MARK.SPACE

NEXT GENERATION INTERNET

A 3D/VR open source platform for creation
and integration of spaces and objects,
powered by the Blockchain.

Abstract

MARK.SPACE is an open source platform for creation of 3D/VR spaces and objects of any purpose, as well as their quick launch and integration into a unique ecosystem. The platform is maintained by a crypto economy and is powered by the Blockchain.

MARK.SPACE supports all internet browsers (preferably Chrome) and, at the same time, is compatible with CardBoard, Oculus and HTC Vive. A desktop PC is all that is needed to create a state-of-the-art VR store, office, community or other space for either business or entertainment.

The MARK.SPACE universe is made up of a great amount of VR spaces (units), where each unit can be linked directly to its own top-level domain. The private property of units is guaranteed by recording all transactions with units (to create, sell or rent) on the blockchain. All unit owners may buy, sell and/or rent their units to others through use of smart contracts.

MARK.SPACE has its own MARK token (MRK), a utility token used as internal currency. The MRK token enables all users to sell and buy VR units and objects, consume various goods and use services, pay salary to their employees and buy ads to promote their businesses through the platform. GPU-miners who will be rendering VR spaces and objects for the platform's users will also receive rewards in MRK tokens (POW conception).

MARK.SPACE IS THE BEST PLACE TO ENTER THE NEXT GENERATION OF INTERNET.

1   Introduction

1.1   BLOCKCHAIN-POWERED VR - A MILESTONE IN THE DEVELOPMENT OF THE INTERNET

Orinofilm, the first novel describing virtual reality (VR), was written in the sixties by Italian science fiction writer Lino Aldani. About 25 years ago, Neal Stephenson's science fiction novel Snow Crash was published. In that novel, Stephenson presented the concept of a metaverse - a collective virtual shared space which is commonly referred to as the future iteration of the internet. In 1998, project "**There"** was launched where users, appearing as avatars, in addition to socializing, could purchase objects and services using a virtual currency called therebucks - purchasable with real money.

With the initial creation of the Internet, nobody imagined that it would achieve such scale. When the first online-store was launched, most businesses believed that e-commerce had no future. Online shopping has already become a rapidly growing market, expected to reach $1.9 bln by the end of 2017. Likewise, when cryptocurrencies first bursted into arena, very few took them seriously. Nowadays, global society is getting used to the idea that Bitcoin and other currencies are becoming a large part of the world economy.

VR follows a similar path, as it took a long time to bring the technology to the present level. Today, most people understand that VR is an incredible technology that opens unlimited possibilities. It has truly become the future, and we're already living in it. Mega-brands, such as Google, Facebook and many others are collectively spending billions on VR technology.

The internet has been developing for a very long time and thus we know: the major change is yet to come, and it's called 3D internet. We have come to a point where the technologies for virtual reality (VR), augmented reality (AR), mixed reality (MR), and cryptocurrencies could merge into a fully functional ecosystem in order to create an economy that would enhance, complement and someday replace the entire online economy

we know today. The goal of the MARK.SPACE platform is to fully develop and implement this philosophy.

1.2   PLATFORM BASIC IDEAS

When we started developing MARK.SPACE in 2015, we came across serious challenges that had to be solved in order to realize our ideas, because VR was a rather complicated technology (and still is), in both production of content and its usability. In order to create and launch any type of VR project, such as a game, online store or social network, to name a few examples, it was necessary to engage a team of professional developers and spend a lot of time and financial resources. At the same time, VR audiences grew slowly, which has to do with the fact that in order to consume VR content, people still needed to buy specialized expensive equipment, such as VR-glasses and headsets, controllers, etc. Another limitation was the need to be at comfortable and safe location in order to use these gadgets. We are proud to say that we have found a way to bypass all these difficulties!

The main idea of MARK.SPACE is to give the world an easy tool to create and launch any VR/3D project, and to do it quickly, without significant costs. Secondly, all projects made on our platform will be accessible from most ordinary devices, such as a PCs, laptops, tablets, or smartphones - through any web-browser and without the need to use a VR-headset. The project was conceived with the idea to leverage VR technologies that just appeared, in order to create a world where everything would resemble real life as close as possible.

We invested 2,5 years and $5 million of personal funds into VR technology research, the making of prototypes and getting feedback from businesses. All this resulted in creating the M1 platform and we are ready to show the capabilities it has today (check out the DEMO at http://demo.mark.space/). No need to download any client or program; no need for expensive VR-gadgets and powerful computers - just your ordinary device and a browser of your choice! Instead of surfing the net, you can now travel through and around the world, and it's going to appear just the way we used to in real life, all thanks to the birth of 3D technology.

While there are many existing VR projects, none of them is currently comparable to the M1 technology. M1 is the logic and driving force based on advanced mathematical algorithms that we developed, aiming to provide maximum 3D visualization precision. As of today, our company has digitized entire shopping malls with branded stores, including all the details of interior and complete product lines. Additionally, we created a working prototype of a social platform, where each user could design their own virtual space and fill it with furniture, paintings and other details of the interior decorations. Users can also add different types of content, such as Youtube videos, Instagram photos, as well as audio and text files. The templates of various spaces are available, including personal appartments, exhibition halls, gaming clubs, restaurants, movie theaters, and offices that could be used as VR headquarters of companies.

1.3   DEVELOPMENT PLANS

After the Token sale, our prototype will be further enhanced to include the functionality, as described in the next section. The ultimate goal is to achieve full decentralization for the benefit of both users and those selling computational and storage resources to enable platform functionality.

2   MARK.SPACE Districts

2.1   MARK ECOSYSTEM

The MARK ecosystem is modelled after the real world economy and has similar features. Real world economy deals with the production, distribution, and consumption of goods and services, where, in well functioning economies, wealth is created and further redistributed. Lets see how a typical economic cycle is implemented in the MARK ecosystem.

Content Creation

The MARK platform is designed to give users all the tools for VR content creation. The current prototype allows for creation of residential, shared and business VR spaces (offices and malls), filled with preselected or custom elements of furniture, interior design, appliances and multimedia content. In the future, there will be an option to add any user-created digital content like articles, books, paintings and music.

At present, we are developing our own scripting language that is going to make it possible for users to create their own 3D objects and applications. Alternatively, you can already easily virtualize the interior of any existing premises by using a 360° camera and importing it to MARK.SPACE.

Goods and Services Distribution, and Consumption

The MARK Shopping area will allow both: the distribution of goods produced in the real world and any content created within the platform. This would include the ability to sell custom elements of furniture and decor created by users (our platform already allows to do this) as well as the entire personal or business spaces purchased earlier. Freelancers will be able to create their own virtual offices for advertising and selling their services. The ability for all users to advertise over common areas (like sidewalks or roads) between buildings and mall interiors will also be implemented. Tokens earned by users could be further used in the value creation cycle.

Distribution of Wealth

Just like with regular real estate, virtual locations will have a long term tendency for appreciation value, due to added 3D details and scarcity of the spaces. Once created, well designed and unique, and filled with quality-content, personal spaces are going to attract many visitors, thus making it a valuable asset from an economics standpoint. A VR store in the MARK Shopping district will be transparent, showing its income statement, balance sheet and cash flows, becoming a real asset which can be evaluated using any conventional methods. If there are assets to be sold, businesses like VR real estate agencies could appear, offering their services to the public. With the growing number of users, virtual economies will be flourishing, as demand for MRK tokens used for all transactions on the platform will increase. Users of the MARK platform will enjoy the appreciation of both their virtual real estates, as well as the cryptocurrency they hold. The wealth created will be further redistributed.

Distributed Rendering

Enormous computational capacities amassed by cryptocurrency miners are going to serve as a backbone for the new emerging crypto economy. Massive amounts of VR content to be generated in various MARK districts will have to be rendered. This provides a great opportunity for yesterday's miners to get revenue by providing their computational resources for distributed rendering of MARK spaces. This is just one of the ways how an internal VR economy extends to real world.

Synergy of Real and Virtual Economies

Products made in the real world will be sold in different stores within the MARK Shopping District. Various existing businesses will broaden their presence in the MARK Business District. Platform users who have their apartments in MARK Residential District will be sharing them via social networks, driving more traffic into all existing MARK spaces. New curious visitors will be exploring the areas and entering shopping malls. A painter, for example, would create their gallery (or fully virtualize the existing gallery) in the MARK Business District, also attracting users. Virtual and real economies would merge together using the power of synergy to its fullest.

2.2   SIZE OF MARK DISTRICTS

To start off, there will be just four districts: Residential, Business, Community and Shopping, but we may add more in the future. Adding new potential districts and buildings will be carefully controlled to make sure it won't affect the market value of existing real estates. Each MARK district will consist of 1296 neighbourhoods, whereas each neighbourhood will be made up of 36 buildings. Each building will have 36 floors and, in turn, each floor will contain 36 groups of units.
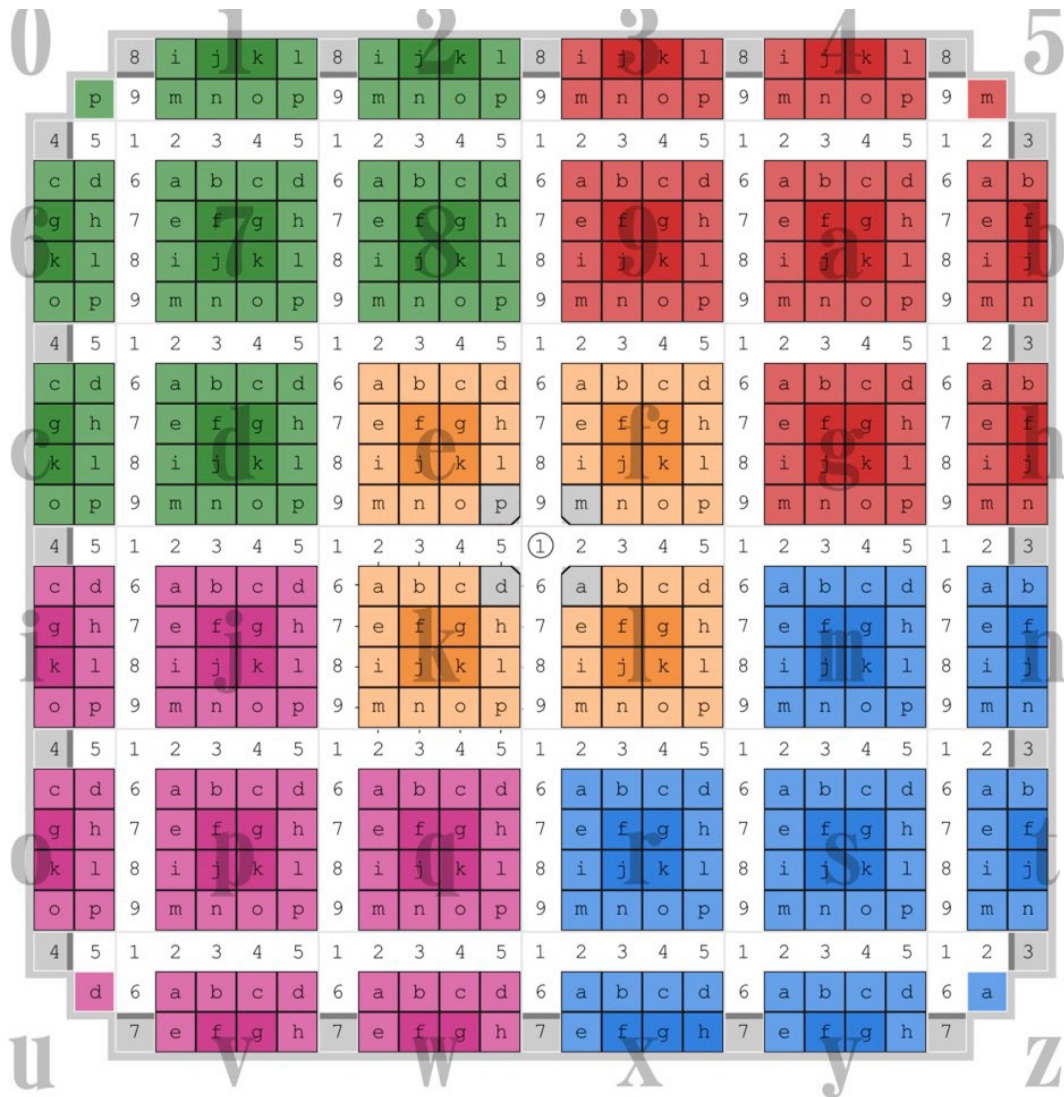
Pic 1. Typical floor layout

These are limitations to the current implementation; in the future, building height and capacity will be increased. Therefore, each neighbourhood may be occupied by 810,000 residents. The maximum capacity of each district will be 1.05 billion residencies. Four districts, consequently, would allow a population of 4.2 billion residents.

To put this number in the perspective, let's compare it to a gaming company called NetEase, which has close to 800 million registered user accounts. The focus of our project is using VR for real world applications, with an estimation that our user base becomes larger than the gaming community.

2.3   MARK COMMUNITY DISTRICT

MARK Community District, as the name already suggests, will be dedicated entirely to various communities formed and united by common interest. A community could organize itself and claim a certain number of units. Large communities could claim entire buildings, if they so wish and have the funds sufficient enough to support it. For example, imagine a music lovers community which occupies the entire building, named after the famous track by Leonard Cohen - "Tower of Song". Each unit could be decorated by fans or artists themselves, displaying various artifacts, including music instruments, disks, vinyls and so on. Artists' portraits would grace the walls. The TV or radio could be playing the artist's music. Most of this functionality is already available in the current prototype. Communities may even form a Decentralized Autonomous Organization (DAO). A DAO is an organization that is run by smart contracts stored on the blockchain. We are monitoring the project development of Aragon and in the future may consider integrating with it to avoid duplicating similar functionality.

2.4   MARK RESIDENTIAL DISTRICT

The Residential District allows any user to do one of two things: digitize their real apartment/condo/house using a 360° camera (in the not so distant future it will be possible to do so with a regular smartphone) or create a dream residence using various designs

and furniture items currently available in the system. It will also be possible to upload your own designs and objects. Once it's done, you could post the link with its unique address to either one of the existing social networks.

For the first time, your friends from the other side of the world will have a chance to actually visit your home. You may choose to virtualize only particular rooms or areas of the house. For example, your home-based music recording studio or a garage where you work on rebuilding your Mercedes SL 1965 model.

In the current prototype, this is a virtualization of Evgeni Malkin's apartment (a famous hockey player) that you could visit. Evgeni is also one of the main investors in our project.

Pic 2. Evgeni Malkin's apartment within MARK Residential District

Entire buildings could be bought by anybody with the aim to resell or rent the units to the public. For example, a particular movie star decides to purchase the building and name it after themselves. They spend money to decorate the units how they wish and then offer each unit for sale on the platform.

2.5   MARK SHOPPING DISTRICT

Four shopping malls have already been virtualized by our team in order to demonstrate the capabilities of our platform. Special attention has been placed on enhancing the technology required to sell clothes in VR. At present, you could select a particular clothing item and put it on a model in our VR fitting room and see how it would look on a real person. The accuracy is so precise that most people don't even realize it's not a photo. Fashion stores occupy at least 50% of any major mall and we already have perfected this technology.

Pic 3. SONY & NIKE showroom windows in MARK Shopping District

Pic 4. Loro Piana store in MARK Shopping District

Pic 5. LORIBLU store in MARK Shopping District

КАТЕГОРИИ

| 48 | 147 | 93 | 18 | 84 | 133 |

ТОПЫ 145 товаров

Desigual
3 045₽
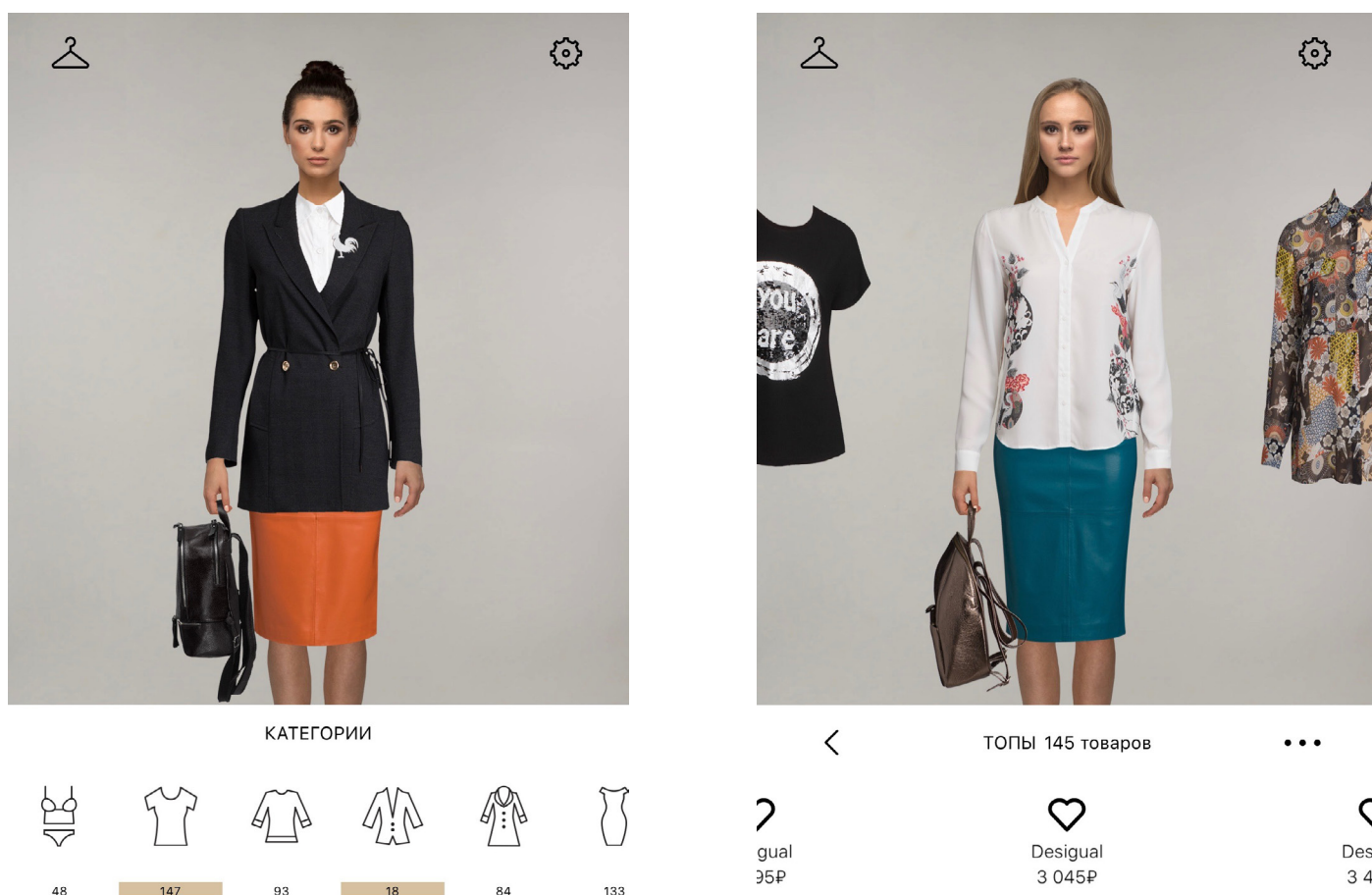
Pic 6. Fitting service in MARK Shopping District

Brands that are not ready to launch a fully functional VR store could still create a VR showroom that would promote their merchandise and drive traffic to their physical stores. For example, furniture stores or various home decor stores. Toy stores are great candidates as well. Electronics stores or Tesla dealerships could also choose to create a virtual showroom that would attract a significant traffic of visitors.

At the moment, we are negotiating with various partners interested in having a store in our first shopping mall that is about to be launched in March 2019.

2.6   MARK BUSINESS DISTRICT

Today, many companies market their services online. Sometimes these companies don't even have physical offices. VR technology allows any reputable company to virtualize their office and allow

it to be visited by potential customers. If you are looking for a lawyer or trying to choose a movie production studio, thinking about hiring an IT outsourcing firm or considering visiting a plastic surgery clinic - having an opportunity to visit its virtual premises first would only help in making a right decision.

Imagine a company has recently managed a successful Token sale having its own virtual office that any investor could visit. As you walk down the hall you see offices of Lisk, AEthernity, Tezos, Civic, Waves, EOS, and the like. Token sale promotional agencies could purchase an office right next to the Ethereum foundation. Copywriters could purchase an office right next door. With the MARK platform it's going to simply take a 360° camera and a few hours of work to make it possible.

Any freelancer or artist could create their own office. For reference, please see the picture below which was created with our system.

Pic 7. SONM (left) and ETHEREUM Foundation (right)
in MARK business district

Pic 7. SONM (left) and ETHEREUM Foundation (right) in MARK business district

2.7 OTHER DISTRICTS

We are not limiting project capabilities to only 4 districts mentioned above. In the future we may add more. An Educational district could be a possible candidate. VR solutions for education are some of the most tangible applications of the VR from the monetization perspective.

2.8 CREATION OF CUSTOM 3D OBJECTS AND APPLICATIONS

We are developing MARK.SPACE scripting language for a virtual machine of 3D interface that will make it possible for the users to create their own 3D objects and applications. This is going to open up unlimited possibilities for both making the interior of any space more diverse and offering more opportunities for monetization.

2.9   UNIT DESCRIPTION

The MARK.SPACE universe consists of a great amount of VR spaces (units). Each unit can be linked directly to its own top-level domain. The private property of units is guaranteed by recording all transactions with units (to create, sell or rent) on the blockchain.

Unit size is 8 x 8 = 64 m2

2.9.1   UNIT TYPES

UNIT TYPE	E-commerce functions	CRM	Advertising	Sell unit	Rent unit
Residential	NO	NO	NO	NO	NO
Commercial (shopping, office)	YES	YES	NO	YES	YES
Community	YES	YES	NO	YES	YES
External	NO	NO	YES	YES	YES

2.9.2   UNIT PRICES

UNIT TYPE	MAIN PRICE	EXTRA INTERNAL	Storage per year
Residential	1 for free, 250 MRK per each extra	100 MRK per each	1,2%
Commercial (shopping, office)	1000 MRK	500 MRK	1,2%
Community	10 MRK	10 MRK	1,2%
External	10000	--------	1,2%

In the beginning, each user will be getting one unit for free but once a critical mass of users is reached, units will cost money. However, we reserve the right to opt for other monetization options like in-world advertising.

2.10   CURRENT STATE OF THE PROTOTYPE

The current prototype already allows for creating personal spaces as described above. There is a great selection of decors, furniture, appliances etc. Social functions like chat between users are also implemented. Launching stores in the MARK Shopping District is also possible but it's a more complex procedure that requires joint effort with a brand or company wishing to open a store. You are welcome to play around with our current prototype at www.demo.mark.space

3   Technology

3.1   CURRENT PROTOTYPE ARCHITECTURE AND CAPABILITIES

The current platform is based on a centralized architecture, however a roadmap has been prepared to fully decentralize it.

Our existing platform is able to automatically detect VR glasses or headsets, working on technologies Web Bluetooth and WebVR. Alternatively, VR content is displayed on regular PC monitor and/or smartphone. Using built in accelerometers, the system is able to process information from sensors in the headset or glasses, in order to improve navigation of the user in the space. Voice recognition technology allows the user to issue voice commands that are detected and executed by the platform.

The existing platform front-end is implemented using:

- HTML5/CSS3/Javascript/JSON + SMX.
- Back-end is written in: Perl, Python, Java, Node.js, PHP
- The protocols used are: VRML/X3D, WebGL, Web3D, WebVR

3.2   CURRENT USER PROFILE FEATURES

At present, each user has access to the following personal information:

- Profile
- Settings
- Friends list
- Messages log
- Personal photo gallery
- Personal content (files, documents and links to the content sent from other systems)
- Personal blog
- Personal apartment with assigned address that allows visits even from the unregistered users
- Personal belongings, furniture and the elements of decor located in the apartment

- Personal fitting room for storing clothes and trying them on
- Gifts from other users
- Personal wallets with MRK tokens balance
- History of purchases
- Purchases planner
- News feed based on subscriptions to the other blogs of internal users.

3.3   CURRENT SOCIAL INTERACTIONS CAPABILITIES

The platform allows for:

- Message exchanges between users (real time chat)
- Private chat
- Personal blog

3.4   FUTURE ARCHITECTURE

3.4.1   Overview
Following the Token Sale, the current system will be fully decentralized and it's going to have the following architecture.

As opposed to other projects, the future MARK.SPACE architecture is not just a solution relying on Ethereum Virtual Machine for smart contracts, implementing core functionality; it's a powerful development platform with its own virtual machine and its own internal blockchain, allowing development of complex applications in its own scripting language (similar to Java). The use of Ethereum smart contracts is limited only to critical functionality and utilizes the Ethereum blockchain.

DAO MARK.SPACE

EXECUTIVE SERVER   RESERVED SERVER
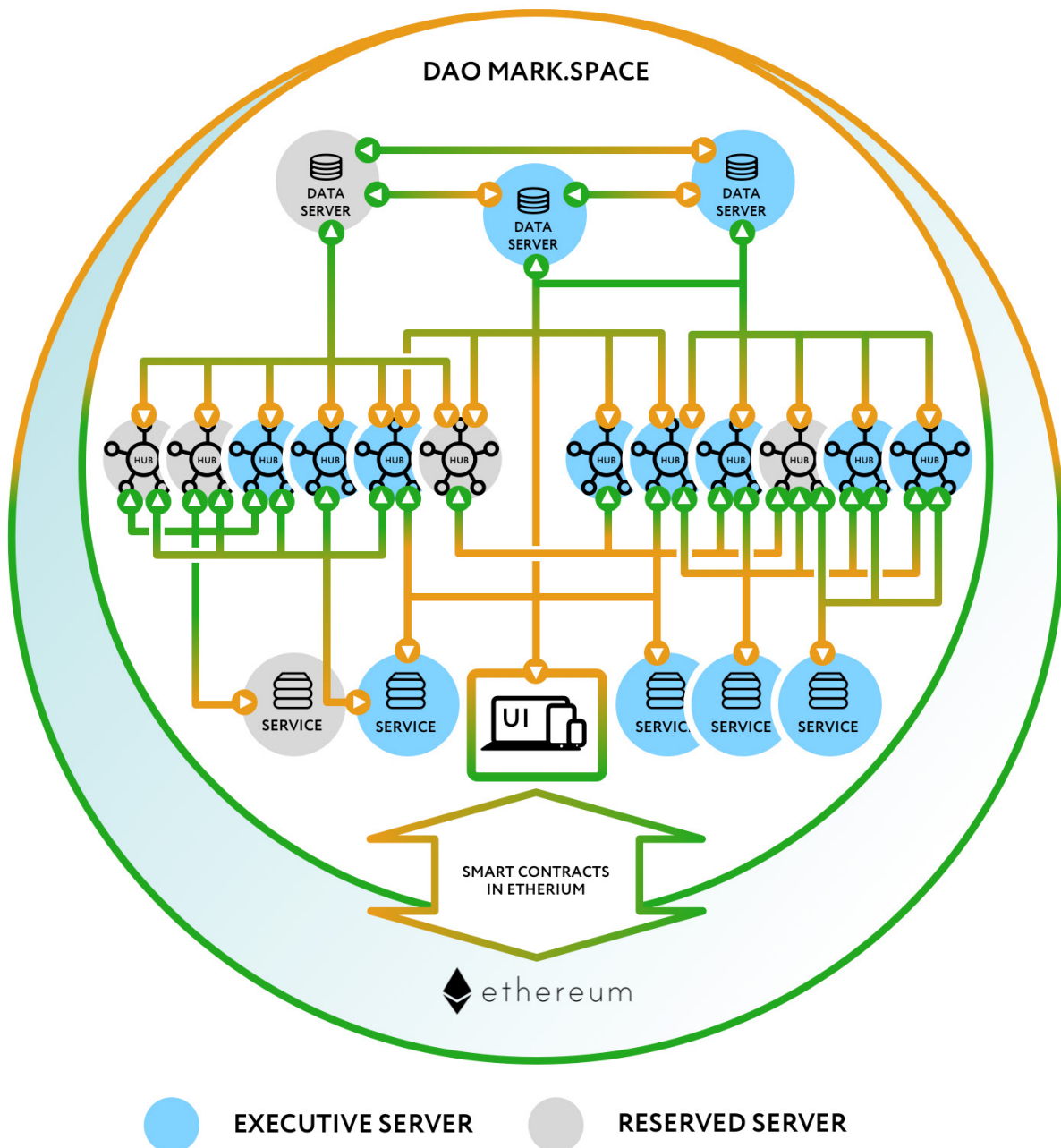
Additionally, the platform has a fully decentralized architecture in contrast to other projects that just call it decentralized. Decentralization is achieved through the use of three types of servers. These servers will be picked from available machines of network participants providing their computational and storage resources and one of three roles assigned:

1 **DATA SERVER** - data blocks storage; receiving, storing and retrieving data.
2 **SERVICE** - accepting and executing tasks and returning results.
3 **HUB** - storing references to data blocks; addresses of DATA SERVERs and SERVICEs; accepting requests from servers and clients (UI); locating servers for executing tasks and returning data about these servers and access keys.
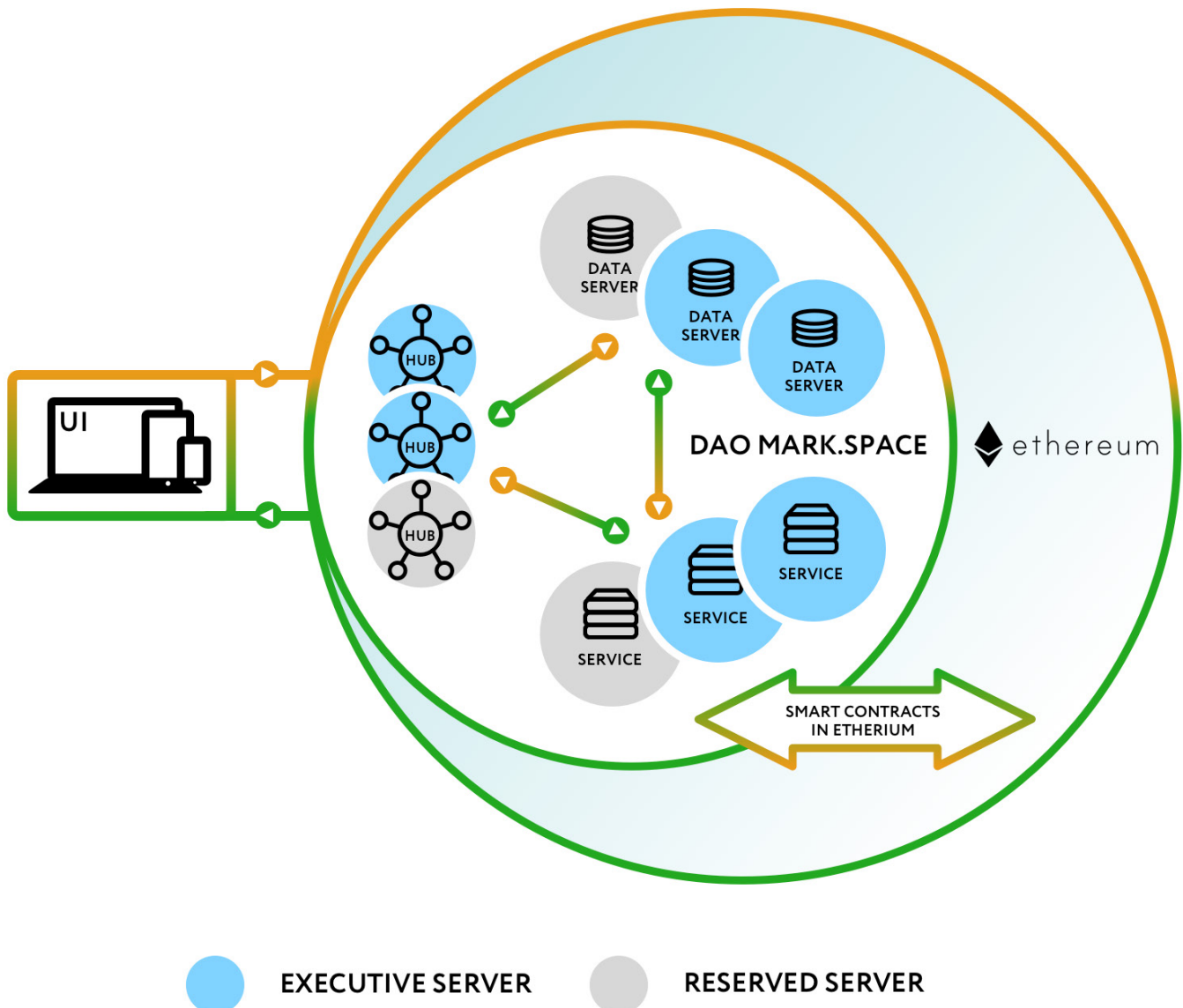
- Servers shown in grey color are inactive most of the time, but are activated when one of the active servers fails.

- Servers shown in green color are fully active and support the functioning of the platform.

- All servers' owners will be compensated in MRK tokens, based on the amount of work done.

  Each DATA SERVER that is receiving data blocks through HUBs is registering and storing them; it also notifies other servers about changes in the blocks registry database. The data is stored on DATA SERVERs in a fully decentralized way and is replicated on at least three other servers. The new data block has to be replicated on at least three servers before it can be used.

  Each HUB is constantly checking the status of other HUBs to notify them about its recent activity. This way the data is eventually consistent.

- Client UI is sending requests to the closest HUB (by address); if this HUB can't respond the client will issue a request to the next closest HUB. If a particular HUB doesn't have the requested data
- it will locate another HUB, containing it and return its address to the client. HUB will respond to the client with an address of the DATA SERVER and access keys that allow to retrieve the data and present it to the user.

- **PORTAL** - open code that is deployed on each server, which allows the server to be replaced by another one without any functionality interruption for the users. This code is deployed on all servers and can't be altered without losing the license allowing its functionality.

- **SYSTEM** - each SERVICE could have its own code WORK compliant with common service protocol SYSTEM. SYSTEM is an alternative name for MOSL (MARK.SPACE Object Scripting Language). SYSTEM is a programming language developed by us for the virtual machine run by the PORTAL code.

UI

DATA SERVER

DATA SERVER

DATA SERVER

HUB

HUB

HUB

DAO MARK.SPACE

ethereum

SERVICE

SERVICE

SERVICE

SMART CONTRACTS
IN ETHERIUM

EXECUTIVE SERVER   **RESERVED SERVER**

The activity of servers is being constantly verified by queries from other servers as a result of which PORTAL code is self validated. If a modification of the PORTAL code is attempted or data on DATA SERVERs is altered by a hacker, the server instantly becomes inactive and a group of HUBs initiates a full scan of the server. If a full scan does not detect any issues the server is then reactivated. If any issues are detected and the server is deactivated, it could be reactivated again only after completing the full registration procedure, which includes the complete removal of all data from the server.

The storage of 3D scenes and enabled rendering for miners willing to make money by providing their computing resources. Rendering is not done in realtime, but in advance by rendering every possible perspective of the user.

Ethereum Smart Contracts will be used to ensure ownership rights of virtual real estate assets and custom 3D items created by users. Various transactions between users or businesses will be conducted, like purchasing goods or services, and regulations for various entities will be enforced and implemented (like communities DAO).

Ethereum EVM is the most widely adopted blockchain-based computing platform with smart contract functionality. The platform, however, is designed in such a way that its dependency on Ethereum is minimal in order to enable fast migration (if necessary) to NEM or other Ethereum alternatives.

MARK.SPACE is going to use its own protocol for distribution of storage and rendering among participating nodes, while achieving full BFT tolerance and protection from Sybil attacks. Reputation and incentivization approaches to stimulate fair behavior will be implemented.

3.4.2   LANGUAGES, PROTOCOLS, FRAMEWORKS

MARK.SPACE is going to utilize the following:

- HTML5/Javascript SS3
- Solidity
- Ethereum JS
- Web3.js
- Mark.js (internal MARK framework)
- IPFS

The web client is written in pure HTML5/Javascript SS3 to achieve maximum runtime speed. The client will be using Javascript libraries to enable smart contract functionality and for communication with peer nodes.

All Ethereum smart contracts will be written in Solidity language. Depending on how Ethereum is going to solve its scalability challenges (sharding is still not implemented) we may migrate our code to other platforms.

3.4.3   OTHER PLATFORM TECHNICAL DETAILS

Our current identification system is implemented using 3 keys:

- User open key - users to get open information about the user;
- User private key - private for each user, stored in browser localstorage and used for runtime user identification by the front-end;
- User fingertip - hidden system key used by the back-end and internode communication.

Users may choose to provide full identification or remain anonymous. Those willing to make sure that their ownership of a particular virtual real estate is tied to their ID should be providing full identification. In addition to the existing ID system, we are planning to use Keybase and other identity systems later, once they become available.

VR Real Estate Exchange

Any VR real estate created by the user, from personal apartments to shops or even entire buildings could be offered for sale on MARK VR Real Estate Exchange. A user could create, for example, a RE sale smart contract to be processed by Ethereum EVM. Such a contract will be signed by the user, then processed and deployed. Transactions will get broadcast and, subsequently, confirmed. Clients will then pass it to one of the Data Servers. Another user, willing to buy this particular piece of real estate could review the contract and decide to make a purchase transaction by paying the price set in MRK tokens to the seller. The typical ethereum smart contract execution would follow.

Rental Contracts

P2P rentals are also governed by smart contracts written in Solidity. These contracts are self-enforcing agreements between two parties similar to regular rental transaction in real world. Such contract creation, deployment and execution is similar to sale contract described above. The platform is also going to have a more complex contract creation functionality, where a virtual real estate agency could get involved as one of the parties of the contact.

Advertising Engine

As the number of users is growing, we consider in-world advertising as one of the forms of monetization. Due to the complexity of such engines we consider using third party solutions developed specifically for VR ads. Right now we are in the process of provider selection. Once we have made a choice we will make an official announcement.

Distributed Rendering

Distributed rendering technology challenges

For smooth VR experiences there has to be < 12 milliseconds time between head movement and image appearing in front of the eyes. While this is challenging even on a device, to make this happen in a distributed environment it is even harder. Rendering all possible perspectives of a user is required in advance, but this comes with serious challenges, in terms of both required bandwidth and the amount of data payload. Both the internet bandwidth and computational resources of modern GPUs are constantly growing and what seems to be impossible today could be possible just by the time the technology itself is ready. Even in distributed environments, data storage is going to have a tendency of getting cheaper all the time. We have seen a lot of very similar challenges being resolved, so we don't consider this an obstacle that should stop us from implementing our own rendering solution at the same time that others are also working on it. If someone solves the problem before us, we would be happy to use a third party solution. Today, multiple companies like SONM and Golem are working on creating a solution for distributed rendering.

Solution

To address the issues of rendering speed in a distributed environment, we will be using the following approach: All available miner's machines/farms will be given certain short computational test tasks to discover both their computational capacity and speed round trips. Only those satisfying the requirements would be able to join the network and make money by providing resources. A decentralized approach has its pluses and minuses compared to its centralized counterpart. Miner networks today

are becoming very impressive in size and scale; therefore it would be quite possible that a miner farm in proximity of less than 5 km will be rendering your experience within MARK.SPACE, in which case it will become very similar to centralized solutions in terms of performance. One of the significant advantages of MARK technology is superb compression, which makes running everything smoothly even on very weak devices possible. This will be helping us a lot when developing our own distributed and decentralized rendering solutions.

From all distributed computing use cases, rendering is actually one of the easiest to implement. An output of a 360° camera is easy to decompose to a 3D scheme which, in turn, is further decomposed into single frames. Every frame is then again decomposed into pixels. Each pixel could be rendered separately independent of other pixels. The simplistic description of rendering is casting a ray from a particular position to determine intersections of a ray with the objects' surface. Each GPU today used in mining rigs have 3000+ parallel stream processors. Thousands of such GPUs working in parallel could render any 3D scene in subseconds time.

camera

3D scheme

**image regions
(up to single pixel)**

single frame
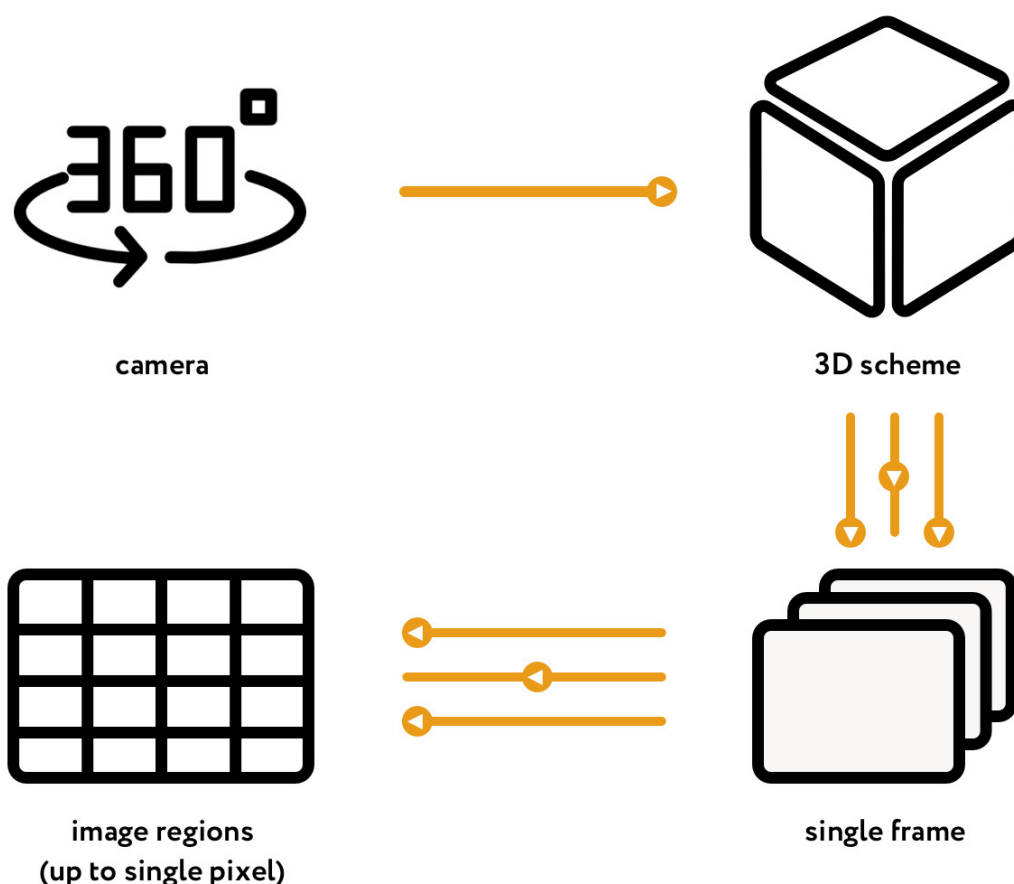
Miner rigs would be used in two roles "Scheduler" and "Worker". A Scheduler would assign the rendering of a pixel or group of pixels to workers, collect the results and pass it back to the client. Since the environment is trustless, the Schedulers would have to put a deposit as a security to guarantee honest behavior. There will be redundancy (x3) of repeating same rendering tasks by the Worker machines to make the system Byzantine Fault Tolerant. Rendering results will be checked against each other to make sure that rendering is successfully completed. Rating the system for both, Scheduler and Worker machines will be put in place. Nodes with good ratings would have a higher chance of getting more rendering jobs.
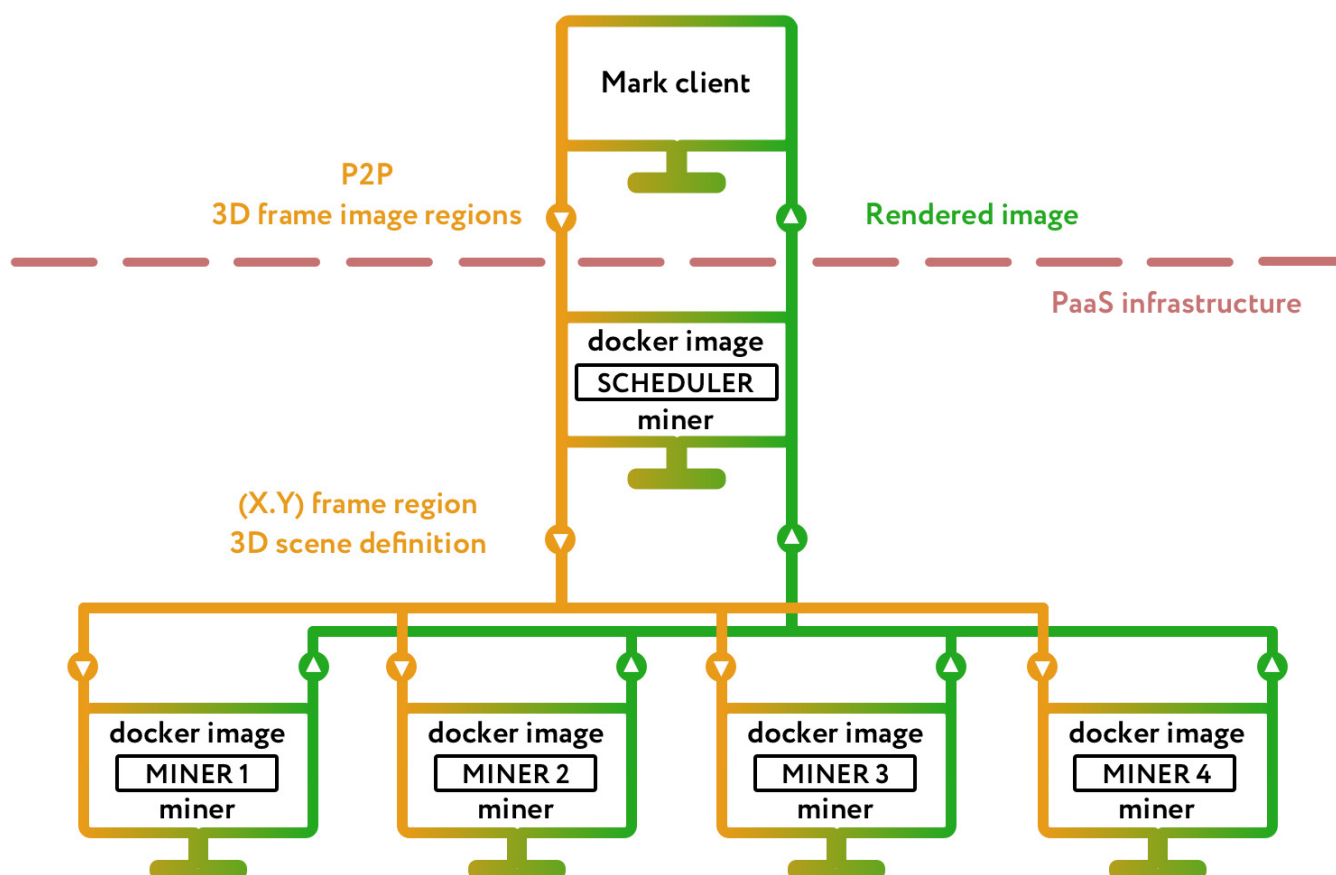
3.4.4   MARK.SPACE OBJECT SCRIPTING LANGUAGE - MOSL

One of the most powerful features of the MARK platform is the ability to create any custom objects, interactive software components or even entire spaces like a store within MARK Shopping District completed with desired functionality. This is achieved by using the language we have developed specifically for this purpose.

MOSL is a language similar to Javascript for creating objects within MARK.SPACE, allowing to implement:

- Visual presentation of an object in 3D;
- Movement of an object in 3D;
- Visual effects of an object;
- Showing content when interacting with an object;
- Content control function when interacting with an object;
- Custom functionality of an object;

MOSL allows not only to display objects in 3D spaces, but also to implement particular use cases with an object as desired by the object creator.

It allows to call API of personal objects directory, MARK.SPACE API, API of financial transactions using MRK tokens, rendering API, other APIs as well as third parties' APIs.

Following is a short description of MOSL internals:

The reflection of 3D space is formed in the interface of a canvas container in the format of a WebGL library. This reflection is similar to a sphere with a 6-sided cubic scan. Also, separate containers of objects are formed (furniture, decor, items, avatars etc) and positioned in the space. Those containers are interactive and can respond to user requests.

Visualization code of these objects is generated in VRML/X3D virtual reality modelling language (for non interactive objects without additional functionality or with some built in functionality) or in MOSL (for interactive objects with own unique functionality).

Then, objects' code is interpreted in Mark Virtual Machine (MVM) and the sphere space containers and object containers are modified as a result.

4   Economy

4.1   MRK TOKEN

MRK is a ERC20 standard token that will be issued on the Ethereum blockchain. MRK token will be used for all transactions across all MARK spaces.

You could earn MRK tokens by:

- Selling or renting your units or even buildings and entire neighbourhoods;
- Selling your products or services;
- Selling your custom 3D objects;
- Selling ads;
- Selling digital content;

Our goal is to enable as many economic interactions as possible. MARK.SPACE is modelled after the real world as well as its economy is modelled after the real-world economy.

4.2   MONETIZATION FOR COMMUNITY MEMBERS

Communities will have public wallets governed by DAO. Advertising is going to be one of the most significant sources of income for communities.

Various communities created on the MARK platform will have the opportunity to organize events. Community members will be able to participate in person through their avatars. By selling tickets to these events those elected by the community could cover the costs related to keeping the community alive and functioning. Community may choose to open its store within MARK Shopping District and sell various merchandise. For example Indie Rock community could sell CDs and mp3 recordings of community members which include various bands.

Another example would be some open source project that is willing to create VR presence in order to engage in discussions and live communication with its member community. Such communities could advertise its MRK wallet address in order to accept donations to support further development of the product.

4.3   MONETIZATION FOR RESIDENTS

While the main purpose of MARK Residential District is to allow everybody to create their own virtual residence there are possible monetization options. For example, a person that is using Airbnb to rent out their apartment could virtualize it using a 360° camera (and a smartphone in the future) and place a link with the address on the Airbnb website.

The ability to virtualize your existing residence, coupled with real estate marketplace/rental functionality within the platform opens up an exciting opportunity to implement both P2P rental functionality and to tokenize properties. Competition with companies like Airbnb becomes possible. Airbnb today is a 29 billion US-dollar company.

As freelancers in real life work from home, you could do the same in MARK.SPACE. If you are a freelance artist you could set up your personal exhibition and sell art-works.

If you are a blogger, VR takes blogging to a whole new level adding many capabilities to add all types of visual content to your blog and, once you have big audiences, sell ads on the platform.

4.4   MONETIZATION OF THE SHOPS

Selling digital content like music, videos, books, images as well as real merchandise in MARK Shopping District shops offers exciting opportunity for entrepreneurs around the world to be first to monetize on technology mature enough to finally allow fully operational VR stores.
Owners of brick and mortar stores could virtualize their stores in VR as a first step to allow potential buyers to see what their

store has to offer on the first stage to increase buyers traffic to existing location. And then on the second stage to create a fully functional store in VR.

We've perfected the technology for selling clothes in VR. Potential buyers just need to provide few measurements of their figure in order to guarantee a perfect fit.

Early Token Sale participators have a unique opportunity to buy many units or even buildings to setup their own shops or entire shopping malls.

4.5   MONETIZATION FOR BUSINESSES

Having your existing office fully virtualized is helping to gain trust of your customers. Your office is the face of your company and most people prefer to deal with well established businesses that have been around for a long time. Your virtual office could be enhanced with banners promoting your services or products. It could also include talking bots. All these elements are going to increase the number of potential customers.

Any projects planning a Token sale can buy their units next to existing successful projects like SONM which has already set up an office in MARK Business District. You could visit the SONM office right now by launching our demo.

5   Executive Team

YANA KONTOROVICH
CEO & Founder

PhD in Economics
Entrepreneur, Investor
10-years experience in e-commerce,
7 years of investing experience, 4 years in
fashion industry

EVGENI MALKIN
Co-Founder and owner of 2 virtual
spaces within the platform

Professional Hockey Player
3-times Stanley Cup Winner
2-times World Champion

OLEG ERSHOV
Managing Partner

Marketing professional, Entrepreneur.
4 years experience in event marketing,
8 years in Internet marketing.
Launched projects: Monster Mania, Moda Mark.

DENIS POLULYAKHOV,
Managing Partner

IT-entrepreneur with 9 years experience.
Founder of CARBYN Blockchain Group,
CCO Moda Mark (fashion e-commerce),

VLADISLAV UTUSHKIN
Marketer, Entrepreneur

10+ years of experience in active sales in TOP-3 bank group. 5 years of experience in internet-marketing. CEO & co-founder "RVR Project"

VLADIMIR SHLIAPIN
CTO

Entrepreneur, IT professional with 25 years of experience
Master's Degree in Mathematics

ALEXANDER SHTANKOVSKY
Head of Developers, IT-developer

MSc in Mathematics. 27 years of experience in IT. Launched Project: Site Makers.

SIRUZ FARAMARZ
Head of VR & 3D Department

12 years of experience in 3D visualization production, 5 years in product design.
Launched Projects: Mall Mark, Mark Space.

6   Crowdsale

6.1   SCHEDULE

Following the example set by the Ethereum foundation there is no cap on the amount of contributions that will be accepted by the foundation. We would like to allow wide participation not limited to insiders. A wide user base will promote the use of the platform and stimulate its future economy.

3 000 000 000 MRK tokens in total will be issued.

1.17 bln MRK tokens will be available during the crowdsale with the initial 1 MRK token price set to the equivalent of 0.10 USD in ETH or BTC.

Hard Cap: 77 300 000 USD

The crowdsale will be stopped as the hard cap reaches 77,3 mln USD, while all unsold tokens will be transferred to the miner's rendering fund (with a maximum of 200 mln tokens).

SOFT-CAP

MARK.SPACE Management has unanimously decided that the platform does not need a soft-cap, contrary to popular beliefs. The reason for this is the fact that MARK.SPACE already has existing agreements with such brands as   JLR, SONM, GAS, Desigual, Trussardi, Baldinini, Patricia Pepe, Liu-Jo, Dstrezzed, Satorisan and many others. Thanks to the token sale, we are able to move much faster and make our project even bigger.

TOKENS ON SALE
Closed pre-sale - 200 mln MRK tokens (min 300 ETH)
Open pre-Token sale - 250 mln MRK tokens
Token sale - 720 mln MRK tokens

CROWDSALE SCHEDULE

The open pre-Token sale will commence on Oct 24, 2017 and will last until 17 Nov, 2017.

The Token sale will commence on Nov 21, 2017 and will last until 21 Dec, 2017.

Maximum transaction size : 30 000 000 MRK (10 000 ETH).

Contributions will be accepted in ETH, BTC and fiat currencies.

There will be an amount dependent bonus as depicted below:

Stage		Discount %	Tokens, mln	USD, mln
Open pre-Token sale, min 0,001 ETH	31.10. - 17.11.17	40	250	15,0
Token sale, min 0,001 ETH	21.11. - 21.12.17	20	250	20,0
Token sale, min 0,001 ETH	21.11. - 21.12.17	15	200	17,0
Token sale, min 0,001 ETH	21.11. - 21.12.17	10	170	15,3
Token sale, min 0,001 ETH	21.11. - 21.12.17	0	100	10,0
TOTAL ON SALE:			**970**	**77,3**

6.2   RECOMMENDED ALLOCATION

6.2.1   TOKEN ALLOCATION

Tokens on SALE - 39%

	Tokens, mln		Tokens Freezing time
CLOSED PRE-SALE FUND	200	6,67%	4 months
TOKEN SALE FUND	970	32,33%	2 weeks
MINERS RENDERING FUND	675	22,50%	6 months
CROSS SALE LIQUIDITY FUND	570	19,00%	3 months
CORE TEAM	300	10,00%	12 months
PARTICIPATORS	90	3,00%	12 months
ADVISERS	90	3,00%	12 months
ANGELS	90	3,00%	12 months
BOUNTY FUND	15	0,50%	1,5 months
TOTAL, mln:	**3000**	**100,00%**	

Products Cross Sale Liquidity Fund

MARK.SPACE will have system participants selling their goods and providing services. The payment for goods and services will be done through various online payment methods, with both fiat and crypto currencies accepted. For the stability of our marketplace, we are setting up a Products Cross Sale Liquidity Fund with 570 mln. MRK. It will function in the following way: if users prefer to pay in fiat currency, it will be automatically converted to MRK according to the current exchange rate and sent to the seller. The seller may keep MRK or automatically convert to the fiat or other crypto of their choice. This means that both parties can transact in fiat if they wish so, which is important

to big multinational brands. MARK.SPACE is open to all type of companies and consumers. Alternatively, users can transact in other popular cryptocurrencies, such as BTC or ETH, without MRK. They can also opt to use MRK only or any combination of BTC, ETH and fiat currencies. Internally MARK. SPACE platform operates with MRK only, with every transaction being recorded on the blockchain. In order to support liquidity Products Cross Sale Liquidity Fund is required.

Rendering fund

Computational resources amassed by cryptocurrencies miners could be used for decentralized rendering. Until the system will enter stable financial operational mode a certain period is required during which computational resources owners (miners) will be paid for their services from the fund. As new units/buildings/spaces are created and sold to the public mining fund is going to be replenished.

Let's elaborate on the CAP breakdown. We are aware of the concern that large funds are reluctant to participate in Token sale if less than 80% of tokens are going to the Token sale. It is, therefore, our conscious and informed decision to sell less. In order to create a large and lively community, we prefer to have as many small participators as possible. They are the ones who will breathe life into our Districts.

6.2.2   TOKEN SALE FUNDS ALLOCATION

Core team	4%
Participators	6%
Research	7%
Development	33%
Marketing	36%
Indirect (office, salary, legal, etc)	10%
Technology Infrastructure	4%

7 Development Roadmap

2015
May - June
Idea formation, MARK.SPACE concept development
July - September
Marketing research, hypotheses confirmation
October - December
Functional requirements definition, team formation

2016
January - May
Development of Alpha-version engine
June - **August**
Launch and test of Alpha-version (Shopping district only)
September - November
Launch and test of Beta-version (Shopping district only)
December
Launch Road Show platform for fashion brands

2017
January - May
Launch E-commerce platform launch with fashion E-commerce proof of concept
June
Launch Alpha-versions for Residential, Business and Community districts
June - July
Development of concept and roadmap for decentralization of MARK.SPACE platform
August - September
Selection of blockchain technologies for MARK.SPACE platform
October
Whitepaper announcement and pre-Token sale launch
November
Token sale launch

2018
April
Start virtual estate / UNIT sale
July
Blockchain implementation
October
Launch Residential district
December
Launch Business district

2019
March
Launch Shopping district
September
Distributed rendering
December
MOSL language available to developer

2020
February
Launch Community district
April
Internal advertising network launch

Platform functionality that will be developed based on the amount of funds raised

	< $5 mln.	$10 mln.	$20 mln.	$55 mln.	$75 mln.	
Districts						
Residential	•	•	•	•	•	Virtualization of personal units in 360 mode, units and objects creation, an ability to publish links to personal units in social networks
Shopping		•	•	•	•	Shopping functionality, representation of goods in 3D, ability to see if clothing fits, ability to create virtual showrooms
Business			•	•	•	Virtualization of business offices in 360, real time negotiations feature.
Community				•	•	Ability to form a community based on common interests
Education					•	
Entertainment					•	
Blockchain implementation						
Unit registration	•	•	•	•	•	Unit is a space of defined size in Mark.Space, its ownership is recorded on blockchain once it's created/sold.
Unit purchase	•	•	•	•	•	Units are bought for MRK
Unit sale		•	•	•	•	
Unit rent		•	•	•	•	
Registration of all transactions in MRK tokens	•	•	•	•	•	
Copyright verification					•	
Connecting of user servers	•	•	•	•	•	
Platform features						
E-shopping platform		•	•	•	•	
Connecting social networks to objects	•	•	•	•	•	
Binding domains to units		•	•	•	•	
Changing unit privacy settings	•	•	•	•	•	
Voice control			•	•	•	
Text messages	•	•	•	•	•	
Voice messages			•	•	•	

	< $5 mln.	$10 mln.	$20 mln.	$55 mln.	$75 mln.	
Payment options						
MRK tokens	●	●	●	●	●	Mark.Space platform tokens used for system transactions, ERC20 token issued on Ethereum blockchain
Cryptocurrency			●	●	●	
Credit card		●	●	●	●	
Integration of external VR services						
Gaming					●	
Educational					●	
Entertainment					●	
Visualization capabilities of internal units						
Adding 3D objects		●	●	●	●	Ability to create custom 3D objects or elements of interior, ability to load objects/images created outside of Mark.Space
Uploading of interiors for units (360 or 3D)				●	●	
Creating 3D objects (MOSL based)				●	●	
Unit infrastructure of visual/audio effects						
Time & date customization			●	●	●	
Uploading custom appearance of units				●	●	
Weather customization					●	
Sound effects	●	●	●	●	●	
Playlists integrated in units			●	●	●	
Technical possibilities						
MOSL programming language			●	●	●	MOSL - MARK.SPACE Object Scripting Language - Platform own scripting language which allows to create any custom objects within Mark.Space system
Distributed rendering				●	●	
Security breach resistance	●	●	●	●	●	
Wiretapping protection (voice messages)			●	●	●	
R&D (VR, AR, MR, Blockchain, MOSL, IPFS etc)					●	

	< $5 mln.	$10 mln.	$20 mln.	$55 mln.	$75 mln.
Smartphone Apps					
Creation of customized panoramas (360)				●	●
Creation of customized objetcs		●	●	●	●
Multiplatform-use					
Browsers (Chrome, Safari)	●	●	●	●	●
- Desktop	●	●	●	●	●
- Tablet	●	●	●	●	●
- Smartphone			●	●	●
- TV				●	●
- VR				●	●
Multilanguage					
- english	●	●	●	●	●
- japanese		●	●	●	●
- chinese		●	●	●	●
- russian		●	●	●	●
- german			●	●	●
- french			●	●	●
- portugese				●	●
- spanish				●	●
Marketing					
Marketing budget		2,50%	5%	10%	20%
Internal advertising network					
- Unit advertisements		●	●	●	●
- External website advertisements (objetcs)			●	●	●
- Distribution of advertising revenue of Communities				●	●
Traffic attraction through third-party advertising services					●
Partnership programs				●	●
Marketplace			●	●	●

	< $5 mln.	$10 mln.	$20 mln.	$55 mln.	$75 mln.
Business					
Identity and Authentication			•	•	•
Document flow			•	•	•
Smart-Contracts			•	•	•
CRM			•	•	•
Labor exchange			•	•	•

MARK.SPACE

JOIN US AND STAY TUNED