradable and transferable on both blockchain networks, Ethereum and Flow, even during the pre-alpha phase.

7.3 Community Pre-sale

What is the community Land pre-sale?

The community Land pre-sale is a special event in which up to 5,000 Matrix Lands on Ethereum and up to 5,000 Matrix Lands on the Flow ecosystem are available for early members to purchase. The purpose of this sale is to gather the early community for Matrix World. We want to gather the power of the community to help us accelerate the process. Coders, artists, scientists, geeks, and metaverse builders are welcome to join us. The sale will be a case-by-case application. Candidates will have to fill out a form explaining their plan for their early access Land(s). Due to the limited supply, candidates may not be able to get all of the Lands and Spaces requested on their form.

How will the community pre-sale work?

To be eligible to join the Matrix World community pre-sale, you have to fill out the application form. If you are selected to be in the first group of Matrix World builders, you will be added to Matrix's whitelist and receive an email to inform you that you are eligible to buy Lands on Matrix World's website. There will be several rounds of selections.

The form requires some contact information and features a couple of questions designed to show us your understanding of the metaverse and the blockchain world.

The application period will be from Oct 8th to Nov 8th at 00:00 Pacific Time. We will evaluate all of the submissions and give offers in several rounds. Earlier applications are likely to get earlier offers.

How much will pre-sale Land cost?

Each Land's price on Ethereum is 0.2 Ether. For Flow users the price is 60 FLOW at the community pre-sale stage.

What are some activities I can participate in during the pre-sale period?

We will open three early access activities in the pre-sale period.

- Referral Contest: The top 200 users with the most referred registrations will be rewarded with one pre-release Land in the Matrix World.
- NFT Airdrop: We will offer free NFT airdrops to owners of certain NFT collections who participated in early access (both Ethereum and Flow). You can check the NFT collection list on the Matrix NFT airdrop event webpage (https://matrixworld.org/airdrop).
- Airdrop for ChainIDE users: We will offer free NFT airdrops to ChainIDE users who registered before Oct 18th and created a project with ChainIDE.

How do I get NFT airdrops during early access?

In order to make the Matrix World a better place, we aim to infuse the world with many diverse elements. Therefore, we will offer special NFT airdrops to many of our early access users who own certain NFT collections. Please check the detailed NFT collection list on the Matrix NFT airdrop event webpage (https://matrixworld.org/airdrop).

Which wallet should I use?

On Ethereum, we support Metamask and all other wallets integrated with web3.js. On Flow, we support Blocto. If your application is approved, you will be emailed with clear instructions on how to pay for your Land.

7.4 Matrix Essentials

Which blockchain ecosystems will Matrix World support?

One significant feature of Matrix World is multichain connectivity. The Matrix World system will maintain identities across various blockchains. At the moment, we plan to support Ethereum and Flow, but we intend to integrate additional EVM-based and layer-2 blockchains in the near future. Creators can also connect Matrix Objects to external smart contracts running on several different blockchain networks. For instance, a creator can create a 3D Uniswap ATM by crafting its appearance and defining the function to invoke Uniswap's swap function in Ethereum. Similarly, a creator can also construct a 3D video gallery featuring Flow's NBA Top Shot moments.

What is a Space Virtual Machine?

Everything inside Matrix World is programmable. All objects in a Land are managed by a canonical virtual machine called a Space Virtual Machine (SVM). Matrix Objects each have their own set of characteristics, 3D appearance, and lifecycle. Users can define custom attributes and implement custom methods to modify the behavior of Matrix Objects. A complex 3D application can be formed by a collection of several programmed/scripted Matrix Objects that interact with each other. Authorized creators can simply program the actions of Matrix Objects using the Matrix Object and Scene Editor.

What is a Matrix Object?

A Matrix Object is the collective name of all programmable 3D objects in the Matrix World. These objects' appearances, actions, and lifecycles are managed by a Space Virtual Machine (SVM). Matrix Objects are hierarchical, which means they can have nested child objects attached to them.

How will Matrix support DApps?

Matrix World is a 3D DApps platform. The Matrix Network consists of several Space Virtual Machines (SVMs), each of which is responsible for running a Scene on a specific Land/Space that offers various functionalities. Creators can make a 3D application solely on one SVM or create Cross-SVM or Multi-Scene applications. Matrix World will provide creators with development and automation tools to facilitate Scene and

DApp development. We hope that in the future, thousands of 3D applications will operate concurrently in Matrix World.

7.5 Others

Where is the Matrix Team's HQ based?

Our headquarters is based in Vancouver, BC. We have offices and remote staff operating all over the world.

Who is the Matrix Team?

The Matrix Team was founded in Vancouver in 2017 and has grown to more than fifty staff worldwide. The Matrix Team has deep experience in the research and development of blockchain systems.

Where can I contact the Matrix Team if I have further questions?

Join our Discord or email us with any questions you have. We will answer all questions as soon as possible. Our community members can help as well.

What is the Matrix Team's goal?

We are long-term builders in blockchain and the decentralized world. We hope our efforts will help bring developers from every part of the world into the metaverse and grow the blockchain community. We want to empower people across the globe and change the way the world works by expanding the influence of blockchain technology.

IN METAVERSE, WE BUIDL!

8. Team

The Matrix Labs team is a passionate group of blockchain enthusiasts. Since the early days of Ethereum, we have wholeheartedly believed that blockchain technology could empower people across the globe and change the world. Today, we are working to make those beliefs a reality.

The core members of the Matrix Labs team met in 2017 in the Ethereum ecosystem. The team started as a group of students, tutors, and professors from prestigious Canadian universities such as the University of British Columbia, the University of Alberta, Dalhousie University, and the University of Waterloo. After graduating, some members went on to hold technical lead positions at well-known enterprises like Amazon and Alibaba. The Matrix Labs team has since grown to more than 50 members worldwide. Our team members are all blockchain and tech geeks at heart, and we have

strong technical capabilities as well as a deep understanding of the blockchain world. Our common goal is to change the way the world works by expanding the influence of blockchain technology.

Our team first met the core members of Dapper Labs in 2017 when Dapper Labs was developing CryptoKitties, the world's first Ethereum based game. Today, we are proud to have Dapper Labs as one of our first official partners for the Matrix World. Their work in 2017 is what inspired us to explore the realm of blockchain gaming and led the way for one of our team members, Ling, to develop and launch a series of blockchain games. One of the games, Cell Evolution, won the Game Creativity Award at the First NEO Game Development Competition and successfully helped us establish close connections in the blockchain gaming world's first developer ecosystems.

2018 marked the start of a long and harsh bear market for the blockchain world. At this time, we realized that blockchain technology in its current state had many major technical bottlenecks that were holding back its growth and adoption. We knew that the blockchain community desperately needed to get more developers from the traditional world to understand and join the blockchain world. This is also when we met the White Matrix team and learned of their project, ChainIDE. Both of our teams agreed that the blockchain ecosystem was lacking a powerful yet flexible IDE, so we gave them our full support and assisted in the development of ChainIDE, a cloud-based multi-chain IDE that allowed developers to create blockchain technologies anytime, anywhere. As of November 2021, ChainIDE has assisted developers in more than 185 countries to compile over 8.5 million smart contracts and more than 70 million blockchain middleware flows.

In 2019, we began researching cross-chain development and the metaverse. We firmly believed that the use of blockchain technology to anchor users' digital assets in the virtual world was the inevitable direction of the digital future. This belief also aligned with our vision and goal of using blockchain technology to empower people across the globe and change the world. Our research on these topics has been featured at multiple major international technology conferences. Our paper, "An Interoperable Avatar Framework across Multiple Games and Blockchains," which was accepted by IEEE INFOCOM2019, a top-ranked computer conference held in 2018, describes an interoperable avatar framework where information gets synchronized across trust subjects on different blockchains and games. Our exploration of the multiverse in the same paper demonstrates the actualization of cross-game battles and information

synchronization in three blockchain games, namely, "Last Trip," "Adam's Adventure," and "Rhythm Dungeon." Another paper, "Metaverse for Social Good: A University Campus Prototype," was accepted by and included in ACM Multimedia 2021, a top international Multimedia conference and "A" class international academic conference recommended by the China Computer Society. It was the first paper concerning a blockchain-driven metaverse to be included in a top computing conference.

In addition to researching and developing blockchain technologies, our team has made significant efforts to grow and contribute to the global blockchain ecosystem. From 2018 to 2021, we held over 100 events and established connections with developers and developer communities across the world.

In March 2021, we held a tech session for Indonesian developers during Indonesian Blockchain Week 2021, a part of X Binance Smart Chain Summit 2021. Over 15,000 users attended the event and learned about coding, development, and design. In April, we co-hosted the Blockchain and Multimedia Data Science (BMDS) Webinar with the University of Alberta and WhiteMatrix. The three-day webinar explored issues relating to the data science of blockchain and multimedia. Professors from the University of British Columbia, the University of Alberta, and The Chinese University of Hong Kong, Shenzhen, along with industry experts from Citibank, WhiteMatrix, Best Buy, and AltaML presented at the event, and more than 30 student projects were displayed. Our team also supported the Vietnam Super Blockathon in May by providing blockchain technology workshops and smart contract support for its related hackathon events. In August, we hosted Metaverse Bootcamp, an event focused on blockchain game development. The event featured courses taught by senior blockchain developers and top university professors with practical expertise. Over 30 blockchain games and metaverse projects were incubated during the one-month developer bootcamp, which produced the first metaverse developer ecosystem in China. In addition, this year we hosted an NFT webinar with over 200 Pakistani blockchain enthusiasts, which brought about the first NFT ecosystem in Pakistan, and we offered a free 8-week comprehensive course on MasterClass to developers across 40 countries in Africa. To date, the MasterClass course has more than 100,000 views on YouTube and has helped more than 1,000 African blockchain developers, which has led to the development of more than 50 blockchain projects.

In 2020, largely due to the impact of the global epidemic, the concept of the metaverse became more familiar and widely recognized. Therefore, we were excited and inspired

to start the Matrix World project and formed Matrix Labs in order to better share our years of technical experience and work with the world. We spent nearly one year developing our vision for Matrix World and creating its high-level framework and technical architecture. By mid-year 2021, we had completed our whitepaper and decided to launch Matrix World in October with a cross-chain pre-sale on the Flow and Ethereum networks.

The Ethereum network was a natural choice for Matrix World because we have been fanatic supporters of and active contributors to the Ethereum ecosystem ever since its inception. It also goes without saying that the Ethereum ecosystem is the largest in the blockchain world and hosts the most comprehensive technology stack of any blockchain ecosystem. The Flow blockchain was another obvious choice due to our long-standing relationship with the Flow team as well as the blockchain's high throughput and low transaction fees. We have seen the continued advancement of the Cadence language over the years as well as its strong potential for the future, and we are excited to contribute to the continued growth of the Flow ecosystem and community, which has shown us great support. Currently, our project is the second largest project and the first ever metaverse in the Flow ecosystem.

We hope our efforts will help bring developers from every part of the world into the metaverse and grow the blockchain community. We want to empower people across the globe and change the way the world works by expanding the influence of blockchain technology.

9. Glossary

Blockchain Network

A blockchain network is a type of technical infrastructure that enables applications to access ledger and smart contract (chaincode) services. There are numerous implementations of blockchain networks, including Ethereum and Flow.

DApp

A DApp, the abbreviation of decentralized application, is an application built to run on a blockchain network, like Ethereum.

Entity

An Entity represents the non-top-level Matrix Object in a Scene.

Ethereum

Ethereum is a decentralized platform for developing smart contract-based applications. The Ethereum platform is being used to mint half of the Matrix Land NFTs. Please visit https://www.ethereum.org/ for additional details.

Flow

Flow is a fast, secure, and developer-friendly blockchain platform designed to power the next generation of games, apps, and digital assets. Half of Matrix's Land NFTs are being minted on the Flow platform. Please visit https://www.onflow.org/ for additional information.

Matrix World

Matrix World is a decentralized 3D open-world built on multiple blockchains, as well as a compute platform for constructing decentralized applications.

Land

A Land is the smallest territorial unit in Matrix World with finite compute and storage resources. A Land is also represented on several blockchains as a tradable NFT. For instance, it will be an ERC721 token on Ethereum, whereas on Flow will be an on-chain Flow resource.

Land Voucher

A Land Voucher is a certificate Non-Fungible Token (NFT) that proves your ownership of a square of Lands in the early stages of Matrix World. It can be freely traded in marketplaces in order to transfer ownership.

SVM (Space Virtual Machine)

An SVM is a canonical server that manages the lifecycles, states, and behaviors of all programmable objects within a given space. A Space can contain one or more Lands.

Matrix Object (a.k.a. Object)

Matrix Object is the collective name of all programmable 3D objects in the Matrix World. These objects' appearances, actions, and lifecycles are managed by a Space Virtual Machine (SVM). Matrix Objects are hierarchical, which means they can have nested child objects attached to them.

NFT (Non-Fungible Token)

In contrast to a fungible token, non-fungible tokens are distinct and unique digital assets. Matrix Land is an example of a digital asset that is not fungible. It means that a single non-fungible token can never be swapped or exchanged for another. The

coordinates, size of a Matrix Land are unique pieces of information that are contained within the non-fungible token and hence all tokens are unique.

Scene

A Scene is the top-level Matrix Object which contains all child Matrix Objects deployed to an SVM.

Space

When a group of Lands shares the same owner, the owner can choose to merge the Lands into a Space for more extensive construction and more complex application development. It will also merge the computational resources and storage of the Lands.

WYSIWYG

WYSIWYG is an acronym for What You See Is What You Get. It describes a system in which editing software allows content to be edited in a form that resembles its appearance when printed or displayed as a finished product, such as a printed document, web page, or 3D models.