Redefining the Game: A Novel Blockchain Approach for Overcoming Historical Challenges in Gaming Industry Integration

Dr. Alan Tominey

`contact@gorki.dev`

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Abstract

Within the gaming industry, blockchain technology promises to emerge as a beacon of innovation, offering many transformative opportunities. As a technology has demonstrated the capacity to be adopted as a true general purpose technology (GPT) [1], in this form blockchain extends beyond its foundational role in finance, demonstrating a versatile potential in various sectors, including the gaming domain[2]. This technology heralds a new era of decentralised gaming ecosystems, where its integration fosters enhanced transparency, trust, and engagement among diverse stakeholders[3]. The advent of blockchain in gaming is further enriched by the convergence with Internet of Things (IoT) technologies, paving the way for novel, immersive gaming experiences that seamlessly blend the digital and physical realms[4]. The utilisation of Non-Fungible Tokens (NFTs) and smart contracts within this domain exemplifies blockchain's capability to innovate game features, ensuring unique digital asset ownership and secure, automated transactions. However, the journey towards fully realising blockchain's promise in gaming is not devoid of challenges. The industry grapples with issues of scalability, network congestion, and heightened operational costs, as evidenced by the experience of pioneering blockchain-based games[5, 6]. The complexity inherent in designing and integrating blockchain solutions poses significant hurdles, demanding meticulous and innovative approaches. Moreover, the integration of blockchain with established gaming technologies, such as cloud gaming, calls for a re-evaluation of existing business models and pricing strategies, ensuring a balance between service quality, resource utilisation, and equitable user experience[7]. As the gaming industry stands at the cusp of this blockchain revolution, it confronts the imperative need for concerted research and development efforts to navigate these challenges, unlocking the full potential of blockchain in gaming[8].

This paper introduces a cutting-edge approach that overcomes scalability challenges and seamlessly integrates with existing gaming ecosystems. We describe the development of a blockchain architecture adept at handling high user engagement and transaction volumes, and allowing interoperability with the web 2.0 world, effectively solving the "day zero" problem. Our strategy emphasises the potential of on-chain data storage, unlocking new dimensions for sovereign content creation and management. This approach not only enhances player control over digital assets but also creates novel, sustainable business models leveraging on-chain data. This paper seeks to pave the way for a more robust, engaging, and economically viable blockchain-based gaming future.

1 Introduction

Blockchain technology, originally conceived as the underlying architecture for decentralised computation, a store of value and eventually cryptocurrencies, rapidly emerged as a cornerstone in the decentralised finance (DeFi) world. Its innovative principles of decentralisation, transparency, and security revolutionised financial transactions, leading to the creation of numerous platforms for digital assets, trading, and borrowing[9]. This technological prowess soon caught the attention of the gaming industry, offering a natural progression into a realm where digital ownership, in-game transactions, and user engagement are paramount[10]. The seamless integration of blockchain into gaming not only mirrored its financial applications but also promised a transformative shift towards more immersive, interactive, and economically robust gaming ecosystems.

Despite the popularity of some blockchain-enabled games in recent years, like Cryptokitties[6] and more recently Axie Infinity[11, 12], these games have not been able to make much headway into the global gaming industry. As of the writing of this paper, the gaming industry global revenue (396.2bn USD,[13] exceeds the entire market cap of all layer 1 platforms[14]. Even now, speculation and investment into the metaverse is driving development at many of the world's largest gaming companies. The excitement around the Metaverse is fuelled by the anticipation of a yet-to-be-realized, deeply engaging virtual world. This buzz is driving diverse experimentation within this domain, with various approaches being explored. The gaming sector is poised

to become the foremost player in this media segment. As the industry grows, technological advancements and gaming experiences evolve concurrently. Developers specialising in Augmented Reality (AR) and Virtual Reality (VR) are diligently crafting new solutions, in line with the growing integration of headsets into everyday life[15].

1.1 Participants in a gaming ecosystem

The gaming ecosystem and its participants can be mapped out through their interactions with each other, Figure 1 presents a high-level overview of the traditional structures. Traditionally, developers create gaming experiences where rewards, often in the form of tokens, are earned through various in-game activities. These activities can range from simple participation to completing complex tasks or achieving certain milestones. Players engage with these games either by making purchases or by performing actions that earn them tokens. These tokens then serve multiple purposes: they can be used to acquire in-game items, trade with other players, or even advance further in the game.

This model, however, is not without its vulnerabilities. The value of these gaming projects often relies on a dual-token system, which, while offering versatility and depth to the gaming economy, also opens avenues for potential manipulation. In these systems, the two types of tokens usually serve different functions—one might be used for in-game transactions while the other could be staked for governance or earning dividends. The interplay between these tokens can lead to complex economic dynamics, making the system susceptible to volatility and speculative behaviour.

Additionally, when these tokens gain real-world value, they become attractive targets for malicious actors. Cybersecurity vulnerabilities, such as those in smart contracts or game mechanics, can be exploited, leading to token theft or unfair manipulation of the game's economy. These platforms can suffer from liquidity shocks—sudden changes in token value or availability—resulting in rapid devaluation or hyperinflation. Such incidents not only disrupt the gaming experience but can also lead to a complete collapse of the game's economy. In extreme cases, these factors can culminate in the entire game failing, underscoring the need for robust security measures and stable economic designs in GameFi projects. The ability to create a more sustainable model is required, merely disrupting the traditional gaming world may not be enough, given that the gaming industry is one of the largest industries today, it can be suggested that certain aspects of that industry are functioning optimally and could be ported into the GameFi world, given the correct technology.

1.2 Blockchain and cloud gaming hybrid

A recent addition to the literature is the Cryptoarcade system[7]. The CryptoArcade system is a blockchain-based gaming platform that comprises three main components: a game store, cloud gaming service, and blockchain platform (represented in Figure 2). Games are run on virtual machines (VMs) in the cloud and configured by a cloud gaming service, with access and game time managed using tokens. Players use tokens to unlock and access games, and the token price is adjusted based on market conditions. The system focuses on coin-op arcade games, where players need tokens to play, and pricing is based on token supply and demand. To optimise payments and reduce blockchain transaction delays, a payment channel is integrated, allowing players to make multiple transactions offline. The system ensures game service setup, information fetching, service purchase, service allocation, and game service access, enabling seamless and secure gameplay. The description of the CryptoArcade system above demonstrates a common paradigm in blockchain integrations, while blockchain is an integral part of the platform, it primarily functions as an adjunct component, enhancing certain aspects of the system rather than being central to its core functionality.

- Core Functions Independent of Blockchain: The main components of the CryptoArcade system - the game store and cloud gaming service - operate independently of the blockchain platform. Games are run on virtual machines in the cloud, and their configuration and access are managed through a cloud gaming service. This setup suggests that the primary gaming experience is cloud-based and not inherently reliant on blockchain technology.

- Token Usage as a Facilitator: The use of tokens for unlocking and accessing games and for managing game time is a significant aspect of the system. However, this token-based mechanism, while enhanced by blockchain for security and potentially for transparent market-based pricing, does not necessarily require blockchain technology. Traditional digital token systems, which are not blockchain-based, could also serve a similar purpose.

- Payment Channel Integration for Efficiency: The integration of a payment channel to optimise payments and reduce blockchain transaction delays indicates a workaround for one of the blockchain's limitations. This suggests that the blockchain component, while useful, presents certain inefficiencies that the system has had to adapt to. Such adaptations imply that the blockchain is not the most efficient or only method for handling transactions within the platform.

- Blockchain as an extension rather than a necessity: The blockchain platform's role seems to revolve around

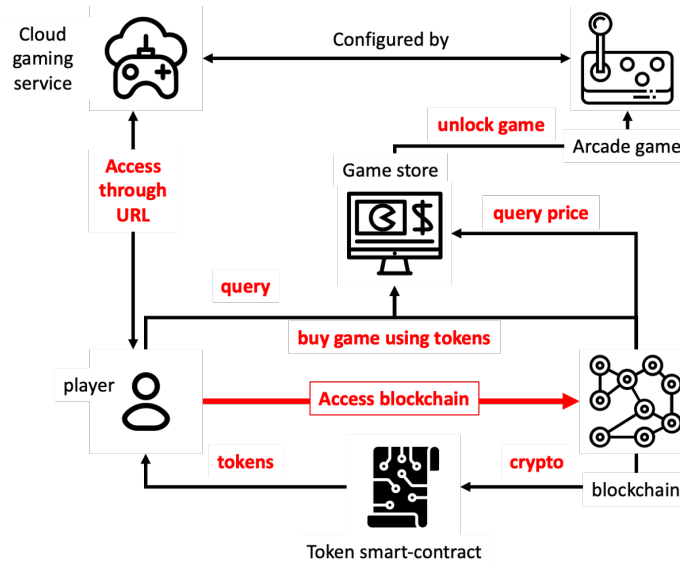Figure 1: Traditional participants in the gaming ecosystem

Figure 2: Typical cloud-blockchain-gaming infrastructure [7]

adding layers of security, transparency, and potentially decentralised market dynamics for token pricing. These are valuable enhancements, but they do not constitute the core functionality of the gaming platform. The primary services of game setup, information fetching, service purchase, allocation, and access are not described as dependent on the blockchain.

The blockchain component in the CryptoArcade system acts as an adjunct, enhancing certain aspects like token management, security, and market-based pricing. However, the core functionalities of the gaming platform - running games on VMs, managing access and game time - are not inherently dependent on blockchain technology. Thus, it could be argued that the blockchain component could be removed with limited effect on the overall functioning of the platform, although this might result in the loss of some specific benefits that blockchain technology provides.

2 Challenges in blockchain gaming integration

Scalability challenges in blockchain adoption for gaming primarily revolve around the need for fast response times and the potential unreliability of some blockchains during times of congestion. Blockchain-based gaming encounters several performance-related challenges. Firstly, many popular blockchains suffer from limited transaction throughput and latency issues, causing slower confirmation times and higher fees. Secondly, network congestion, particularly on platforms like Ethereum, results in sluggish transaction processing and elevated fees, negatively impacting the gaming experience and discouraging participation[16]. Moreover, this congestion leads to increased latency, causing delays between player actions and on-screen reactions, making competitive gaming challenging. Lastly, congested networks may experience packet loss, causing game data packets to be dropped or delayed due to bandwidth limitations, resulting in visible glitches, jerky movements, and disconnections, further undermining the gaming experience. This has led many developers to already explore layer 2 scaling solutions[17].

2.1 The "day-zero" problem

The "Day Zero Problem" is often talked about in technology with respect to a known vulnerability that is present from the launch of a system. In the context of integrating extensive existing ecosystems into new platforms like blockchain it can be thought of as the initial challenges that arise when attempting to incorporate legacy systems and processes into a new, often fundamentally different, technological framework. This problem is particularly pronounced in the case of blockchain due to its decentralised nature, the need for interoperability, and the significant changes it brings to traditional business processes.

Blockchain networks often operate in isolation, indeed their limitations can often lead to this being part of the design of the system (Fig. 2); each with its own protocol, code language, consensus process, and privacy safeguards. The lack of common standards that would allow different networks to connect with one another is a significant hurdle. This lack of interoperability can hinder security and make mass adoption nearly impossible. Similarly, integrating blockchain with existing IT infrastructure can be complex and resource intensive. It requires significant investment, technical expertise, and time to ensure that the new system works seamlessly with the old one. This is especially challenging if the existing system is outdated or incompatible[18, 19].

2.2 Limitations in current business models and the need for novel approaches

Game-Fi economic models have emerged as a fascinating methodology within the realm of blockchain applications in gaming, presenting opportunities to raise funds and liquidity on-chain. However, it is essential to acknowledge that this ecosystem is inherently fragile[20], as evidenced by several recent collapses in Game-Fi applications. These instances underscore the need for scrutiny and risk mitigation strategies when venturing into this space. Despite its fragility, the widespread adoption of blockchain in gaming may not solely hinge on disrupting older business models but could derive strength from a harmonious coexistence. Achieving this synergy would involve the creation of a blockchain infrastructure capable of interoperating seamlessly with legacy systems. Integrations like this would allow gaming platforms to leverage familiar business models, such as freemium models, while also exploring innovative ways to incorporate marketing content on-chain. This approach can pave the way for a more accessible and practical path toward widespread adoption, bridging the gap between traditional gaming and blockchain technology, and ultimately enriching the gaming experience for users.

2.3 The promise of on-chain data in gaming

Blockchains revolutionise backend computational infrastructure by tokenizing its operational costs and decentralising the system. This approach democratises access to data centre economies, like how Uber broadened the hired transport market to include millions of individuals outside traditional taxi companies. In this context, it is possible to tokenize the sponsorship and advertising aspects of Web3.0. By expanding the attention economy, which has already driven significant platform adoption and user engagement, this strategy presents an economic opportunity for decentralised applications (dApps) and end-users. It sets the stage for a new era of platform adoption and engagement, leveraging

the unique benefits of blockchain technology. - Opportunities for sovereign content creation and management.

The initial decade of the web (1990-2001) witnessed enormous speculative investment in a plethora of ideas about how the web would revolutionise our lives. However, the lack of robust business models led to the dot com boom and subsequent bust (2000-2001). Following this, advertising evolved on the web, paving the way for major companies to profit from internet usage. This era saw users unknowingly agree to End-User Licence Agreements (EULAs) that effectively transferred their data to corporate databases, marking a significant and rapid wealth transfer in human history, akin to the exploitation of natural resources like oil.

This period can be compared to the early years of blockchain technology. Over the past decade, thousands of blockchain projects have emerged, many lacking sustainable business models and relying on speculative token prices. This parallels the dotcom era, suggesting that the blockchain sector is at a juncture where it needs sound business models post the 'crypto winter' of 2018.

The rise of web companies post-2001 was fuelled by centralised advertising. Similarly, the recovery of blockchain and the Game-Fi ecosystem from the 2018 downturn may hinge on the concept of Decentralised Marketing and the application of On-Chain data to new business models.

All this requires the need to connect and interoperate. This will also require smart contract execution to be done concurrently because there will be latency and computation involved (Gorki is particularly designed for this).

2.4 Benefits of on-chain data for players and developers

Gorki is a blockchain that seamlessly interoperates with legacy systems and is able to distribute data on-chain; this allows for truly transformative business models, particularly within the gaming industry. This technology's ability to integrate with existing gaming infrastructure while leveraging the benefits of blockchain, opens up avenues for more sustainable and innovative business models (fig. 3).

In traditional GameFi tokenomics, the focus has been on dual-token models and Play-to-Earn (P2E) strategies, which, while effective, have their limitations in terms of economic stability and scalability. The new technology addresses these issues by offering a more flexible and dynamic approach to tokenomics. It allows for the creation of diverse business models where developers can be rewarded for delivering content directly to users. This system incentivises content creation and fosters a more vibrant and engaging gaming ecosystem.

Moreover, this technology enables both gamers and developers to propose and manage rewards, adding a layer of democratisation to the gaming experience. This feature is particularly significant in fostering community engagement

and ensuring that the rewards system aligns with the preferences and interests of the user base.

Another notable aspect is the facilitation of freemium business models. By utilising blockchain's inherent security and data distribution capabilities, the technology ensures that user data is protected, while still allowing for the monetization of certain aspects of the game. This approach is especially appealing in today's digital landscape, where data privacy is a paramount concern for many users.

The on-chain distribution of data also means that all transactions and interactions are transparent and immutable, adding a layer of trust and reliability to the gaming experience. This transparency is crucial in building and maintaining a loyal user base, as players can trust that the game operates fairly and as advertised.

3 The proposed blockchain framework

Figure 4 details shows a high-level overview of a blockchain-based gaming integration system/application through a communication API, creating a self-contained, highly secure, and efficient data management and gaming ecosystem.

3.1 Features and capabilities of the new blockchain enabling this system

The Gorki protocol aims to minimise synchronisation issues to address the blockchain trilemma of liveness, safety, and fault-tolerance. It incorporates four major innovations: a mathematical model based on process calculus, where computation is the exchange of data between process "names"; a tuple space, inspired by the Linda coordination language, for concurrent access and easy sharding; Rholang, a programming language that mirrors the computer's state and supports a secure, concurrent state machine; and a leaderless Proof of Stake (PoS) consensus algorithm inspired by Casper CBC research. This approach enhances data manipulation, balances simplicity with efficiency, and is designed to meet specific market needs, particularly in supporting decentralised applications with its focus on concurrency and composability.

4 Conclusion

Gorki, a new and novel layer-1 blockchain, presents a groundbreaking solution to some of the most pressing challenges in the blockchain gaming industry, those stalling adoption. By addressing the blockchain trilemma of liveness, safety, and fault tolerance, the protocol ensures a more robust and reliable gaming experience, crucial for both developers and players in the decentralised gaming ecosystems.
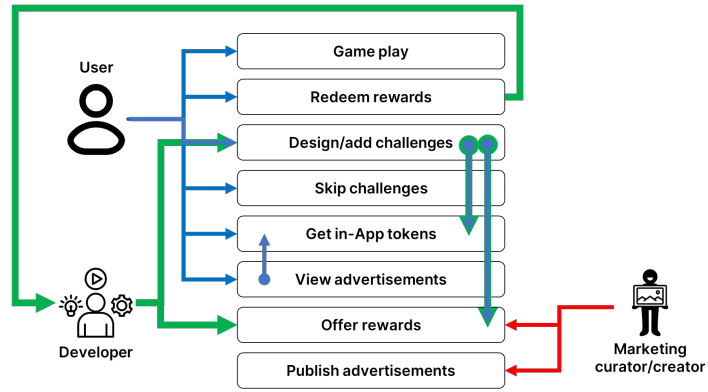
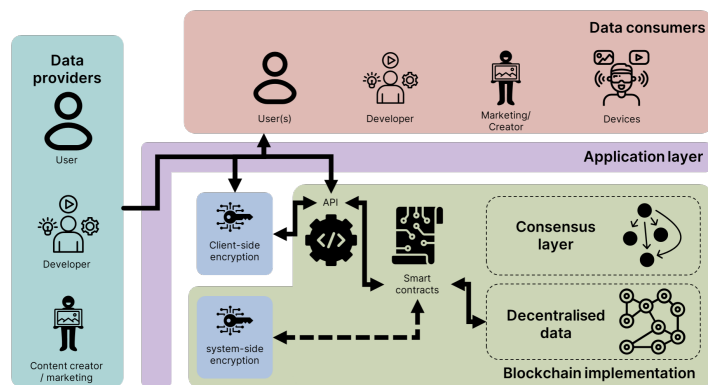Figure 3: Novel business models made possible through on-chain data and interoperability with legacy systems.

Figure 4: Novel business models made possible through on-chain data and interoperability with legacy systems.

The protocol's mathematical model based on process calculus represents a significant advancement in the way computation and data exchange are handled within blockchain systems. This approach allows for more efficient and dynamic interactions between different processes, which is especially important in gaming environments where real-time data exchange and high levels of user engagement are common.

The incorporation of a tuple space, drawing inspiration from the Linda coordination language, is another innovative aspect of the Gorki protocol. This feature enables concurrent access and facilitates easy sharding, addressing the scalability issues that have long plagued blockchain-based games. By allowing for more efficient data distribution and management, this technology significantly reduces synchronisation issues, leading to smoother and more enjoyable gaming experiences.

Rholang, as the core programming language of the Gorki protocol, plays a pivotal role in enhancing security and concurrency. Its ability to mirror the computer's state and support a secure, concurrent state machine is vital for developing decentralised applications where multiple processes need to operate simultaneously without compromising system integrity. Finally, the novel, leaderless Proof of Stake (PoS) consensus algorithm, marks a departure from traditional blockchain consensus mechanisms. This approach not only improves the efficiency of the network but also aligns with the ethical and environmental concerns associated with blockchain technologies. By reducing the energy consumption typically associated with Proof of Work systems, this PoS algorithm makes blockchain gaming more sustainable and accessible.

The Gorki protocol, with its four major innovations, thus provides a comprehensive solution to the challenges faced by the blockchain gaming industry. It enhances data manipulation, strikes a balance between simplicity and efficiency, and is specifically designed to support the unique needs of decentralised gaming applications.

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