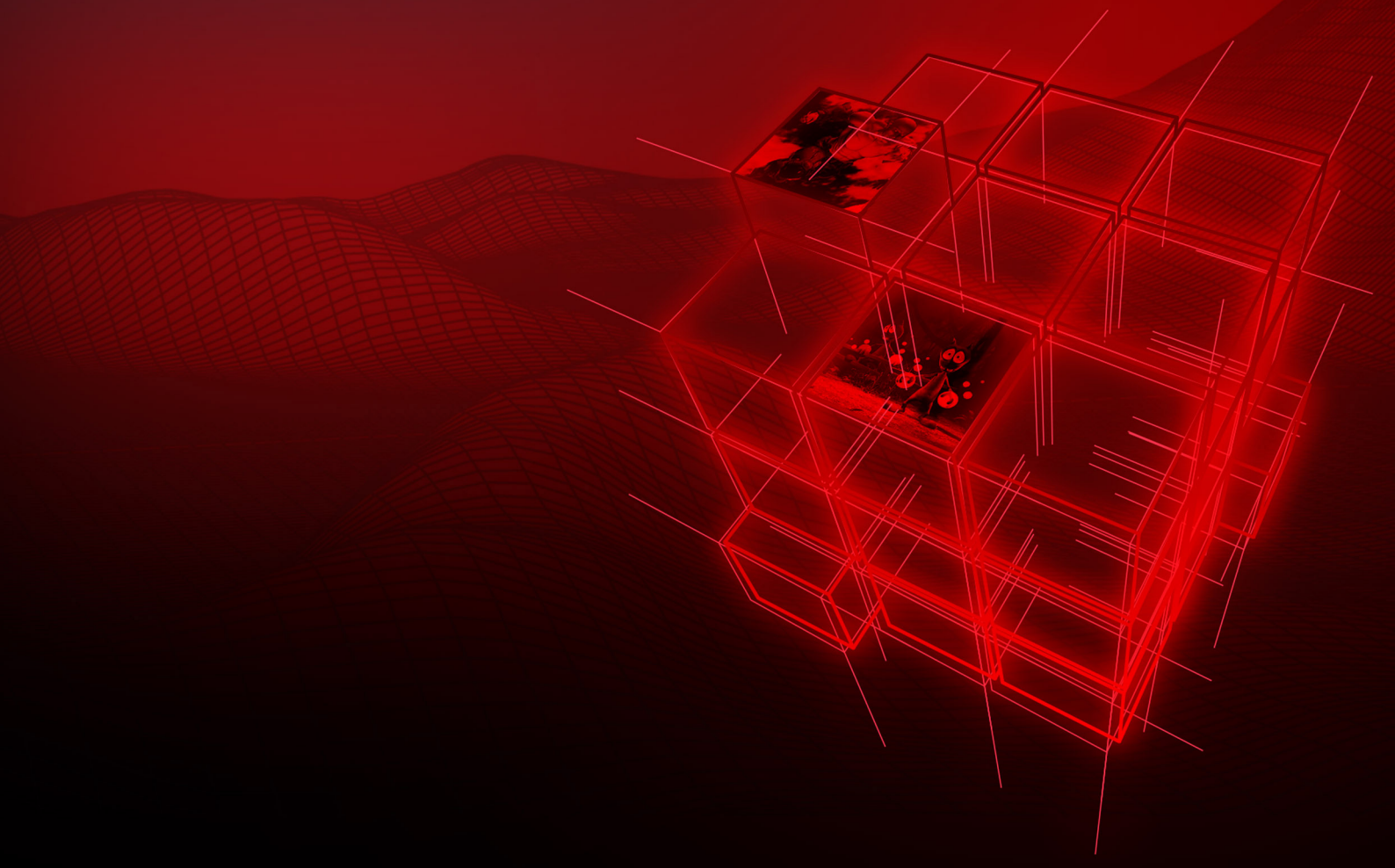
WHITEPAPER - v2.04

THE ULTIMATE BLOCKCHAIN GAMING PLATFORM



ABSTRACT

This paper presents a realisable and unique vision for the future of gaming built on top of or using the XAYA (pronounced “zay-ya”) blockchain to manage increasingly complex and appealing game worlds as well as securing and simplifying the ownership, sharing, and trade of virtual assets.

The XAYA platform achieves this through the democratisation of game development and deployment, allowing developers to bring their vision to life quickly with significantly reduced costs. It will provide a wealth of tools and a state-of-the-art infrastructure for game developers to build their own blockchain-based games. Furthermore, developers can fully leverage the XAYA technology to issue their own game currency that can be traded for ‘CHI’ (the reserve currency and “fuel” in the XAYA ecosystem - the X is pronounced ‘chi’ in the old greek alphabet) or other XAYA game coins and assets.

Additionally to the benefit of gamers, developers can create fully decentralised, autonomous games where players can expect 100% uptime and have provably fair gameplay with true ownership of their in-game items.

Until now scaling has been a major difficulty for blockchains and particularly for massive game worlds and their virtual asset inventories. The XAYA team has overcome this with world leading breakthroughs in Trustless Off-chain Scaling for games (Game Channels)[1] and Ephemeral Timestamps[2] and will continue to invest strongly in this important and novel field.

The assembled XAYA team is comprised of the original creators of blockchain gaming, experienced developers, and blockchain and business experts. So whilst this is a new frontier for cryptocurrency and gaming, the assembled team has the experience, insight, and initial designs available to readily solve the challenges ahead. This will usher in a new era of game-changing blockchain technology and a whole new gaming ecosystem. XAYA is developed and maintained by Autonomous Worlds Ltd.

CONTENTS

OUR VISION

"Decentralised Realities"

Imagine countless millions of players competing and cooperating in decentralised virtual realities that run serverless and unstoppable. In provably fair environments, they use their skill and intelligence to harvest resources and acquire rare artefacts that hold significant real world value.

What if developers could provide autonomous, decentralised worlds, rich in tradable virtual items for gamers? What if developers could go from concept to game release in less time and for less money without worrying about infrastructure costs (such as servers) and recurring costs (such as account administration)? What if we could offer true ownership, simple and safe trading methods for gamers to convert virtual items into real world value through an entirely flexible system? What if both gamers and developers could share in a win-win outcome with both able to capitalise on new revenue streams and participate in thriving new economies? What if we could realise a substantial and growing demand for a cryptocurrency, increasing its utility and value for users?

XAYA will achieve all of this through a single, custom, blockchain-based platform that is able to provide:

- *Truly decentralised massively multiplayer Decentralised Realities (DRs)*
- *True and fair virtual item ownership with simple and safe trading and sharing*
- *Rapid and cost effective game concept to market for a wide range of new massively multiplayer games and games in general*

Just imagine, being inside a decentralised reality, unstoppable and secure. Interacting on the blockchain itself and communicating securely over encrypted text or voice. Imagine owning your own virtual apartment that you can sell or trade for real world value, or even share the keys (symbolic of encryption keys) with a friend.

A NEW FRONTIER

What is being proposed here is gaming using the blockchain to provide a secure, decentralised, autonomous, and flexible platform upon which a variety of games can be built.

This is a new frontier in both cryptocurrency and blockchain based gaming, but it is not an unknown frontier. In 2013, the XAYA team developed and successfully deployed the Huntercoin experiment. This achieved a number of world firsts including, but not limited to:

- *The world's first decentralised massively multiplayer game*
- *The world's first game world built entirely on the blockchain*
- *The world's first human mining permissible cryptocurrency*

Huntercoin was a proof of concept to develop solutions to the technical challenges and to test the market. Huntercoin was successful and within just a few months of launch achieved over 35,000 simultaneously controlled characters[3] in the game despite a low profile launch, and despite requiring some specialist hardware (i.e. solid state drives, which were uncommon at the time) and a reasonable level of technical know-how from the gamer. Huntercoin was largely autonomous and required no servers or other infrastructure. It achieved a market capitalisation of over $1 million in the first few weeks[4], putting it as a top crypto currencies of the time by market cap, and peaked to around $10 million in 2017[5]. The Huntercoin experiment served its purpose several years ago and provided a number of world leading insights into blockchain technology, including publication in the blockchain journal 'Ledger'.

The XAYA platform builds upon the significant know-how developed across Namecoin and the Huntercoin experiment and will provide a wealth of tools and infrastructure for game developers to build their own game worlds that fit their vision and project. They can fully leverage the XAYA technology to build decentralised games and issue their own game currency that can be traded for 'CHI' or other XAYA game coins or assets.

It is important then to point out that XAYA aims to:

- *Enable developers to create provably fair games in decentralised realities*
- *Build a blockchain-based gaming ecosystem*
- *Provide developers with tools for asset trading for new and existing games*
- *Provide a full-scale virtual asset trading platform*

EXPERIENCE

The assembled XAYA team is comprised of the original creators of blockchain gaming, experienced developers, and blockchain and business experts. So whilst this is a new frontier, the assembled team has the experience, insight, and initial designs available to readily solve the challenges ahead and realise game-changing blockchain technology and a whole new ecosystem.

MARKET

OVERVIEW

XAYA addresses both the existing gaming and cryptocurrency markets and further creates an entirely new market in the process through games created on top of the blockchain. This new market is attributable to the creation of new virtual universes and item trading possibilities that are substantially deeper and more flexible than other emerging and simple trading systems using smart contracts.

XAYA targets both developers and gamers. The XAYA team aims to empower a large proportion of new developers who find taking their game visions to market challenging because of time and financial constraints. In this sense, XAYA aims to democratise game development. Through the creation of a virtual item trading and sharing platform, the XAYA team aims to allow players to generate real world value or capitalise on previous gaming achievements in new games through the trade of virtual items from one game to the next. This is achieved through the adoption of XAYA tools and applications by gamers and existing developers and studios.

The following sections describe the gross magnitude of the existing markets, all of which will be addressed through XAYA.

GAMING

The video gaming market is highly lucrative and is estimated at $108.9 billion per annum[6] with a 2016-2020 forecast of 6.2% CAGR[7] (Compound Annual Growth Rate) or 7.8% YoY[8] in 2017. This is in part a result of mobile gaming, which accounts for $35.3 billion with a 22% YoY growth[9], and the lowering cost of computing platforms thus increasing their accessibility to larger human populations. Estimates of the current desktop computer gaming share vary from $24.8 to $33.7 billion[10].

The general message, however, is a consistent one, inasmuch as there are significant opportunities and potentially billions per annum of opportunity.

Player numbers for both subscription and freemium model games tend to be measured in the millions for some of the leading games. *World of Warcraft™* for example had circa 12 million subscribers in 2011[11].

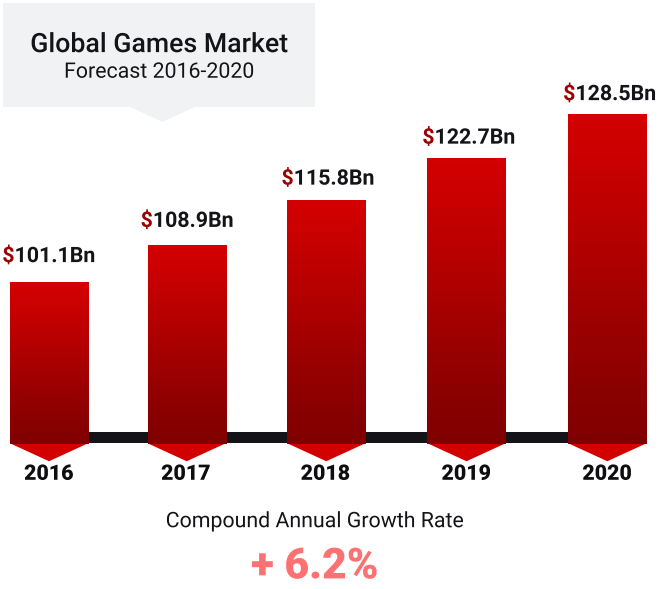


Figure 1 'Global Games Market'

Freemium models have emerged as a significant means of generating revenue. They allow players to play for free or pay in order to improve their performance within the game (e.g. 'levelling up', or acquiring 'power ups'). The models are essentially supported by advertising revenues and in-app purchases made by players. By means of example, the *Clash of Clans™* strategy game for mobile devices achieved over $45 million a month in revenue with some estimates suggesting as high as $150 million a month[12].

Arguably one of the emerging biggest growth areas within computer gaming is from the populous Asian countries (e.g. the gaming market in Asia Pacific is growing at over $4.7 billion per annum[13]). As a result, any solution proposed should consider accessing these markets through tailoring of the solution to meet cultural and other sociological needs.

Our potential inside the gaming market initially consists of the approximately 75% of all gamers who play on mobile and/or desktop platforms. We are not initially pursuing other non-gaming markets that XAYA is also technologically well suited for, but this might be a long term aspiration.

CRYPTOCURRENCY

Cryptocurrency capitalisation is, at the time of writing of this document, circa $350 billion[14] with trades and transaction volumes accounting for billions (USD) each day. Cryptocurrencies are becoming more accepted globally, although there are still barriers faced by their proponents. These include regulation and usability.

The underpinning 'blockchain' technology behind Bitcoin and the alternatives ('altcoins') is being proposed for a range of applications in banking, defence, and other sectors. Successful cryptocurrencies bring new technologies and innovative solutions to the market, such as how Zcash and Monero have enjoyed great popularity due to their strong privacy features. Even Microsoft is using the Ethereum blockchain technology as part of a 'blockchain as a service' model.

Beyond the utility question, cryptocurrencies largely derive their value from the number of users they have and how much they are used. That is, with many users and a high "velocity of money", currency values go up.

XAYA, in addition to being a cryptocurrency, is essentially a blockchain-based gaming and virtual item trading platform. Consequently, the value of the XAYA economy will increase as more developers and gamers adopt and use the platform. Given the time to market and cost saving potential of XAYA, the team anticipates rapid adoption by a significant number of developers trying to get their visions to market quickly and affordably. As pioneers in the blockchain gaming sector, XAYA will essentially democratise gaming development.

PROBLEM DEFINITION

There are two major aspects to the problem being solved. These are listed below:

- **DEVELOPERS**: Time and cost from concept to market for many new and independent developers is often prohibitive. It is commonly known that the majority of these developers are unable to reach the gaming market because of the aforementioned constraints. With appropriate developer tools and using the blockchain to create decentralised realities, with a 24/7 uptime, the costs and setup time associated with servers or cloud based services are eliminated, as are the recurring costs, such as user account administration. This democratisation of game development through the blockchain will usher in a new era of game development as well as create new gaming genres. However, there are technical challenges relating to scalability associated with increasingly rich and complex universes within MMO games, as well as scaling challenges associated with cryptocurrencies and asset storage ledgers. These challenges are often underestimated, including in other emerging virtual asset storage ledgers.

- **GAMERS**: In general there is a growing desire for increasingly rich virtual gaming universes in which virtual asset ownership is important for gamer status and progression through a particular game. In addition, the time and effort expended by the gamer could be rewarded beyond simple enjoyment alone and through the exchange of in-game virtual items for real world value or for virtual items available in another game. This represents a challenge on two fronts. The first challenge is that a truly scalable and real or near real-time asset storage ledger is required for the gamer independent of the games they play. The second challenging requirement is to create a means of managing ownership and sharing in increasingly complex game universes, like those in typical MMO games. Over time and given the likely high value of many virtual assets and the gameplay itself, it will be critically important to ensure ‘provably fair’ gameplay and ‘provably fair’ item acquisition, which is not addressed in other emerging asset trading platforms.

MODEL CHARACTERISTICS

The following describes the key characteristics of the solution to the problem statement (earlier) in terms of gamers, developers and supporters.

For gamers:

- Provably fair gameplay
- Reliability and stability (i.e. 24/7 uptime)
- Secure virtual asset ownership
- Rapid and easy trade and/or sharing of virtual assets and conversion to real world value (e.g. play to earn or Human Mining)
- Secure social networking
- Easy to use game app launcher
- Human readable wallet accounts and “addresses”

It should be noted that in blockchain gaming, provably fair gameplay is unique to XAYA. Other asset trading platforms require developers to pre-create or spawn all items in a closed environment, which means that items can be printed at will. Therefore items that have been acquired by provably fair methods will inherently have greater value.

For developers:

- Fully-, partially-, or non-decentralised game development
- Supporting scalable massively multiplayer game development
- Virtual currencies and asset creation
- Ability to build gamer loyalty
- Broad game engine compatibility (e.g. Unity, Unreal, etc.)
- Exportable game engine templates (e.g. support for Unity assets and Unreal blueprints)
- Pre-built libraries
- Accepting and managing gamer payments simply, securely, and affordably

For supporters:

- A cryptocurrency with high utility value (e.g. 'CHI' is the 'fuel' for games, creating accounts, purchasing valuable in-game items, etc.)
- Access to large existing gaming markets
- Access to untapped gaming markets (e.g. virtual asset trading)
- Creation of new gaming genres (e.g. blockchain-based gaming and Human Mining)

SOLUTION

OVERVIEW

The XAYA platform will provide a wealth of tools and infrastructure for game developers to build their own game worlds that fit their vision and project. They can fully leverage the XAYA technology to build decentralised games and issue their own game currency that can be traded for CHI or other XAYA game coins/assets secured by the XAYA blockchain.

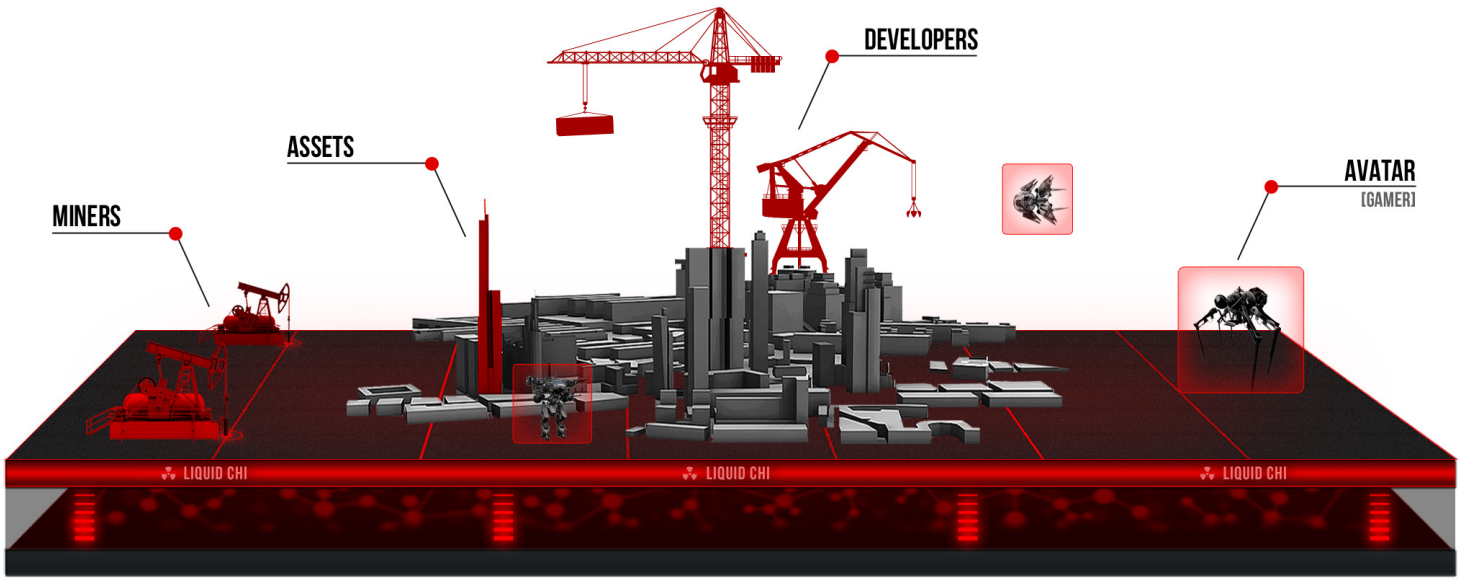


Figure 2 'XAYA platform'

Scaling is a major difficulty for blockchains and particularly for massive game worlds. The XAYA team has overcome this with breakthroughs in Trustless Off-chain Scaling for games (Game Channels) and Ephemeral Timestamps and will continue to invest strongly in this important field.

KEY TECHNOLOGIES AND INTELLECTUAL PROPERTY

The XAYA cryptocurrency will be based on a blockchain secured by proof-of-work (PoW). Player accounts and the most important game data (e.g. ownership of valuable items) are persisted with a decentralised name/value store built directly into the blockchain. For this, we can leverage the experience and intellectual property that our team has gained from Namecoin (the very first altcoin) and Huntercoin since 2013.

In addition to these proven technologies that will form the most critical fundamental layer of XAYA, the project's success is ensured by additional unique innovations developed by our team:

- **Atomic transactions:** Pioneered in Namecoin[15][16][17] by members of the XAYA team in 2013, this technique will be made easy to use in XAYA. It will allow trustless trading of game items, game-specific currencies and whole game accounts for CHI to enable a thriving economy on top of the XAYA platform and ensure demand for CHI.
- **Game channels**[18]: We have developed an extension of the payment channels in Bitcoin that can be applied to game moves between multiple players off the blockchain and thus aid in scaling XAYA to its global target size. The same concept can also be used for "shards" of a global game world to enable limitless and near-real time gaming on the blockchain.
- **Ephemeral timestamps**[19]: If disputes arise in a game channel (analogous to "closing" a Bitcoin payment channel), transactions on the main blockchain need to be made in order to resolve it. By mixing the time-stamping property of a blockchain, Merkle-ized hash commitments, amortised mining incentives, and fraud proofs in a clever way, we've been able to develop a new protocol that ensures that the occurring transaction fees can never be a loss for any honest participant.

TECHNICAL DETAILS

Based on the proven technology of Namecoin[20], the XAYA blockchain will implement game accounts and tradable in-game items in a way similar to Coloured Coins[21]. This ensures that their ownership is securely tracked on the blockchain in a decentralised way, and it also enables atomic (i.e. trustless) trades for CHI or between items. This works by transferring both the sold item and the corresponding payment in CHI between the two participants of a trade in a single (atomic) transaction. This transaction needs to be signed by both parties, so that either both transfers happen or none. This prevents fraud where just the payment is made and the item isn't transferred, or vice versa. To illustrate the importance of such prevention: worldwide for every legitimate IAP (In-App Purchase) there are 7.49 fraudulent ones[22].

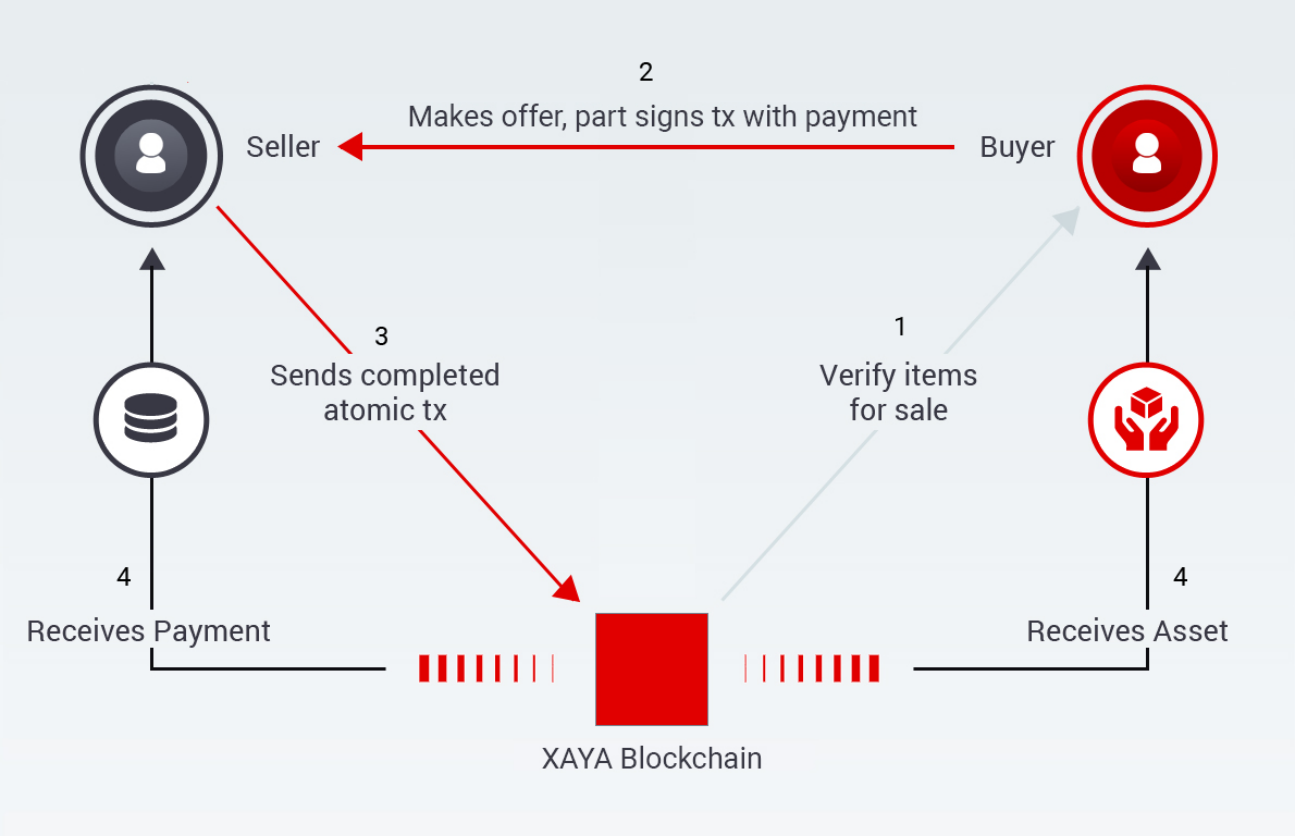


Figure 3 ´Atomic transaction´

Games on the XAYA platform will be based on the concept of a global 'game state' that was pioneered by Huntercoin. In abstract terms, every cryptocurrency on a blockchain can be interpreted as consensus about a global state that can be manipulated by each participant through transactions. In Bitcoin, this state is the UTXO[23] set (the shared 'ledger'). In Ethereum, this is the global state of all contracts. Games built on the XAYA platform can take this concept one step further — the game state for them can be just about any global data that encodes the whole game world in its entirety. This state is tracked by clients for specific games, so that a XAYA client only needs to process and store states for games that it is interested in. Gamers can update the global state through transactions made on the XAYA blockchain or through off-chain game channels (see *Figure 4*). Time-stamping through XAYA's blockchain ensures that all participants in each game reach consensus on the shared game state in a decentralised and provably fair way.

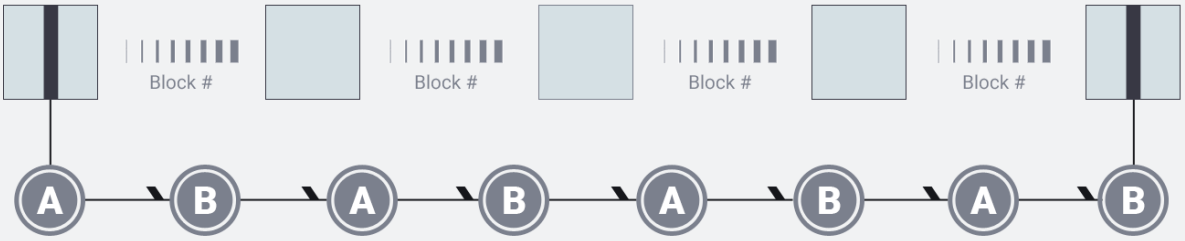
In addition to Coloured Coins described earlier, ownership of items can also be represented directly in this game state. In this case, trading for in-game currency or other items can be done on an internal marketplace according to rules specified by the game developer. Using pegged sidechains or a semi-trusted escrow setup (federated sidechains)[24], such in-game trading can still be denominated in CHI.

We believe that the key to successful blockchain gaming lies in solving the scalability problem. This is evident from the recent discussion in Bitcoin, and one of the lessons we learned from the Huntercoin experiment (as discussed in more detail in the Game Channels paper[25]). We have been able to solve the scalability problem for blockchain gaming with the invention of game channels in 2015.

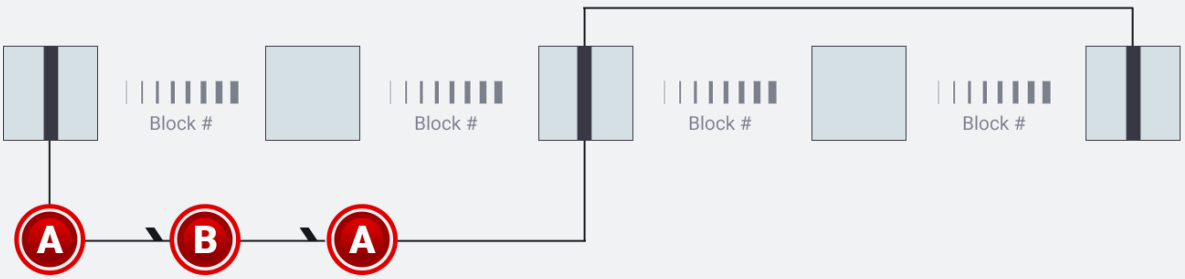
In the simplest form, game channels allow two players to perform a turn-based game in a trustless way without recording every move persistently on the main blockchain. Instead, they record the moves on a private "side chain". Digital signatures and a hash-chain structure ensure that moves cannot be forged or changed backwards in time. As long as both players agree on the outcome of the game, the resulting prize coins (or whatever else the game is about) can be distributed accordingly by a 2-of-2 multi-signature transaction. If the players disagree, then the data in the sidechain allows an honest player to prove to the public that she's in the right according to the game rules and thus still claim her reward. See Figure 4 on the next page.

Sketch of the blockchains involved for a game channel in various scenarios. The chain on top is the public blockchain, while the chain below is the private chain containing blocks mutually created and signed by Alice and Bob (marked with "A" and "B". respectively). The dark bars indicate transactions related to the game channel included in the public blockchain.

Example 1. Consensus about the blockchain with no dispute at all. The private chain indicated in grey can be discarded after the game channel is closed.



Example 2. Alice files a dispute and receives the prize money after waiting for the threshold time to elapse. The sequence of moves is recorded permanently in the public blockchain inside of the dispute transaction.



Example 3. Alice files a dispute. Bob resolves the dispute with his next move, and the game continues in agreement. Only the part up to the dispute-resolution transaction needs to be in the public blockchain.

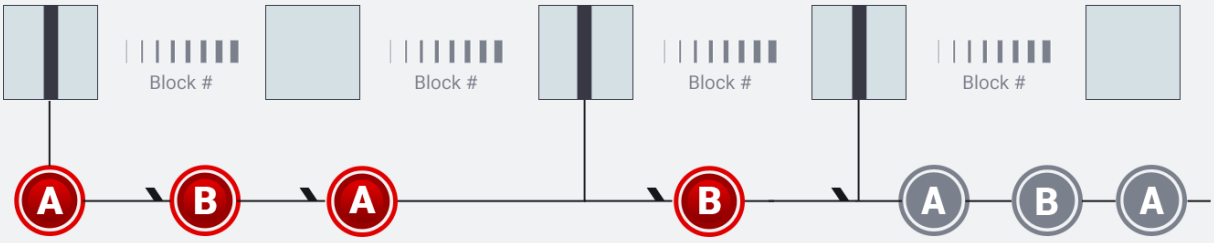


Figure 4 ´Game Channels´

Building on this simple case, one can further extend and generalise game channels to work with multiple players and for games that are not explicitly turn-based. For more details, we refer to section 5 and 6 in the Game Channels paper[25].

The main issue that remains with the original game-channels design is the following: If a dispute is raised but then resolved, the game continues as before. However, this process puts transactions onto the main blockchain, thus removing the scalability gains and costing (both) players transaction fees. A player whose objective is to disrupt a game built on top of XAYA can thus repeatedly cause disputes and resolve them; this is not rational behaviour according to game theory since it costs them unnecessary fees, but this strategy can nevertheless be employed to irritate honest players and disturb the game platform.

The solution to this problem are ephemeral timestamps. They have the following useful two properties:

- Nodes can send some data D to be timestamped at time T by the public P2P network and blockchain. Due to a Merkle construction, this does not cost any blockchain space or transaction fees per timestamp. Miners still have an economic incentive to process these timestamps.
- Later, and only if necessary due to a dispute, such a timestamp can be used to prove to the P2P network that another game participant could have known D at time T. This, in turn, can be used to prove that this participant did not act in a game channel according to the rules, and thus claim payout of the prize money. Only this act of actually using the timestamp requires a transaction on the blockchain and transaction fees, which are then offset by the prize money that is guaranteed to be paid out. In other words, the cost incurred by the dispute will always be paid by the defecting player in the end via awarding the game prize to the honest player.

With these properties, ephemeral timestamps allow us to improve game channels such that an honest player can never lose any money due to a dispute. In the worst case, a defecting player can just cause a minor disturbance, for which the honest player will be rewarded by winning the game's prize money on the spot.

DOWNLOADS

The XAYA main net was launched in August 2018. The wallet downloads (Electron and QT) as well as the XAYA specifications can be found here: https://github.com/xaya.

USE CASES

There are multiple use cases for XAYA spanning the majority of gaming genres from simple collectable card games to real-time strategy and virtual reality. Three concrete examples of fully decentralised and provably fair game possibilities are described below, including some monetisation potential for developers. Note that any game can make use of the payment gateway or asset storage functionality in XAYA.

COLLECTABLE CARD GAMES

As with most blockchain technology, it is possible to store assets on the blockchain. Collectable game, sports, or other cards are simple examples of asset storage. Cards can be traded or sold safely and securely on the XAYA blockchain using atomic transactions as pioneered by our team over 4 years ago[26]. For the end user this will be a very easy to use feature using the XAYA trading application. In addition, XAYA tools allow developers to build card games that can be played entirely on the XAYA platform, trustless, serverless, and provably fair – if the developer so wishes.

REAL-TIME STRATEGY (RTS) / MULTIPLAYER ONLINE BATTLE ARENA (MOBA)

League of Legends™, *Dota™*, and *Heroes of Storm™*, just to name a few, are part of a rapidly growing real-time strategy genre called MOBA (Multiplayer Online Battle Arena). To put the genre in a financial context, *League of Legends™* alone took in over $1.7 billion in revenue in 2016[27]. It is possible to develop games of this genre entirely on the XAYA platform using game channels and ephemeral time stamps. Developers can code the game so that matchmaking takes place entirely on the blockchain or in a XAYA off-chain lobby, or even in a centralized fashion. The key here is that XAYA offers a high degree of flexibility for the developer. Further advantages to using XAYA include a true or literal 24/7 uptime, zero gaming server costs, improved scalability, and easier monetisation by, for example, selling skins, power ups, or virtual game coins that are used to buy these in-game items. The same is true for classic RTS games, such as *Dune 2*, *Command and Conquer™*, and *Starcraft II™*.

TURN BASED GAMES

Classic turn based games such as *UFO Enemy Unknown* are easily hostable on the XAYA blockchain in a multiplayer fashion. More complex multiplayer turn based games, such as *Civilization™* or *Total War™*, are also possible with XAYA. It is even possible without the use of off-chain game channels and ephemeral time stamps as gamers would make all their moves in just one transaction (tx) per turn, so this in itself reduces blockchain bloat compared to games that require transactions more often, such as real time games. Using our unique method of taking the game state externally as described in the technical section, a turn based game can be playable by many tens of thousands of simultaneous players and only those who are interested in the game need to verify that the game's current state is correct. More specifically, miners do not need to verify moves and actions for their validity; they only need to process the transactions because the game state ignores invalid moves. These game genres can be persistent worlds with, for example, procedurally generated maps (in other words, these worlds can be infinite). Currency generated in these games can be traded for CHI and other assets, and used to purchase in-game items or power ups. This gives these in-game currencies real value and adds the term Human Mining to the cryptocurrency lexicon.

OTHER GENRES AND USE CASES

There are of course many other game genres and use cases, such as head-to-head games, social VR worlds that are fully autonomous, and so on. The above are simply brief outlines with various examples of how XAYA can power different fully decentralised and provably fair games given its flexibility and high potential.

MONETISATION

Monetisation of games with XAYA is in many ways simpler than traditional methods. The following is by no means an exhaustive list, but covers some common cases and how monetisation can be achieved with XAYA.

- A percentage of "banked" human mined coins go to the developer.
- A one-off fee to join or subscribe to the game, similar to how one would purchase a boxed game.

- In-game stores can sell various permanent or consumable products, such as:
  - Items
  - Powerups
  - Game coins or gems
  - Unlock codes
- In-game stores can sell various permanent or consumable services, such as:
  - Healing
  - Item repair
  - Level-up training
- In-game advertising or sponsored messages
- Offer in-game services, such as an in-game trading platform
- Or any method currently available to developers

How a game is monetised is entirely up to the developer, with the added invaluable benefit of always being able to rely on the trustless, secure backing of the XAYA blockchain with no third parties that can potentially disrupt payments.

CORE TEAM

Andrew Colosimo

has over 20 years of experience in IT, computing, and computer gaming. He was one of the earliest pioneers to capitalise upon the sale of virtual items in massively multiplayer online (MMO) games. He was instrumental in the success of Namecoin, supporting the cryptocurrency at a time when development had stalled. Andrew has run a successful IT and computing business and provided advanced 'dialler systems' development and consultancy to small and medium enterprises (SME) and moderately sized companies. He is the founder of the Huntercoin experiment which led the World in demonstrating the art of the possible with blockchain technology, achieving the World's first game built on the blockchain, the World's first server-less / decentralised MMO game, the World's first 'human mineable' cryptocurrency, and the World's first provably fair MMO game. Andrew is a self-taught entrepreneur who has successfully capitalised on a number of technology trends but is now focussed on bringing whole new game universes and their trading systems to life and the mass market.

Dr Daniel Kraft Phd MSc MSc

studied applied mathematics and theoretical physics in Graz, Austria, where he obtained his PhD from the University of Graz in 2015. After that, he started as a Software Engineer in Zurich, Switzerland. He has been strongly interested in Bitcoin and cryptocurrencies since 2011, and involved in Bitcoin development since 2013. Since 2014, he has been the main developer for Namecoin and Huntercoin, and successfully reimplemented both on top of the modern Bitcoin Core codebase. Where possible, Daniel also contributed improvements back to upstream Bitcoin, and is currently the #29 contributor to Bitcoin Core. He published multiple research articles in peer-reviewed journals, including two directly related to cryptocurrency.

Konstantin Gorskov

has 10 years of experience in IT and game development. He has worked as a freelance game developer for several years on various projects and gained a broad set of skills. Konstantin follows the development cycles of all major game engines and game development software in order to help him manage technical solutions of various magnitudes. He is valued for his deep knowledge on game production, pipelines, and his versatility. As an indie developer, Konstantin released his own RPG game, which was Greenlit on Steam in 2015. Konstantin is adept in various programming languages, including C++, C#, PHP, and Java, and has deep knowledge and experience with the Unreal and Unity game engines.

Bas de Gruiter

has over 17 years of experience in business development, marketing and design. Bas' entrepreneurship has journeyed through a variety of markets, ranging from gaming and software to the retail market, and pioneering in the industrial field of hydrogen gas and thermoelectric applications in the durable energy sector. His interest in cryptocurrencies began in 2012. Since then he has been involved in the development of exchange, gaming, and other software projects. Bas now brings his broad experience in business, design and cryptocurrency development to the XAYA team.

Ryan Smyth

is an award winning software author, entrepreneur, marketer, trader, and recipient of the Australian Governor-General's Bravery Medal. His audio software for musicians has received multiple awards, but the bulk of his software has been custom utilities, such as n-ary Cartesian product software for mobile AI corpus creation. Ryan's clients have included Fortune 100 companies, mobile phone manufacturers, as well as many online game studios; he has 12 years of experience working on different genres of online games. Ryan first heard of Bitcoin when the Satoshi paper was first released, and finally bought his first Bitcoins in 2013.

ENDNOTES

[1] See “Game Channels for Trustless Off-Chain Interactions in Decentralized Virtual Worlds” at https://www.ledgerjournal.org/ojs/index.php/ledger/article/download/15/64

[2] See https://bitcointalk.org/index.php?topic=1784048.msg20136789#msg20136789

[3] See https://public.tableau.com/profile/andrew.colosimo#!/vizhome/Huntercoin-EarlyBlocks/QuadView

[4] See https://gomedici.com/huntercoin-worlds-first-peer-peer-massively-multiplayer-online-cryptocurrency-game/

[5] See https://coinmarketcap.com/currencies/huntercoin/ June 3, 2017

[6] Page 8 of the Newzoo Global Games Market Report 2017 Light Version available as a PDF at https://newzoo.com/insights/trend-reports/newzoo-global-games-market-report-2017-light-version/

[7] See https://newzoo.com/insights/articles/the-global-games-market-will-reach-108-9-billion-in-2017-with-mobile-taking-42/

[8] Page 12 of the Newzoo Global Games Market Report 2017. This number is also in line with the Woodside Capital Partners’ “Game Industry Overview August 2016” report. See page 3: http://www.woodsidecap.com/wp-content/uploads/2016/12/WCP-Gaming-Industry-Overview-2016.pdf

[9] Page 13 of Newzoo Global Games Market Report 2017

[10] Estimates for desktop gaming vary with some estimates placing the market value at about $34 billion in 2017. Growth estimates also vary, e.g. http://www.gamesindustry.biz/articles/2017-05-04-chinese-games-market-to-hit-USD35bn-by-2021-niko-partners.

[11] See http://ca.ign.com/articles/2010/10/07/world-of-warcraft-reaches-12-million-subscribers or http://www.ibtimes.co.uk/world-warcraft-subscribers-hit-5-5-million-lowest-numbers-10-years-1527035

[12] See https://www.androidheadlines.com/2015/05/supercell-makes-5-million-per-day-off-clash-clans.html

[13] Page 21 Newzoo Global Games Market Report 2017

[14] See https://coinmarketcap.com/

[15] See https://forum.namecoin.org/viewtopic.php?f=2&t=1316

[16] See https://forum.namecoin.org/viewtopic.php?f=11&t=1701&sid=060bcdb887c0ca43e08bedeb272f93b2

[17] See https://wiki.namecoin.info/?title=Atomic_Name-Trading

[18] See https://www.ledgerjournal.org/ojs/index.php/ledger/article/download/15/64

[19] See https://bitcointalk.org/index.php?topic=1784048.msg20136789#msg20136789

[20] See https://namecoin.org/

[21] See https://en.bitcoin.it/wiki/Colored_Coins

[22] See https://apsalar.com/wp-content/uploads/2015/07/APSALAR-FRAUD-INDEX_FINAL.pdf

[23] Unspent transaction outputs

[24] See “Enabling Blockchain Innovations with Pegged Sidechains” at https://www.blockstream.com/sidechains.pdf

[25] See https://www.ledgerjournal.org/ojs/index.php/ledger/article/download/15/64

[26] See https://forum.namecoin.org/viewtopic.php?f=2&t=1316

[27] See https://segmentnext.com/2016/12/22/league-of-legends-revenue-figures-beat-2016/

[28] The mobile relay service will provide mobile clients with light-weight access to the blockchain in order to save battery power and bandwidth.

[29] https://www.xaya.io/huntercoin.pdf