MARK.SPACE

NEXT GENERATION INTERNET

An open source platform for the creation of 3D- and VR- compatible online spaces (sites) and objects, powered by Blockchain.

mark.space

V 2.0.7

Abstract

MARK.SPACE is an open-source platform for the 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 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 or notebook is all that is needed to create a state-of-the-art VR store, office, community or other space for business or entertainment.

The MARK.SPACE universe consists of multiple VR spaces (units), in which each unit can be linked directly to its own top-level domain. The property right to the units is guaranteed by recording all transactions involving units (creation, sale, purchase or rental) on the Blockchain. All unit owners may buy, sell or rent their units to others using smart contracts.

MARK.SPACE has an internal currency - the MARK token (MRK), which is a utility token (not a paper bond) allowing all users to sell and buy VR spaces and objects, consume various goods and use services, pay salaries to their employees and to buy ads to promote their businesses through the MARK.SPACE platform. GPU-miners who will be rendering VR spaces and objects for the platform's users will also receive rewards in MRK tokens (Proof of Work (PoW) Concept).

MARK.SPACE IS THE NEXT STAGE
IN THE INTERNET'S DEVELOPMENT

1 Introduction

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

In the 1960s the Italian sci-fi writer Lino Aldani described a world in which onirofilm provided a multi-sensory medium that stimulated the minds of those seeking an escape from reality. Onirofilm was an early precursor of Virtual Reality. Then, some twenty-five years ago, Neal Stephenson's science fiction novel "Snow Crash" was published. In the 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, in which users, appearing as avatars, in addition to socializing, could purchase objects and services using a virtual currency called "therebucks" - purchasable for real money.

With the initial creation of the Internet, nobody imagined that it would achieve its current scale. And when the first online-store was launched, the owners of most businesses believed that e-commerce had no future. Yet online shopping has already become a rapidly growing market, expected to reach $2.7 tn by the end of 2018. Likewise, when cryptocurrencies first burst onto the scene, very few took them seriously. Nowadays, global society is getting used to the idea that Bitcoin and other cryptocurrencies are becoming a significant part of the world economy.

VR follows a similar path, in that it took a long time to bring the technology to its present level. Today, most people grasp that VR is an incredible technology that opens up unlimited possibilities. It has truly become the future, and one in which we already live. Mega-brands, such as Google, Facebook, Sony and many others are collectively spending billions of dollars developing VR technology.

The Internet has already been developing for a fairly long time, but we know that the most important change is yet to come. It is the advent of the 3D Internet. We have arrived at 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, completely replace the entire online economy we know today. The goal of the MARK.SPACE platform is to fully develop and implement this idea.

1.2 THE CORE IDEA

When we started developing MARK.SPACE in 2015, we came across serious challenges that had to be solved to realize our ideas, because VR was a rather complicated technology (and still is), in terms of content production and usability. 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, consuming large amounts of time and money. At the same time, VR audiences grew slowly, due to users wishing to consume VR content having to buy specialized, expensive equipment, such as VR-glasses and headsets, controllers, etc. Another limitation was the need to be in a comfortable and safe location 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 created 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 of leveraging the VR technologies that had just appeared, to create a world where everything would resemble real life as closely as possible.

We have invested 2.5 years and more than $5m of personal funds into VR technology research, the making of prototypes and getting feedback from businesses. All this resulted in the creation of the M1 platform and we are ready to demonstrate the capabilities it has today (check out the demo at http://demo.mark.space/). There is 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 are 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 a logic and driving force based on advanced mathematical algorithms that we have developed, aiming to provide maximum precision in 3D visualization. As of today, our company has digitized entire shopping malls with branded stores, including all the details of interiors and complete product lines. Additionally, we have created a working prototype of a social platform, where each user can design their own virtual space and fill it with furniture, paintings and other details of interior decoration. 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 apartments, exhibition halls, gaming clubs, restaurants, movie theatres, and offices that could be used as the VR headquarters of companies.

1.3 DEVELOPMENT PLANS

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

2 MARK.SPACE Districts

2.1 THE MARK.SPACE ECOSYSTEM

The MARK.SPACE ecosystem is modelled on the real-world economy and has similar features. The real-world economy consists of the production, distribution, and consumption of goods and services. In well-functioning economies, wealth is created and further redistributed. Let's see how a typical economic cycle is implemented in the MARK.SPACE ecosystem.

Content Creation

The MARK.SPACE platform is designed to give users all the necessary tools for VR content creation. The current prototype allows for the 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.SPACE Shopping area will allow both the distribution of goods produced in the real world and any content created within the platform. This will include the ability to sell custom elements of furniture and decor created by users (our platform already facilitates this) as well as carry out operations with entire personal or business spaces acquired by users previously. Freelancers will be able to create their own virtual offices for advertising and selling their services. The ability for all users to advertise in common areas (like sidewalks or roads) between buildings and mall interiors will also be implemented. It will be possible to use Tokens earned by users further in the value creation cycle.

Distribution of Wealth

Just like with regular real estate, virtual locations will have a long-term tendency to increase in value, due to added 3D details and scarcity of the virtual spaces. Once created, well-designed and unique, and filled with quality content, personal spaces will attract many visitors, thus making them valuable economic assets. A VR store in the MARK.SPACE Shopping District will be transparent, showing its income statement, balance sheet and cash flows, and thereby becoming a real asset, which can be evaluated using conventional methods. If there are assets to be sold, businesses like VR real estate agencies could appear, offering their services to the public.

Distributed Rendering

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

Synergy of Real and Virtual Economies

Products made in the real world will be sold in different stores within the MARK.SPACE Shopping District. Various existing businesses will broaden their presence in the MARK.SPACE Business District. Platform users who have their apartments in the MARK.SPACE Residential District will share them via social networks, driving more traffic into all existing MARK.SPACE districts. New and curious visitors will be able to explore the districts and enter shopping malls. Artists, for example, will create their picture gallery (or fully virtualize the existing gallery) in the MARK.SPACE Business District, also attracting a flow of users. The virtual and real economies will merge together using the power of synergy to its fullest.

2.2 MARK.SPACE DIMENSIONS

The MARK.SPACE Platform consists of cities that, according to certain rules, a community, company or person can create on their own. The first city on the platform will be launched according to the Roadmap. The number of cities in the system is unlimited.
A city is a virtual space with a maximum estimated area of 713,440,000 m2, which is divided into districts, blocks and units.

The owner of a city establishes the rules for registration, the sale and rental cost of units, as well as transaction commissions and conditions for advertising; the owner retains the right to the domain name.

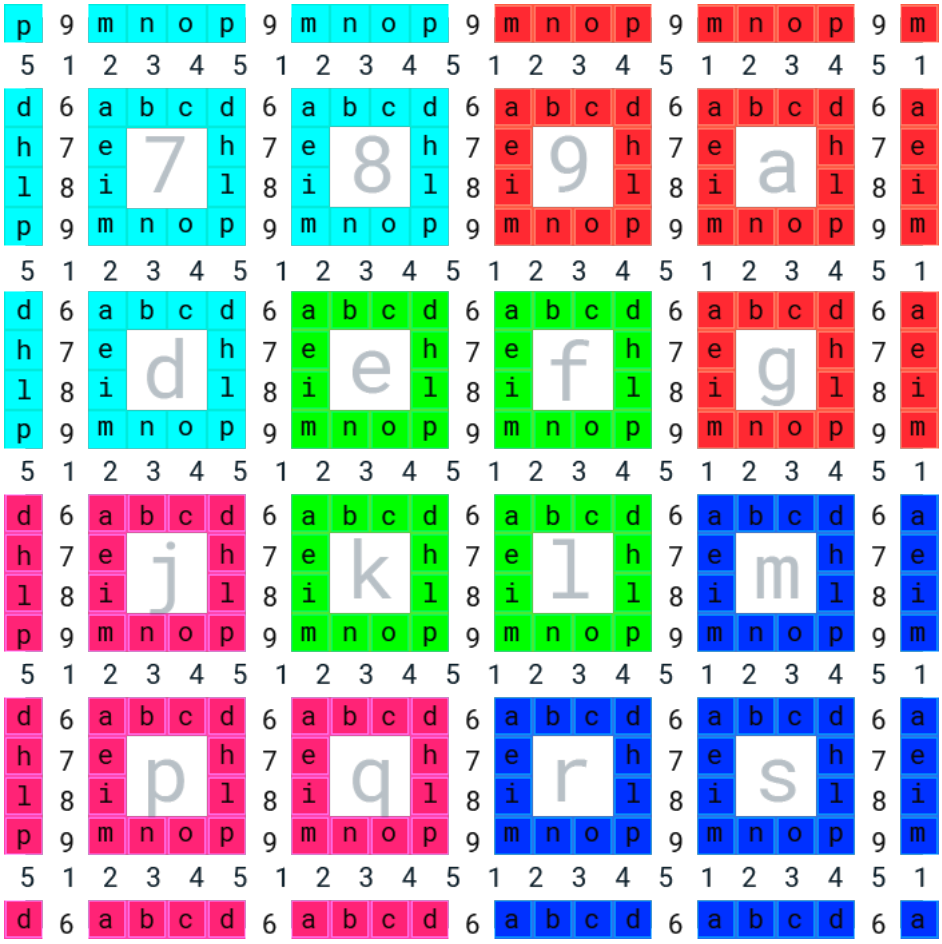
Minimum city values:
In one city - 1 district
In one district - 1 block
In one block - 260 units
In one unit - 1 box

Maximum city values:
In one city - 35 districts
In one district - 35 blocks
In one block -260 units
In one unit - 35 boxes

Total in one city:
35 districts
1,225 blocks
318,500 units
11,147,500 boxes

A District is a space with a maximum estimated area of 20,384,000m2, divided into blocks and units. A district can have an exclusive owner, who: establishes their own rules for the sale and lease of units; determines what types of units may enter the area; creates or digitizes the basic design of the district (blocks can have one basic or different designs); can connect the district to its own domain name.

A Block is a space with a maximum estimated area of 582,400 m2, divided into 260 units, 10 streets, and 25 intersections. The neighbourhoods can connect to each other and operate according to the rules of the District. A block may have an exclusive own owner, who: may establish their own rules for the sale and lease of units, as well as the block's appearance; and can connect a block to its own domain name.



Pic 1. Typical district layout

A Unit is a space with a maximum estimated area of 2,240m2, which can consist of boxes. The minimum required number is one box, the maximum being 35 boxes. A unit has a street exit and entrance, leading to the location of other units (websites). The owner of a unit determines its appearance, places objects inside the virtual space, and fills them with content. There are several types of units that differ in functionality:

- Residential
- Shopping
- Business
- Communities
- Education
- Entertainment

A unit has its own web-address and may also be connected to its own domain name. Thus, the unit is a three-dimensional website that works on most devices and supports 3D, VR, AR, and HTML5 technologies. Managing a unit is made as simple as possible and can be done with an in-house visual designer.

A Box is a space with an estimated area of 64 m2, which acts according to the same rules as the unit it is in, but without street access. One can rent one or more boxes. Each box can have any appearance. All boxes are of the same type of unit to which they are attached. Boxes do not have their own domain name and cannot be sold.

2.3 MARK.SPACE DISTRICTS

Initially, there will be just four districts: Residential, Business, Community and Shopping, but in the future new types of districts will be added, such as Education and Entertainment districts.

2.4 MARK.SPACE COMMUNITY DISTRICT

A MARK.SPACE Community District, as the name already suggests, will be dedicated entirely to various communities formed and united by a 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 sufficient funds to support it. For example, imagine a music lovers' community which occupies a whole building named after the famous track by Leonard Cohen - "Tower of Song". Each unit could be decorated by fans or the artists themselves, displaying various artefacts, including musical instruments, disks, vinyl's and so on. Artists' portraits could 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.

2.5 MARK.SPACE 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 any of the existing social networks.

For the first time, your friends from the other side of the world will have the chance to 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 1965 Mercedes SL.

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.SPACE Residential District

Entire buildings could be bought by anybody with the aim of reselling or renting the units to the public. For example, a movie star decides to purchase a 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.

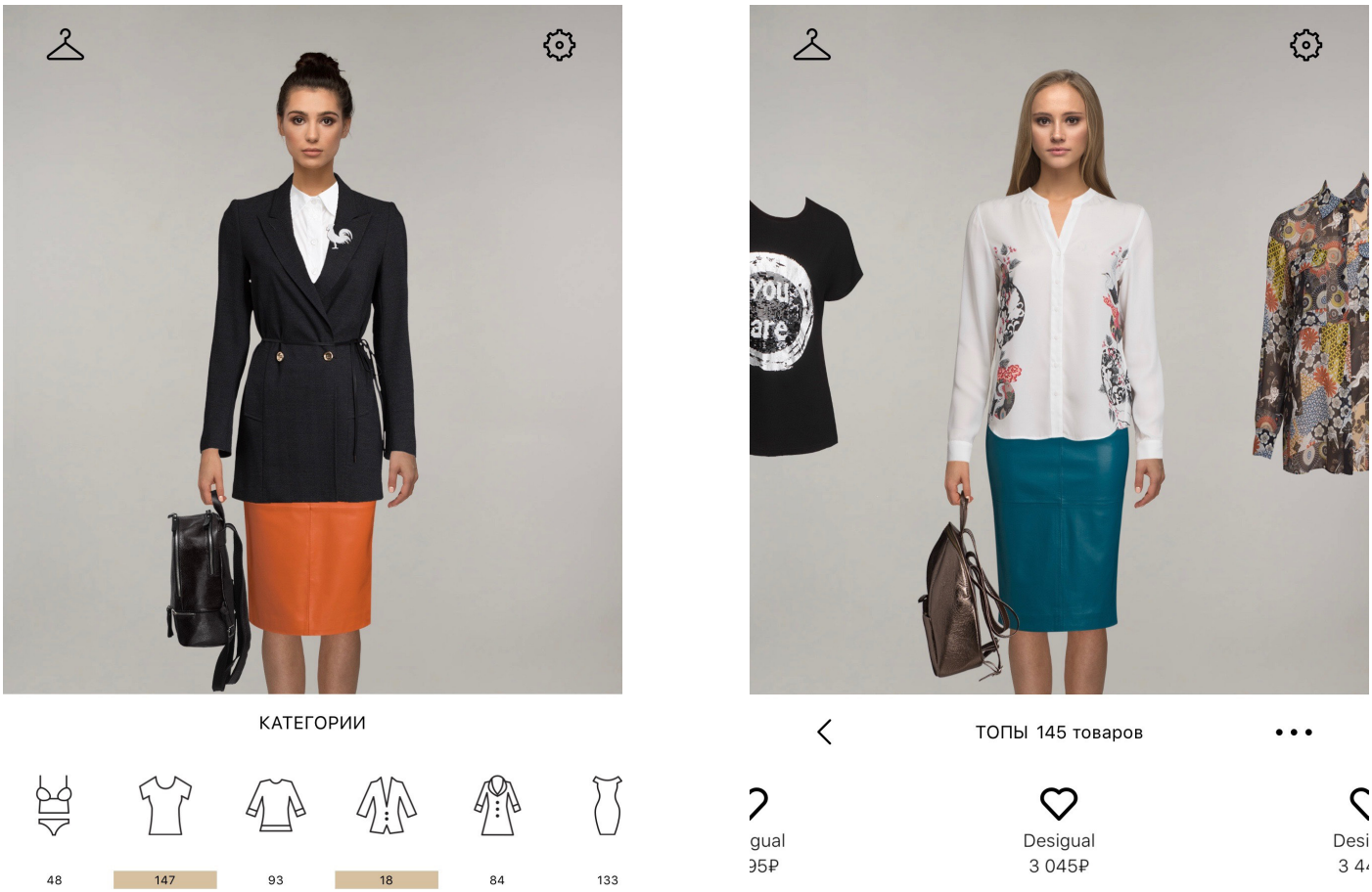
2.6 MARK.SPACE SHOPPING DISTRICT

Four shopping malls have already been virtualized by our team 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 item of clothing 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 they're looking at a photograph. Fashion stores occupy at least 50% of any major mall and we have already perfected this technology.

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

Pic 4. Loro Piana store in MARK.SPACE Shopping District

Pic 5. LORIBLU store in MARK.SPACE Shopping District



Pic 6. Fitting service in MARK.SPACE 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 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 significant visitor traffic.

We are currently negotiating with various partners interested in having a store in our first shopping mall that will be launched in December 2018.

2.7 MARK.SPACE BUSINESS DISTRICT

Today, many companies market their services online. Sometimes these companies do not even have physical offices. VR technology allows any reputable company to

virtualize their office and allow it to be visited by potential customers. Whether 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 the ability to first visit their virtual premises will help you to make the right decisions.

Imagine a company that 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 promotion agencies could purchase an office right next to the Ethereum foundation. Copywriters could purchase an office right next door. With the MARK.SPACE platform it will take just a 360° camera and a few hours of work to make this 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.SPACE business district

Pic 7.1 SONM office in MARK.SPACE business district

2.8 OTHER DISTRICTS

We are not limiting the project capabilities to only the four 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 VR from the monetization perspective.

2.9 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.

2.10 UNIT DESCRIPTION

The MARK.SPACE universe consists of a large number 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 (creation, sale or rental) on the blockchain.

min Unit size (1 box) is 8 x 8 = 64 m2
max Unit size is 64 x 35 = 2240 m2

2.10.1 UNIT PRICES

UNIT TYPE	MAIN PRICE	ADDITIONAL BOX	MAINTANCE COST 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%
Street	10000 MRK	--------	1.2%

After registration each user will receive one Residential unit for free . However, we reserve the right to opt for other monetization options like in-world advertising.

2.11 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.SPACE 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 or try to create your own space using our constructor www.sandbox.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 can automatically detect VR glasses or headsets using Web Bluetooth and WebVR technologies. Alternatively, VR content is displayed on a regular PC monitor and/or smartphone. Using built-in accelerometers, the system can process information from sensors in the headset or glasses, 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

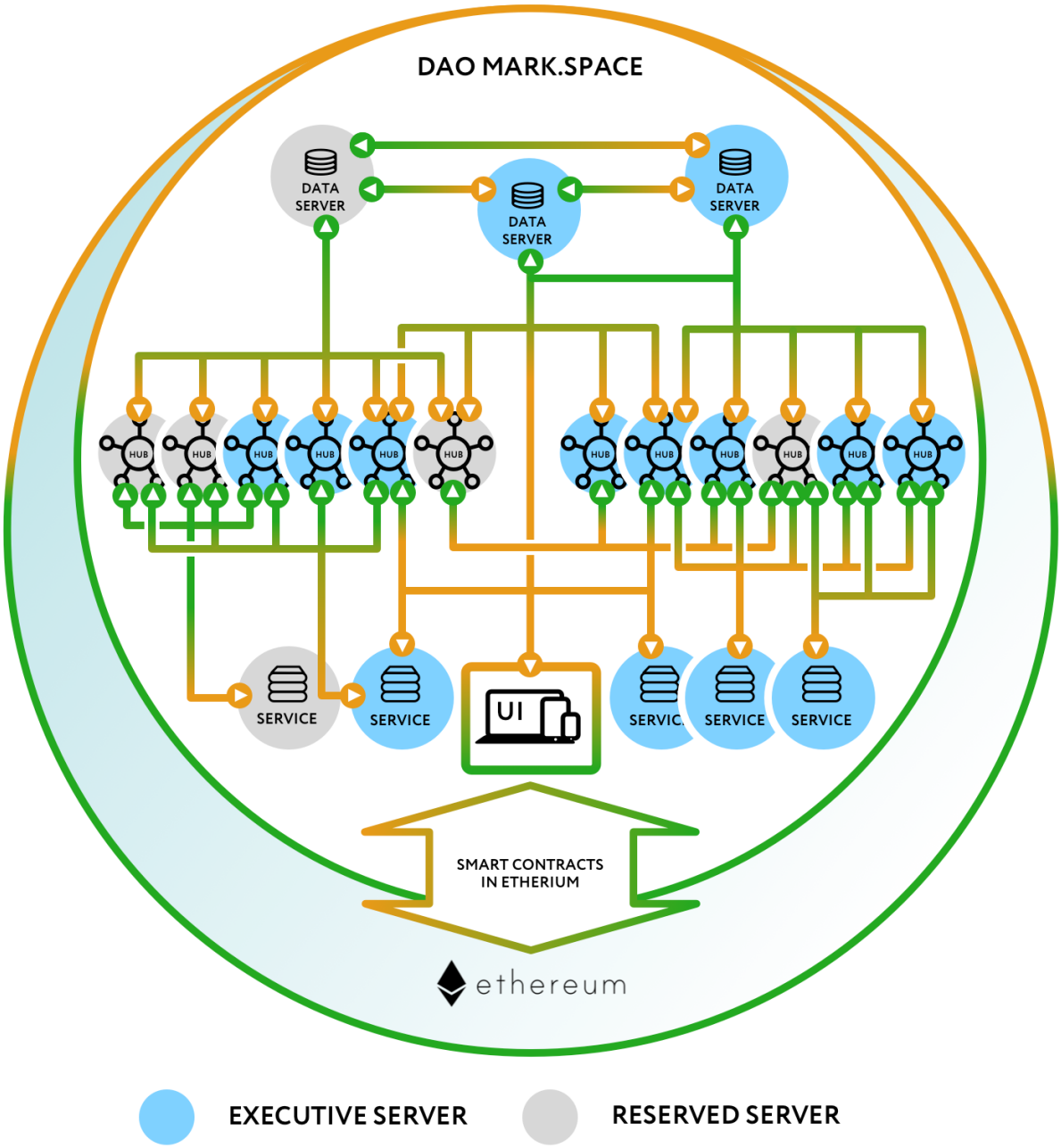
3.4 FUTURE ARCHITECTURE

3.4.1 Overview

Following the Token Sale, the current system will be fully decentralized and will assume 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 and 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 (which is similar to Java).

The use of Ethereum smart contracts is limited only to critical functionality and utilizes the Ethereum blockchain.



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

1. **DATA SERVER** - storage of data blocks; 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 are inactive most of the time, but are activated when one of the active servers fails.

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

- The owners of Servers will be compensated in MRK tokens, based on the amount of work carried out.

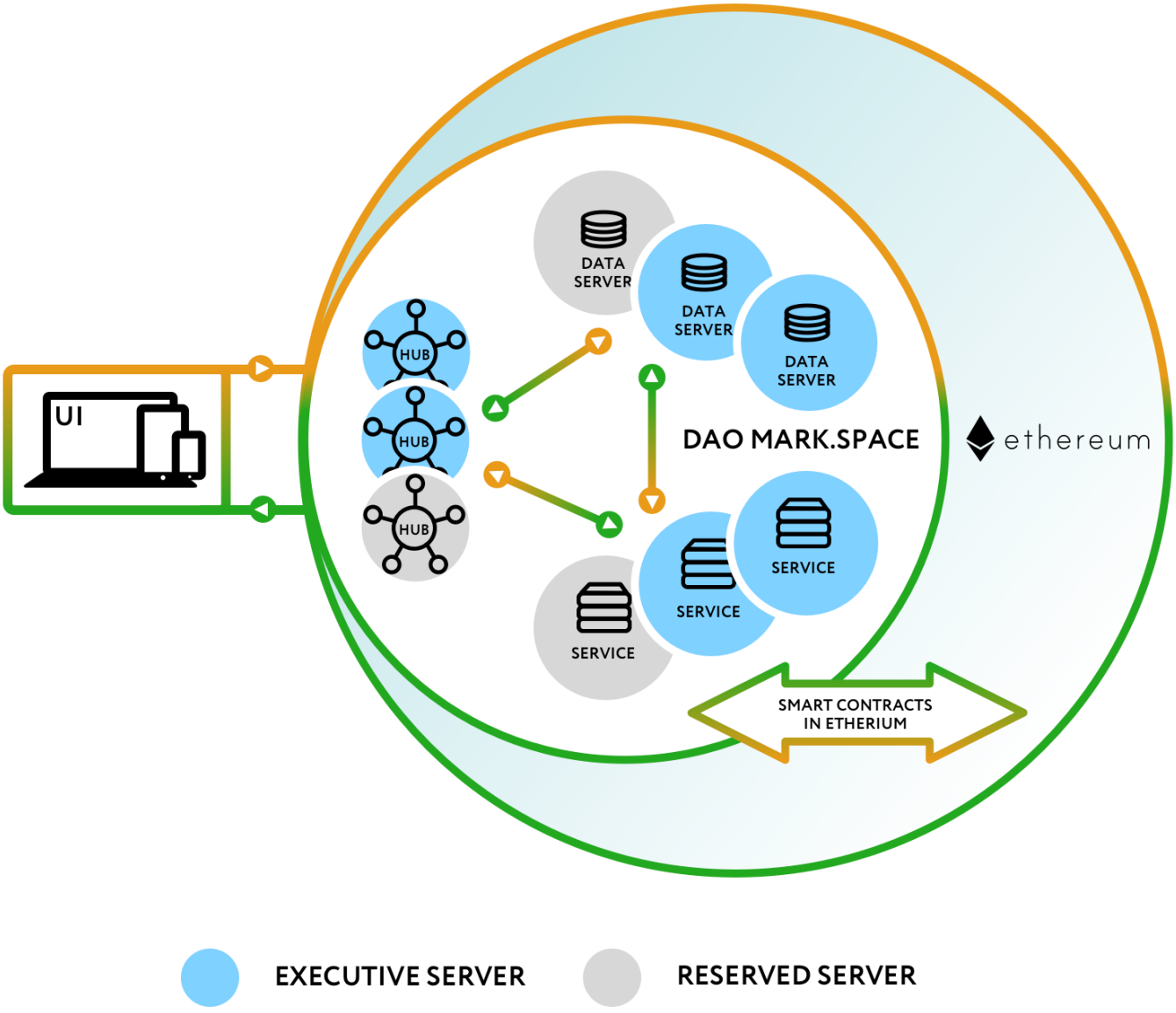
  Each DATA SERVER that is receiving data blocks through HUBs registers and stores them; it also notifies other servers about changes in the blocks registry database. The data is stored on DATA SERVERs in a fully decentralized way and is replicated on at least three other servers. The new data block must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

  Each HUB constantly checks the status of other HUBs to notify them about their recent activity. This is to ensure ultimate consistency of data.

  The Client UI sends 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. The HUB will respond to the client with the address of the DATA SERVER and access keys that allow the retrieval of 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 interruption to functionality 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.



The activity of servers is 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 can only be reactivated again after completion of a full registration procedure, which includes the complete removal of all data from the server.
The storage of 3D scenes and rendering allows miners to earn by providing their computational resources. Rendering is not done in real time, 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. However, the platform is designed in such a way that its dependency on Ethereum is minimal 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. Depending on how Ethereum solves the challenges of scalability (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 local storage 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 shops and even entire blocks could be offered for sale on MARK.SPACE VR Real Estate Exchange. A user could create, for example, a smart contract for a real estate sale, to be processed by Ethereum EVM. Such a contract will be signed by the user, then processed and deployed. Transactions will be 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. A 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 a regular rental transaction in the real world. Such contract creation, deployment and execution are similar to the sale contract described above. The platform will have a more complex contract creation functionality, in which a virtual real estate agency could get involved as one of the parties to the contact.

Advertising Engine

As the number of users grows, we consider in-world advertising as one of the forms of monetization. Due to the complexity of such engines we are considering using third-party solutions developed specifically for VR ads. Right now we are in the process of selecting providers. An official announcement will be made once we have made our decision.

Distributed Rendering

Distributed rendering technology challenges

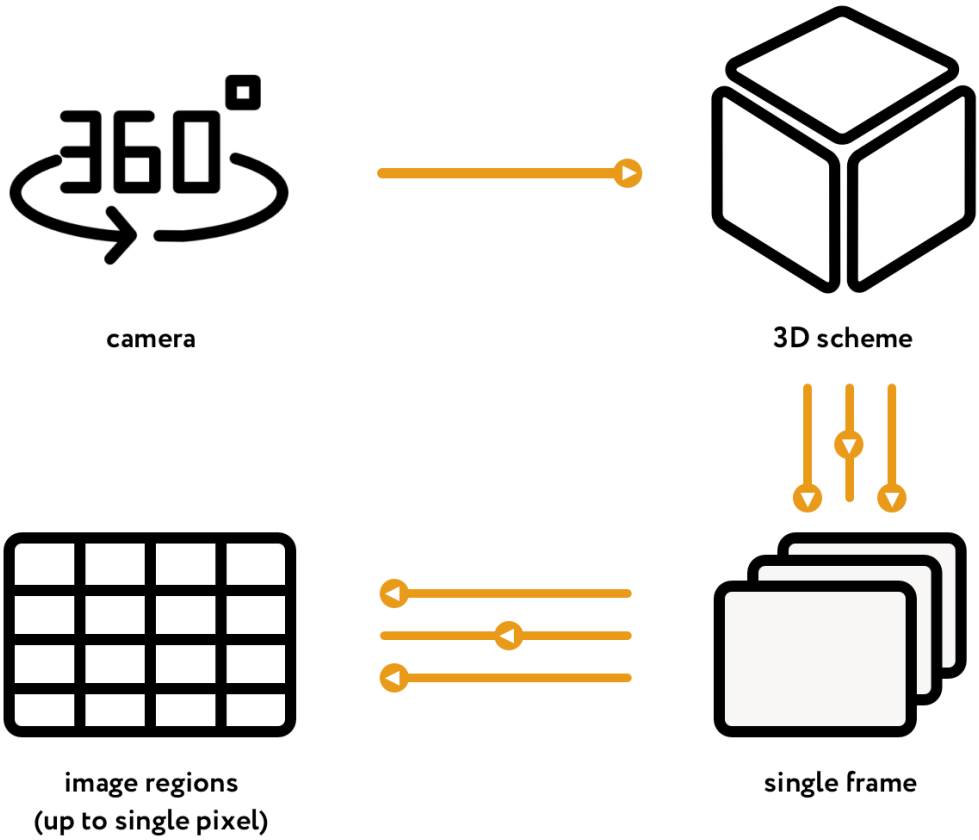
For smooth VR experiences there must be a delay of less than 12ms between head movement and the image appearing before the eyes. While this is challenging even on a device, to make this happen in a distributed environment is even harder. Most images on MARK.SPACE are already rendered and can be quickly opened on users' devices. However, the speed of adding new partners to the platform is of great importance, as these partners may, in turn, need unique designs that also require rendering. 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 volume of data. Both Internet bandwidth and the 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 will tend to become cheaper over time. We have seen many similar challenges being resolved, so we don't consider this an obstacle that should stop us from implementing our own rendering solution while 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

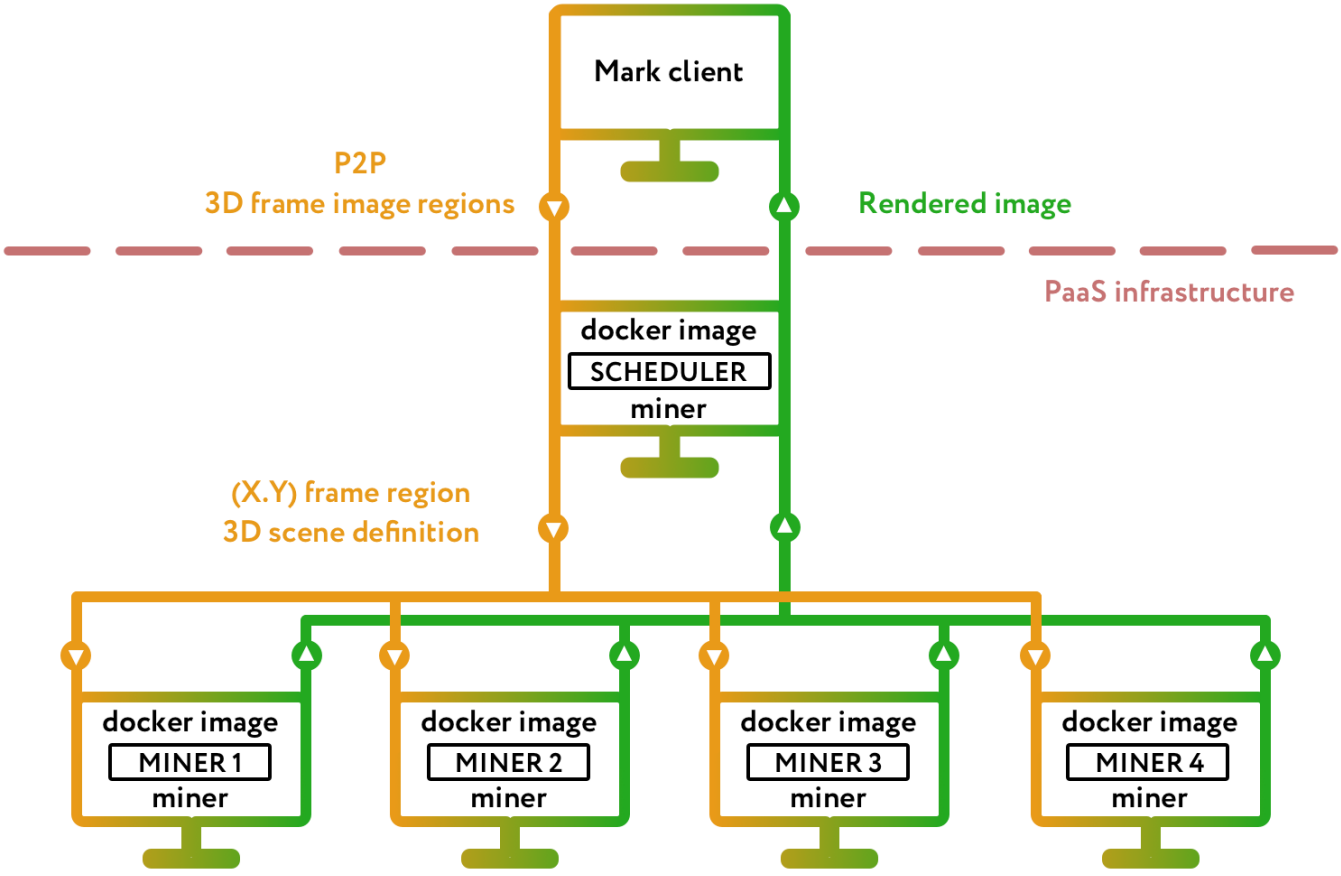
To address the issues of rendering speed in a distributed environment, we will be using the following approach: all available miners' machines/farms will be given certain short computational test tasks to determine both their computational capacity and speed round trips. Only those satisfying the requirements will 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 located within a 5km proximity 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.SPACE technology is superb compression, which makes running everything smoothly even on very weak devices possible. This will be of great assistance to us when developing our own distributed and decentralized rendering solutions.

Among all the uses of distributed computing, rendering is one of the easiest to implement. The 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 has 3,000+ parallel stream processors. Thousands of such GPUs working in parallel could render any 3D scene in less than a second.



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 make a deposit as a security to guarantee honest behavior. There will be redundancy (x3) by repeating the 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. Scheduler and Worker machines will be put in place by checking their performance for both functions. 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.SPACE platform is the ability to create any custom objects, interactive software components or even entire spaces like a store within the MARK. SPACE Shopping District, complete 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 the implementation of:

- 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 the display of objects in 3D spaces, but also the implementation of particular use cases with an object as desired by the object creator. It allows APIs to be called from a personal objects directory, the MARK.SPACE API, or the API of financial transactions using MRK tokens, rendering API, other APIs as well as third parties' APIs.

The 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 their 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 an ERC20 standard token that will be issued on the Ethereum blockchain. The MRK token will be used for all transactions across the MARK.SPACE platform.

You could earn MRK tokens by:

- Selling or renting your units or even blocks and entire districts;
- 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 on the real world; in the same way its economy is modelled on 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.SPACE 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.
The community may choose to open a store within the MARK.SPACE Shopping District and sell various merchandise. For example, an Indie Rock community could sell CDs and MP3

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

4.3 MONETIZATION FOR RESIDENTS

While the main purpose of the MARK.SPACE Residential District is to allow everybody to create their own virtual residence, there are possible monetization options. For example, a person 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 $29bn company.

As real-life freelancers 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've built sizeable audiences, to sell ads on the platform.

4.4 MONETIZATION OF SHOPS

Selling digital content like music, videos, books, images as well as real merchandise in MARK.SPACE Shopping District shops offers exciting opportunities for entrepreneurs around the world to be the first to monetize 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 towards allowing potential customers to see the quality of merchandise and services ahead of visiting the real-life stores. This will boost customer traffic to the existing physical stores. The next state will be the creation of fully functional VR stores.

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

Early Token Sale participants have a unique opportunity to buy many units or even buildings for eventual resale, or to setup their own shops or entire shopping malls.

4.5 MONETIZATION FOR BUSINESSES

Having your existing office fully virtualized helps you to gain the 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 will boost the number of potential customers.

Any projects planning a Token sale can buy their units next to existing successful projects which have already set up an office in the MARK.SPACE Business District.

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
Co-Founder

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

DENIS POLULYAKHOV,
Co-Founder

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 TOKEN SALE

6.1 SCHEDULE

Participants understand and accept that the they can send an amount of ETH or BTC equal to not less than 10.00 (ten) USD according to the cost of ETH to the date of the beginning of the MRK Token Sale into a smart contract system on Ethereum and receive an amount of MRK Tokens in exchange. The maximum contribution amount is 10,000 (ten thousand) ETH.
Please remember that all transaction amounts at all times fluctuate based on the applicable exchange rate of either ETH or BTC.

The HARD-CAP of stage 1 is 35 000 000 USD

The price of one MRK Token is set forth in USD and increases with time, depending on the stage of the Token Crowdsale Campaign.

Stage	Dates	Token price
ROUND 1 2017 Pre-sale	31.10. - 31.12.17	$0.0714
ROUND 2 2018 Token sale	23.01. - 07.02.18	$0.0833
ROUND 3 2018 Token sale	08.02. - 14.02.18	$0.08696
ROUND 4 2018 Token sale	15.02. - 21.02.18	$0,0909
ROUND 5 2018 Token sale	22.02. - 28.02.18	$0,1
ROUND 6 Token sale	2019	Market Price

SOFT-CAP

MARK.SPACE has already invested more than $5 million of personal funds in the development of the platform and currently has a working prototype (https://demo.mark.space). On December 13, 2017, a designer kit was launched and made available to all users. In addition, the platform already has agreements on cooperation with such partners as Jaguar Land Rover, GAS Jeans, Desigual, Trussardi, Baldinini, Patricia Pepe, Liu-Jo, Dstrezzed, Satorisan and others. Therefore, there is no need for a SOFT-CAP installation.

However, thanks to the token sale and the influx of additional funding, the team will be able to develop, scale and promote the platform much faster and more efficiently.

6.2 RECOMMENDED ALLOCATION

Tokens on SALE - 32,84%

	Tokens, mln		Tokens Freezing time
ANGEL FUND TOKEN SALE	100	3.34%	4 months
TOKEN SALE FUND	885	29.50%	-
RENDERING FUND	860	28.66%	6 months
LIQUIDITY FUND	570	19.00%	3 months
CORE TEAM	300	10.00%	12 months
CONSULTANTS	90	3.00%	12 months
ANGELS	180	6.00%	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 members selling products and services. Payment for goods and services will be carried out using online payments of various types, with both conventional and cryptocurrencies accepted. To support the stability of our market, we are creating a Liquidity Fund with a volume of 570 million MRK. It will work as follows: if users prefer to pay for purchases in a regular currency, it automatically converts to MRK according to the current exchange rate and is sent to the seller.
A seller can save their MRKs or automatically convert them to a fiat or cryptocurrency of their choice. This means that both sides can fully work with conventional money without the use of cryptocurrency, if they so wish, which is very important for large multinational companies. MARK.SPACE is open to all types of companies and consumers. Alternatively, users can make transactions in other popular cryptocurrencies, such as

BTC or ETH, without MRK. They can also use only MRK or any combination of currencies BTC, ETH as well as conventional currencies. Inside the platform itself, MARK.SPACE only works with MRK, each transaction being saved on the blockchain, which ensures transparency and traceability of transactions. To support such a wide range of payment options, we need a stable Liquidity Fund, which will support automatic conversion from external means of payment to MRK and vice versa.

Rendering fund

For decentralized rendering, computational resources accumulated by cryptocurrency miners can be used. Until the system enters a stable financial regime, a certain period will be required during which the owners of computing resources (miners) will be paid for services from the fund. Immediately after the creation and sale of new units / buildings / spaces, the Rendering Fund will be replenished.

Let's take a closer look at the distribution of the released tokens. It is widely known that if less than 80% of tokens are sold, large funds will be reluctant to participate. Therefore, it is our well-informed decision to put up less of them for sale. To breathe life into the project, it is necessary to create a large and lively community, and so we prefer to attract as many medium and small contributors as possible. It is these contributors who will bring our Districts to life.

6.2.2 TOKEN SALE FUNDS ALLOCATION

Core team	4%
Angels	6%
R&D	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
November - December
Pre-sale and Constructor launch

2018

January - February
Token sale (Stage 1)
April
Start virtual estate / UNIT sale
July
Blockchain implementation
October
Launch Residential district
November - December
Launch Shopping district

2019

January
Token sale (Stage 2)
March
Launch Business district
September
Distributed rendering
December
MOSL language available to developer

2020

February
Launch Community district
April
Internal advertising network launch

Milestones

	STEP 1			STEP 2	
	$5 mln.	$10 mln.	$20 mln.	$20 mln.	$20 mln.
DISTRICTS					
Residential	▪	▪	▪	▪	▪
Shopping		▪	▪	▪	▪
Business			▪	▪	▪
Community				▪	▪
Education					▪
Entertainment					▪
BLOCKCHAIN IMPLEMENTATION					
Unit registration	▪	▪	▪	▪	▪
Unit purchase	▪	▪	▪	▪	▪
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	▪	▪	▪	▪	▪
VR Voice control			▪	▪	▪
Text messages	▪	▪	▪	▪	▪
Voice messages			▪	▪	▪

	$5 mln.	$10 mln.	$20 mln.	$20 mln.	$20 mln.
PAYMENT OPTIONS					
MRK tokens	▪	▪	▪	▪	▪
Cryptocurrency			▪	▪	▪
Credit card		▪	▪	▪	▪
INTEGRATION OF EXTERNAL VR SERVICES					
Gaming					▪
Educational					▪
Entertainment					▪
VISUALIZATION CAPABILITIES OF INTERNAL UNITS					
Adding 3D objects		▪	▪	▪	▪
Uploading of interiors for units (360 or 3D)				▪	▪
Creating 3D objects (MOSL based)				▪	▪
UNIT INFRASTRUCTURE OF VISUAL /AUDIO EFFECTS					
Day and night time customization			▪	▪	▪
Uploading custom appearance of units				▪	▪
Weather customization					▪
Sound effects	▪	▪	▪	▪	▪
Custom playlists			▪	▪	▪
TECHNICAL POSSIBILITIES					
MOSL programming language				▪	▪
Distributed rendering				▪	▪
Security breach resistance	▪	▪	▪	▪	▪
Wiretapping protection (voice messages)			▪	▪	▪
R&D (VR, AR, MR, Blockchain, MOSL, IPFS etc)					▪
SMARTPHONE APPS					
Creation of customized panoramas (360)				▪	▪
Creation of customized objects		▪	▪	▪	▪

	$5 mln.	$10 mln.	$20 mln.	$20 mln.	$20 mln.
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%	7.50%	10%	20%
INTERNAL ADVERTISING NETWORK					
Unit advertisements		▪	▪	▪	▪
External website advertisements (objects)			▪	▪	▪
Distribution of advertising revenue of Communities				▪	▪
Traffic attraction through third-party advertising services					▪
Partnership programs				▪	▪
Marketplace			▪	▪	▪
BUSINESS					
Identity and Authentication			▪	▪	▪
Document flow			▪	▪	▪
Smart-Contracts			▪	▪	▪
CRM			▪	▪	▪
Labor exchange			▪	▪	▪

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