Stox Platform for Prediction Markets

White Paper

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Overview

Prediction markets are a disruptive economic instrument that has yet to penetrate mass investor audiences due to excessive regulation and the fragility of existing centralized implementations. The maturity of blockchain technology is poised to change that as decentralized implementations for scalable prediction markets are within reach.

Stox is an open source, Ethereum based platform for prediction markets where people can trade the outcome of events in almost any imaginable category - sports, celebrity marriages, election results and even the weather. The platform targets mainstream audiences and provides a haven for investors to find refuge from traditional financial instruments and participate in prediction events with the purpose of making profit, leveraging their knowledge in almost any imaginable field.

Stox was designed by veterans of the online trading industry, using the knowledge and experience acquired by invest.com. invest.com is an established online financial company which has been operating in the investment field since 2014. invest.com's trading platforms accommodate over 3 million registered users and facilitated more than 8 million transactions last year alone. invest.com currently employs over 200 employees across 5 countries, providing the solid foundation and infrastructure of the franchise to bootstrap the Stox network.

Combining expertise in regulated markets together with blockchain technology creates a unique solution for prediction markets that are tailored towards approaching the masses. Stox is creating a robust business model that incentivizes other providers and industry leaders with existing customer bases, such as invest.com itself, to join the Stox network and drive traffic to the network. Event syndication between providers carries this traffic beyond the confines of a single provider. Providers are motivated to cooperate as part of a larger network. On the other hand, users will enjoy a well-rounded selection accommodating their diversified interests, increasing overall engagement.

The power behind Stox is the STX digital token. All activity in the network revolves around STX, from serving as the primary form for fees and collaterals, to serving as the main currency used for predicting event outcomes. STX is the driver of a sustainable economy where demand grows as more users and providers join the ecosystem.

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Introduction

What are prediction markets

Prediction markets are an exchange where any individual or organization can tap into the "wisdom of the crowd" to ask any question or predict the result of any event. Like any other exchange prediction platform, Stox utilizes the relevant event in the form of a stock where participants can trade on the outcome of the event.

Predicted events are diverse and can be based on any imaginable topic such as election results, sports, entertainment, financial instruments and even the weather. Similar to the financial markets, which assign a price to the future estimated earnings of a stock, prediction markets assign a traded price to a belief about the future. The market price can also be used to indicates how the crowd in general sees the probability of the outcome of an event.

Individuals buy and sell outcome shares based on what they see as the probability at any given moment. As long as a prediction is active, the price continues to fluctuate and indicates the probability of an outcome according to the crowd's wisdom.

Let's assume that a certain event is given a 60% chance of happening. This percentage represents the price of the event, in this case 0.6. As more people believe this event is going to happen, normally because they are in possession of information about this event but sometimes just because they are "following the crowd", more “shares" of this event outcome will be purchased and the price will increase. On contrary, some people may predict that this event will not happen and this opinion will effectively cause the price to drop. During the prediction period, the crowd analyzes the chances of this event happening, creating a useful tool to understand the crowd mindset on certain topics.

Because prediction markets represent diverse thoughts and opinions from different locations and personal observations, they have proven to be effective as a prognostic tool, similar to economic markets. As a result of their visionary value, prediction markets have been utilized by institutions and large companies like Google to predict internal outcomes of product development.
We believe that due to their increasing popularity, prediction markets will become a popular tool with traders, especially as more platforms are introduced and decentralized technologies increase trust in these systems.

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Challenges

There are various challenges in implementing prediction markets that serve as barriers of entry to this field and have prevented it from reaching mass adoption thus far.

Definition It is yet unclear how this activity is treated from a regulatory viewpoint. In the past, certain prediction markets were treated as financial activities as they predicted financial instruments and the regulator treated it as futures trading. It is clear that financial predictions will continue to be monitored by financial regulators, however it is not certain how other predictions such as political events, product releases etc will be governed, especially in a decentralized world and whether such activity will be captured by online gaming regulations. Stox is committed to following all required regulations.

Liquidity as with any exchange may also present issue. If there is not enough liquidity, investors may be deterred from participating. Another important consequence of lack of liquidity is that predictions might be less accurate when the amount and diversity of users is limited.

We believe that the answers to these challenges lie in decentralized platform and blockchain technology. These innovations have the power to bring prediction markets closer to users and increase trust in the system, its oracles and its operators.

Market size and projections

Prediction markets have an immense potential. Companies working in this field have tens of thousands of active traders generating millions of dollars of trading volume. Profits are growing exponentially. Nevertheless, none of these companies appear to be exploiting the full potential of prediction markets.

PredictIt, a NZ-based company specializing in prediction markets, offers exchanges on political and financial events. It launched operations on November 3rd 2014 and by March 2016 had had 29K active traders. SMarkets is another example, it was founded in 2008 and almost doubled its trading volume between 2014 to 2015, increasing its pre-tax profit by 1,568%.

The vast majority of companies offer prediction market services in just a single area and each of the major areas within the prediction market arena shows growth. The global market for sports for example was almost 50 billion dollars in 2016 and keeps growing steadily by at least 10% annually. Financial predictions also show potential which is already seen in centralized online companies

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where daily trading volume tops $5.5 billion. These numbers are expected to grow significantly in a decentralized environment.

Many prediction verticals are not currently available in prediction markets including weather, current events, environmental, social, entertainment, decisions and policy set by governments and many more. These offer great potential and the chance for users to find new ways to profit from leveraging their interests and personal knowledge.

About invest.com

invest.com is an established online financial services provider. The invest.com brands are at the cutting edge of the fintech industry and their innovative platforms empower new and experienced investors to actively manage their finances with a large variety of instruments such as currencies, commodities, indices, CFDs, shares and automated investment strategies.

invest.com has been operating in the online investment field since 2014, serving a registered user base of over 3 million customers. The group currently employs over 200 people in five locations around the world - Berlin, Limassol, London, Sofia and Tel Aviv.

invest.com has experience with regulated markets and operates a legal division with expertise in licensing and compliance in multiple territories. The group is licensed to provide cross-border investment services in the European Union.

The invest.com group has developed a multitude of innovative investment platforms. These include a suite of automated investment strategies which use artificial intelligence to take advantage of market movements. These strategies, similar to quant hedge funds, are available to investors through robo-adviser technology. This is the first time this type of investment has been made available to retail investors.

The group's trading platforms harness technology to offer a choice of ways to trade and are suitable for all levels of traders. They includes leveraged trading, buying and selling stocks and social trading where investors can follow and automatically copy others. The group has released a web-based trading app and online investment portfolio as well as a set of popular native mobile apps for iOS and Android.

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The invest.com Pro platform is designed for experienced traders. It gives professional investors full control over their trades with the ability to reverse, double positions or close all trades in the click of a button. In addition, it offers competitive spreads and deep liquidity as expected from platforms of this caliber.

The invest.com Simple™ trading platform is tailored for introductory level investors and was designed with the novice in mind. The platform has innovative features that help minimise risk and simplify trading. It allows users to practise before performing actual trades and get the real trading experience with zero risk. All practice trades are based on actual real-time market movements.

In 2016 alone, invest.com's group achieved:

- More than $50 million revenue
- A trading volume of over 8 million trades on invest.com platforms
- Transaction volume of $12 billion

These achievements are due to the group's development of innovative investment products which focus on a user-friendly experience, their top-class marketing capabilities and excellent customer support.

The scale of ambition in developing audacious investment products and the strong track record in attracting and retaining customers makes invest.com an ideal partner for Stox. As a launch partner invest.com will assume the role of an initial provider and operator of events in the Stox network and will drive traffic into the network to help bootstrap activity using invest.com's existing user base. Since the Stox platform is decentralized and open for anyone, other industry leaders will follow and join as providers as the ecosystem matures.

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The Stox Token

The Stox ecosystem is based on an open source cryptographic token named STX (the Stox Token). Like other similar cryptocurrencies, STX is fractionally divisible, transferable and fungible

Purpose and usage

Activity in the Stox ecosystem is performed primarily using STX, making the token an integral part of the Stox platform and the driver for its economy. This includes:

- Users apply STX in the prediction of event outcomes and accordingly, profits over successful predictions are collected in STX. Users are required to purchase STX in order to participate in prediction markets running over the Stox network.
- Fees for participating in event predictions and investing in event outcomes are collected in STX. These fees are the primary channel of revenue for event creators and market makers.
- Syndication fees for promoting events between apps of different providers in the Stox ecosystem are paid between providers in STX.
- Event operators are required to hold STX as collateral for publishing new events for users to invest in. This means that providers are required to purchase STX in order to participate in the Stox network and generate revenue from it.
- Event operators must hold a reserve of STX to act as a counterparty for investments made by users on specific outcomes during the event.

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Technical implementation

The Stox token (STX) is implemented as an ERC20-compatible token over the public Ethereum blockchain. Ethereum is the natural fit for Stox as it is quickly becoming the industry-standard for issuing custom digital assets.

Compatibility with the ERC20 standard leverages the rich existing infrastructure of the Ethereum ecosystem such as development tools, wallets and exchanges. The ability to program trustless smart contracts over Ethereum with a Turing-complete language allows for robust and secure customization of the cryptocurrency to the domain-specific requirements of the Stox network in a fully decentralized manner.

[1] *ERC20 is the Ethereum token standard. https://github.com/ethereum/EIPs/issues/20*

Bringing cryptocurrency to the masses

One of the primary goals of Stox is the introduction of decentralized prediction markets to mainstream audiences. Such audiences are likely to have little experience with cryptocurrencies and likely to have little to no knowledge of blockchain-based technologies. Stox is looking to expand beyond the crypto community and focus its activity on broad audiences of regular investors in traditional financial instruments. Similarly, catering to this audience requires expertise on part of the application providers and operators: acquaintance with the industry's marketing ecosystem, regulatory framework and UX know-how are a significant hurdle in providing a prediction market app, without which a provider would be slow to grow to achieve critical mass required for a successful prediction market.

As such, acquisition and utilization of STX will be made as straightforward for users as using tokens in an online game. The complexities of opening and maintaining a cryptocurrency wallet and paying Ethereum contract transaction fees in ether are abstracted in full by the Stox app.

Stox is developed in close cooperation with incumbents providers in the industries of stock trading, options trading and currency trading, intending to operate as providers in the Stox ecosystem. Incumbents are expected to be the main channel for acquiring mainstream users as they are expected to introduce STX to their existing customer base. Our launch partner is invest.com, with a user base of over 3 million registered users. These users will have a cryptocurrency wallet opened seamlessly for their benefit at launch, making STX one of the most popular cryptocurrencies among mainstream users.

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Incentivizing established companies and organizations that currently focus on traditional financial tools to enter the field of prediction markets through adoption of the Stox platform and technology will leverage their experience in maintaining active communities of investors and marketing efficiently towards these crowds. As the blockchain market is maturing, the time is ripe for established companies to benefit from decentralized systems and reap value from the rapid growth of this ecosystem.

A sustainable economy

For a cryptocurrency to be successful over time, it must become the driver for a sustainable economy. As STX is utilized by more users and adopted by more providers, the network effect of the Stox ecosystem will grow, building the value of the ecosystem for the benefit of long time holders and token sale participants.

A successful economy requires STX to have growing demand within the Stox network. Since participation in event prediction requires users to acquire STX, demand for the token will grow in proportion to the number of active users and the number of active events they invest in. Demand will also grow in proportion to the number of active providers who rely on STX to create events. Providers are incentivized to hold significant reserves of STX in order to provide the required collaterals and market making reserves for running many events concurrently.

Aside from spending STX, the model also provides a means of earning STX as reward for services given. Event providers in the Stox ecosystem such as invest.com, are compensated in fees for the work they put towards operating events, acting as oracles and assuming the risks of functioning as market makers.

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Liquidity and volatility

STX will be a single currency used both for the operation of the Stox network (transaction fees, syndicate payments, oracle payments) and as the functional currency for predicting event outcomes. Unlike other proposals for investment currencies, it is a flexible exchange-rate currency, making it exposed to liquidity and volatility risks:

- Liquidity: the risk of investors unable to acquire tokens when they want to speculate on the outcome of an event, and of users unable to sell tokens when they want to cash out.

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- Volatility: the risk of currency fluctuations between the time an investor entered the action and purchased shares of an event outcome and the time the user wants to cash out.

These risks are a big concern for most bootstrapping markets, when the proposed service launches together with the currency, and in the subsequent period of no or little growth of the service. This is typical because peer-to-peer markets tend to follow an exponential growth pattern, due to the network externalities inherent to peer-to-peer services. Several techniques are being used to mitigate these risks, mainly usage of secondary currencies or an introduction of a pegged currency / stablecoins to be used by consumers. In the case of prediction markets, this comes at the price of separating the currency used for operational mechanisms from the investment currency. Such separation has adverse effects in thinning out the market for the operational currency, in addition to the missing out on the advantages that flexible exchange rate currencies have against monetary shocks.

Relying on Bancor as a token platform for STX will provide an unlimited liquidity pool and resolve liquidity risks. Volatility risk is also mitigated as our data shows that STX will enjoy a thick market from day one, eliminating the need for pegging or stabilization mechanism. invest.com, committed to be the first provider on the Stox network, enjoys more than 8 million trades annually. Such activity volume ensures the required liquidity and achieving a critical mass of end users needed to create efficient trade.

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Bancor as a token platform

We aim to implement the STX token as a Smart Token which uses the Bancor protocol to maintain liquidity. Bancor is an ERC20-compatible token template, which offers continuous liquidity via an on-chain market maker. The Bancor smart contract holds a reserve of another currency (BNT) amounting to 4% of the STX market cap, and determines an appropriate exchange rate between BNT and STX in such way that assures the BNT reserve remains at 4%. Individuals wishing to buy or sell STX buy from, or sell to the market maker at the current price. The market maker can always act as the counterparty to such trade, as it holds a BNT reserve with which it can buy STX, and it has the sole permission to create STX which it can sell. Among the special properties of such token:

- Anyone can buy or sell STX at any time, without risk of not having a counterparty, and at predetermined cost (even “slippage” - exchange rate changes during the trade - can be calculated in advance).
- The total amount of STX in circulation can vary dynamically, as the market maker creates or removes STX.
- The core value of an STX unit is backed by its BNT reserve, assuring holders that the token has intrinsic value.
- BNT itself is a smart token backed by ETH, making conversion to and from ETH a simple two-step function.

More information about Bancor can be found on Bancor website and the Bancor white paper. Our data shows that STX will enjoy sufficient liquidity and volatility from day one, eliminating the need for pegging or stabilization mechanism. invest.com, committed to be the first provider on the Stox network, enjoys more than 8 million trades annually. Such activity volume ensures the required liquidity and achieving a critical mass of end users needed to create efficient trade.

[2] *https://www.bancor.network/static/Bancor_Protocol_Whitepaper_en.pdf*

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The Stox Ecosystem

The Stox Ecosystem will seek to establish a global decentralized network centered around prediction markets where users are able to discover and participate in events created by providers and operators. The ecosystem builds a long term cooperative operating model where providers enjoy the opportunity to innovate and compete for compensation, and users enjoy the diversity of experiences and the ability to profit from participating in a wide variety of prediction events.

Providers and operators

Providers develop the prediction market client apps, based on the open source implementation provided by Stox (the reference implementation). Providers may customize the app, to create a user experience according to their best practice.

The roles of a provider include:

- Provide users with access to the network through the original Stox app or release a branded version of the app according to the reference implementation provided by Stox
- Bring traffic into the Stox network by promoting the app to its customers

Operators create events and upon time resolve their real-world outcome. Upon creating an event, the operator determines the participation fee in that event, out of which the syndication fee will be paid to the provider. Any entity, individual or organization
can become an operator in the Stox network.

The roles of an operator include:

- Create prediction events that users will be interested in
- Act as a centralized reputable oracle for these events
- Provide the necessary collaterals and market maker reserves required for running these events

It is possible for a single entity to act as both a provider and an operator; similarly, a provider may integrate prediction markets from different operators in their app.

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The model incentivizes existing companies such as invest.com to join the Stox network as providers and operators. Hubs of similar financial instruments such as investment platforms, short term trading platforms, binary options, Forex can capitalize on their existing customer base by introducing them to prediction markets through Stox. Even companies such as William Hill that focus on online betting are incentivized to adopt STX and bring their customers into prediction markets on Stox.

invest.com will be one of the launch partners for the Stox network and serve among the first providers and operators. This will bootstrap activity in Stox from day one.

Stox

The official entity that creates the Stox token (STX), model and technology. Stox is focused on releasing open source cryptographic technologies that enable the decentralized operation of the Stox network.
The roles of Stox include:

- Create the Stox token (STX) and execute its token event to fund development and operation of the network
- Define the model for executing prediction markets over the Stox network in a secure, fair and decentralized manner
- Create incentives for providers to join the Stox network, adopt STX and introduce their customer base to prediction markets on Stox
- Develop the technology required for running the network such as Ethereum smart contracts that run prediction events
- Release the Stox app as an open source reference implementation for allowing users to participate in the Stox network
- Promote the Stox network by forming partnerships and marketing to bootstrap activity
- Dealing with regulatory aspects of the ecosystem

Stox Ltd. is incorporated as a for-profit company in Gibraltar. The revenues of Stox Ltd. will come from consulting services to companies that are using the STX platform and from its assets. Stox Ltd. does not operate events but may curate them in the apps it distributes.

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From individuals to an ecosystem

The power of the Stox network comes from creating a whole that is larger than the sum of its parts. Basing operation on a common currency, STX, will generate trust for users and mainstream audiences as well as provide a liquidity pool required for frictionless operation. Basing execution of events on a common technology will ensure interoperability between providers and a standard level of security and fairness throughout the network.

A decentralized ecosystem provides a robust model of operation. While specific nodes can always be shut down, without a centralized point of failure, new ones will emerge as the ecosystem keeps growing. The infrastructure is separate from the entities that act as providers and operators, minimizing the exposure to regulatory scrutiny and related costs.

Tools for growth

Providers are incentivized to bring traffic into the network and share their customers with other operators for fair compensation. A provider's app may display events operated by the same provider; providers may choose to display events they operate alongside other operators' events, in order to provide broader selection of events; some providers may be whitelabel curators bringing valuable events operated by 3rd parties to their users.

The syndication fee mechanism assures that such models are beneficial to both the provider and operator, since cross promotion of events is not a hard requirement of the network. The diversity across a broad range of categories will guarantee users enjoy larger variety of events in their app and find engaging matches for their personal interests and passions.

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The Stox Platform

Events

Events in prediction markets constitute the basic activity that prediction actions revolves around. An event has the format of a speculative question about the future. For example: “Who will win the upcoming soccer match between FC Barcelona and Real Madrid?” or “What will the opening weekend box office revenue for the upcoming Star Wars movie be?”

For simplicity and practical reasons, events on the Stox platform are required to have a discrete and well-defined number of potential outcomes. For example the soccer match mentioned above has three possible outcomes for a winner, either “FC Barcelona”, “Real Madrid” or “No winner” (in case of a tie, game cancellation etc). Events with continuous outcomes, such as the opening weekend revenue for Star Wars above, can be normalized into discrete ranges by the event creator.

Every event has a well defined and agreed upon resolution point. This is the point in time where the speculative question about the future is given a definite answer. For example, in the soccer match above, this is the point where the match ends and a victor is declared. The multiple potential outcomes of the event resolve into a single outcome that is a deemed winner and all other outcomes are deemed losers.

Event creation

The Stox platform is a decentralized system which allows events to be created by anyone, including users. In practice, we expect the vast majority of events to be created by providers. Creating events of quality is a laborious process that takes expertise. Consider events related to sports - this would includes following the various leagues, processing a realtime feed for every match in the list of available sports and formalizing an event for each one detailing the potential outcomes.

We expect different providers to focus on different niches of events. One provider might focus on sports events in certain leagues, while another might focus on politics in a certain country and a third might focus on movies and entertainment news. Users are expected to participate in prediction events they feel a strong affinity towards. Identifying these tastes and crafting events that will spark a passionate debate is the art practiced by seasoned event operators.

A new event is created by publishing a smart contract to the blockchain.
To create the smart contract, the operator determines the following parameters:

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- **Formal description**; The formal phrasing of the speculative question the event is attempting to predict. For example “Who will win the soccer match on date 1/1/18 between FC Barcelona and Real Madrid?”

- **List of potential outcomes**; A discrete list of all potential outcomes for the event. When the event is resolved, a single element of this list will be deemed winner.

- **Oracle**; Identity and characterization of the entity or process that will declare the official outcome of the event at the point of resolution.

- **Participation fee**; The event creator defines the fee charged from users for participating in investing in specific event outcomes. The fee is defined as a percentage from the investment made by a user. The event creator is free to make the fee as high or low as they want as fees are ultimately paid to them. Part of the fee can be reserved for event syndication by other providers bringing traffic to this event. The size of this part is also defined by the game creator. For example, the total fee for the game is 1%, out of which 30% is given to the provider who brought the user who made the investment.

- **Collateral**; To protect users from fraud and make sure deliberate false reporting by an oracle cannot be profitable, operators need to provide a collateral securing the event. Collateral can be put per-event, as a collateral in STX which is locked in a smart contract for 24 hours past event resolution by the oracle, or by linking the event to the operator’s CR collateral. Depending on the collateral type, its amount must surpass a defined proportion to the total amount of active investments in all outcomes. If a user disputes the oracle’s report on the event and wins this dispute, part of the collateral will be lost. The exact amount lost is proportional to the total investment amount on losing outcomes and divided between all users that have suffered a loss. However, all disputes are made publicly and we expect operators to strive to eliminate false reporting on both small and big events for risk of affecting their reputation.

- **Market maker reserve**; The event creator acts as a market maker for the event by providing a reserve in STX towards bootstrapping prediction as the counterparty for the first investments. The reserve size affects the rate at which the LMSR market maker adjusts the prediction ratios of the different outcomes. This reserve is expected to return to the operator, although it may diminish or grow as a result of the actual distribution of user speculations.

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Event participation

All investments in prediction of event outcomes are made with STX. A user can invest in a certain outcome with this workflow:

- The user performs a call to the smart contract's "buyOption" method with the following parameters:
    - Amount of STX to spend on shares of the outcome
    - The potential outcome to invest in
    - Provider address (for transferring syndication fees)
    - Optionally, a maximum price for outcome options
- The "buyOption" method is executed on the blockchain, allocating the caller with outcome shares according to the current market price.
- The amount of invested STX is locked in the contract until the event resolves, and the user is allocated outcome shares on the blockchain.
- Participation fees are deducted from the bet amounts according to the percentages defined on event creation. Syndication fees are deducted from the participation fees. Each fee is sent to its addressee.
- The user may liquidate part or all of her outcome shares by calling the "sellOption" method of the smart contract.
- If the user didn't sell all her outcome shares, she waits until the event is resolved and the oracle reports the outcome of the event
- If the user has shares of the correct outcome, she calls the "collect" method of the smart contract. The method will send its caller with the gained amounts according the the amount of outcome shares the caller has.
- In the next 24 hours, any user can choose to dispute the oracle's report by sending STX to the dispute smart contract. This will trigger a dispute process that is outlined below.

At any given point in time, users can see the current prediction of the market on event outcome. The prediction ratios are calculated according to the total amount of STX placed on each of the event outcomes.

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When a user participates by placing STX on an event outcome, they are effectively buying shares of the outcome payout. If the event resolves to a different outcome, shares of the losing outcomes are worth zero and STX placed on the outcome is lost. If the event resolves to the predicted outcome, the user may collect her share of the payout according to the amount of outcome shares they have. The price of outcome shares fluctuates as the event progresses and more investments are made. The price is derived from a variant of LMSR market maker algorithm, coded into the event participation smart contract, which takes into account the total amount of STX placed so far on each of the potential outcomes. More details on market makers and LMSR are provided in the technical considerations section below.

The steps outlined above are performed by users using the official Stox app or a derivation of this reference implementation app released by a specific provider. The purpose of the apps among others is to abstract the technicalities of the process and provide an easy to use product with minimal friction and a great user experience.

Event discovery

Providers act as curators of events, maintaining up-to-date databases of categorized events, and distributing these databases to client apps using decentralized file storage network (see “Stox P2P Protocol” in the technical considerations section below).

The reference implementation of the app sorts events by default and display active events first (events with at least one investment made on one of its outcomes). Providers may distribute proprietary apps derived from the reference implementation, in which they can choose other sorting methods and filters to use on displayed events.

Syndication mechanism

Events have part of their participation fee designated for syndication by providers who bring traffic to the event. When an outcome investment is placed by a user via the event smart contract, and this activity was facilitated by the syndication mechanism by another provider, this provider address must be included in the transaction. If there is no syndication involved, the operator’s address should be used. Syndication fees are paid directly to this address.

Using this mechanism, providers are incentivized to share their own traffic with events from other providers and help their own customers discover events created by others.

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This mechanism enables providers to engage their users in other operators' events, when the provider's collection of self-operated events does not suffice. The provider is paid for his part in bringing the user to the event, compensating for the sales and marketing costs of such. The mechanism assures the user remains in the provider's app, helping the provider to retain his customers rather than risk losing them.

Unrelated to the syndication mechanism, providers may have their own traditional affiliate programs to incentivize traditional affiliates (who deal with traffic) to promote their apps. In this case, any user the affiliates bring to the provider and is staying in the provider's app for a long time period, is expected to yield a larger reward. These programs may form separately and the Stox platform is not directly involved in them.

Promotional credit mechanism

Providers can provide users with promotional credit in order to reduce barriers for first play. Similar mechanisms have been used successfully in related industries and have shown to increase user engagement with the platform in a significant manner. This mechanism has been adapted to the decentralized nature of Stox.

Using promotional credit, users can start playing and place STX on outcomes before going through the friction of buying STX. Promotional credit is given in STX. The provider can set an expiry time for this credit. If set, the STX credit will return to the provider address unless used on an event before the expiry time.

Promotional credit mechanisms are subject to Sybil attacks. It's under the provider's responsibility to mitigate this risk and make sure that users that are about to receive credit are not fake ones. The provider can use any validation method for this purpose, for example verify the user's phone number.

The promotional credit mechanism is implemented as part of the Stox token smart contract. When promotional credit is given, a new Ethereum wallet is created for the user. This wallet is marked in the on-chain ledger as a promotional one with the required expiry time. Tokens from this wallet can only be used to participate in an event prediction. This is enforced by allowing tokens from this wallet to only be sent to specific event smart contracts (as investment in outcome shares). Promotional credit can be locked to events created by the issuing provider only, and will return unspent credit back to the provider if the expiry time has passed.

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Collateral mechanism

Event operators are required to provide a collateral in STX which is locked in a smart contract for 24 hours past event resolution. The collateral amount should be proportional to the amount of STX placed on all outcomes.

One of the purposes of the collateral is incentivizing event operators to choose trustworthy oracles and report event outcomes accurately. If there was a successful dispute on this event, the losing parties which invested in losing outcomes would receive part of the collateral in proportion to their total losses.

Should the collateral be made to be required or optional? If the collateral is required, the barrier for creating events is increased and regular users will create significantly less events by themselves. This is probably not a problem since we expect most quality events to be created by providers. If the collateral is optional, we are trusting in users to prefer events with high collateral. Our current recommendation is making the collateral required.

How high should the collateral amount be? A general guideline is that the collateral should be high enough to compensate losing parties in case of dispute. We can allow event operators to put more tokens than needed into the collateral to generate more trust with users. If a mechanism that reverses all event payouts on a successful dispute is implemented, this will also guard against investor loss due to incorrect reports and can make the required collaterals smaller. The drawback of this approach is reducing market activity due to freezing event profits for 24 hours on average past an event end. The two different approaches can be experimented with during the development process to measure their effect in practice.

Oracles and dispute mechanism

One of the challenges in implementing a trustless decentralized system for prediction markets is event resolution. Decentralized implementations traditionally rely on trustless smart contracts that are executed on-chain. Smart contracts are limited in their ability to read data outside the chain because there is no way to guarantee different nodes will receive the same results or that the results will not be manipulated. Since the majority of events are tied to actual events taking place in the real world, the source of truth for their outcome is naturally external to the chain.

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The common solution to this problem is relying on an oracle to report event outcome from the real world onto the chain. Once the oracle has reflected external outcome on-chain, this data is available for consumption by the various smart contracts implementing the system.

One of the design principles behind the Stox platform is no compromise on practicality of actual use. The purpose of the Stox network is to become the leading enabler for high scale prediction markets and encourage mass participation of mainstream users in prediction events. As such, mechanisms like decentralized oracles with slow convergence and resolution times are impractical and provide a subpar user experience. Instead, we propose a mechanism of fast resolving centralized oracles protected by a decentralized dispute mechanism.

When creating an event, its operator is required to specify the address of the oracle associated with the event. The platform is agnostic to oracle type, so decentralized oracles can be used as well, but in practice we expect most event operators to specify their own address as oracles, so that the operator's private key is required to sign the oracle report. This means many oracles in the system will be inherently centralized. The system transforms every centralized oracle into effectively a decentralized one by providing a decentralized dispute mechanism for users who disagree with an oracle's report.

Various approaches for resolving disputes in a decentralized manner are considered. The default method is to resolve disputes using consensus from other members of the Stox network. The mechanism follows the frontrunner method: the disputing party must place tokens on the line against the oracle report. Anyone in the network can agree or disagree and put tokens on the line as well. The frontrunner is the side (agree/disagree) that has the most tokens on the line so far. If the frontrunner doesn't change in a period of 24 hours, we have a victory and the dispute is resolved. The victorious side shares all the tokens from the losing side, which is penalized by losing all tokens put on the line. This dispute mechanism can be implemented in a trustless and decentralized way using a dedicated smart contract.

An alternative model for dispute resolution relies on polling of random users of the ecosystem as to the true event outcome. Ideally, only users who aren't involved in the disputed event will be picked. In addition, chances of being picked should depend on amount of STX held to deter Sybil attacks. Users will be incentivized to respond to the poll using funds from the collateral (if the dispute wins) or the disputing party (if the dispute loses).

We expect the majority of events in the Stox ecosystem to be created by established providers. Since providers are compensated in proportion to the volume of STX placed on outcomes of their events, successful providers will grow by increasing their customer base and attracting more traffic. Creating a loyal customer base goes hand in hand with maintaining a trustworthy brand. This

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gives strong incentivization for providers to act as truthful oracles and avoid public disputes of its reporting, rendering the dispute mechanism unnecessary in practice in the vast majority of cases.

Review of platform incentives for providers and operators

The Stox platform model provides the following incentives for providers and event operators:

- Operators are incentivized to create popular events because they profit directly from investment fees charged for participating in these events.
- Syndication fees incentivize providers to advertise to customers and promote Stox in order to get traffic for their events.
- Providers are incentivized to serve as truthful oracles and report event results accurately. If a provider fails to do so, it stands to lose its collateral under a dispute process. In addition, it jeopardizes the reputation it has won with its customers.
- Providers are incentivized to share their own traffic with syndicated events and help their own customers discover events by other providers. If a user did not find a suitable game in the provider's portfolio of self-operated events, it makes sense for the provider to promote events from other providers, earning a syndication fee and keeping the user engaged.
- Providers are incentivized to participate in the token sale and hold significant amounts of STX. Since collateral and reserve are required for creating a large number of concurrent events, a provider will need to hold STX to grow and create more events. Special discount is offered for sale of tokens intended for operator use.
- Providers are incentivized to customize the reference implementation of the Stox app and release it with their own branding. Once users choose this app, there's better chance for retention and repeat use. If providers make smart use of syndicated events, users are unlikely to use multiple Stox-ecosystem apps, since they're likely to contain the same events.

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Review of platform incentives for users

The Stox platform model provides the following incentives for users:

- Users have a single significant incentive under the model - play in a prediction market with a chance to win more money than you put in. This financial instrument is not available to most users due to excessive regulation, so a decentralized approach that prevents external regulation lowers the barrier of participation for everyone.
- New users can be incentivized to start playing by receiving promotional credit from a provider.
- Users are incentivized to open a dispute against an oracle report only if this report isn't truthful. By jeopardizing more tokens for dispute, users are deterred from abusing the dispute process.

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The Stox App

Stox will develop and publish a client for the Stox platform in the form of a fully functional prediction market app. The app will be open source and implement the user side of the model including on-chain access over Ethereum to Stox smart contracts and access to content, listings and event metadata from decentralized cloud storage.
The app is aimed to run on the following platforms:

- Native application for Windows
- Native application for Mac
- Native application for Linux
- Native application for Android

Besides source code, Stox will place a pre-built version of the app binary for download in multiple public locations on the web. These public locations may include decentralized networks like

BitTorrent (via easy to use web-based client interfaces like instant.io) to guarantee they are resilient and always available. PGP signature of the binary will be placed on the official website and will allow users to verify that the binary has not been tampered with.

Once a user downloads the app binary successfully, they will be able to run it locally on their computer. The app will provide a fully functional P2P prediction market client. Anyone will be able to use the app to place actual STX on event outcome and use the product in real life. Since the app is designed to be completely peer to peer, it does not rely on any centralized points of failure. Future versions of the app will include a mobile version that will run natively on iOS and Android devices and web-based versions that will run inside a web browser without the requirement of local installation.

Reference implementation

The official Stox app will be published as open source software on GitHub and serve as the formal reference implementation for a fully compliant client to the Stox network. To maintain compatibility with the Stox network, the following aspects of the app must be maintained:

- Reliance on STX as the token of choice for all network activity
- Usage of the official Ethereum smart contracts of the Stox platform
- Compliance with the Stox P2P protocol for peer-to-peer event discovery

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Derived and customized versions

Any entity, individual or organization is encouraged to alter the official reference implementation and release their own branded and customized client to the Stox network. This is true for providers in particular as they are encouraged to perform this process in order to provide their customers with their branded experience. By specifying their own provider address as a syndication address when calling event methods, providers will enjoy the syndication fee paid by third party operators for investments made by users of their app.

Stox will publish an open source customization SDK with tutorials and documentation to make the customization process as easy as possible. This is crucial for encouraging providers such as invest.com to adopt Stox while retaining their own brand identity.

The following aspects of customization will be officially supported and documented:

- Changing the UI, graphics, colors and branding of the app
- Setting the provider address for syndication fee settlements
- Modifying the UX for participating in an event in order to provide innovative industry-specific event experiences
- Customization of the event discovery process by changing the filters and sort order of displayed events from across the network

It is important to emphasize that derived and customized app implementations are not forks of the Stox platform and are not forks of the Stox token STX. Derived implementations are simply a different client for the same network providing a different user experience while maintaining the core characteristics of the network such as reliance on STX for event participation.

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Product concept and screenshots

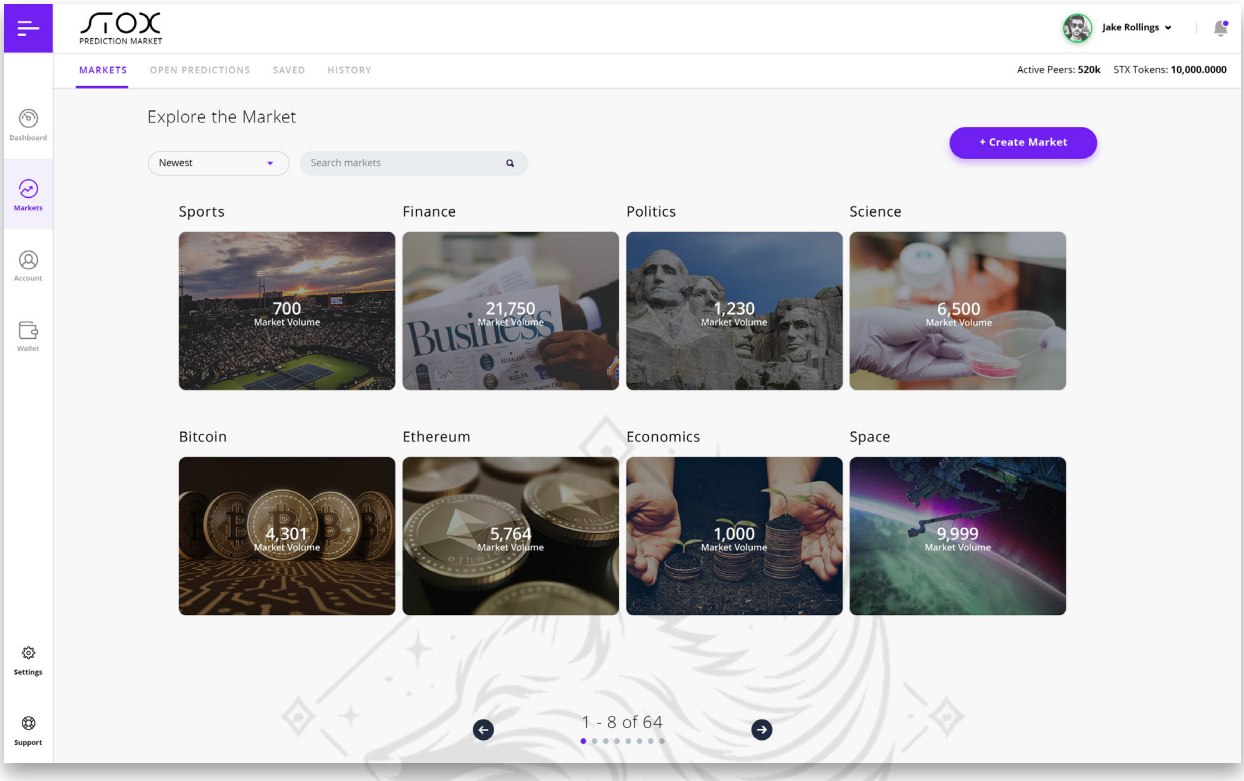


Illustration 1 - Exploration and event discovery in multiple categories

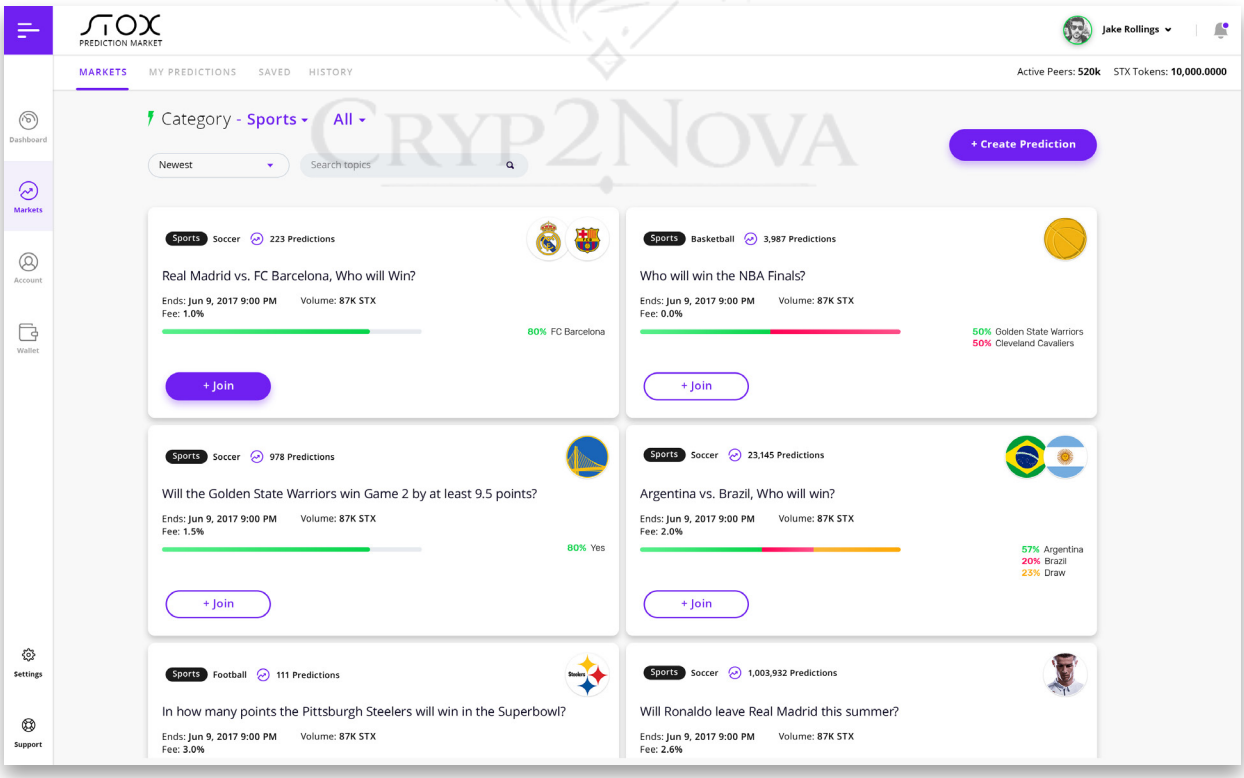


Illustration 2 - Detailed listings of active prediction events ready for participation

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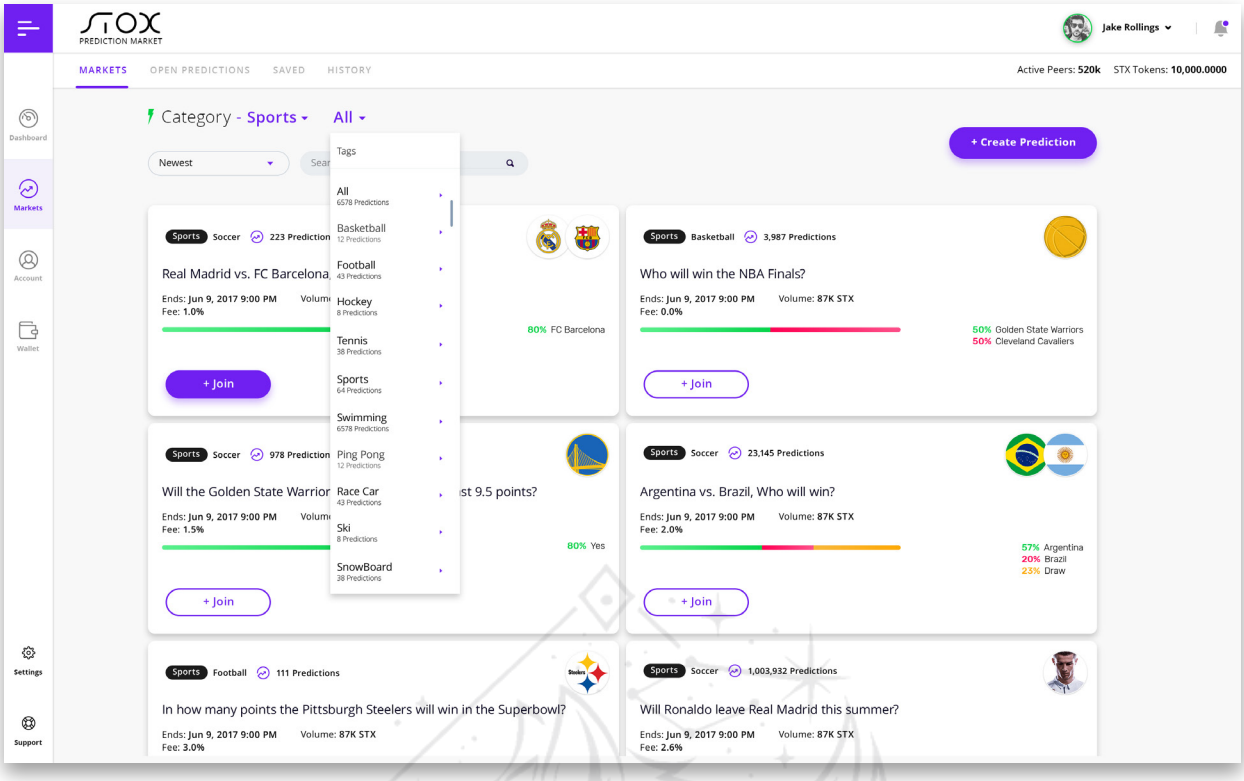


Illustration 3 - Event filtering by category

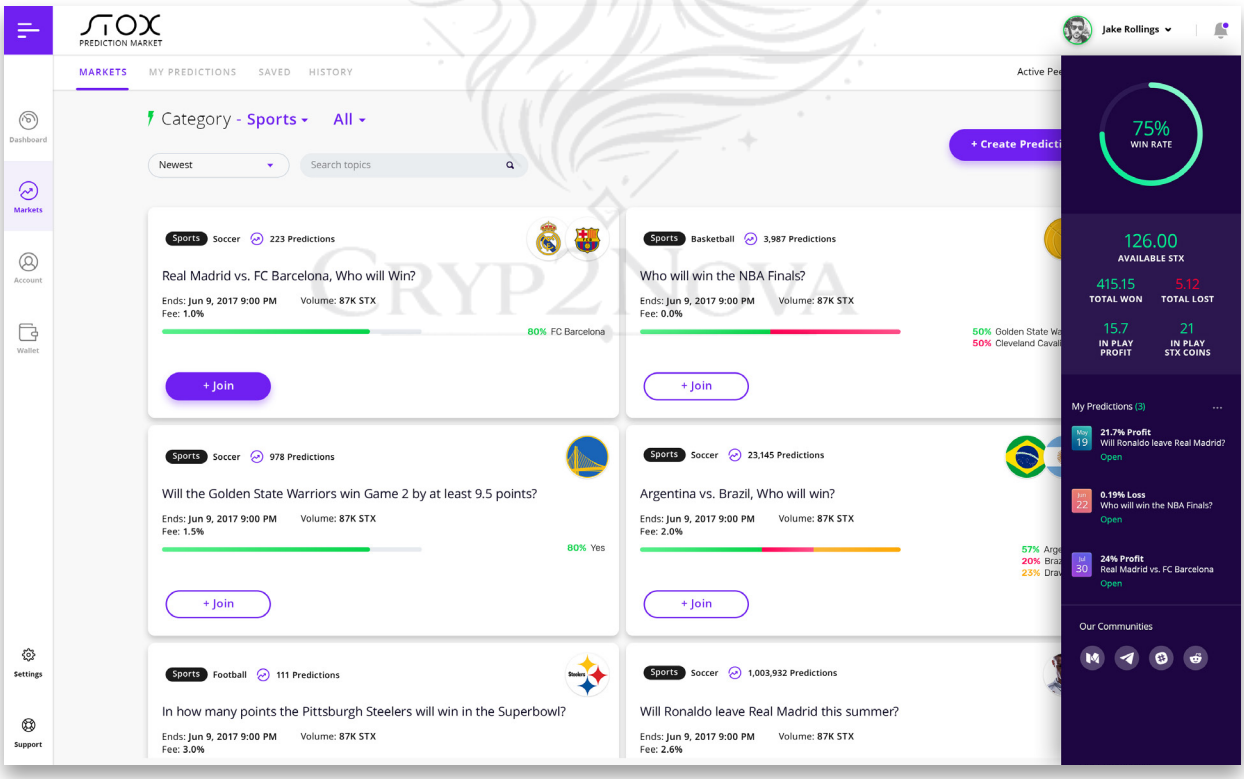


Illustration 4 - Account overview and STX balance

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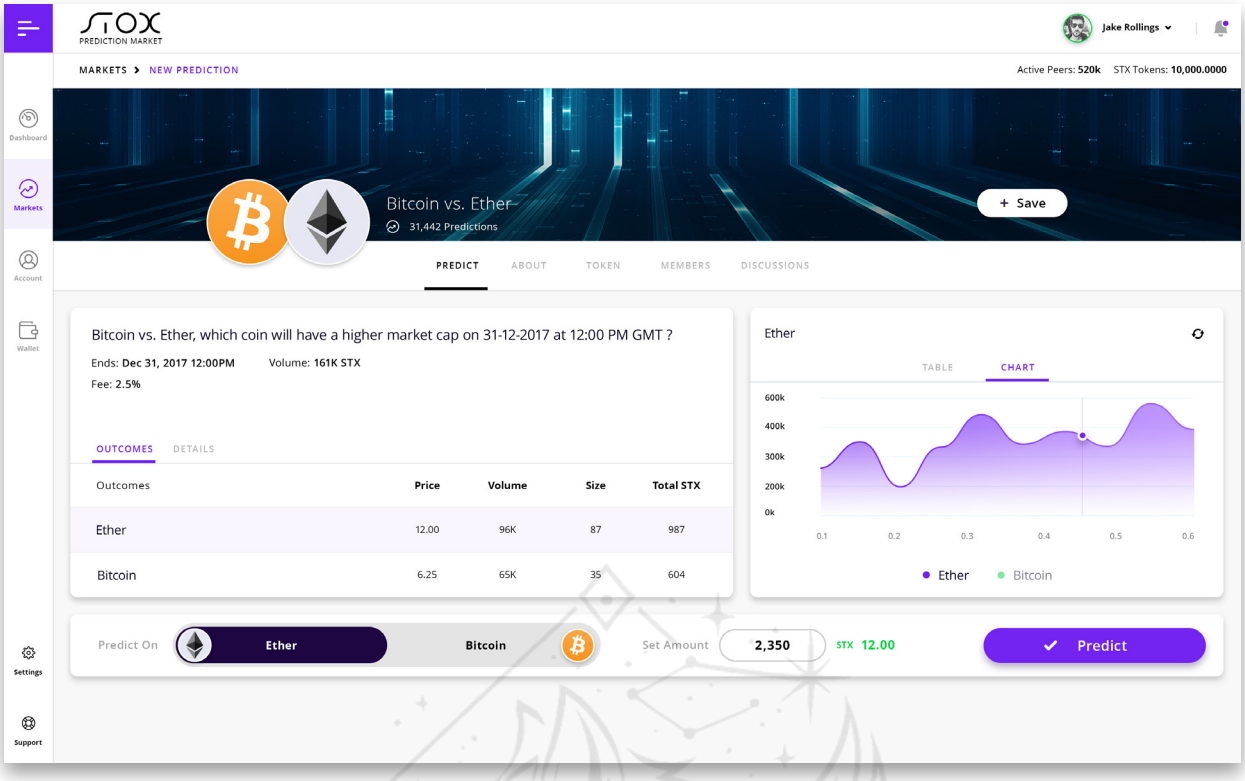


Illustration 5 - Details about a specific event with ratio history

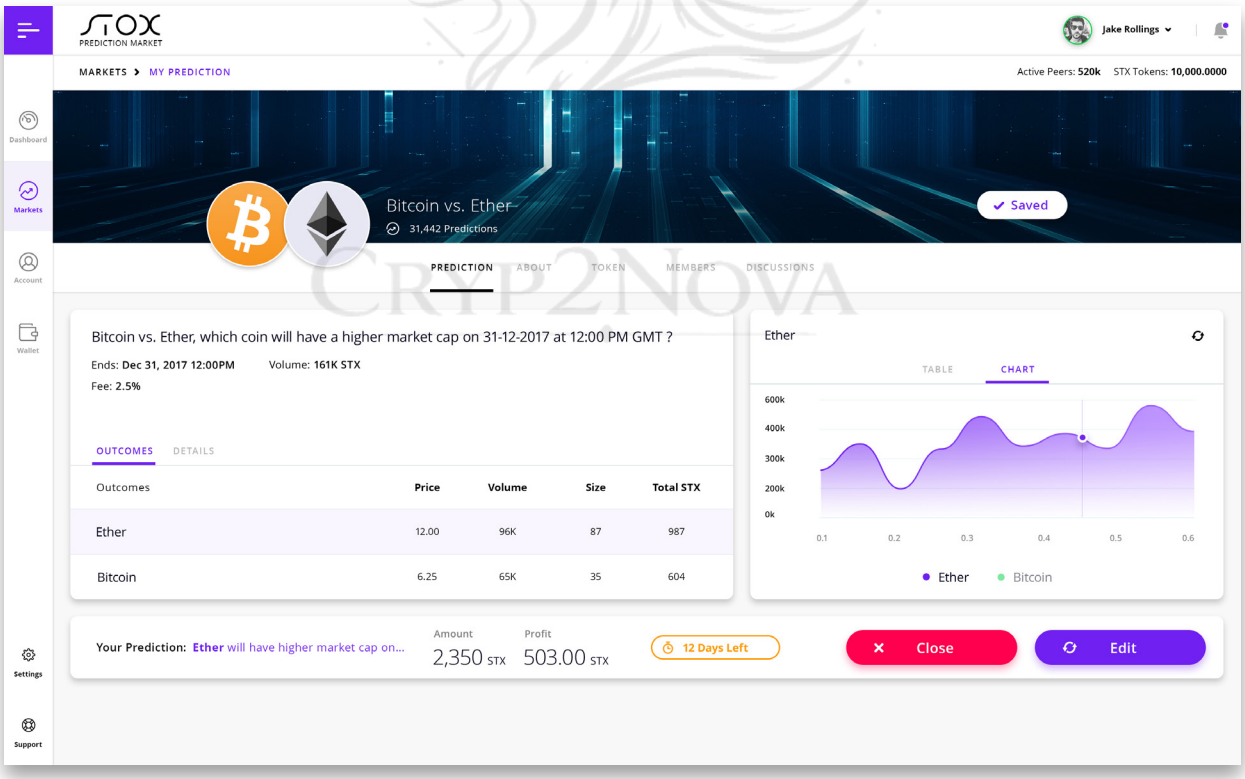


Illustration 6 - Managing an active prediction in real time as events progresses

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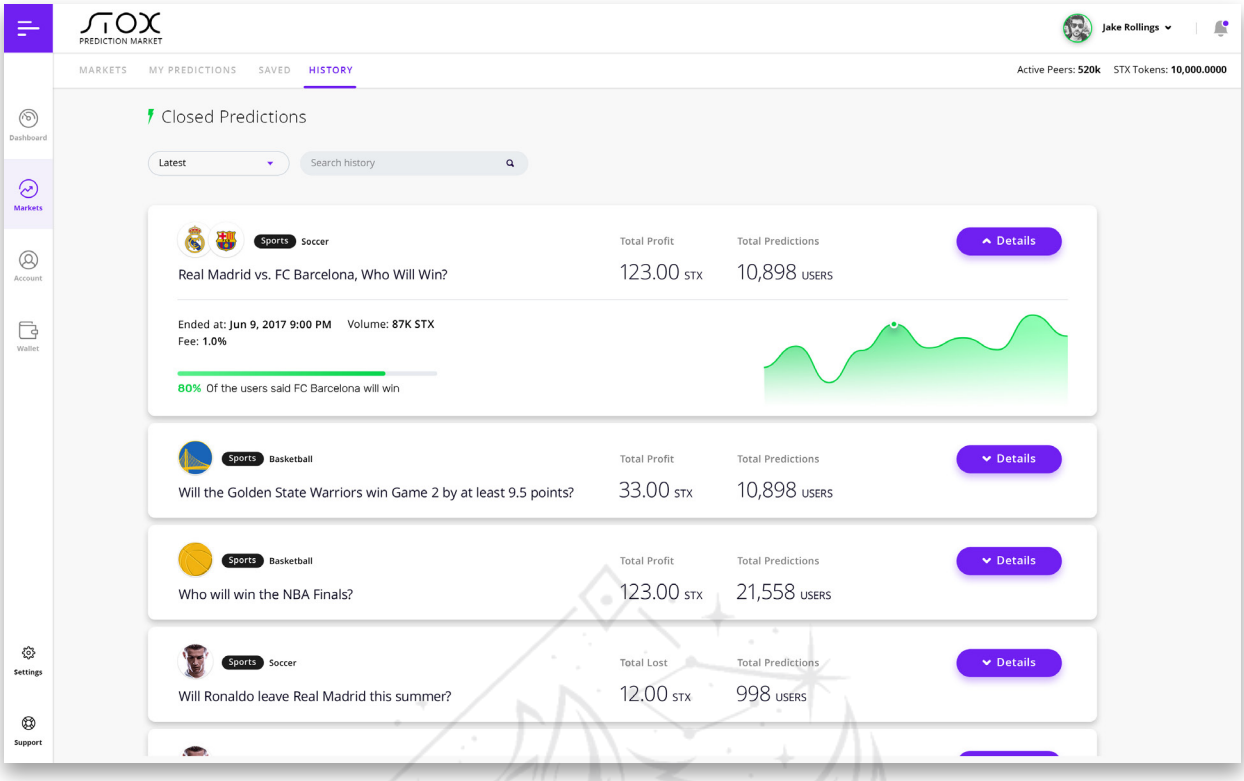


Illustration 7 - Platform history and closed predictions



Illustration 8 - Mobile App platform

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Competitive Analysis

Prediction market platforms are among the more successful projects utilizing blockchain technology and applying it to a real world use case. The market has reached a certain maturity and several excellent implementations are already available. This section aims to discuss the differentiators of Stox compared to competing implementations.

Traditional option markets and betting exchanges have provided a centralized platform for predicting discrete events outcomes. These platforms have always attracted users, proving beyond doubt the appeal of prediction markets to the masses. These centralized platforms are plagued by over-regulation and are limited in their capacity to serve broad audiences. Since they are not competing directly with Stox due to the decentralized nature of the Stox platform, they are beyond the scope of this discussion.

Stox is introduced to a market already offering two prominent decentralized implementations - Augur and Gnosis. Both carried out successful ICOs and paved the way for blockchain-based solutions in this field. The estimated target market for these solutions goes well beyond the crypto community and is large enough to host multiple projects focusing on different aspects of the problem. Moreover, we expect that because the different solutions can each have advantages in their area of focus, there could be opportunities for arbitrage between events on the different networks.

Augur

Augur is a hub for market making activity, giving ample focus to generating data and testing prediction market theory in an applied setting but with a declaratively purist approach. For example, Augur's oracle system is completely decentralized which is fully aligned with the ideals of a truly trustless and fair system. The trade-off of this approach is that events are slow (8 weeks) to resolve and the feedback cycle for event participants becomes impractical for most mainstream audiences looking for a viable investment channel.

Gnosis

Gnosis, on the other hand, positions itself as a platform for building decentralized prediction market applications with focus on the production of actionable information. The project looks far beyond the trade engine and the economy of prediction markets as a business, and declares a mission of transforming the large set of prediction market data points into meaningful information

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that can be utilized by human and AI decision-making agents. The end goal revolves around knowledge - making it simpler and easier for users to gain insights into complex topics and make more well-informed decisions. This focus opens up a diverse world of indirect applications for prediction markets such as insurance and asset hedging.

Stox

Stox is designed, first and foremost, as a practical framework for mainstream investments in prediction markets. Several key factors in its structure were put in place to accommodate proven business practices in distribution and operation of prediction markets, for example:

- Smart contracts that process syndication fees, enabling incumbent marketing channels and cross promotion of events between different providers;
- Smart contract support for promotional credit, enabling marketers to lock tokens for use with a specific provider and limiting their lifetime;
- Capital requirements on operators are aligned with common regulator requirements for MSBs and betting licenses;
- Quick event resolution, separate from dispute processing;
- A liquidity-sensitive market maker, curbing the operator's need to predict amount of activity in an event for determining the optimal market-maker deposit

The focus of Stox is to create a sustainable economy revolving around a functioning prediction market where investors can find refuge from traditional financial instruments and participate in prediction events with the purpose of making profit. Stox views prediction markets as a business, where those who possess information of a greater quality and are able to make better informed decisions can leverage this knowledge for personal material gain by investing STX in event outcomes.

For Stox to carry out its mission, the trade engine must be practical and able to operate at a velocity that satisfies its users. This, for example, lead us to design the oracle mechanism with the assumption that it would usually use a centralized oracle, which - contrary to the decentralization ideal - mainstream users do not normally consider a disadvantage.

The main utilization of the Stox token serves the same goal - driving the economy. STX is an integral part of the prediction and investment process. It serves more than a sideline mechanism for oracle

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reports, and it goes beyond being an alternate currency for fees. All activity in the Stox network revolves around STX. In addition to serving as the primary form for fees and collaterals, it is also the main currency participants use for investing in event outcomes. The fact that STX is a special-purpose currency enables providers to offer their customers with exchange services from fiat, without needing to become general-use exchanges.

Stox was designed by veterans of the online trading industry, using the knowledge and experience acquired by invest.com, an established online financial company which has been operating in the investment field since 2014. invest.com's trading platforms accommodate over 3 million registered users and facilitated more than 8 million transactions last year alone. invest.com currently employs over 200 employees across 5 countries, providing the solid foundation and infrastructure of the franchise to bootstrap the Stox network.

Combining expertise in regulated markets together with blockchain technology creates a unique solution for prediction markets that are tailored towards approaching the masses. Stox is creating a robust business model that incentivizes other providers and industry leaders with existing customer bases, such as invest.com itself, to join the Stox network and drive traffic to the network. Event syndication between providers carries this traffic beyond the confines of a single provider. Providers are motivated to cooperate as part of a larger network. On the other hand, users will enjoy a well-rounded selection accommodating their diversified interests, increasing overall engagement.

The following table summarizes the key differentiators between the three platforms:

Feature	Stox	Gnosis	Augur
Support for decentralized oracles	✓	✓	✓
All funds held by contract	✓	✓	✓
Quick market resolution	✓	✓	✗
Scalable platform	✓	✓	✗
Diverse applications such as insurance	✗	✓	✗
Focus on single token economy	✓	✗	✗
Past experience in regulated markets	✓	✗	✗
Business model for growth via providers	✓	✗	✗
Critical mass of users on launch	✓	✗	✗
Unlimited liquidity using Bancor protocol	✓	✗	✗

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Roadmap

The end goal for Stox is to create the leading decentralized prediction market used by mainstream audiences by maintaining a thriving ecosystem of users looking to invest in event outcomes and providers looking to create events and be compensated for operating them. The main role of Stox is to develop the open source technology required for running the decentralized Stox platform and network and create a successful model incentivizing both users and providers to join the network.

The Stox platform is built with the solid foundation of invest.com's infrastructure, resources and franchise. invest.com's main product to date is an investment and trade platform with multiple apps used in production by investors in traditional markets over a large variety of financial instruments such as currencies, commodities, indices, shares and CFDs. Apps include both a web-based trade platform and online portfolio management and a set of native mobile apps for iOS and Android. invest.com's products cater both to professional investors and hobbyists / first-time traders. Invest Pro platform is optimized for professionals while the Invest Simple™ platform is optimized for a user-friendly experience with intuitive controls abstracting most of the complexity behind online trading. The experience gained by catering both types of audiences is key to designing an easily accessible platform for prediction markets that will successfully engage mainstream audiences.

invest.com's experience with regulation and ability to bootstrap the network with its existing customer base will drive traffic to the Stox network from the first days after launch. invest.com will also leverage its ties in the trade field to bring additional established partners as event providers to the Stox network.

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Milestone 1 - development of the Stox Platform

The first milestone after raising funds through the token sale is implementation of the decentralized Stox platform according to the guidelines outlined in this white paper. We are seeking feedback from the community regarding the specifics of the model and plan to iteratively improve the model in order to reach a platform that is both secure and fair.

Some of the model parameters, like collateral amount requirements, will be tweaked over time in a discretionary manner and according to feedback by experimenting over actual events to analyze

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actual impact on operation of the network.

The main part of the decentralized platform will be implemented as a set of Ethereum smart contracts carrying out the behaviors described in the Stox Platform section of this document. The official smart contracts will be published as open source software on GitHub. The contracts include implementation for:

- ERC20-compatible implementation of the STX token itself including basic functionality like trading tokens between addresses
- Creation of a prediction event, specifying the formal description, discrete list of potential outcomes, identity of the oracle, participation fee particulars and syndication fee particulars
- Per-event collateral system locking an STX amount from event creation until 24 hours after game resolution
- Provider CR collateral system locking an STX amount for long periods, which can be used as alternative to the per-event collateral system
- Market maker implementations, with both a standard LMSR and a Liquidity-Sensitive automated Market Maker variant, controlling the current price of outcome shares based on total STX placed on the various event outcomes
- Ability for event investors to buy and sell event outcome shares according to the LMSR market makers during an active event that has not been resolved
- Verification of an event details, reading its various parameters, current totals of STX placed on the various outcomes and the current prediction ratios
- Oracle report mechanism for game resolution
- Dispute mechanism for users to object to oracle report jeopardizing the event creator collateral
- Promotional credit mechanism locked for participation in events by specific providers for a limited amount of time until refund

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Milestone 2 - development of the Stox App

While the first milestone concentrates on backend of the system, the second milestone concentrates on frontend and end user experience. Stox will release a reference implementation of the Stox app according to the guidelines specified in the relevant section of this document. The app will be released as open source software on GitHub. Conceptual screenshots of the app can be seen as well in the relevant section.

The app is planned to be developed using cross-platform web technologies using the electron framework. The app will include a thin Ethereum client based on a standard open source implementation that will allow the app to communicate with the various smart contracts that make the Stox platform. Initial versions of the app will be published in various online locations to allow users to download and operate the app without building it themselves from source code.

Planned functionality of the app in the reference implementation includes:

- Ability to create an STX wallet, see current balance and perform basic transactions
- Ability to buy and sell STX using various fiat currencies using dedicated specialized third party providers which will provide a streamlined process
- Ability to consume promotional credit
- Security and protection of the local wallet operated by the app
- Event discovery using a event categories published by various providers and a sorted list of events under each one
- Search and filter of events during the event discovery process
- Event details screen explaining the formal question, event details, various outcomes and current investment ratios for every outcome
- Calculator of event participation showing the potential profit and loss per investment amount on a specific outcome
- Ability to participate in an event and invest STX in a specific outcome
- List of active predictions and the current profit/loss ratio for each one with the ability to cash out instead of seeing the event through

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Milestone 3 - launch with invest.com customer network

As development of the platform and app moves forward in parallel, the first execution milestone of the model is using customer infrastructure provided by invest.com. By leveraging invest.com's ability to market the app to its existing active user base, mainstream traffic will be directed towards the Stox network and real users will be introduced to an operable prediction market.

In order to test and tweak the platform and app implementations as early as possible, this process will not wait until development is finalized. We plan to launch experimental beta versions of both as soon as a minimum viable product is available. User participation in the network may be limited during initial testing periods.

It is important to emphasize that invest.com will only be the first provider, bootstrapping network activity. Additional established providers interested in experimenting with the network in its earliest beta stages are welcome to join; the platform is fully decentralized and does not favor one provider over another. They can choose to provide and distribute their own Stox-based app (becoming "providers"), or create events, provide the oracles to resolve them and act as market makers during user participation in investing in event outcomes ("operators").

One of the goals of the initial launch is to experiment with various model parameters and analyze their effect over network behavior with actual users. We believe that without practical measurements and analytics, we will not reach an optimum of incentives for both users and providers.

Milestone 4 - development of an ecosystem member SDK

While bootstrap of the Stox network is expected to take place with initial launch partners such as invest.com, the network will not thrive until more providers join in. The model incentivizes providers to compete for compensation by creating events in the network. Providers are also expected to drive traffic into the network by marketing an app to their existing customers.

It is expected that not all providers will choose to market the official Stox app and prefer a branded version of the app that will prioritize their own events over third party events in the network and maintain the relationship with their own customers under their own brand and their own control. The purpose of the ecosystem member SDK is to make rebranding of the reference implementation as easy as possible. The SDK will give providers immediate access to all required

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technology to release their own derivative of the Stox app and create a fully functional prediction market app under their own name in minutes.

The Stox platform incentivizes providers to promote syndicated events. The reference implementation will always prioritize the provider's own events for users of their own app. Users that are not satisfied with these events, for example those seeking events in other categories that the provider does not specialize in, will be given access to events by other providers sorted by syndication fee. This enables the provider to profit from users which would otherwise not participate in an event. The ecosystem member SDK will set the correct wallet address of the provider for syndication compensation purposes.

The various customization supported by the SDK are described in detail under "Derived and customized versions" in the Stox App section of this document, and include:

- Rebranding of the reference implementation with their own logo, name and colors
- Setting the provider address for syndication fee settlements
- Modifying the UX for participating in an event in order to provide innovative industry-specific event experiences
- Customization of the event discovery process

Milestone 5 - growing the ecosystem

With the majority of required technology for operating the Stox network at scale available (the platform, the reference implementation app and customization SDK), the main focus of the Stox team will shift from development to growth. Investment in network growth will not wait until all development is finalized and will take place in parallel as soon as viable versions of these products are available for preliminary release.

Growth of the network is two sided. The first side focuses on providers. The Stox network will benefit from as many providers as possible joining the ecosystem. Providers are the main creators of events in the network and serve as engines for driving traffic to the network. Providers consume STX for collateral and market making as they are depended on STX to operate. Channels for attracting providers include forming partnerships with established companies in adjacent fields, promoting the Stox model among individuals and organizations with access to relevant customer bases and providing guidance and support to new providers interested in joining the network in order to make the process as friction free as possible.

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A more aggressive approach to bring providers into the network includes pre-creation of a branded app for relevant entities that can profit from acting as providers and approaching these entities with a ready-made solution that only requires advertizing in order to turn profit. Since advertizing to an existing customer base does not require significant investment, potential providers will be in a position to generate an additional revenue stream with very little effort.

The second side of network growth focuses on end users. The more active users in the network, the more participation in events and the greater the profits for providers. Greater participation will increase the demand for STX and increase the network value. Channels for increasing the Stox user base include marketing and promotion of the Stox app to relevant audiences, marketing and promotion of specific events that are likely to have strong user engagement and promotion of education about prediction markets in general.

Attracting more users is not the only avenue of growth as improving engagement of existing users is equally important. User retention in the network can be increased by ongoing improvement to the core product. Such improvements will be published as updates to the reference implementation and encouraged to be adopted in derived apps as well. The standard practice of ongoing improvement includes monitoring app usage, analyzing user behavior and introducing iterative product changes while measuring their impact on key performance metrics.

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Funding breakdown

Figure 1 summarizes Stox project expected use of proceeds, assuming we raise $30M USD denominated in ETH in our token sale.

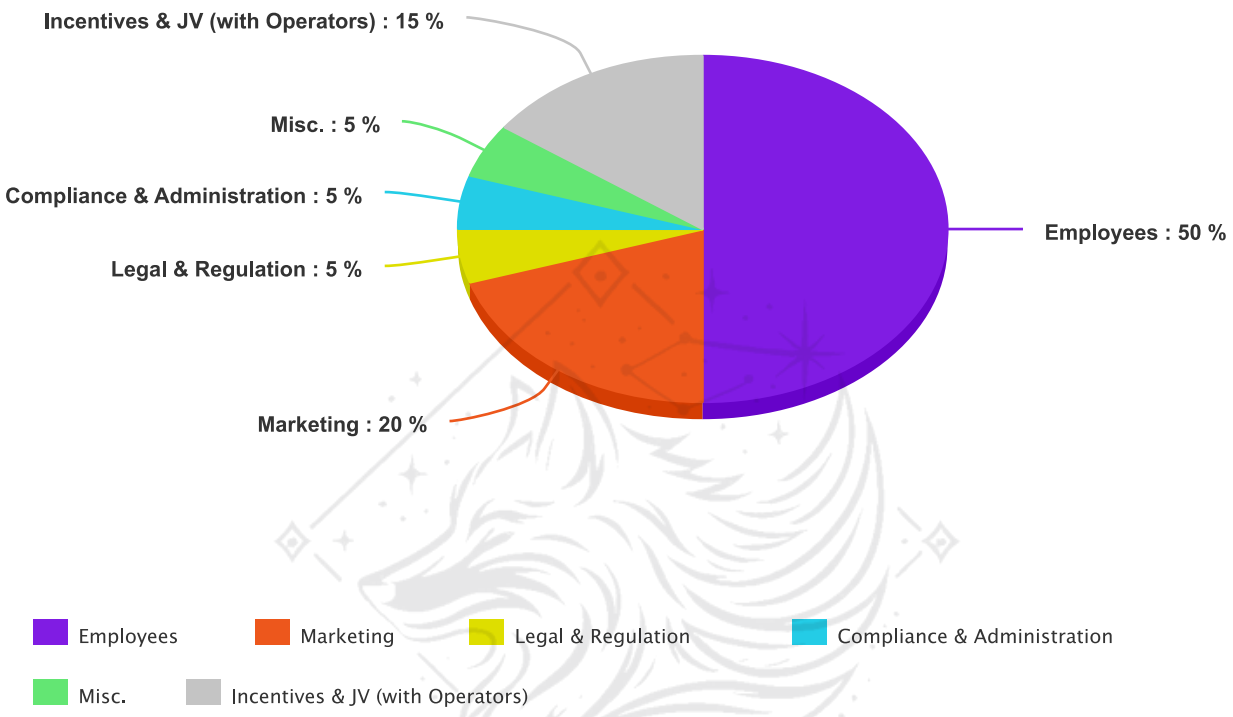


Figure 1 - Stox Project Expected Use of Proceeds

- Employees; Developing the Stox platform involves substantial R&D expenditures. As described in the Milestone section above this includes all components of the Stox platform as well as the open source app.
- Marketing; Our marketing efforts include enhancing cooperation with potential providers and operators in order to allow as many of them to join the platform. In addition, we plan to focus efforts on marketing the platform to the broad audiences, acquainted traditional centralized prediction markets.
- Legal; Legal efforts include among others incorporation, regulation, compliance and ongoing operation.
- The expected breakdown may be altered as the project progresses.

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Token Issuance

In order to finance Stox's road map, Stox will conduct a token sale of an initial supply of STX tokens. STX will be sold at a constant price (in ETH) and the initial supply will depend on amount of STX sold. As of the conclusion of the sale, the distributed STX will constitute the entirety of the available liquid supply. A portion of the supply would be preallocated to invest.com as the founding member of the ecosystem, in a long term vesting schedule. Major portion of the allocation to Stox Ltd. will be used for bringing further strategic partners to the Stox platform.

The STX distribution is summarized in the table below:

% of Total Supply	Beneficiary	Special terms
50%	Token sale participants	Coins cannot be transferred until end of token sale period
12.5%	invest.com Ltd.	Uniform 12-month vesting schedule
10%	Stox team	Uniform 24-month vesting schedule
27.5%	Stox Ltd.	Will be used to bring strategic partners to the Stox ecosystem, and as operational reserve.

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Sale event

The sale event will start in the following weeks and continue for 14 days, or until the sale cap of ETH is reached. Participation instructions will be published on the Stox.com website.

STX price will be fixed (in ETH) throughout the sale. The STX price will be published on the Stox.com website before the sale starts.

After the event

After the end of the sale period, Stox will deposit 4% of the STX market cap in BNT as the currency reserve of STX, thereby activating its Bancor Smart Token features. From this point forward, the smart token's market maker will enable anyone wishing to buy or sell STX to do so at a determined market price. At the moment of activation this price is equal to the token sale price, and later it may fluctuate according to market supply and demand. Further details about STX as a Bancor Smart Tokens can be found under Bancor as a token platform above, and in Bancor's documentation.

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Founding Team

Ophir Gertner

Founder, Chief Strategist

An entrepreneur at heart, Ophir has a strong track record of developing market-leading products and services, including technology start-ups and real estate development. He has a wealth of international experience, including leadership roles in several companies and over 15 years' experience in financial markets. Founded invest.com, the fulfillment of an aspiration to harness technology and financial expertise to provide a genuine investment alternative to enhance the lives of retail investors.

Yossi Peretz

Chief of Operations and Technology

Skilled COO and business development professional with a proven track record in the financial services industry. Skilled in leading global business activities, operations management, technical support, service management, IT security & strategy and finding solutions for insurmountable challenges.

Marek Lorinc

Executive Director

Has over 20 years' experience in investing, finance and banking as well as international project management. Received his MBA from Concordia University, Montreal.

Leonid Beder (CoinTree)

Blockchain Security Architect

Seasoned professional of system security, cryptocurrency systems and various blockchain protocols, architecture, and implementations. An all-around player and a technology geek with proven experience in management and hands-on development.

Oded Noam (CoinTree)

Blockchain Architect

Founder of VidWatch and PhraseTech technology startups. Senior engineering and management positions at Mobixell Networks, Adamind, Schema and Gate42. Holds BSc (cum laude) in Mathematics, Economy and Psychology.

Assaf Moalem

Financial Controller

Expert in all things finance. 6 years' experience in online trading markets as a CFO & Head Finance Controller. MBA in Finance and Financial Management Services from the Recanati Business School, Certified Public Accountant (Israel).

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Jose Danon Saltiel

Online Marketing Wizard

Experienced online marketer with over 10 years' experience in many industries including gaming, gambling, fintech and more. Has a deep understanding of the industry, particularly in channels as affiliation, media buying, social and RTB . Self-driven, responsible and with vast experience in English, Spanish, German, Dutch and French markets.

Oren De-Lange

Community Manager

Active crypto enthusiast since 2014. Holds an LLB in Law and B.A in Business Administration, both cum laude, from IDC Herzliya.

Shay Cohen

Master of UX & Design

Passionate & versatile UX/UI designer driven by curiosity in user experience. Believes in the appeal of visual language and pixel- perfect design. Creates IOS, Android and web interfaces and crafted the Stox platform & visuals.

Ilya Kolesnikov

Core developer

Highly effective software engineer with over a decade's experience mainly in ecommerce and fintech. Has managed international teams of developers. Strongly believes in the brilliant future of blockchain technologies.

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Varda Bachrach

Content Specialist

Finds the right words at the right time. Has over 15 years' experience communicating difficult subjects to different audiences including finance, economics, pediatric heart disease, regenerative medicine, sport and the arts.

Liron Golan

HR Manager

Over six years experience in HR, including 3 years in online companies. Has a first and masters degree in Human Resources. Passionately believes that the workplace should be a pleasant environment for all employees.

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Eran Klein

Head of product and QA

With almost 20 years' experience in high tech companies, Eran is an expert in product and Quality Assurance. He specializes in online product and is an expert in both mobile and web applications.

Nissim Ben Alus

Support Team Leader

Responsible for Customers Success, always challenges the status quo and seeks holistic solutions and approaches to customer service. Focuses on added value, exceeding customer expectations and building loyalty.

Yevgeny Michlin

Support Engineer

With over 8 years' experience in technical support, Yevgeny utilizes his passion for networking and solving complex technical issues into practice on a daily basis, creating real value for both customers and colleagues.

Konstantin Rezhets

Mobile developer

With over 5 years' experience in startups, specializes in building lean, optimized and secure applications from scratch. Keeps Apps at the cutting edge.

Israel Shenkar

System Administrator

Experienced IT specialist with over 10 years' experience. Always seeking improvements and the latest technology. Self-learner with a passion for new technologies and ensuring that all office functions run smoothly 365 days a year (366 in leap years!).

Rutty Yeziorsky

Office Manager & PA to CEO

An expert at creating and maintaining a happy and efficient working environment. Takes care of all office administration from the mundane to fun activities.

Eyal Perera

Analyst

Experienced stockbroker and investment portfolio manager with over 7 years' experience in the financial markets. Holds an MBA and a degree in economics and business management.

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Advisory Board

Eyal Hertzog

Foundation Council of Bancor

Venture-backed technology entrepreneur for over 20 years. Founder of MetaCafe, Israel's fastest growing video sharing site reaching over 50m uniques at its peak. Previously, Eyal founded Contact Networks, one of the first social networks in 1999.

Uriel Peled

CEO of CoinTree

Uriel Peled is head of operations at CoinTree, a blockchain advisory firm based in Tel Aviv, Israel. Prior to CoinTree, Uriel was a co-founder and CPO at Visualead, an Israeli O2O and IoT startup with investors such as Alibaba. Uriel Holds BSc summa cum laude in Electrical Engineering from the Technion university.

Joe Chen

Founder, Chairman & CEO of RenRen

Joseph Chen is a pioneer of China's internet industry. Chen holds a master's degree in engineering from the MIT, and a MBA degree from Stanford. Board member at Invest.com

Moshe Hogeg

Founder & Chairman of the Singulariteam Group.

A serial entrepreneur and Board member at invest.com.

Itai Avneri

CEO invest.com

Entrepreneur and experienced executive, expert in online marketing with expertise in players / traders life cycle (acquisition, conversion, retention) for the gaming and finance industries. Has vast experience in business leadership including marketing, operations, and technology. Held several leadership roles in global online companies including CEO of Playtech Marketing.

Eduardo A. Schilman, Ph.D.

A Behavioral Psychologist at Playtika (sold for $4.4B). Earned post-doctorate from the Weizmann Institute of Science.

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Risk Factors

The following are the risk factors in relation to Stox business in general and the Token Sale event in particular.

- Stox may not reach the target sale amount and may not have the sufficient funds to execute on its business plan
- The STX token may be significantly influenced by digital currency market trends and STX value may be severely depreciated due to non-STX related events in the digital currency markets.
- Prediction market may be coming under global or local regulation that may limit the use of tokens for predictions trade
- Stox is relying on the infrastructure and talent of invest.com hence any detriment scenario that may occur in invest.com is likely to impact significantly on Stox
- Stox is a complex software platform and its launch may be significantly delayed due to unforeseen development barriers
- Competition may introduce same or better prediction market solutions and cause Stox to lose market share and eventually fail to deliver on its business goals
- Digital currencies are extremely volatile and STX token may suffer from said volatility
- International laws and regulations may render the STX trade impossible
- The use of STX tokens may come under the scrutiny of governmental institutions
- The ownership of STX tokens may fall under new and unpredicted taxation laws that will erode STX benefits
- Stox may not succeed in creating the necessary momentum and acceptance for the STX token which may result in low liquidity and depletion of trades
- The positions and plans outlined in this white paper may be altered as the project progresses.

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Regulatory Strategy

Prediction markets utilize a large set of activities that may be subject to regulatory scrutiny in various territories. This large and varied set may need to comply with regulation on securities trading, on financial institutions and money services businesses, on gaming and on gambling. Complying with each of these regulations, and sometimes in each jurisdiction, requires experience and comes at a great cost.

In decentralized applications, no single entity has control over the infrastructure required for its operation. This allows separating the infrastructure from the app content, in our case the prediction markets. The resulting structure has the advantage of modular isolation: separate functions in the system can operate in isolation from one another, and possibly be provided by different vendors.

Modular isolation brings an advantage to companies and individuals when it comes to regulatory compliance: each only needs to comply with regulation in a limited field, lowering the cost of creating the required expertise and making it easier for new businesses to start up.

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Technical Considerations

The Stox P2P protocol

The Stox App aims to provide complete functionality of a prediction market app without requiring a central server for any of it. Prediction markets require functionalities such as curation of events, market making, providing players with information and analytics, reporting event outcomes, and of course collection and payments. Each these services requires some expertise, and may be subject to a different set of rules of conduct and regulatory restrictions. Centralized applications need to gain all expertise and comply with all regulations under one roof, creating an incentive for consolidation and centralization resulting in higher fees for the consumer. The decentralized architecture simplifies the collaborative offering of these services: each operates separately from the others, focusing on their area of expertise and able to provide better services at lower costs. Stox uses existing distributed protocols as the building blocks for the Stox protocol for prediction markets apps:

- **Smart contracts** for managing events and market making.
- **IPFS for content discovery**. The Stox App runs on clients and does not require a central backend. To enable clients to discover all active markets with their taxonomy and metadata, each provider maintains a hierarchical structure of active markets descriptors, as JSON files stored on IPFS. This content includes each category and each event's metadata (name, description, images etc). IPFS is a decentralized file storage network, operating with no single points of failure, and no dependence on geographic or political territory. Each file on IPFS can be located using a canonical URL. Each provider's client app is hardcoded with the the URL of its content root; the content root may contain sub-category descriptors linking to their URLs, which in turn may link to further sub-categories.
- **Ethereum LOG directives** for push notifications. Clients may need to alert or notify users of remote events; the initiator of such events will normally be the smart contract, notifying clients of changes in its lifecycle states and announcing the market maker's offered rate. Additionally, the market operator may want to send custom messages to clients participating in a market. These notifications shall be distributed using the Ethereum network: clients participating in an event remain subscribed to the smart contract's events. Ethereum protocol carries events emitted from executed smart contracts as LOG records on block closure and propagates them to subscribed clients.

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- **Whisper** for real-time peer-to-peer communications. In the future, the Stox app may provide users participating in a certain event with an in-app chat. Whisper, a decentralized protocol for peer to peer communication, which routes messages between ethereum nodes as an addendum to the ethereum protocol, will be used to deliver the chat messages in a decentralized way.

Stox App architecture

Ethereum client

The Stox app is required to perform transactions in STX which is an ERC20 compatible token over the Ethereum blockchain. In addition, the app is required to transact with Stox Ethereum smart contracts. Performing these actions on-chain requires an Ethereum client to be distributed with the app.

There's a wide variety of available open source Ethereum clients. One of the most robust and feature complete implementations is the go-ethereum client commonly referred to as Geth. If Geth is running in standalone mode, the app can communicate with it programmatically using JSON-RPC over one of the available transports (IPC, HTTP or WS). Geth can also be used as a library for iOS, Android and Go projects.

Running an Ethereum client creates a node in the network which synchronizes blocks in the chain in order to verify and validate the current state. Full synchronization is the most secure but can take a long time and consume a large amount of disk space. As a compromise, the Ethereum client can run in fast mode which cuts back validation of older blocks. The synchronization process in this case may still take several hours and consume several GB of disk space - more resources than what we'd like to allocate for the Stox app. This leaves us with light mode which only gets the current state without validating previous blocks. The resource budget in this case is several hundreds of MB of disk space and an initial sync time of several minutes with later updates taking several seconds.

Cross platform desktop framework

The Stox app is required to run as a standalone desktop app for Windows, Mac and Linux. For easy support of multiple platforms with a single codebase, a cross-platform app framework should be used. The Stox app relies on electron for this purpose. The electron framework provides high

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development velocity by leveraging web technologies such as JavaScript, HTML and CSS.
Another benefit of the electron framework is lowering the barrier for customization of the Stox app. Altering the UI, brand and colors of the app using HTML and CSS for all platforms at once will make the customization process accessible for most developers in a rather painless manner. The same codebase could later be used for web hosted client solutions as well although those are not planned in the immediate future.

Market makers

In an abstract prediction market, each player has an idea as to the distribution of probabilities of the possible outcomes of an event. Two players that have a different idea of these probabilities can make a trade.

In the most basic example, suppose Amanda believes there's a 100% chance of rain on Monday, and Brian is certain Monday will be sunny (0% chance of rain). Amanda and Brian could pledge $1 each. They meet up at 11:59pm on Monday, and Brian collects his $2 because it did rain.

On Tuesday, Amanda believes there's a 80% chance of rain, and Brian expects a 30% chance. If they are both confident with their forecasts, they could take a bet for any betting ratio between 8:2 and 3:7, because both expect a positive outcome (though by 11:59pm on Tuesday they will discover that only one of them was right):

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Range	Example wager	Amanda's expectation	Brian's expectation	Result
Prediction ratio greater than 8:2	9:1	Expectancy of proceeds if speculating: $E_{rainy} = 80\% \cdot 1 = 0.8$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 20\% \cdot 9 = 1.88$ Amanda will prefer to bet on a sunny Tuesday.	Expectancy of proceeds if speculating: $E_{rainy} = 30\% \cdot 1 = 0.3$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 70\% \cdot 9 = 6.3$ Brian will prefer to bet on a sunny Tuesday.	No trade: both Amanda and Brian want to bet on a sunny Tuesday.
Prediction ratio is exactly 8:2	8:2	Expectancy of proceeds if speculating rain: $E_{rainy} = 80\% \cdot 2 = 1.6$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 20\% \cdot 8 = 1.6$ Amanda has no preference.	Expectancy of proceeds if speculating: $E_{rainy} = 30\% \cdot 2 = 0.6$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 70\% \cdot 8 = 5.6$ Brian will prefer to bet on a sunny Tuesday.	Probably no trade: Amanda has nothing to gain from plaaying. (unless she enjoys the thrill, and would play for no expected gain)
Prediction ratio between 8:2 and 3:7	1:1	Expectancy of proceeds if speculating: $E_{rainy} = 80\% \cdot 1 = 0.8$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 20\% \cdot 1 = 0.2$ Amanda will prefer to bet on a sunny Tuesday.	Expectancy of proceeds if speculating: $E_{rainy} = 30\% \cdot 1 = 0.3$ Expectancy of proceeds if speculating no rain: $E_{sunny} = 70\% \cdot 1 = 0.7$ Brian will prefer to bet on a sunny Tuesday.	Game on: Amanda wants to bet on a rainy Tuesday, Brian wants to speculate a sunny Tuesday.

How would Amanda and Brian find each other to make the trade? In a double auction market, all players meet up at an exchange, and some of them announce the rates they are willing to speculate. All players listen to these announcements and take the offers they find acceptable. The announcers are called the "market makers" the listeners taking on an offer are called the "market takers".

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The problem, however, is that this exchange is a high burden on all players:

- They need to be at the exchange at the same time;
- Some of the players need to make announcements, thus need to determine an optimal rate to announce;
- Some of the announcements will not be taken, frustrating some players that took the burden of announcing but didn't get to participate in the trade;

This burden becomes smaller if there are many players in the market. In practice, such market is a reasonably good solution for a prediction market if there are many players active at any hour of the day, although the burden of making an announcement is creating "product friction" reducing the number of predicted events.

The solution to this is to use a market maker: a party interested in enabling the prediction deposits a sum, which it will use to be the counterpart to any player wanting to speculate (liquidity). To rule used by the market maker to determine, at each point in time, the prediction ratio it accepts is called a Scoring Rule. The family of Scoring Rules that are applicable to prediction markets, i.e. incentivise players to hedge their beliefs, are called Proper Scoring Rules. Of these, the gold standard in prediction market is Hanson's Logarithmic Market Scoring Rule: suppose at the time Christopher wants to speculate that Wednesday will be rainy, after Amanda and Brian already put their wagers. The quoted rate he sees is

$$r_{rainy} = e^{\frac{q_{rainy}}{b}} / \left(e^{\frac{q_{rainy}}{b}} + e^{\frac{q_{sunny}}{b}} \right)$$

Whereas e the natural logarithm, q_{rainy} and q_{sunny} are the sum of previous wagers on either outcome, and b is the calculated from the liquidity sum deposited by the market maker.
The actual rate Christopher needs to pay differs from the quote, because his bet changes one of the q's (the quote would only apply to an infinitesimally-small wager). Supposing Christopher wants to place a wager that would pay him $x if Wednesday turns out to be rainy, the market maker would accept his wager if he pays

$$c = b \cdot ln \left(\frac{e^{q_{rainy}/b} + e^{q_{sunny}/b}}{e^{(q_{rainy}+x)/b} + e^{q_{sunny}/b}} \right)$$

The Stox network will initially offer two variants of market makers derived from LMSR, namely

- Liquidity-Sensitive automated Market Maker
- Standard LMSR

[3] *Robin Hanson.* ***Combinatorial information market design.*** *Information Systems Frontiers, 5(1), 2002.*

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Platform limitations

The events are operated on the public Ethereum blockchain, requiring all operations that change the market's state (creation, users' opening and closing positions, oracle reports, users' collection of payments) to be broadcast to the blockchain. Technical and throughput limits of the Ethereum network and its processing costs have several adverse effects on Stox:

- The throughput of the Ethereum network puts an upper bound on the rate at which an on-chain prediction market can process orders and modify positions, which in practice stands at hundreds of calls per minute. In the near future, high-traffic prediction markets, with participation of thousands of users, cannot be supported by the Ethereum network.
- When the Ethereum network is under low load, its block confirmation time of 17 seconds means a user would wait an average of 8.5 seconds for each operation. Under a normal workload, transactions may be processed only after a block or two, resulting in a longer wait of around one minute. Such latency is not reasonable for UX and require designing the user experience in a way that provides immediate feedback for actions, then processes blockchain operations in the background.
- At higher network loads, the Ethereum network suffers from a very high variance in confirmation times. Transactions may queue for several blocks' time, resulting in a wait of minutes or hours. When this happens, users' predictions may fail to register on the blockchain, due to the event closing or significant change in the rate offered by the market maker.
- Ethereum currently supports fee payments only by the sender, and only in ETH. Transaction fees on Ethereum network are expected to amount between $0.02-$0.20 per operation when the network is under reasonable load, in addition to the fees collected by the prediction markets. This also creates product complexity as it requires users to hold a small ETH balance in order to make payments (we recommend that operators refund users their transaction fees, so that a small ETH deposit could be sufficient for a user).

[4] *A. Othman, T. Sandholm, D.M. Pennock, and D.M. Reeves (2010).* ***A practical liquidity-sensitive automated market maker****. ACM Conference on Electronic Commerce: 377-386*

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Despite these drawbacks, Ethereum is still the best public blockchain available today. New developments in the Ethereum network should mitigate all of the abovementioned issues:

- RAIDEN and CASPER are expected to increase the capacity of the Ethereum network enabling significant reduction of block times and variance in block waits. Similarly, the increase in capacity and offloading of large amounts of transactions to state channels are expected to result in significant reduction in network fees.
- CASPER proposes abstractions that could enable contract-pays schemes for fees, eliminating the need for users to hold ETH.

Several bodies are promoting research on off-chain scalability of prediction markets. We are monitoring the advances in these fields in hope for a viable solution, however, at the moment we will be taking a cautious approach in planning, as we consider currently known models to be impractical.

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