Virtual Arena

Whitepaper

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Decentralizing One to Many Video Streaming

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Preface

Media consumption over the globe is progressively occurring in advanced digital formats. The expansion in the number of gadgets fit for supporting advanced media alongside expanding internet access speed has given customers an alternative to getting to their preferred media content be it data, entertainment or social activity whenever, wherever.

Online media consumption has seen massive development in the course of recent years. Among the gadgets, cell phones have taken over as the favored mechanism of consuming on the web media. The cell phone market has seen an exceptional development over the most recent five years. Smartphone gadgets over the globe developed at a CAGR of 17% when contrasted with 9.5% development in all mobile phone devices. Smartphones crossed 2 billion imprints in 2014 and are relied upon to achieve 4.6 billion by 2019. This increment in the number of smartphones is making it simpler for buyers to get to music and video content in a hurry.

In 2014, the smartphone information traffic alone remained at 1.73 EB every month (69% of worldwide portable information traffic), which is relied upon to grow 10-overlap from 2014 to 2019, a compound yearly development rate (CAGR) of 60%. Tablet mobile data traffic will grow 20-overlap from 2014 to 2019 (CAGR of 83%) to achieve 3.2 EB every month.

With the technological leap we have seen in the past decade, the video streaming sector has developed into a vigorous market and a professional community. This industrial progression has been ceaselessly empowered by the advent of the web and the huge changes that have happened on the internet, particularly within the most recent decade. To put it plainly, we trust video streaming is at the cross-segment of some amazing trends: social networks being forged and kept up on the web, digital consumption of video, blockchain, smart contracts and worldwide enthusiasm in the video audience.

There is a shift in buyer inclinations towards digital media utilization when contrasted with conventional types of media that incorporate TV, print press, and radio. Individuals are investing more energy every day on digital instead of traditional models of media.

The expanding fame of electronic media has accommodated a change in perspective in the worldwide publicizing spends. Advertisers are following the changing pattern and progressively assigning their financial budgets to advanced digital mediums.

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With the rise of blockchain and smart contract advancements, we here at **Virtual Arena** see a unique opportunity to decentralize live video streaming and help build the multi-billion-dollar video streaming economy. Versatile innovation has been perceived as the impetus behind the dynamic rise of video streaming, yet blockchain innovation is taking the sector to another dimension by genuinely professionalizing the business and empowering a decentralized environment that engages streamers and viewers to accomplish better and gain advantage from their video consumption.

Team Virtual Arena

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1   Introduction

This whitepaper introduces **Virtual Arena**, a blockchain-based platform which decentralizes one too many live video streaming. Conventional definitions of watching TV are changing, and consumers are in charge. About 66% of worldwide respondents in a Neilsen survey state they observe some video-on-request programming (incorporates long-and short-structure content). Expanding web entrance and cell phone multiplication and comfort of devouring the substance whenever anyplace are the key drivers for this pattern.

The more significant part of worldwide respondents (51%) to Nielsen study to some degree or unequivocally concur that advertisements showed previously, after or amid video-on-request programming give them quick thoughts for new items to try, and 59% state they wouldn't fret getting advertised if they can see free content.

Live streaming is gaining significant traction within the digital marketing space due to its potential of reaching out to millions of prospective clients/customers, with just a click. This makes it an ideal way to increase revenue tremendously for your business. This marketing tool has demonstrated an impressive growth rate in the past half a decade. In 2016, the live streaming industry was worth more than $30 Billion with a projected growth of $70 Billion by 2021[1].

There are many largest live streaming sites in the world, brings in nearly 10 million daily active users who are watching for an average of 106 minutes every day. Besides, a number of social media platforms are integrating live streaming onto their platforms, making it even easier to reach customers. Moreover, 81% [2] of Internet users viewed more live-streamed content in 2016 than they did in 2015. Lastly, people of all ages are watching and creating live-streaming videos.

However, currently, the entire streaming industry operates on a centralized model, controlled by few top companies. When live streaming industry was incepted, over a decade ago, the opportunities for monetization were quickly capitalized upon and people started making a living off the video platforms. However, the security of that living has been challenged by the ever-changing advertising rules and compensation models set forth by organizations and governments, who control the streaming industry.

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[1]https://www.prnewswire.com/news-releases/video-streaming-market-worth-usd-7005-billion-by-2021---online-video-streaming-has-increased-viewership-60-research-and-markets-300267717.html
[2] https://livestream.com/blog/62-must-know-stats-live-video-streaming

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Live streaming has evolved beyond YouTube and has platforms such as Twitch and Periscope, but the same challenges of a consistent income and brand autonomy exist. Virtual Arena is a response to these challenges, whereby we hope to create a secure future for live streaming content providers by utilizing blockchain technology. At Virtual Arena, we seek to compete with centralized payment models and limited streaming hardware, by decentralizing the process of encoding and delivering video streams.

Challenges and Opportunities

The live streaming industry currently is plagued by many flaws and inefficiencies that need to be solved. We briefly explain the existing challenges and the opportunities for Virtual Arena in the Live streaming industry.

Challenge 1: Ever-expanding Bandwidth Demand

With the worldwide Internet, traffic is increasing by an expected 22% every year, the demand for data bandwidth is quick surpassing suppliers' earnest attempts to supply it.
The increase in the measure of content accessible over the internet has led to web penetration getting competitive for organizations, requiring a bigger transmission capacity with top-notch content and increment in average online time. The resulting digital traffic jams threaten to throttle the information-technology revolution.

Solution 1: Decentralization of Content Delivery

The problem of scalability is addressed by the decentralized video distribution platform by leveraging the computing power available at the viewers in the network. Virtual Arena's Blockchain would enable countless users of the internet to share their unused bandwidth capacity of their PCs. This would prompt a boundless system of information exchange. As such, every individual utilizing the network of nodes turns into a Point-Of-Presence. The decentralization of such a system alongside the worldwide incorporation of everyday users will essentially improve the efficiency of content distribution and delivery.

Challenge 2: Monopoly of Live Streaming Industry

With a combined market share of about 90% of the online video platform market, YouTube (75%) and Vimeo (15%) leave very little space for the competition. This gives tremendous power to those platforms to dictate the monetization methods, how much the content creator gets and how much the advertiser pays.The concentration of power is even more visible with traditional broadcast networks or with more recent platforms

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like Netflix, which is accessible to a very limited group of content creators (big studios) and advertisers.

Platforms like traditional broadcast TV, Hulu, or Netflix, are practically inaccessible to most content creators. And the fact that Netflix is now transforming into a modern-day studio further limit outsider's options as it now pushes mainly its own productions.

Solution 2: Decentralization of Market

Blockchain allows users to come together to transform the world. Decentralized CDN solves this most important issue leveraging blockchain technology to achieve transparent and fair monetization policies. Virtual Arena would empower users with more freedom and opportunity, leading to the end of monopolistic manipulation of markets.

In Virtual Arena, content creators can publish their content for free and it is accessible to everyone in the world.

Challenge 3: Advertising Revenue Distribution
The market as it is today is especially hard for the smaller creators who are forced to accept prices and conditions imposed on them. This is how YouTube can change monetization conditions overnights or keep about 60% of the advertising revenue generated by a video for example.

Solution 3: Micropayments to Monetize Content Creation

The revenue distribution at Virtual Arena is transparent and fair as the stakeholders Proof of Work is stored in the blockchain. Our Blockchain allows for cryptocurrency-based micropayments for our user's content. The blockchain makes micropayments—even a fraction of a penny—possible. As Deloitte explains, it becomes "an enabler for penny price content purchases, such as paying for reading a single news article or streaming a single song."

Challenge 4: Cost
Streaming is a costly industry yet it can possibly end up less expensive. Virtual Arena should be significantly speedier as the compatibility of these platforms is yet to concoct new innovation to offer better speed and streaming. Last-mile deliveries are relating to the uneven stream of content, bringing about terrible client encounters, such as buffering and rough spilling

Solution 4: Crypto based Rewards and Incentives System

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Virtual Arena provides a solution to the problems mentioned in the previous section. When users view the videos, they get rewarded with Virtual Arena tokens and the content creator is also compensated out of a pool of tokens that have been generated. Thus, our goal is to move towards a fully decentralized service with a vision to have a system where no centralized middleman is needed. This would eliminate the 30- 60% cut which platforms currently take.

Thus, Virtual Arena provides the following advantages:

1. **Complete Decentralization**: Virtual Arena's network is designed to eliminate reliance on any middlemen or intermediary service provider.
2. **Reliability**: Virtual Arena's decentralized architecture ensures network reliability by leveraging the computing power available at the viewers in the network. The network has a reliable storage layer at its core ensuring that content stored on the network persists till a predefined expiry
3. **Low Latency**: The network intelligently reorganizes data and performs predictive fetching on relays to ensure that content can be retrieved with very low latency
4. **Low Latency & High throughput**: Reputation and incentive structure are defined in Virtual Arena to meet the throughput requirements of bandwidth-intensive applications like live HQ video streams.
5. **Horizontal Scaling**: In Virtual Arena, every new node joining the network increases the transaction processing as well as storage capability of the network in contrast to centralized networks where every node stores and processes every transaction.
6. **Configurable Security**: Virtual Arena is privacy-oriented and allows users to preserve their anonymity while using the network at a reasonable performance cost.
7. **Low Storage Overhead**: Virtual Arena's architectural design allows it to store the least amount of metadata required to access and ensure the persistence of any file without compromising on performance.

Our Vision

Virtual Arena plans to support makers and viewers by dispersing tokens, made by VA Protocol, and circulated through the blockchain-based Virtual Arena network. Unlike the centralized frameworks, Virtual Arena will allow a reliable trade of

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content and reward over a blockchain-based worldwide system. Thusly, Virtual Arena gives an ability to gain a sensible living, to Video Streamers and viewers by getting compensated for the engagement of their video content, without a quick expense to viewers, and without the need to offer and surrender to promoting corporate sponsorships, or partnership deals. This will be made possible by the creation of a blockchain-based video content sharing system.

As we base on decentralizing the conveyance of a wide range of content, we give a performant and flexible system for live video stream conveyance, where hubs are incentivized to share computational power and transmission capacity. It looks good for ace hubs of our framework with GPUs to share their additional computational power alongside their capacity. After some time, Virtual Arena would unite with a couple of video streaming organizations. These organizations could display new sorts of use of movies, educational courses, TV shows and different broadcasts for viewers. Using Virtual Arena brings the central focuses back to streamers - Virtual Arena framework would allow the streaming of recordings through our platform in return for tokens. Then again, viewers who watch those streams will be paid Virtual Arena tokens for giving their reviews and participating in the gamification of such streams. Streamers use our framework to interact and improve engagement with their audience. The viewers can also buy memberships by spending their tokens to access their favorite streams.
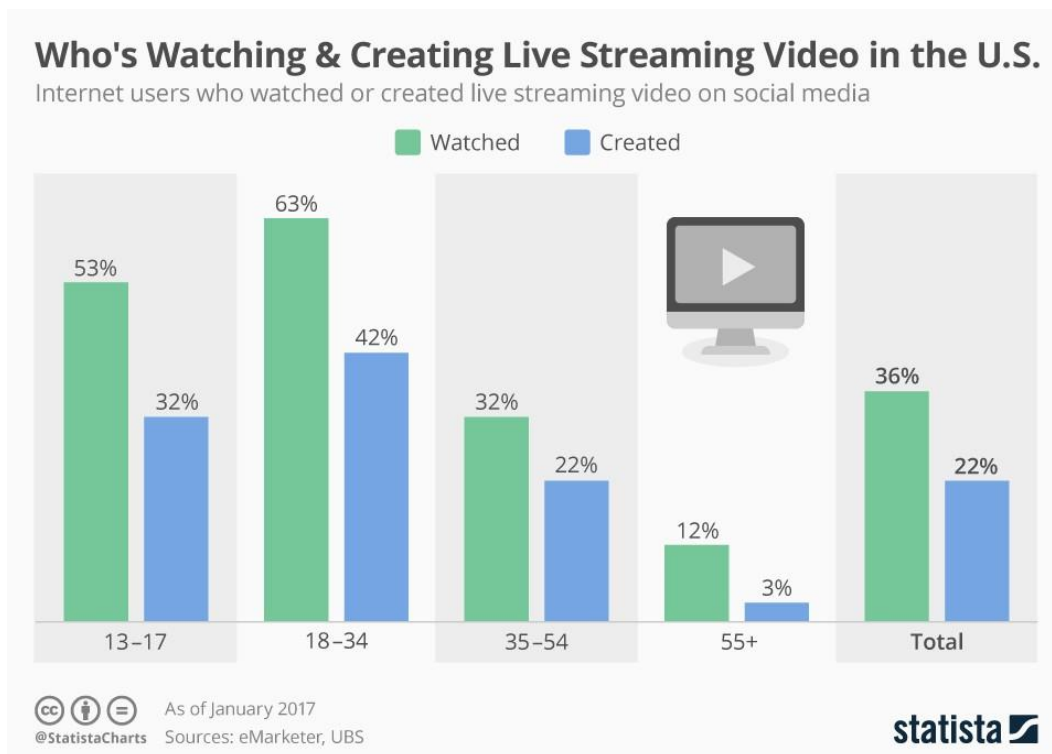
In addition to using blockchain and VA based tokens, we intend to research decentralized information data conventions like IPFS, Swarm and a few others, keeping in mind the true objective to make content delivery and conveyance secure and snappy.

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2   The State of Video Streaming Markets

The world of marketing is continually advancing, leaving advertisers always on their toes with regards to better approaches for reaching the audience and spreading brand awareness. In a previous couple of years, we've seen an enormous increment in the utilization of standard video. Individuals are observing more video-based substance than ever before. In addition, live video use is gradually outperforming standard video-watching patterns. The worldwide video streaming market was valued at $30.9 billion in 2015 and is evaluated to develop at a CAGR of more than 16% from 2017 to 2024, with expected valuation of $123.2 billion by 2024. 63% of individuals, within ages 18-34 are observing live-streaming content frequently. Indeed, even more seasoned target markets like mature individuals (35-54) are utilizing and making their own live-stream recordings. The absolute most well-known platforms include Facebook, Twitter, and YouTube, among others. Live Streaming is the go-to path for organizations to begin exploiting the unfathomable, dynamic client bunches that are always observing live substance, keeping in mind the end goal to help their income.

Who's Watching & Creating Live Streaming Video in the U.S.
Internet users who watched or created live streaming video on social media

Watched   Created

	13–17	18–34	35–54	55+	Total
Watched	53%	63%	32%	12%	36%
Created	32%	42%	22%	3%	22%

As of January 2017
@StatistaCharts   Sources: eMarketer, UBS

statista

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Live Streaming: Creating Active, Immediate Audience Engagement

Live streaming makes a dynamic and active engagement. In a previous couple of years, we've seen a sensational increment in the utilization of standard video. Individuals are watching more video-based content than any time in recent memory. From cell phones to tablets, video content is assuming control. Also, in addition, live video use is gradually outperforming standard video-watching patterns

There are incalculable advantages of live streaming that both organizations and communities can and will appreciate. Live streaming gives an approach to produce social engagement with your audience, giving them the quick chance to impart their remarks and worries to you progressively and, when conceivable, for you to promptly handle these inquiries and concerns.

Truth be told, an ongoing report found live streamers to lean toward live streams for an entire host of reasons, discovering them energizing and quick, and in addition feeling progressively associated with the broadcast(s) than increasingly customary substance mediums; moreover, advertisements seen amid live substance drove more noteworthy engagement (75% expansion), higher brand positivity, and buy probability, supporting the brand awareness.

Live streaming additionally welcomes a wide assortment of content/programming openings, including:

1. Q&As and discussions with your audience
2. Special Announcements and Product Launches
3. Meetings and influencer outreach
4. Partner facilitated streams
5. Live Events

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Conversations and discussions can be driven by these remarks and questions, opening the entryway for brands or influencers to contact watchers specifically and have an open, true discourse with them.

Crypto Market Overview

The total cryptocurrencies came to $211 bn in October 2018. By the end of 2018, 1% of web users will possess crypto wallets. The adoption rate of cryptocurrencies might be as high as that of phone and broadband web because of the inherent advantages that the blockchain provides, like simplicity of international transactional exchanges, low exchange expenses, and security. By 2025, the aggregate capitalization of cryptocurrencies is projected to surpass $5 trillion as crypto wallet penetration surpasses 5% of total world populace.

The aggregate market cap of all cryptocurrencies rose 830% in a year from August 2016 to August 2017, achieving $165 billion. It is as of October 2018 at $211 billion. [3]Adoption rates of new advancements altogether quickened at the start of the 21st century. The penetration of Smartphones and Social Media in the USA expanded from 5% to 90% in under 5 years.[4] The adoption rates of cryptocurrencies depend entirely on their utility and usability.

The net capitalization of asset crypto tokens could represent 80% of aggregate market share by 2025, as they have the advantages over conventional cryptocurrencies, like low instability and greater avenues for portfolio enhancement.

Exchange expenses of transacting on the blockchain could dip under 0.001% of the net asset value in under 10 years because of innovative breakthroughs in blockchain architecture and rising computational power. We expect that lower exchange expenses could essentially drive up the trading volume of asset cryptocurrencies.

Tokenization of illiquid assets appreciates the market rates by 10-40% as illiquidity costs disappear. The trading volume of asset cryptocurrencies connected to real-world asset costs could surpass the capitalization of these assets by an excess of 10x. As indicated by our research, trading volume of these asset cryptocurrencies could surpass $40 trillion by 2025.

As of now, when the confidence of crypto investors in conventional cryptocurrencies drops, they reallocate assets from their portfolios into FIAT and real assets. Asset crypto is an alluring option for crypto holders for real assets, as it gives a similar

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[3] Coinmarketcap.com
[4] Market Realist, Blackrock

exposure to real assets, while sparing expenses of conversion from crypto to fiat. Asset crypto value and utility are driven by the cost of the underlying asset and in this way does not depend much on mood of the crypto market. In this way, asset crypto can be viewed as countercyclical to conventional cryptocurrencies, making it fundamental for crypto portfolio diversification.

Recent restrictions in the form of regulatory controls forced by a few governments on cryptocurrencies for fundraising purposes make conventional cryptocurrencies even less reliable. Interestingly, asset crypto is a more secure option in contrast to conventional cryptocurrencies, since for this situation it is simpler to refute charges of illicit fundraising and Ponzi schemes.

To see a rise in the number of crypto users relies upon the number of sellers and shippers that acknowledge crypto as a tool for transacting. Worldwide, towards the start of 2015 around 100,000[5] traders acknowledged crypto as currency. Now, in the middle of 2018 the number is in excess of 300,000 stores.[6] As crypto adoption and acknowledgment rises, it is becoming considerably more alluring to users because of the network effect.

The quantity of cryptocurrency wallets has increased twofold each year since 2013. On the off chance that it keeps on multiplying, the adoption rate could hit 75% by 2025. Be that as it may, considering the current hurdles, forced by a few governments, we ought to expect a yearly growth rate of 45%. All things considered; the adoption rate is expected to be over 5% by 2025.

Currently, 19% of 16.5 million blockchain wallets have crypto worth more than $100 in the wallet, while 7% have more than $1000. The normal wallet measure is $9,983. We expect that by 2025 the average wallet size will surpass $12,000. Consequently, we expect that aggregate crypto market capitalization will surpass $5 trillion by 2025.[7]

3   Building Virtual Arena

Background

Virtual Arena provides a solution to the problems mentioned in the previous section. When users view the videos, they get rewarded with Virtual Arena tokens and the

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[5] https://news.bitcoin.com/rollout-of-260000-bitcoin-accepting-stores-in-japan-begins/

[6] https://www.ibtimes.co.uk/bitcoin-now-accepted-by-100000-merchants-worldwide-1486613

[7] Blockchain.info

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the content creator is also recompensed out of a pool of tokens generated. Thus, our goal is to move towards a fully decentralized service with a vision to have a system where no centralized intermediary is needed. This would eliminate the 30-60% fee which platforms currently take.

Our focused markets include:

- Video Streaming
- Live broadcasting of game and video content
- Advertising
- Predictions
- Donation

Platform

The Virtual Arena platform will claim a significantly greater level of interactivity, contrasted to other centralized systems, due to the use of blockchain. Our solution changes the traditional operational models of the broadcaster/streamer in the streaming market, giving an opportunity to earn, not only for a streamer but also for a viewer. The interaction of streamers and users is direct and transparent due to the use of blockchain technology.

All users of the platform incur costs (for example, streamers can purchase promotion in the ratings on the main page, users pay for a premium subscription, etc.), but at the same time, everyone can earn tokens including the viewers. Virtual Arena also connects influencers and brands for sponsorship and collaborations. Users across these platforms can get access to buy merchandise or tees signed by their favorite players and streamers.

We aim to design and develop a cutting-edge system of interaction between viewers and streamers with a blockchain-based distribution system powered by consensus and peer-to-peer networks.

Platform Revenue:

- **Ads:** Considering today's advertisement market Virtual Arena is creating a world-class platform for advertisements to be posted on it in different means. The advertisers can approach the streamers through the platform and request to publish the ads and based on the available slot's streamers can post ads that are monitored by the auditors. Based on the analytics and the quality of the content streamed the revenue generated from the ads is shared across the stakeholders on the platform with the application of blockchain technology.

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- **Predictions:** Providing the privilege of becoming a predictor on the platform to earn extra tokens along with entertainment. The users among themselves can predict the outcome of the game with other users online.

- **Merchandise:** This can be an alternate source of income to streamers increasing their popularity by selling the gadgets and merchandise that promotes the brand of the streamer, or the creates a brand for the streamer him/herself.

- **Marketplace**: Any stakeholder can utilize this opportunity in the ecosystem, or the sponsor companies itself can create a virtual arena to showcase their merchandise and accessories. Immediate availability of the accessories posts the advertisement can be a promotional and marketing strategy for a better ROI.

- **Subscription Fee:** Subscriptions are the significant sources of revenue for the platform. Though the platform charges meager fees compared to the competitor's basis, the number of users on the platform can generate a decent income to Virtual Arena.

- **Badges:** Exciting opportunity to promote your favorite streamers to the next level and make them earn more than they expected. It also helps the users receive tokens for the better choice. This enables users to receive tokes if the streamers stats are considering changing the revenue of the platform.

- **API:** In Spite of having many revenue streams this can also be an outstanding feature that turns out to be one of the models to the platform. Virtual Arena is so built that whole ecosystem can be used as a new concept altogether with a plug and play facility.

- **Tournaments:** Virtual Arena creates and organizes competitions for the streamers and establishes a path to all the stakeholders to earn more tokens. These tournaments increase the visibility of the platform and can be used for multiple promotions.

- **Stickers and Virtual Gifts:** These are emoticons for the virtual gifts that fans can send performers. The cost of the awards is debited from prepaid accounts that viewers set up, and 30%-40% of the money goes to the performers. The applause emoticon costs a bit more than 1 cent; a bottle of virtual Chanel No. 5 costs about $3.

- **VIP Status** This is a list of the VIP fans for Content Creators/performers who are online. Fans can buy different tiers of VIP status for 'n' number of TOKENS per month. VIPs' messages and gifts are displayed in an eye-catching space, so Content Creators/performers are more likely to respond to their messages. VIPs also get priority entry to popular shows that limit the number of viewers.

- **Virtual Gifts:** Virtual gifts are similar to donations in that each gift usually represents a fixed amount of real-world money (i.e. one 'private jet' gift will always cost $10). The difference between this and a donation is the gamification layers of using a virtual currency (which costs money) to purchase virtual gifts, i.e.: $10 USD = 500-star coins = 1 private jet.
- **Education**

- **Podcasts**

- **Chat Bots**

- **B2B** (ex. Bollywood streaming)

- **GIF Videos** (recording talents and social sharing), karaoke

- **Screen sharing** like team-viewer

Operating Costs

A small transaction fee covers the cost of running the platform, and the operational and other expenses for Virtual Arena, to drive mass user adoption and for research and development to enhance the platform and economy.

Advertisements

VA will let the user choose the amount of advertising they want to see and what category of advertisement they want to see. The more ad they want to see, the more they get paid in tokens. With this model, users will become more engaged by the advertisement, making the ad even more accurate than the traditional digital advertising model built on top of big data. Users will be more interested in viewing ads that suit their tastes and receive monetary value for it.

- **Pre-Roll, Mid Roll, Post Roll Advertising** - The model of showing advertisements at various stages of a broadcast. A streamer can put multiple commercials in a single stream.
- Banners are situated in different places on the platform, enabling efforts to keep running with exemplary CPA/CPM models and also a possibility for marking the fundamental page.
- The stage includes the referral arrangement of working with distributors, enabling a streamer to run far-reaching advertising efforts proposed by the distributors with a straightforward execution, following framework on all stages.

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The platform shares this income as indicated by the income offering model to the streamer. Choices concerning displaying promotions and its parameters (recurrence, situating amid the communicate, term) are at the tact of the streamer. The streamer may determine video promotions with the capacity for watchers to skirt the content, to restrict the most extreme time of the business, to position recordings toward the start of the communication or amid breaks.

In the meantime, watchers comprehend that by viewing the commercial, they bolster their most loved streamer and the platform, which encourages their diversion. The system for incomplete sharing of publicizing income between platform clients enables every person to get a part of the revenue from promoting and watching the most relevant and valuable advertisements in light of their inclinations. This forestalls the requirement for promotion blocking programming, as clients do not commit to viewing commercials.

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Need for a native token

The choice for a native token was a heavily considered decision. While a well-designed economic logic can create avenues for new revenue streams and wealth, a poorly designed logic can negatively impact the platform. Our analysis has led us to the conclusion that a native token for the Virtual Arena Platform was the best way forward to achieve our objectives.

Virtual Arena uses the blockchain to build a worldwide Peer-to-Peer network for live-streaming, that has smooth transactions, international 24/7 availability and an economic model optimized for live streaming based transactions. Below is a breakdown of the factors considered in reaching this conclusion.

Global Payments available 24/7
Virtual Arena and customers exist globally. A native token is required to make sure that everyone has fair access to the platform. Fiat transaction channels present institutional barriers and overhead. Virtual Arena also becomes vulnerable to external manipulation if we depend on any other currency—be it crypto or fiat.

Scalable Infrastructure
For Virtual Arena to achieve its vision, it needs a scalable infrastructure that can support the expected transaction volume. Current leaders—Bitcoin and Ethereum can't support the volume required. Therefore, it makes sense to implement the native token model with its public chain, optimized for performance.

Lower fees and costs
Virtual Arena will be driven by microtransactions, whose volume increases, corresponding with rising demand for live streaming services. A tailor-made token solution specific for Virtual Arena is the best way to go forward. Other currencies would have fixed transaction costs or models not suitable for Virtual Arena goals.

These reasons present the clear need for a native Virtual Arena token.

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4   Tech Specs

Blockchain Overview

Virtual Arena platform is built on Virtual Arena Protocol. The trading logic is formed on the concept of Bit Torrent Protocol, and it inherits all the infrastructural advantages of Decentralization.

We plan on implementing blockchain to enforce rules for entities to interact in tokenizing video streaming via blockchain. Virtual Arena will be a blockchain-powered platform to digitize assets using digital identity, and it applies the smart contract to self-manage digital assets, thereby providing a distributed network of all stakeholders to benefit from this smart economy.

Virtual Arena wants to integrate digital assets, digital identity, and smart contracts into its platform. We also want to introduce new features, such as cross-chain protocol, quantum-resistant cryptography, a distributed storage protocol, and a secure communication protocol, by leveraging blockchain.

Our platform's open API enables integration with other platforms and systems in a seamless manner.

Digital Asset

The blockchain platform will allow the user to register, create and share video content like a digital asset. Thus, videos being streamed on the platform will become programmable assets that exist in the form of electronic data. Virtual Arena user will create his/her profile and use it to engage in viewing, sharing, and creation of the digital assets. It helps in the decentralized streaming of videos in a highly secure & reliable environment, which is free from any third-party intervention. The video can leverage the Contract Asset functionality of blockchain to be recorded in the private storage area of the smart contract and require a compatible client to recognize them. It has to match to specific predefined protocols and standards, set by Virtual Arena community, to achieve compatibility with most clients using it to transact.

Digital Identity

Maintaining digital identity is critical to the operation of Virtual Arena. The Digital identity feature refers to the identity information of individuals, organizations, and other entities that exist in electronic form, making it efficient, error-free, secure and cost-effective, thus avoiding lousy customer experience. Virtual Arena uses a secured mechanism to store, transact and authenticate the digital identity which is efficient and quick, by employing the Public Key Infrastructure (PKI) X.509 digital identity standards.

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Consensus Mechanism

Proof of Viewership

Rewarding viewers have proven an effective way to retain users in the live streaming industry. It makes users feel engaged and empowered and on the other hand, provides more reliable data to streamers. We allow publishers and advertisers to allocate a budget to be distributed amongst viewers. As one of the ways to prevent master nodes or relay nodes from faking viewership, we require viewers to solve small cryptographic puzzles.

Though the puzzles are not as resource-heavy as, say, Bitcoin mining, it's enough to deter master nodes from spending resources on solving Proof of Viewership (PoV) puzzles as compared to relaying data.

Proof of Availability

We want our nodes to respond to client requests and deliver the requested content with high probability. To ensure that, we have devised a challenge verifier protocol that penalizes unavailable nodes and awards a trustless challenger.

The protocol proceeds as follows:
A node (accuser/challenger) registers a claim with the smart contract that a particular node (accused) is unavailable.

The claim transaction contains the following fields:
• Encrypted IP of the accused, using a randomly generated key pair.
• Signature of the accuser to authorize the smart contract. The accuser needs to put some tokens as a stake in the contract, which can be slashed if the claim turns out to be false.

The IP of the accused is encrypted to ensure that it doesn't learn of the accusation. The decryption key is not shared publicly until later.

Using the hash of the block in which the Claim transaction is mined, a few transcoder nodes (auditors) are chosen to test the accused node.

The accuser gossips the Claim transaction hash and the decryption key corresponding to the encryption of the accused's IP in that transaction, encrypting the message using the public key of the auditor nodes.

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The auditor nodes query the accused node for files using onion routing and then submit their judgment to the smart contract.

To prevent nodes from withholding their judgment and trying to predict the majority opinion, nodes follow a commit-then-reveal protocol; first sending their encrypted judgment and then revealing the value.

The accused node is identified through a Reveal transaction that contains the IP address of the accused node and can be made by the accuser himself or any node (tester) knowledgeable of the public key used during the encryption in the Claim transaction.

If the majority of the auditors agree with the accusation, the accused node's stake is slashed, and the accuser is awarded else the accuser's stake is slashed.

Analysis
We require accusers to put tokens at stake prevents DoS attacks on the network. Else, malicious nodes would make frivolous complaints to keep the network busy with unnecessary checks. The transcoder nodes are incentivized to act as auditors by giving them a part of the stake that is forfeited by the node failing the challenge (either the accuser or the accused). Only the nodes in the majority are awarded. The commit-then-reveal protocol in Step 6 ensures that nodes respond honestly instead of trying to follow the majority. Since the auditors have nothing to lose and only gain, they have no reason to not respond to the voting contract. There is a block limit within which the votes have to be submitted. Since votes are revealed before the accused node's IP is, if the votes received are not conclusive to determine an overall majority, a retest is feasible. The use of onion routing ensures that an accused node does not selectively respond only when he is being tested.

Auditors
We require accusers to put tokens at stake prevents DoS attacks on the network. Else, malicious nodes would make frivolous complaints to keep the network busy with unnecessary checks. The master nodes are incentivized to act as auditors by giving them a part of the stake that is forfeited by the node failing the challenge (either the accuser or the accused). Only the nodes in the majority are awarded. The commit-then-reveal protocol in Step 6 ensures that nodes respond honestly instead of trying to follow the majority. Since the auditors have nothing to lose and only gain, they have no reason to not respond to the voting contract. There is a block limit within which the votes have to be submitted. Since votes are revealed before the accused node's IP is, if the votes received are not conclusive to determine an overall majority, a retest is

feasible. The use of onion routing ensures that an accused node does not selectively respond only when he is being tested.

Incentives

We propose a Reputation-based Incentive model. Whenever a master node/relay serves a request, in addition to the base tokens for serving the request, they also receive incentive tokens corresponding to their reputation. Master nodes can increase their reputation by providing more uptime and bandwidth. This approach is introduced to incentivize nodes to stay in the network for a longer duration, thus increasing the network throughput. The incentive a master node gets can be as big as 30% of base payoff.

*Payoff = Base Tokens + Incentive Tokens Where, Incentive Tokens = 0.3 * reputation * Based Tokens*

A user's reputation is calculated as follows - Nodes enter the network with a reputation value of 0.5. Each request served by the node is digitally signed by the node and logged as a service certificate. At the end of each day, all the service certificates for the day are accumulated, and a 'day Value' is computed based on the uptime provided and bandwidth utilized. The day value lies between 0 and 1.

dayValue= f (bandwidth, service certificates)

At the end of each day, the reputation value for the node is reset according to the following Reputation = $1 - e - \sqrt{0.8x/(1-0.8x)}$

Where x = $0.4 *$ Current Reputation + $0.6 *$ day Value

The reputation value is always between 0 and 1. Another critical thing to note here is that the node's reputation is more susceptible to the day Value than the previous reputation. This is to ensure consistent availability and deter nodes from taking a few off days, thus improving the overall performance of the network.

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Network & Data Dynamics

Network Dynamics

Virtual Arena is a combination of newly innovated protocols as well as currently well-established ones that power current blockchain platforms. The consensus is established via Proof of Computation. The task results and various players are tracked through the Kademlia Distributed Hash Table (DHT) which is similar to IPFS. NoSQL is the standard for data storage across the network. All these cogs along with our proprietary off-chain technology run the Virtual Arena.

Virtual Arena Streaming platform involves interaction between the following stakeholders:

Broadcasters: The first and the foremost entity to initiate the whole workflow is the broadcaster. He can also be named as an originator. These broadcasters have to register on the Virtual Arena platform to initiate the process. Post the successful registration the broadcaster would be assigned with a unique ID generated by the platform. These ID's are used to track all the activities of the entity that are performed in each regular interval. When a broadcaster requests for a stream the tracker server of the platform creates a membership certificate from the request with swarm ID (unique identification for a content), a timestamp, external IP and port received from the message signed with trackers private key. The video or the stream contains sequence of chunks which would be signed with private key and are delivered to transcoders with the swarm ID (public key).

Virtual Arena Transcoders: Virtual Arena transcoder hubs are in charge of encoding video streams to various bitrates, resolutions and video positions utilizing diverse codecs. They relay streams through transfers. They may alternatively go about as transfers themselves and could transmit the streams to viewers. It's in light of a legitimate concern for ace hubs to go about as Virtual Arena transcoders as well in the event that they have sensible register control. Devices or systems with prescribed high configuration with the combination of specific CPU and GPU computational power can be established as a transcoder on the virtual Arena platform. Once the transcoders are registered on the network these devices or systems would be designated with a unique ID. It is a software module that is used to convert the incoming single bitrate streamed chunks from broadcaster to multiple bitrates, formats and resolutions. To inform the network that the transcoder is available, transcoders send a request to tracker server with these system specifications which should ideally be a high configured device and tokens at stake along with the network information. Post the submission the platform identifies the available transcoders and assigns the task to transcode the content. The transcoded content is sent to relay nodes.

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Virtual Arena Relay Nodes: Virtual Arena hand-off goes about as L1 storing layer and come in the layer between Virtual Arena transcoders and watchers. The pre interphase to the users are relay nodes. The main functionality of these relay nodes is to support the content delivery with low latency to the users for the best live streaming experience. Users can also act as relay nodes. These relay nodes are distributed across multiple geographical locations which can serve data to the surrounding users. A large number of relay nodes provides our viewers with incredibly low latencies.

Auditors: Auditors are in charge of keeping up the honesty of the system through randomized checks. They are trustless and can take an interest in the framework through a test verifier convention. Tokens must be put on a stake to challenge errors, and prizes are granted on redress check.

Advertisers: Advertisers utilize Virtual Arena tokens to embed ads in streams and alternative partners gather information with client assent.

Viewers: Viewers are the end-users in VA Platform. They are reward with tokens for viewing the tokens and sharing their bandwidth with other users. The stream comes from Relay nodes with different resolutions, bitrates, and formats. Based on the bandwidth and device the viewer will watch the stream, these streams that are cached in the browser can be sent to nearby users who request with same resolution and bitrates. The viewer will also get paid for solving the puzzles that are given by broadcaster. They can use these tokens to reward broadcasters for their creative content, skip advertisements or buy subscriptions for premium content.

Data Dynamics

Decentralized storage is a unique challenge for a video-based company. After research we concluded that with the following properties, we could port our existing infrastructure to blockchain:

Decentralization: The databases involved must be decentralized.
Public Access: The databases must allow any individual to make changes to it.
Byzantine Fault Tolerant: Since anyone can make changes to the Database, it should be resistant to BFT and other Tolerance attacks.
Sharding: Each node is responsible for a set of primary keys. Replication (repeated storage of the same keys) would be controlled with respect to size of network.
High Speed: At peak, we expect millions of micro-transactions using QRK token.

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IPFS (Interplanetary File System) is used for storage of files. It is a filesystem-based on K DHT and BitTorrent Protocol. It combines multiple file systems across various devices in the network using Content Addressing. Content Addressing provides fast access to data, fixing its position on the disk. Retrieval is straight forward, unlike its counterpart technique Location Addressing.

Each node will only store files that are required, with metadata related to addresses and locations of nodes across the network. The database is also inherently shielded against Flooding Attacks and also doesn't require much trust among nodes as the data is content addressed.

Thanks to BitTorrent Protocol, our IPFS network is more than capable to maintain our Worldwide Network 24/7.

Risks and Attacks

Fraud detection

An essential feature of the VA network is the concept of Auditor node. Auditor nodes act as an alternative to 'Proof of Viewership'. Any node is eligible to be an auditor node. Each auditor is required to put up some stake when making challenges, which would be forfeited if the claim turns out to be false. This would prevent DoS attacks by malicious actors making false claims to engage the network continuously.

An auditor node picks up nodes/relays at random, goes through their service certificates and runs several fraud detections and machine learning algorithms to make sure they haven't committed any fraud in calculating their reputation or faking their requests. For additional performance, an auditor can augment its information using the client's or web server's logs if the domain has support for Google Analytics or some other kind of a metered system.

Distributed Denial of Service

A malicious actor might try to DDoS a group of nodes (clusters), but due to no central node, this kind of attack will be rendered useless. The only way viewers will be affected is that instead of getting the packets from the nearest node, they will get the packets from the next nearest node which is not being attacked by the malicious agent. We also plan to integrate algorithms and mechanisms that can detect and thwart such attacks. Due to a large number of nodes, bringing the entire network down would be economically infeasible.

Service Denial Attack

A relay may deny service to a viewer either due to uptime issues or as a deliberate act. This won't be an issue for viewers for small resources since requests can be made redundantly to a few relays. After every few rounds, nodes have to share their service

receipts so that the network can arrive at a consensus for their reputation scores. Based on statistical analysis and random checks through the network on such master nodes or relay nodes, their reputation can be degraded. It is detrimental for such nodes do not serve requests since they lose out on corresponding request's fees and a possible loss of reputation which decreases their payout rate and thus their block rewards.

Mitigating Inference Attacks

Web security measures focus on preventing eavesdropping - third parties listening to private conversations. However, traffic analysis, i.e., figuring who is talking to who is possible with encrypted messages too. Browsing history can reveal a user's geographical location, interests, political ideology and ultimately, identity. Onion routing impedes traffic analysis by connecting the initiator and responder through a series of random nodes.

To encourage nodes to act as relay and exit nodes and avoid bandwidth bottlenecks, we require users needing anonymity to act as relay nodes themselves. New technologies such as HORNET - High-Speed Onion Routing Network deliver the promise of speed up to 93 gigabits per second while providing anonymity.

Like any distributed system, a variety of attack vectors exist. Some of these are listed here along with strategies to mitigate the dangers.
- A Transcoder can try to prevent or slow down a Broadcaster from getting their encoded stream out to the network by accepting a job but refusing to transcode.
- A Broadcaster can prevent a Transcoder from being able to do the job that they believe they were assigned by refusing to send segments.

Both attacks have a cost and can be mitigated, with slight annoyance.

Consensus Attacks

The consensus in the Virtual Arena ecosystem is provided by the underlying blockchain platform. 51% attacks, double spend of Virtual Arena Token, and forks of the network would require the same resources and cost-of-attack as the blockchain itself.

Virtual Arena is a stake-based protocol, and while Transcoders have the role of participating in the work verification process and the token reward distribution process, they actually do not have the role of validating or accepting another Transcoders' work.

There is no concept of a chain, nor is there validation of previous blocks. There simply exist the economic incentives to verify one's own work and distribute one's own portion of token allocations when it is one's turn. Attacks are seen in a proof of stake protocols, such as the Long-Range Attack, the Nothing at Stake problem. However, one should be aware that as the underlying blockchain migrates to proof of stake, these attacks do threaten to undermine Virtual Arena if the benefit of carrying them out on Virtual Arena were to exceed the cost of an attack on the blockchain itself.

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While relying on the security of the underlying blockchain is nice for the prevention of consensus attacks, there still exists a class of quality and efficiency attacks that can harm the Virtual Arena network.

Sybil

Sybil attacks involve creating a large number of nodes in the network in the hope of disrupting the network to the attacker's advantage.

Since nodes in the verifier pool are selected at random based on the number of tokens staked, for an attacker to control 51% of the Virtual Arena network involves insurmountable financial and computational hurdles and a high risk of losing all of the staked tokens if the verifier pool deems the alpha node rogue.

Not only does an attacker have to control 51% of all nodes in the network, but the attacker also needs to end up with a verifier pool with 51% of nodes that vote in his favor, making the attack financially unfeasible.

Illegal Content

A common problem with video distribution networks is piracy and illegal content. These problems can be addressed with a client reputation system and a smart contract-based content flagging system. Several reputation systems are being evaluated at Virtual Arena Token and findings will be published in an upcoming technical report.

Network Security

Transactions Security

Transactions between all parties are secured by the blockchain and Smart Contracts. In the final version of the Virtual Arena Network, there is no need for a trusted authority to confirm all transactions between all parties.

Content Security

The content broadcast by Broadcasters is encrypted in a way that only chosen Transcoders and Recipients who have paid for the transmission are able to decrypt it.

Risk Factors

We use a rational attacker model in which the attacker makes decisions based upon their own economic self-interest. A number of attacks are mitigated via it being unprofitable to conduct such attacks, but we also strive to ensure that at worst, the network suffers the loss of efficiency in case of a sustained unprofitable attack, and doesn't suffer a failure.

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If a malicious miner tries to forge service certificates, the expected mining reward actually decreases. Thus, a rational miner would not try to forge service certificates.

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5   The Blockchain-Based Virtual Arena Token

Virtual Arena Token Purpose Statement

The Virtual Arena token is intended to act as an incentive to encourage users to participate and grow Virtual Arena platform. The following are its use cases:

1. Virtual Arena tokens will be used to reward miners, auditors and content creators and curators for their services.

2. Virtual Arena tokens can be used by users to pay for the various services provided on the Virtual Arena platform. These services include Advertising, Predictions, Merchandise and Marketplace.

   a. Methodology for Token Distribution
   b. Use of ITO Proceeds

6 Project Roadmap

The product development timeline is subject to change depending on the Virtual Arena community feedback.

Q3 2017 - Q4 2017

- Review on peer-assisted live streaming
- Research on multiple possible solutions

Q1 2018 – Q2 2018
- Research on Blockchain as a Solution
- Review about the live streaming industry

Q3 2018 – Q2 2019
- Completion of White Paper
- Prototype building

Q3 2019
- Prototype Building

Q4 2019 Q1 2020 VA SMASH
- Research & Design
- Database Planning
- Product Development
- Test for Pre-Launch

Q2 2020 VA FLICK
- Research & Design
- Database Planning
- Product Development
- Test for Pre-Launch

Q3 2020 VA GAMEHUB
- Research & Design
- Database Planning
- Product Development
- Test for Pre-Launch

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Q4 2020 VA SERIES
- Research & Design
- Database Planning
- Product Development
- Test for Pre-Launch

Q1 2021
- Development of customized video player
- The accomplishment of platform prototype
- Video screen capturing
- Proof of concept
- Launch of the test environment
- Completion of a blockchain prototype

Q2 2021 – Q3 2021
- The launch of the blockchain integration to the main net
- Implementation of code to the open-source
- Peer to peer video distribution
- Integration of smart contract into the system
- Completion of transcoders
- Implementation of adaptive bitrate streaming

Q4 2021
- Customer-centric Enhancements
- Building a customized analytics tools token swap

Q4 2021
- Artificial intelligence to the virtual arena product
- Advancements for the betterment of the project
- Crowdfunding on creativity

7 Partners

Streaming Media Hosting

Industry-leading CDN streaming provider. We deliver quality desktop and mobile audio and video streaming services for live and on-demand webcasting. A recognized leader in the OTT TV (Over the Top TV), OVP (Online Video Platform), EVP (Education Video Platform) and EVP (Enterprise Video Platform) markets, SMH has emerged as one of the fastest-growing video and VR platforms, and as the one with the widest use-case and appeal. SMH is deployed globally in thousands of enterprises, media companies, service providers and educational institutions and engages hundreds of millions of viewers at home, in work, and at school.

Squire Patton Boggs

Squire Patton Boggs is a full-service global law firm. They provide insight at the point where law, business, and government meet, giving the customer a voice, supporting their ambitions and achieving successful outcomes. They combine sound legal counsel with a deep knowledge of their client's businesses to resolve their legal challenges. They care about the quality of their services, the success of their clients and the relationships that are forged through those successes.

Futbolita

Ash Hashim better known as Fútbolita™ is a Singaporean sports journalist, FIFA Players' Agent, personality and international blogger known as the "Female Voice of Football". Her website and brand, Futbolita (Futbolita.com), is known for featuring exclusive interviews with world-renowned sports personalities in the European football world, including David Villa, Xavi, Fernando Torres, Cristiano Ronaldo, Romário and José Mourinho.

8 Conclusion

Blockchain technology has the potential to transform the world as we know it, but its current functionality limits practical applications that are fundamental for mass adoption. Virtual Arena advances blockchain enhancing it by achieving the following goals

- **Creating the world's best blockchain-based Conversational Interface Platform**

We aim at every vertical market including Retail, Hospitality, Financial, Service and many more. We intend to leverage decentralization and open mechanisms to support contributions from the widest range of contributors. Our Deep Learning techniques will be pushing forward the boundaries of what video platforms can do.

- **Pushing forward next-gen AI and ML research**

We intend to create an open and inclusive economy and culture where AI and ML research is pushed forward and the findings quickly find their way into the enterprise market.

The realization of this vision will not only require top-notch technical execution but also growth of the user base and community. So an effective business, as well as technical execution, will help us achieve these goals. We expect these to propel us to the top of AI scene.

Virtual Arena Platform possesses tremendous potential for the commercial and research side of AI and Blockchain as we are pioneering towards the previously uncharted territories of Blockchain-based Video Platform.

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9 Risks and Disclaimers

This Whitepaper is intended solely to assist prospective participants' decision whether to participate in the Virtual Arena platform. We emphasize that this is an open-source initiative where everyone makes the decision independently.

The financial information contained in the Whitepaper and accompanying materials is unaudited. The projections contained herein and the accompanying materials are based on certain assumptions. No assurance can be given that these assumptions will prove to be correct. Accordingly, no assurance can be given that actual results will conform to the projected results.

The Virtual Arena platform, the management and the development teams of the project, each expressly disclaim any responsibility for ensuring the accuracy or completeness of the information contained herein and in the accompanying materials. Accordingly, neither us, nor any other individuals or entities, nor any of our affiliates, representatives or advisors will be subject to any liability for any inaccuracies in or any omissions from materials contained herein or the accompanying materials or any other oral or written information provided with respect to the Virtual Arena token or the Virtual Arena platform, and no express or implied representations or warranties will be deemed to have been made with respect to the Whitepaper or any other matters.

Neither Virtual Arena, nor the project management and core development teams, nor any affiliates, representatives or advisors are under any obligation to update, supplement or correct this Whitepaper or accompanying materials in any respect, or otherwise provide any recipient or reviewer of these materials with access to any additional information. In addition, the project management, core development, and development teams reserve the right, without prior notice to any reviewer or recipient of this Whitepaper or any accompanying materials, to terminate, at any time, further participation in the Virtual Arena platform, until tokens are generated, we reserve the right to modify any applicable procedures, without giving advance notice thereof and without providing any reason therefor.

We emphasize in the strongest possible terms that a Virtual Arena token does not represent ownership or a security interest in the Virtual Arena or any other entity. Nor is a Virtual Arena token related to any other assets or properties. The token does not represent a debt owed by the Foundation or any other entity, and shall not be considered a debenture. To acquire Virtual Arena tokens, you must be genuinely interested in contributing skills, time, energy and expertise to Virtual Arena by becoming a member of the Virtual Arena community of volunteers. If you   determine

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that Virtual Arena tokens may constitute a security subject to regulations in any country, we strongly advise you not to acquire them and suggest you immediately notify us of any possible risks. In addition, we feel compelled to advise you of the following risks and indicate that these and additional risks need to be factored in your decision.

TECHNOLOGICAL & TOKEN VALUE RISKS

Due to the very short history of crypto tokens and crypto-economic systems, there are several challenges that token holders face when attempting to value these projects and their underlying tokens.

Firstly, the short history of crypto tokens shows an even shorter lifespan for many projects, often due to a large principal-agent problem. This is different from startups, which usually raise money in a series of different rounds over several years.

Second, as the nascent industry crypto markets are subject to a level of systemic risk that cannot be diversified away. Therefore, token holders take on both project-specific risk and market risk when acquiring tokens.

The systemic risk is very hard to predict, due to the short time span and is unique to the industry. Everything from hard forks to new crypto attacks is a source of systemic risk that traditional investments don't suffer from.

Finally, many projects are interdependent which causes dependency risk to projects. For example, a crypto project built on Ethereum will be affected by things happening in Ethereum, like a bug found in a compiler, or an attack on the Ethereum network.

Furthermore, as layers of the ecosystem build-up, this dependency risk deepens.

REGULATORY RISKS

We emphasize in the strongest possible way that Virtual Arena tokens do not grant a claim against or represent ownership or a security interest over the Platform or any other entity or any other assets or property. They do not represent a debt owed by the Virtual Arena or any other entity and shall not be considered a debenture under any applicable law. It is for these reasons that we believe that our tokens are not securities and may be purchased by anyone who is genuinely interested in becoming a member of the Virtual Arena platform.

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TAX, LEGAL AND ECONOMIC RISKS

Without proper consultation of tax, legal and economic advisors - taking into account your personal circumstances - you may not be able to fully assess the tax, legal and economic impact of participating in this Initial Token Offering.

Insufficient or faulty consultation can lead to unintended or unforeseen tax, legal and economic consequences. The absence of advice from experts such as financial advisors, lawyers, and tax consultants can have detrimental consequences for a Participant in this ITO. Prospective participants should carefully consider the following risks together with their expert advisers before deciding whether participation in the Initial Token Offering is suitable for them or not. Virtual Arena is not liable for a loss in connection with erroneous or insufficient consultation or advice provided by third parties.

The exchange of virtual currencies (Virtual Arena/Ether) without taking into account the individual circumstances and the financial situation of the Participant might have negative consequences. The decision to obtain a Virtual Arena token should take into account the individual knowledge of the Participant. Only freely available capital should be used for participation in this Initial Token Offering as a total loss cannot be excluded.

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