DELPHY

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Delphy Prediction Market

Whitepaper

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Contents

Chapter 1 Executive Summary

Delphy is a decentralized and open-sourced mobile prediction market platform built on Ethereum, and Delphy App is a light Ethereum node running on mobile devices.

Delphy uses market incentives to help market participants transparently express their confidence and judgment about the outcome of future events instantaneously such as to effectively predict future. Delphy is born decentralized, which ensures that the prediction results are hard to maneuver. It meets three necessary conditions of collective wisdoms raised by Surowiecki, diversity of information, independence of decision-making and decentralization of organization.

Delphy is a mobile platform for prediction market and an ecosystem of PaaS (Prediction as a Service). Users can participate in transactions in any prediction market anytime and anywhere, as well as use Delphy API & SDK to customize prediction markets on basis of different parameters in vertical fields. Delphy can be applied extensively to prediction markets in finance, insurance, national defense, healthcare, public management, sports, entertainment, and even those within organizations.

Delphy, as indicated by Greek mythology, is the place where the god of light Apollo announced the oracle. Delphy prediction market hopes to leverage the wisdom of crowds to forecast future events and even create the future.

Chapter 2 Project Background

There are two main methods of scientific prediction; one is using statistics and mathematical models, and the other machine learning and data mining. In essence, these two methods mainly use historical data and software systems to generate predictions.

In recent years, the use of "social analysis" as a third method presents a sudden rising trend in prediction market. The market uses market incentives to allow the public, not just those experts, to contribute their own experience and wisdom, pools market information together to help make decisions, so that the crowds could be more intelligent than a single individual and expert.

2.1 Prediction Market：Theories and Operations

Scientific prediction methods had been introduced since the Information Age. In particular, the theories underlying prediction markets include Efficient Capital Markets Hypothesis (ECMH) and Hayek Hypothesis. These hypothesis help explain how information is aggregated such that market prices provide accurate estimates on the likelihood of future outcomes.

According to ECMH, capital markets are extremely efficient in reflecting information about individual stocks and about the stock market as a whole, such that no amount of analysis in an attempt to forecast future stock prices can beat the market. Hayek Hypothesis assumes that market prices are the means by which those disparate pieces of information are aggregate. The market works even when people only have limited knowledge about their surrounding environment and their counterparties.

In essence, the market collects the confidence and judgment of the parties involved in the same event on basis of the principles of the market, resulting in a prediction of the future outcome of the event. Similar to the stock market, which serves to assign a price to the future estimated earnings of a stock, “prediction markets” assign a value to a belief about the future (a prediction).

Specifically, prediction market usually predicts the outcome of an event by asking questions, with each outcome having its own probability, the sum of the probabilities of all outcomes is equal to 100%. The probability of a outcome represents the transaction price of the outcome in the market. Traders can buy shares of a outcome based on their confidence and judgment. For example, the stock is set as $1, the probability of the result is now 60%, then its price is $0.6. If the result eventually occurs, the trader who buys the shares is the winner, earning a profit of $0.4（1 - 0.6）per share, and the other person will receive no profits.

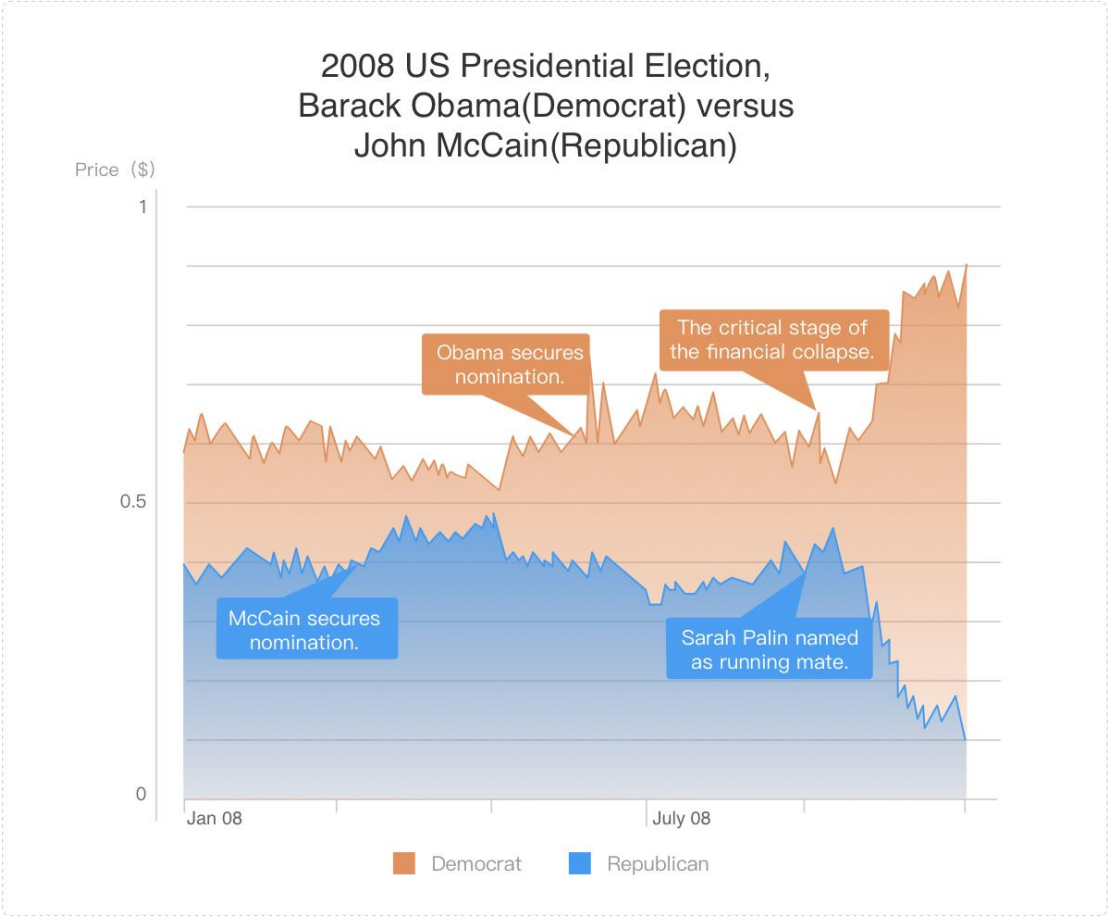
For example, Will China Stock Index (CSI) 300 break through 4000 points this year?

(A) Yes. (Price is $0.60) = 60% winning probability

(B) No. (Price is $0.40) = 40% winning probability

(A) + (B) = $1.00 (100% winning probability)

In prediction market, the probability of event outcomes represents the judgment of traders, number of shares purchased represents weight and confidence, and comments of traders represent their rational.



The well-known U.S. financial journalist James Surowiecki raised three conditions for wisdom of crowds: diversity of information sources, independent decision and decentralization of organization. Similarly, prediction market can work at its best when market participants have different backgrounds and independence of decision-making, and the organization of the market is decentralized.

Prediction markets have three characteristics: 1) it can efficiently collect diverse and disparate information; 2) it provides an effective and transparent incentive mechanism to obtain truthful and relevant information; 3) it incorporates near real-time information update so that manipulating the results becomes quite difficult.

The market is widely used in many sectors, including but not limited to finance, insurance, national defense, healthcare, public management, sports, entertainment, and even prediction markets within companies.

For example, in 1996, HP Labs and California Institute of Technology co-chaired a three-year prediction market experiment. The study conducted 12 different predictions with 20 to 30 employees from different departments (business, finance and marketing, etc.) of HP Labs. Experiments showed that more than 75% of the predictions are more accurate than HP's official predictions.

In 2003, the U.S. Department of Defense publicized a "Policy Analysis Market" (later dubbed as a "terrorism futures market"), which mainly predicted the political and military turmoil in eight Middle East countries as well as the response of America, aiming at improving the country's capacity of gathering intelligence around the world, but later canceled because of the rejection of U.S. Senators.

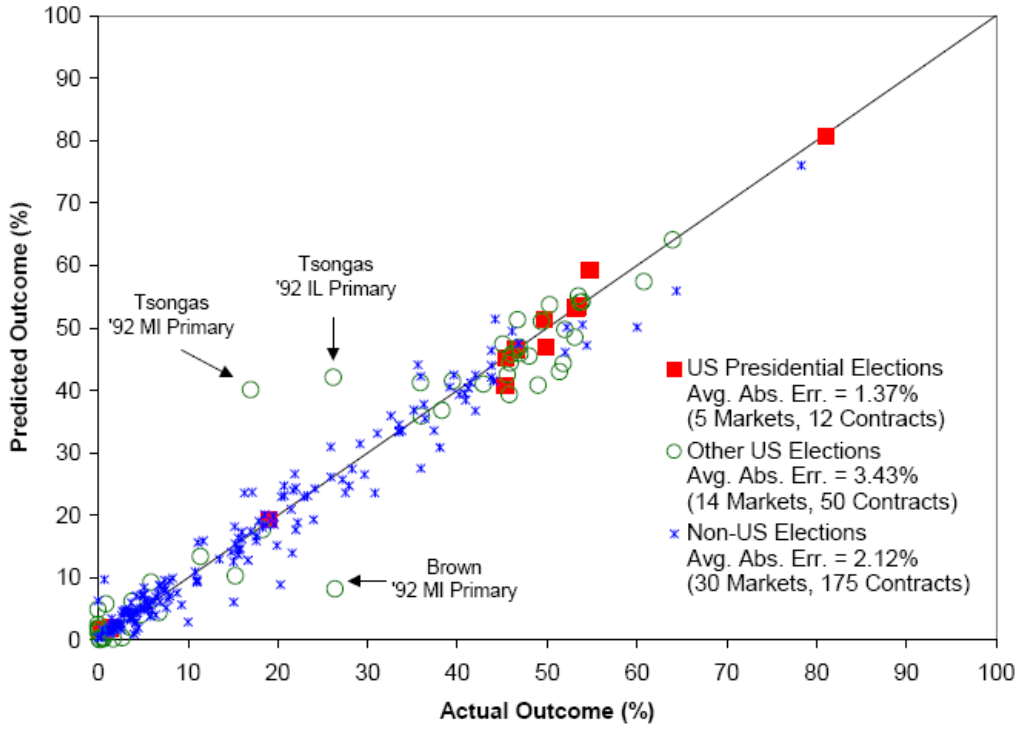
In 2005, Google announced its use of prediction market within the company to predict product release date, new office opening and other strategic events.

Intrade.com is a famous political prediction market where the participants can trade the results of the presidential elections of different countries. And the accuracy of the prediction is incredible, for example, as for the 2004 U.S. presidential election, Intrade.com predicted which states Bush and Kerry would win respectively, and its prediction was surprisingly similar to the result of the election.

2.2 Accuracy of Prediction Market

The probability of outcomes of future events is traded in prediction market and the price of future contract reflects the dynamic expectation of the probability of those events. Due to the incentives of winnings, the market is able to collect wisdom of all the participants. Experiments show that prediction market is often more accurate than traditional predicting tools with many other advantages like continuous real-time information gathering, active participation, information disclosure, high efficiency and measurability.

Consensus Point, a website Dr. Robin Hanson is working as its chief scientist, once announced that the accuracy rate of its prediction markets was 92%. In 2008, a survey found that IEM of the University of Iowa predicted five presidential elections more accurately than ordinary polls for 74% of all cases. The election data in the figure below clearly shows that the predictions of prediction market are quite accurate.



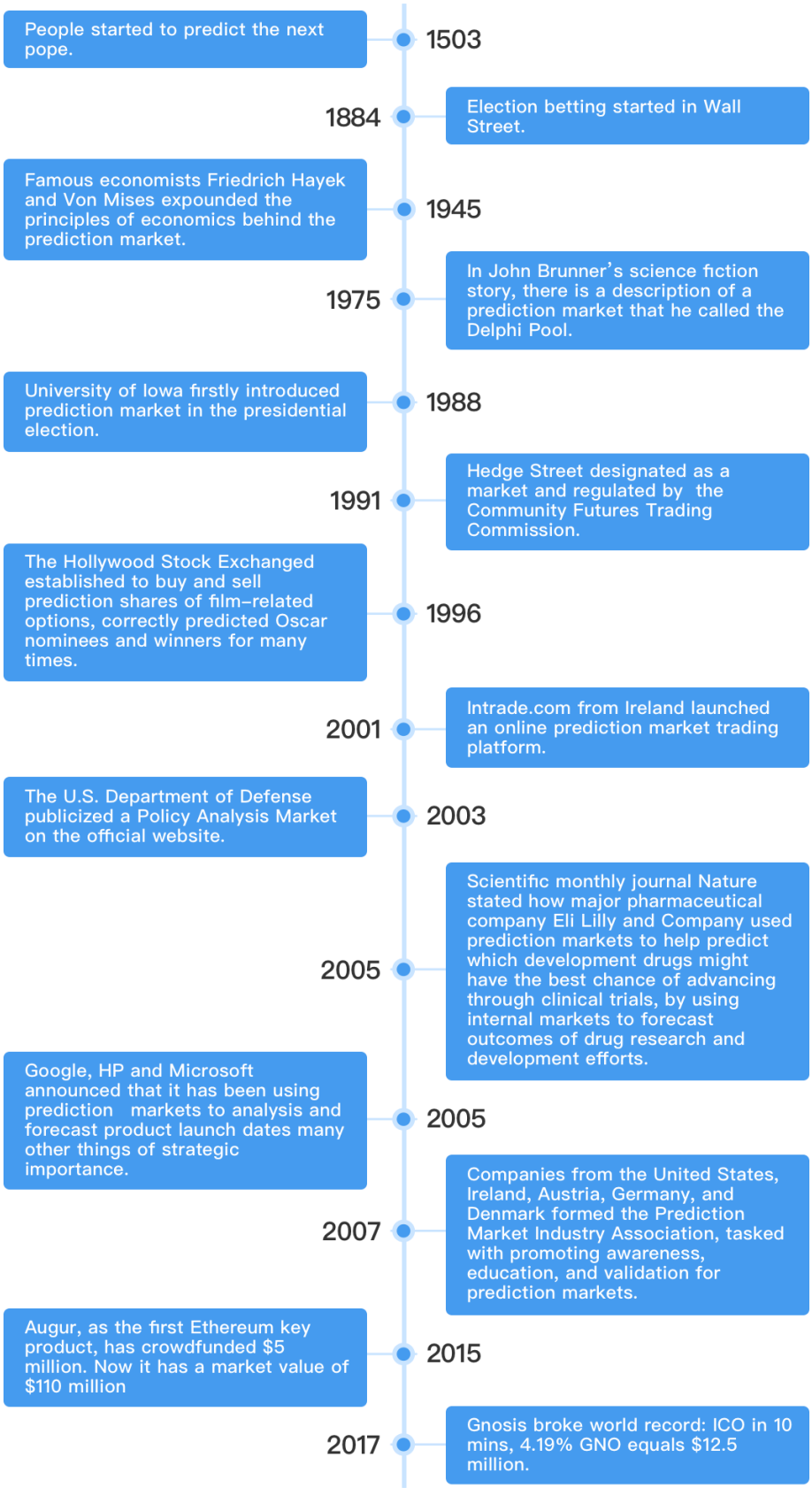
The long-term prediction market has a great advantage in accuracy over individual predictions. The more participants, the more accurate the market will be. The following three reasons might help explain why. 1) Due to the complexity of events, no individual could possess complete information while the knowledge is diversified among a group of people. 2) Prediction market provides a mechanism for those with insight information to express their ideas, and people will vote via trading expectations rather than simply succumbing to peer pressure of consensus when different ideas occur. 3) Trading with real money involved will make people think differently and behave cautiously.

Prediction market, fairly accurate as it is, also faces some challenges, for it represents the public opinion which can be affected by many factors.

Segmented prediction market lacks liquidity: people are only concerned about big things or those related to their own interests, therefore general predictions are difficult to collect enough samples. Many people will participate when the prediction is about the U.S. presidential election between Clinton and Trump, but it is another story when it comes to a presidential selection in a small developing country in Africa.

Prediction market has also made some big mistakes in practice, e.g. the Brexit vote. On June 23, 2016, the very day of the Brexit vote, prediction market forecast that the rate of staying in EU was 85%, whereas the reality was that the “exiting” party won by a nose.

2.3 History of Prediction Market



2.4 Differences between Prediction Market and Betting

Throughout the history, financial products have met and overcome skepticism of gambling. At the very beginning, life insurance was considered immoral, and stocks were also regarded as a means of betting. Today, however, people have fully accepted insurance and stocks as an indispensable part of modern finance. Insurance can help people hedge risks, while stocks are important for companies to raise fund.

There are great differences between prediction market and betting. First, gambling has no practical meanings for most part, while prediction market has great social significance as it solicit people's views toward future events. For instance, the prediction market for U.S. presidential election can help financial markets with risk assessment, the public expectations of housing prices can become a reference for macroeconomics and governmental regulation, and weather prediction market can help farmers hedge extreme weather risks.

Second, gambling is just a simple game with its own rules, with no externality. However, prediction markets are influenced by many factors, such as economic data, spontaneous international events and other human or natural factors.

Third, while gambling involves large-scale funds, capital involved in prediction markets is limited, with no or limited financial impact.

2.5 Prediction Market vs Traditional Prediction Methods

	Prediction Market	Poll	Experts' Opinions/Panel
Sampling	People participate actively	Random sampling	Recommendations screening
Scale	Big	General	Small
Frequency	continuous；until the event ends	once	once；periodic
Method	interactive	solely	solely；interactive
Content	Predicting the probability of events	Expressing personal preference	Personal preference + probability of events
Weight	Depended shares purchased	Equal	Uncertain
Motivation of Participation	Equal proportion of economic returns	None	Reputation ； One-time economic returns
Motivation of Truth-Telling	economic returns	None	Popularity
Opinions Update	Reflecting changes of participants' views via price movement；continuous	One-time analysis ； discontinuous	One-time analysis
Accuracy	high	Average	Very high
Execution	Setting up trading market	Large-scale interviews; questionnaires	Selecting experts

2.6 Blockchain Redefines Prediction Markets

Although prediction market is good, traditional centralized prediction markets have plenty of shortcomings.

First, centralized markets cannot prove their innocence by themselves. For example, many markets are suspected of to manipulation, subjecting users to financial loss. Second, markets are usually under tight financial supervision, resulting in the lack of user participation and limited transaction volume, keeping it away from the mainstream market. For example, the famous intrade.com was forced to close because it failed to comply with laws of CFTC of USA. Third, there is a certain conflict of interest between prediction market and the current intellectual circles (experts opinion) as well as public opinion polling.

Today, with the rise of peer-to-peer blockchain technology, prediction markets can take advantage of its decentralization and help populate their applications. First, data on blockchain are replicated across the network, and its feature of tamper-proof enables prediction platforms to prove their innocence. Second, decentralization also makes prediction market gain global liquidity and attract massive users. Third, blockchain-based prediction market can encourage and attract more insiders and professionals to participate with necessary token incentives.

2.7 Delphy: A Decentralized Prediction Market Platform

Delphy is a decentralized social mobile prediction market platform built on Ethereum. Its endogenous decentralization mechanism ensures that predictive results are hard to manipulate and promotes the diversity of information, the independence of decision-making and the decentralization of the organization.

Delphy is a mobile application platform for prediction market and an ecosystem of PaaS (Predictive as a Services). Users can participate in transactions of any prediction market anytime and anywhere, as well as use Delphy API & SDK to custom-tailor all kinds of prediction markets in vertical fields.

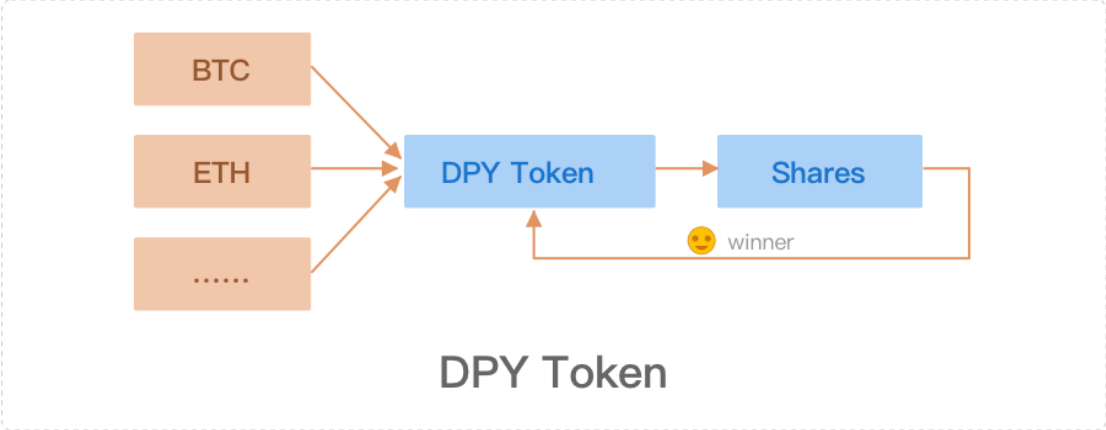
The Similarities and Differences between Delphy and Existing Decentralized Predict Markets			
Features	**Delphy**	**Gnosis**	**Augur**
Distributed Oracle	√	√	√
Funds owned by contracts	√	√	√
Quick clearing	√	√	×
Token holders undertaking certain responsibilities	×	×	√
Scalability	√	√	×
Ecosystem of application	√	√	×
Research on market-based Governance Protocol	×	√	×
Multi-platform compatibility standards	√	√	×
Mobile app as a light Ethereum client	√	×	×
Customizable	√	×	×
Events filter	√	×	×
Social	√	×	×

Chapter 3 Delphy Market Mechanism

3.1 Market Making

3.1.1 DPY Token

Delphy will issue its token DPY which is based on Ethereum smart contract and in compliance with ERC20 standards. (ERC20 enables Ethereum wallets, exchanges and other smart contracts to interact with a variety of tokens in a common way). DPY Token, generated by Delphy smart contracts, will be released during Delphy ICO and can be purchased by digital tokens like Bitcoin and Ether. In Delphy prediction markets, DPY tokens are only ones used to buy shares and award winners.



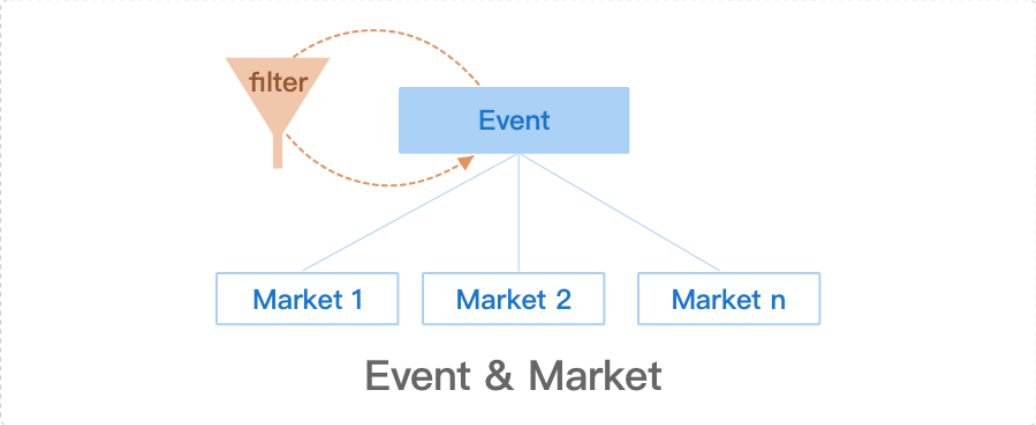
3.1.2 Create Event

“Event” refers to a future event of interest to be predicted in Delphy in form of question and answers. For example, will the Germany national football team defend the crown in the 2018 FIFA World Cup?

Users can create Events based on future events in the real world by using Event Editor and Event Template in Delphy. When creating an Event, clients should submit a detailed description, all possible outcomes, and the Oracle that determines the outcomes and so on.

The outcomes of an Event can be of three types: binary, list and range. Binary Events have two or more outcomes but only one single correct answer, while List Events have more than one correct answers. And In Range Events, the outcomes are in forms of [5..9], for example. Events can be open or invitation only. All Delphy users can participate in an open Event, while an invitation-only Event is visible and available to invited users only.

The Event created will enter a temporary Event Pool in Delphy. The system also has an Event Filter which is used to filter out illegal or unethical events, such as predictions on the assassination of a country's leader or the overthrow of a government. The remained Event after filtering will enter the system's Live Event Pool to create Markets.



3.1.3 Create Markets

After users create an Event, they can build the corresponding prediction market to provide a trading platform for participants.

Users can search the system's Live Event Pool and select the Event they are interested in to create a Market. First, the user must set the loss limit designated as an integer. The loss limit represents an important parameter of the market creators' deposit. The higher the loss limit is, the bigger the creator may suffer and the bigger reward he or she might gain, the more liquidity the market will have, and the less impact on price fluctuation.

Second, the user must have enough balance in his wallet. The deposit is calculated by loss limit and the number of event outcomes. It signals the biggest loss the market creator may have to pay, and is directly related to the result of the entire market. (Please refer to the following Section 3.2 for more details). The system will lock the number of Tokens equivalent to the deposit in the market creator's wallet, and he will not be able to use the deposit until the Market is closed and liquidated.

The same Event can be used to create Markets with different preferences, and each Market may have different loss limits, deposits, market liquidities, delivery dates, Oracles and dispute resolutions. Users with different preferences can choose Markets of their own likes to trade.

3.1.4 Pricing & Trading

Delphy uses LMSR (Logarithmic Market Scoring Rule) to calculate the price of every outcome in the market in real-time as traders start to buy and sell shares. LMSR provides virtually unlimited market liquidity. This is where it is different from the traditional non-LMSR prediction market and the stock market. (Please refer to the following Section 3.2 for more details).

In general, the more shares of a particular outcome are purchased, the higher its price will be, while the more it is sold, the lower the price is. Users can find out real-time prices of each outcome and its trend in Delphy.

Delphy users can use their own DPY Token to purchase a certain number of shares of an outcome at the market price calculated in real time if they are eligible to participate in that market. Similarly, users can also sell their own shares in the market for DPY Tokens.

3.1.5 Liquidation & Delivery

When a market matures—the Event of the market happens in the real world, Delphy will determine the winning outcome based on the Oracle of the Event.

Users who own shares of the correct outcome will be winners, with their shares automatically converted into DPY Tokens. After certain fees being deducted, those DPY Tokens will be automatically delivered to the winners' wallets. Those who lose will not be liable for any other expenses. When the total amount of shares purchased by the losers is not sufficient to cover the profits of the winners, the deposit from market creator will be spent to help liquidate the market.

Certain transaction fees (e.g., Gas required in Ethereum) might occur when markets are created and shares traded. In the meantime, for all the risks the market creator takes, there should be reward in general to help incentivize such behavior. As result, Delphy will charge a small percentage from the winners' profits and the fees will be used for the following purposes: 1) to cover all necessary transaction costs associated with the Market; 2) to reward the market creator; 3) to reward all DPY Token holders; 4) Other usages.

When the market is liquidated, the Event & Market is officially closed and no transaction is allowed. If the Oracle associated with the Market cannot decide the outcome, or users dispute the correct outcome, Delphy will provide a variety of ways to resolve the dispute.

3.1.6 Messages & Comments

For every market in Delphy, usually it comes with all necessary outcomes and a comment area where traders can leave messages showing why they choose to do so and

their rational. Such event-based social activity provides more signals besides the prediction price. In the meantime, Delphy will also provide functions like peer-to-peer messaging, peer-to-peer payment, OTC trading, etc.

3.2 Pricing Principle

LMSR (Logarithmic Market Scoring Rule), proposed by Hanson, is an automated market creating mechanism that always maintains a consistent probability distribution to reflect the market's evaluation of each event outcome. LMSR is becoming a de facto standard for prediction markets, as it has many excellent features, such as the limited loss resulted from the logarithmic growth of a predicted outcome, the infinite liquidity and the modularity of independent relationships. Many internal prediction markets and projects are using LMSR as pricing mechanism, such as inkling-Markets.com, Microsoft, yoonew.com, Augur and Gnosis.

In a prediction market, when the market is created from the Event Φ, Φ's outcome can be one of the following types：

Boolean type, e.g., will the German national football team win the 2018 FIFA World Cup? The outcome can only be “yes” or “no.”

List type, e.g., which teams will be in the finals of the 2018 FIFA World Cup? The outcome will be in a list of 32 items.

Range type, e.g., how much is Apple's stock price on January 1st, 2018? The outcome will have a wide range.

LMSR will decide how market participants trade shares, how to determine the price of the share of each event outcome, and the probability of each outcome at any point of time.

Definition

The number of the outcomes of Event Φ is n, q_i refers to the number of current shares of the i-th outcome.

Loss Limit ℓ An integer determined by the creator himself, which can be used to calculate the creator’s potential loss. The bigger ℓ is, the bigger loss the creator may suffer, yet the more liquidity the market will have, and the less impact participants will have on price when they buy more shares.

Deposit $\mathcal{F}$ It refers to the maximum limit of loss, and it must be provided when the market is created. $\mathcal{F}$ is decided by ℓ and n.

$\mathcal{F} = \ell \cdot \ln(n)$.

Market Status It represents the vector of the number of shares of all outcomes $(\mathbf{q_1}, \mathbf{q_2}, \cdots, \mathbf{q_n})$, and one trade will only change $\mathbf{q_i}$ and then change market status.

Cost Function C The cost function of market status is:

$C(q_1, q_2, \cdots, q_n) = \ell \cdot \ln(e^{\frac{q_1}{\ell}} + e^{\frac{q_2}{\ell}} + \cdots + e^{\frac{q_n}{\ell}})$,

ℓ is loss limit , ln is natural logarithm. Cost function C is the core function of LMSR. The specific payment amount for the purchase and sale of the shares will be represented by the status difference of the cost function.

If you buy Δ (number of shares) of outcome i in current market, you need to pay:

$$C(q_1, q_2, \cdots, q_i + \Delta, \cdots, q_n) - C(q_1, q_2, \cdots, q_i, \cdots, q_n)$$

If you sell Δ (number of shares) of outcome i in current market, you need to pay:

$$C(q_1, q_2, \cdots, q_i - \Delta, \cdots, q_n) - C(q_1, q_2, \cdots, q_i, \cdots, q_n)$$

When the selling price is negative, you can make profits from the trade.

So the trading of shares is a serial of atomic operations, and the next transaction begins only after the previous one is completed.

Instant Price Function $\boldsymbol{p(q_i)}$ It is the price of shares of the i-th outcome and it's the partial derivative of cost function：

$$p(q_i) = \frac{dC}{dq_i} = \frac{e^{\frac{q_i}{\ell}}}{e^{\frac{q_1}{\ell}} + e^{\frac{q_2}{\ell}} + \cdots + e^{\frac{q_n}{\ell}}}$$

If the i-th outcome wins as the predicted event happens, then $p(q_i) = 1$, $p(q_{j\neq i}) = 0$.

Probability Function $\boldsymbol{P(q_i)}$ It refers to the winning probability of the i-th outcome of current predicted event.

Creator's Profit Amount $\mathcal{R}$ If the i-th outcome wins as the predicted event happens, then

$$\mathcal{R} = C(q_1, q_2, \cdots, q_n) - q_i - \mathcal{F}$$

When $\mathcal{R} < 0$, the creator is suffering loss.

Based on LMSR above, we present the following propositions:

Proposition 1 Deposit $\mathcal{F}$ equals the cost function of initial market status.

Because no trades of shares are conducted in the initial status, $q_1 = q_2 = \cdots = q_n = 0$, then

$\mathcal{F} = \ell \cdot \ln(n) = C(0,0,\cdots,0)$.

Proposition 2 The cost function of current market status equals the total capital of current market.

The total amount of market funds equals the deposit plus the capital used to purchase shares, minus capital used to sell shares and transaction fees involved.

Proof：

It is known that the amount paid for purchasing shares or received from sale of shares is the difference between the consecutive cost function of market status. Suppose there are m transactions between initial status $\alpha_0 = (0,0,\cdots,0)$ and status $\alpha_m = (q_1, q_2, \cdots, q_n)$，every transaction can only change the number of shares of one single outcome, and x_j means the capital put into the market for the m-th transaction：

$$x_1 = C(\alpha_1) - C(\alpha_0),$$

$$x_2 = C(\alpha_2) - C(\alpha_1),$$

$$x_m = C(\alpha_m) - C(\alpha_{m-1}),$$

Add up the above m equations ，$\sum_{j=1}^{m} x_j = C(\alpha_m) - C(\alpha_0) = C(\alpha_m) - \mathcal{F}$ ，then

$$C(\alpha_m) = \mathcal{F} + \sum_{j=1}^{m} x_j$$

QED

Proposition 3 $p(q_i) = P(q_i)$.

This proposition demonstrates that in LMSR, the instant price at which a participant buys the shares of one outcome is equal to the winning probability of that outcome.

Proof：

The standard entropy of the market is：

$$S(q_1, q_2, \cdots, q_n) = -\sum_i P(q_i) \cdot \ln(P(q_i)) \quad (1)$$

The Lagrange interpolation of the market is：

$$\Lambda(q_1, q_2, \cdots, q_n) = S - \sum_i q_i P(q_i) - 1$$

The biggest constraint entropy is obtained by taking the derivative of Λ，then

$$d\Lambda = \sum_i dP(q_i)[\ln P(q_i) + 1 + \alpha + \beta q_i] = 0 \quad (2)$$

(2) must work for all i，then

$$\ln P(q_i) + 1 + \alpha + \beta q_i = 0 \quad (3)$$

And the sum of all probabilities is 1，

$$\sum_i P(q_i) = 1 \quad (4)$$

Combine (3)(4), and eliminate α, then：

$$P(q_i) = \frac{e^{-\beta q_i}}{e^{-\beta q_1} + e^{-\beta q_2} + \cdots + e^{-\beta q_n}} \quad (5)$$

In LMSR market，$\beta = -1/\ell$，then

$$p(q_i) = P(q_i)$$

QED

Proposition 4 When the Event happens, if the profit for market creator $\mathcal{R} < 0$，i.e., the creator suffers loss, then $|\mathcal{R}| \leq \mathcal{F}$.

The proposition demonstrates that if there is a loss for market creator, then the loss is, and the biggest loss equals the deposit.

Processes of buying and selling shares

We will describe the processes of buying and selling shares in prediction market according to LMSR based on the definition and propositions listed above.

Assumption: The creator creates a market based on an Event with n outcomes, defines the loss limit ℓ，and provides the deposit $\mathcal{F} = \ell \cdot \ln(n)$. When the market is initially created, no one is trading the shares，$q_1 = q_2 = \cdots = q_n = 0$. Suppose the probability of each outcome is $1/n$，and the instant price of each share is $p(q_i) =$

$1/n$.

The first participant Alice supposes outcome 1 will win, and buys a shares of it，then $q_1 = a$. The amount to be paid by Alice is decided by the difference of cost functions, $C(a, 0, \cdots, 0) - C(0,0, \cdots, 0)$. Please note that before Alice make the purchase, the instant price of outcome 1 is $p(q_1) = 1/n$，but the amount Alice pays for buying a shares is not $ap(q_1)$, because the instant price $p(q_1)$ reflects only the current purchase price for small number of (infinitesimal) shares. The bigger a is, the more Alice will have to pay. The instant price $p(q_1)$ will rise immediately after Alice buys, and its instant price of $j \neq 1$ will decline, which means the more shares of outcome i purchased, the higher its price will become and the higher its winning probability is.

At some point, the market cost is $C(q_1, q_2, \cdots, q_i, \cdots, q_n)$，

If Bob buys b shares of outcome i，he will pay:

$$C(q_1, q_2, \cdots, q_i + b, \cdots, q_n\ ) - C(q_1, q_2, \cdots, q_i, \cdots, q_n).$$

When Alice sells a shares of outcome 1，she will pay:

$$C(q_1 - a, q_2, \cdots, q_i + b, \cdots, q_n) - C(q_1, q_2, \cdots, q_i + b, \cdots, q_n)$$

Selling shares leads to negative cost difference, which means Alice will make profits by the amount of the cost difference. If the current instant price is higher than the purchase price, then Alice can make profits by selling her shares.

If outcome i wins when the Event happens, those who hold its shares can redeem all shares at the price of 1 per share, while people holding other outcomes' shares $j \neq i$ will all suffer loss. When the total funds of $j \neq i$ can not cover the money paid to winners, the difference will be deducted from the deposit $\mathcal{F}$. This means that the more accurate the market forecasts, the bigger loss the creator suffers, while the less accurate the market forecasts, the more profits the creator makes. A good LMSR model makes the market creator lose most deposit $\mathcal{F}$.

In the extreme market, the creator will lose all the reserves $\mathcal{F}$，for example, when outcome i wins and all the participants buy its shares, which means q_i is big enough, $q_{j \neq i} = 0$. Therefore, the redemption the creator should pay is $\mathrm{q_i}$，and the net profits of the market (the bytes put by all participants) is

$$\mathrm{T} = \mathrm{C}(0,0, \cdots, \mathrm{q_i}, \cdots, 0) - \mathcal{F} = \ell \cdot \ln\left(\mathrm{n} - 1 + \mathrm{e}^{\frac{\mathrm{q_i}}{\ell}}\right) - \mathcal{F} \cong \mathrm{q_i} - \mathcal{F}\ ,$$

$\mathcal{R} = \mathrm{T} - \mathrm{q_i} \cong -\mathcal{F}$, so the creator's maximum loss is desposit $\mathcal{F}$.

Case Study

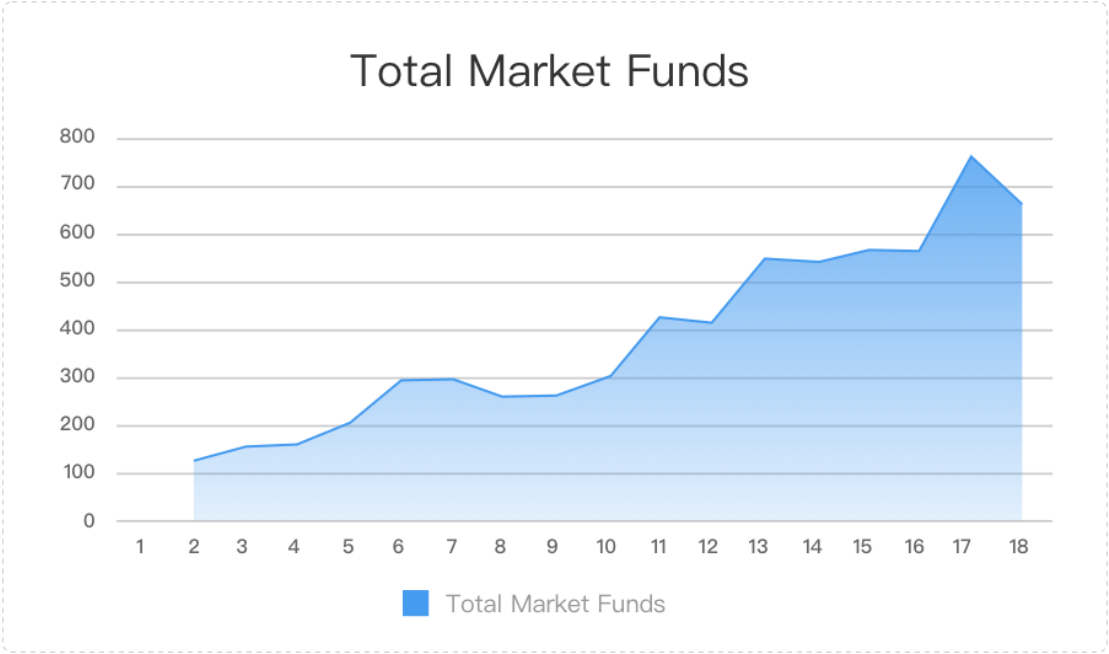
The creator created a Boolean Event: Will Ke Jie lose all the games to Alpha-Go on May 27th, 2017. It was a prediction event created in April 2017, and its outcome would be "yes" or "no". If the creator defines $\ell = 100$, the amount of the reserves he will provide for the market is $\mathcal{F} = 100\ln 2 = 69.31$.

The total market capital before betting is $\mathrm{C}(0,0) = \mathcal{F} = 69.31$.

The prediction market operates step by step as following. If you buy 100 shares of "yes" for the first transaction, the payment will be $\mathrm{C}(100,0) - \mathrm{C}(0,0) = 62.01$, the probability of "yes" after transaction is $\frac{e^{\frac{100}{100}}}{e^{\frac{100}{100}}+1} = 0.731$. Subsequent transactions will be calculated in the way described above.

Step	Shares purchased		Expense	Earning	Probability		Total number of shares		Total market capital
	yes	no			yes	no	yes	no	
0					50.00%	50.00%	0	0	69.315=$\mathcal{F}$
1	100		62.01		73.11%	26.89%	100	0	131.326
2	40		30.72		80.22%	19.78%	140	0	162.042
3		20	4.29		76.85%	23.15%	140	20	166.328
4	50		40.45		84.55%	15.45%	190	20	206.779
5	100		89.73		93.70%	6.30%	290	20	296.504
6		50	4		90.03%	9.98%	290	70	300.508
7	-40			35.21	85.82%	14.19%	250	70	265.298
8		30	4.84		81.76%	18.24%	250	100	270.141
9	40		33.8		86.99%	13.01%	290	100	303.939
10		300	124.79		24.97%	75.03%	290	400	428.734
11		-10		7.41	26.89%	73.11%	290	390	421.326
12		150	126.56		7.59%	92.41%	290	540	547.889
13	-40			2.53	5.22%	94.79%	250	540	545.356
14		20	19.05		4.31%	95.69%	250	560	564.406
15	40		2.1		6.30%	93.70%	290	560	566.504
16		200	194.4		0.90%	99.10%	290	760	760.905

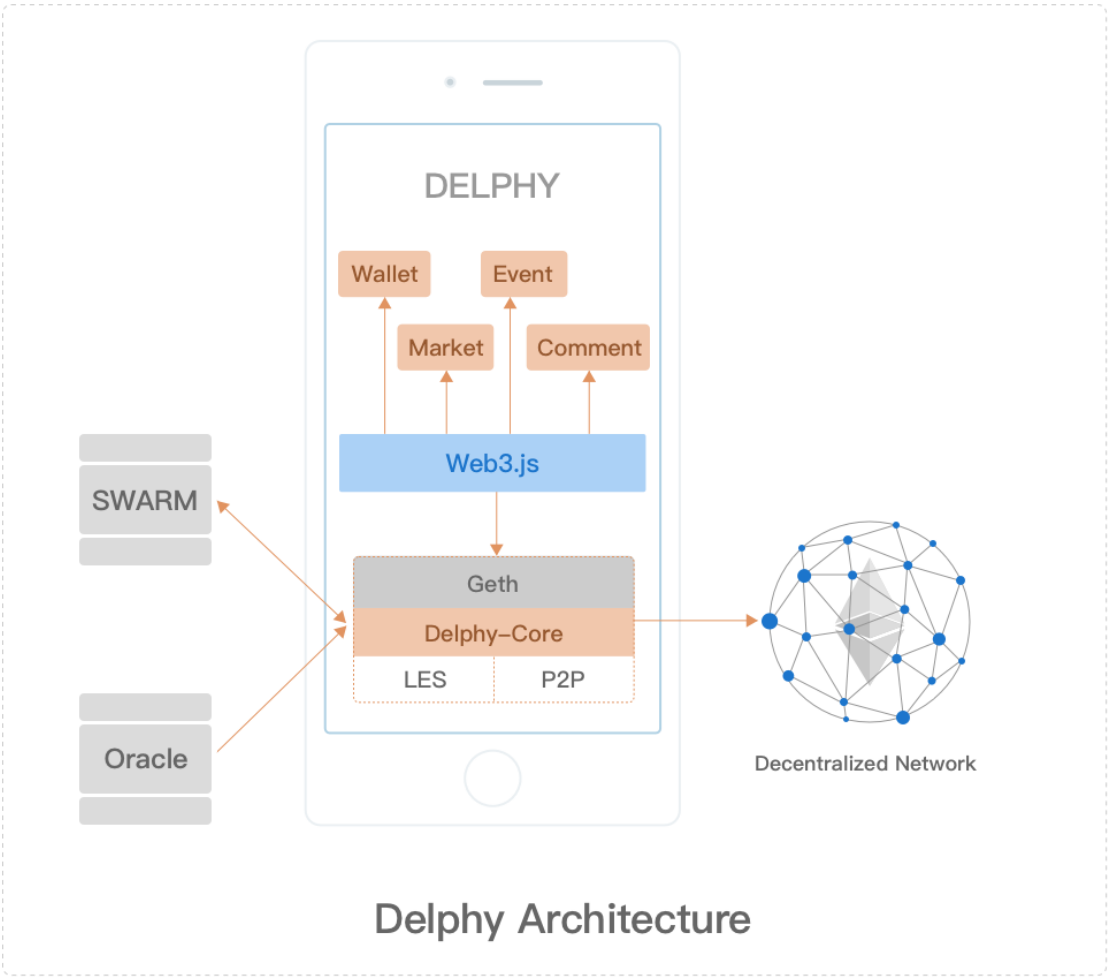
17		-100		98.46	2.41%	97.59%	290	660	662.442



If the prediction market is closed, the probability of "no" is as high as 97.6%, which means the market forecasts that Ke Jie can win at least 1 game. But this prediction is opposite to the real result, which means the prediction is a big failure and the creator makes profits. As the probability of "yes" is as 1, while that of "no" is 0, the market should pay 290 shares of "yes", the total market is $C(290, 660) = 662.44$, and the creator's profits is $662.44 - 290 - 69.31 = 303.13$.

Chapter 4 Delphy Architecture

Delphy is a decentralized and social prediction market platform built on Ethereum, and Delphy App is naturally a light Ethereum client running on mobile devices. Delphy is an open source project with contributions from around the world.



Delphy Architecture

4.1 Delphy Core Elements

Ethereum: It is an open-source, public, blockchain-based distributed platform featuring smart contract (scripting) functionality, and provides decentralized, trust-free and permissioned assets issuing and trading infrastructures for Delphy.

Ethereum is essentially a social computing platform. Delphy is a prediction market of social network and mobile Distributed Application (DApp). As a Dapp on a public Ethereum blockchain, Delphy can help promote Ethereum among mass market.

Smart Contract：Delphy takes advantage of Ethereum smart contracts to issue DPY Token，create Events and Markets, connect Oracle & Event Filter, as well as to

complete pricing, trading, matching, liquidity and so on.

SWARM: It provides a decentralized file management mechanism that helps Delphy store static files and metadata related to Events & Markets in prediction markets to provide distributed storage and retrieval services for Delphy mobile applications.

LES (Light Ethereum Subprotocol): LES is a mechanism designed for mobile devices (such as smartphones, etc.) that only downloads the head of a block rather than the entire block when the blockchain is synchronizing. It provides a fully secure blockchain access function, but does not participate in mining or the formation of consensus.

4.2 Delphy Mobile App

With the ubiquity of smartphones and the great success of Wechat, Delphy adopts a strategy of "born mobile", i.e., Delphy takes advantage of the LES protocol of Ethereum to provide a decentralized prediction market as a mobile application, which is a light Ethereum client independently running on mobile devices rather than browser-based or stand-alone desktop applications.

Delphy mobile app uses LES to run the Geth & web3.js framework on smartphones, providing very powerful and secure functions. Users can create events very easily, create Market according to the Event they have interest in, set the Event & Market description and metadata, quickly query Event & Market along with the share prices and movements, and buy or sell shares, make payment and receive profits in different markets.

4.3 Oracle

Oracle is the information release mechanism of the real outcome of the Events in Delphy. The predicted outcome of an Event in Delphy must be determined by Oracle that provides a series of APIs by which Delphy uses to determine the outcome of prediction market and achieve the final settlement.

Oracle can be centralized (such as RealityKeys and Oraclize), as well as multi-centralized. A centralized Oracle will be enough when some predictive applications only need a single data point to verify the results. For example, the prediction of a NBA game, as the results on NBA official website may be enough. For a multi-centralized Oracle, we will devise an incentive mechanism and implement the “m out of n” mode and Oracle's dispute resolution solution.

4.4 Delphy Features

Delphy App is A Light Ethereum Client

Delphy is a mobile platform running a light Ethereum client based on LES. Delphy App supports almost all the functions of the Ethereum full node minus mining,

leveraging the P2P protocol to communicate directly with other nodes in Ethereum network, greatly improving efficiency, making Delphy App, SDK & API powerful and scalable.

Naturally Mobile

Smartphone is the preferred platform choice for Delphy to develop its application. Delphy iOS and Android mobile app will be launched simultaneously with the Delphy platform, and it will improve user friendliness, maximally meet users' needs, and boost the popularization of Ethereum and the ecosystems development.

Customizable

The same Event can be used to create Markets with different preferences, and each Market may have different loss limit, deposit, market liquidity, delivery date, Oracle and dispute arbitration mechanism. Users with different preferences can choose their own Markets for transactions, and really achieve creation and cooperation of personalized markets.

Event Filter

The Event created by users will enter a temporary Event Pool provided in Delphy. The system provides a default Event Filter that is used to filter out illegal or unethical events, such as predictions on the assassination of a country's leader or the overthrow of a government. Delphy also provides Filter APIs for users to create their own Event Filters to comply with the laws, regulations and ecosystem in their countries and jurisdictions.

Social

Delphy mobile app is a social prediction market. Predicting is a social, and Delphy features functions like comments, P2P payments, P2P messaging and OTC to provide users to socialize with one another on one single platform.

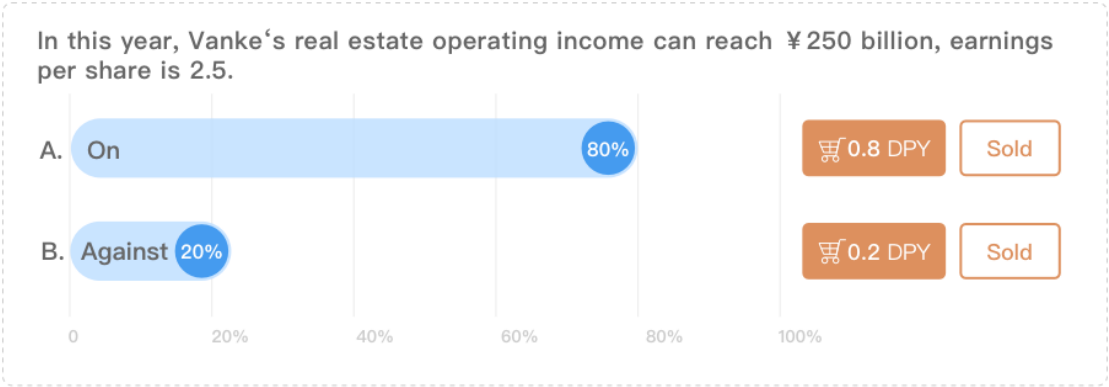
Chapter 5 Delphy Applications

5.1 Finance

Prediction market could generate financial instruments more refined than existing derivatives, providing asset managers with more accurate tools to hedge risk.

If we regard traditional financial instruments as representations of economic value, the present “representations” of financial instruments could be considered limited to the claims of assets (such as currency, stock), the announcements of financial relationships between economic entities (such as bonds), and the statements of instrument-related values (such as derivatives). Prediction market can bring more subtle and detailed representations of economic events to embody value (and risk) at the macroeconomic and microeconomic levels more clearly.

For the professional institutional investors who manage billions of dollars, forecasting the performances of the companies in their portfolio is the most important. Prediction market will provide opportunities for market involvers familiar with relevant situations to express themselves, as well as more market data to secondary market stock analysts.



5.2 Insurance

Prediction market can be used to hedge against risks due to its high liquidity and great accuracy. It essentially crowdsources risk assessment and creates opportunities for participants to monetize their valuable private knowledge. One of the typical examples is the agricultural weather forecast.

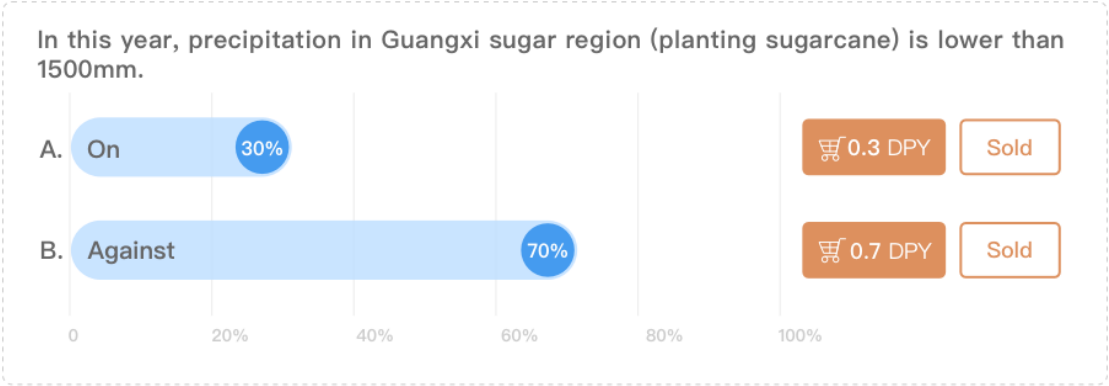
Agriculture is highly vulnerable to meteorological disasters, such as heavy rain, typhoon, low temperature, dust storm, which can cause great losses to agricultural production. According to the statistics of the China Meteorological Administration, from 1949 to 1991, China experienced 14 major droughts, several of which reduced grain production by more than 15 million tons.

As a result, farmers are in a great need of hedging against risks. According to the statistics released by the China Insurance Regulatory Commission, China's agricultural insurance premiums have increased sevenfold from 2007 to 2016. However, it is difficult to cater to each region and each crop merely relying on agricultural insurance. Delphy prediction platform enables farmers to create prediction markets that meet their individual needs and to get more refined risk hedging services.

For example, the sowing of early rice in Northeast China should hedge against the risk of low temperature, as it is susceptible to a cold spring, while the sugar cane should hedge against the risk of too much or too little rainfall as it has to be 1500 mm to 2000 m.

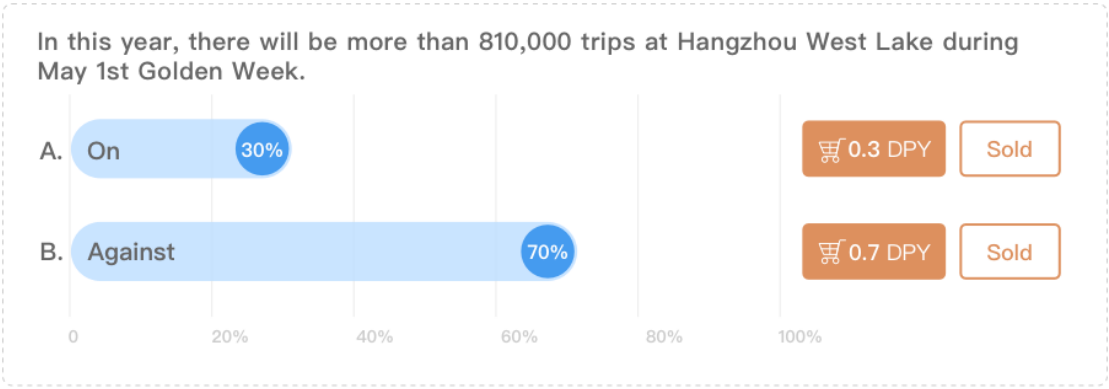
Delphy prediction market is quite useful in agriculture. Farmers can participate prediction market to hedge against risks of meteorological disasters and reduce economic loss, and meteorological experts can monetize their valuable experience while helping farmers.

Prediction themes：The rainfall in the sugar crane field in Guangxi Province this year will be less than 1500mm.



5.3 Points of Interest (PoI)

With the improvement of people's living conditions, tourism has become an important way of leisure for Chinese people. However, because the tourism resources are centralized and limited, most scenic spots are extremely crowded when people travelling around during holidays, only a few famous spots can avoid such situation. That is why predicting which scenic spots have relatively less visitors in advance seems appealing to most people.



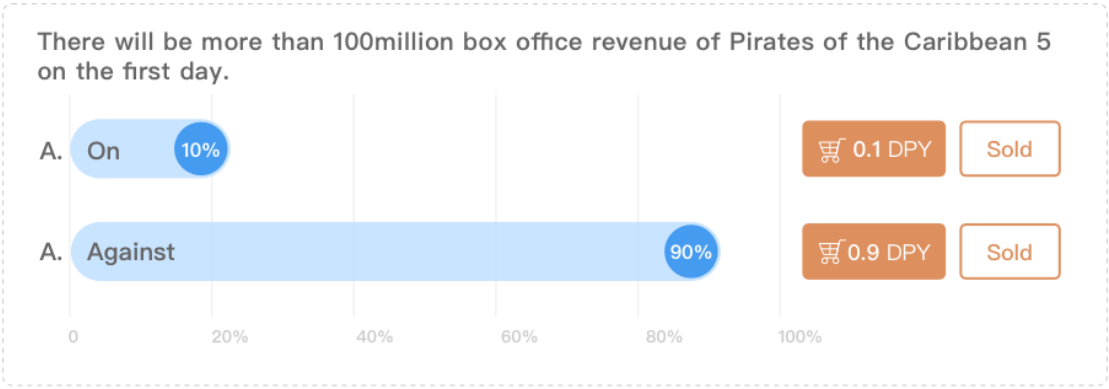
West Lake—a world-renowned scenic spot in Zhejiang Province, has taken a series of measures to limit the amount of tourists, because the number of tourists it received these years often exceed the maximum carrying capacity set by the country—797,500 times. In recent years, the scenic area has also adopted the technology of big data to analyze the data of tourists, providing reference and basis for managing, setting appropriate tour routes, dynamically mastering tourists' information and developing business strategies.

5.4 Entertainment

Entertainment industry is one of the most prosperous industries. According to the "13th Five-Year Plan", the market cup of the culture and entertainment industry will reach ￥450 billion in 2015, and may be ￥1 trillion in 2020 with the television and film sector valuing ￥500 billion.

Prediction market can be used widely in the entertainment industry, such as forecasting auditions of variety shows, ratings, movie box office results and so on.

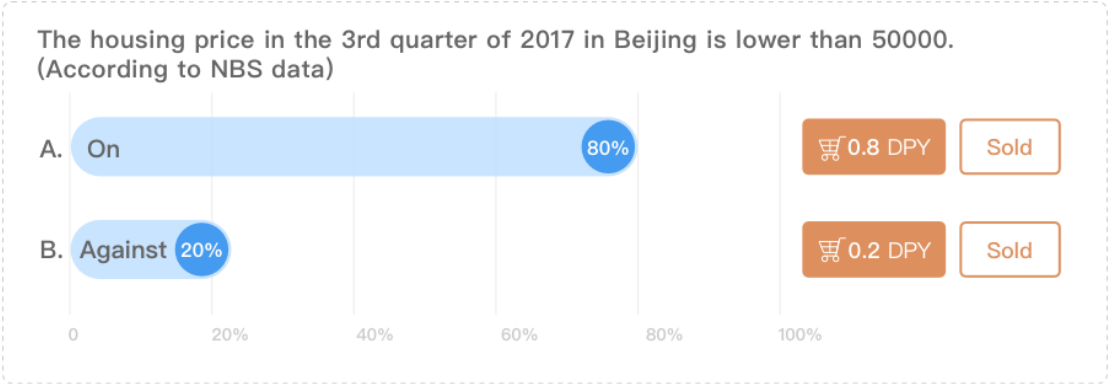
It is notable that Hollywood already has a prediction market of movie box office. Its amazing accuracy can be demonstrated by the prediction on the 2007 Academy Awards Ceremony. Hollywood Stock Exchange successfully predicted 32 out of the 39 nominations via ranking by transaction prices, and it correctly predicted seven out of the eight main awards before the ceremony officially began.



5.5 Housing Price

Housing price is the topic that Chinese people concern the most, as house is an asset of the highest holding among most Chinese households, but key opinion leaders (KOL) or third-party transaction data are currently the main data source to predict the current housing price.

Obviously, prediction market, with the public participating to express their viewpoints, can intuitively reflect the current public expectations of housing prices, which also provides valuable reference to the government's macro-control policies, real estate companies' investment plans as well as purchasers and sellers.



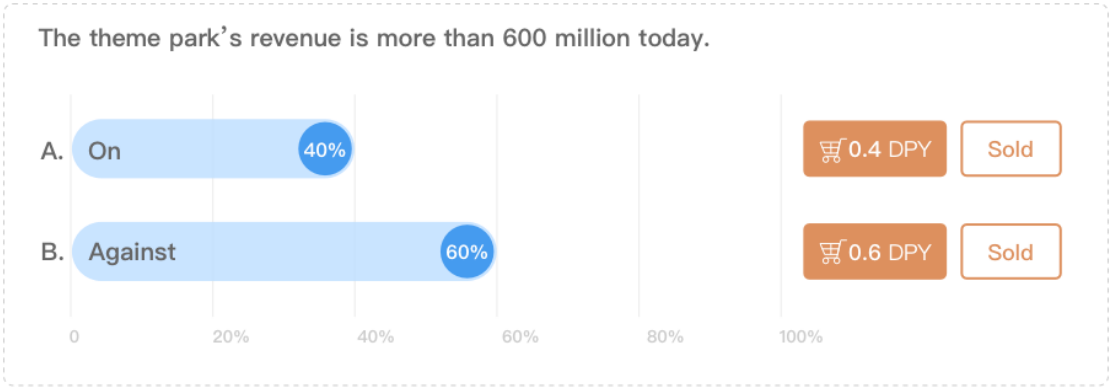
Although there are several channels to collect housing price data, the prediction market will use the data quarterly released by the National Bureau of Statistics to ensure data reliability.

5.6 Games

The market size of online games is huge, and according to the "2016 China Game Industry Report", the market cap of China's game industry scale reaches more than ￥160 billion and keeps growing fast.

As for games in prediction market, we can call our APIs within the games to provide prediction market game playing methods and mechanism to players instead of relying on game developers to build the methods and mechanism.

When it comes to games like theme parks, players can build and operate their own theme parks meticulously and even invite friends to join, for example, players need to buy land, hire employees, set game facilities the way they want them.

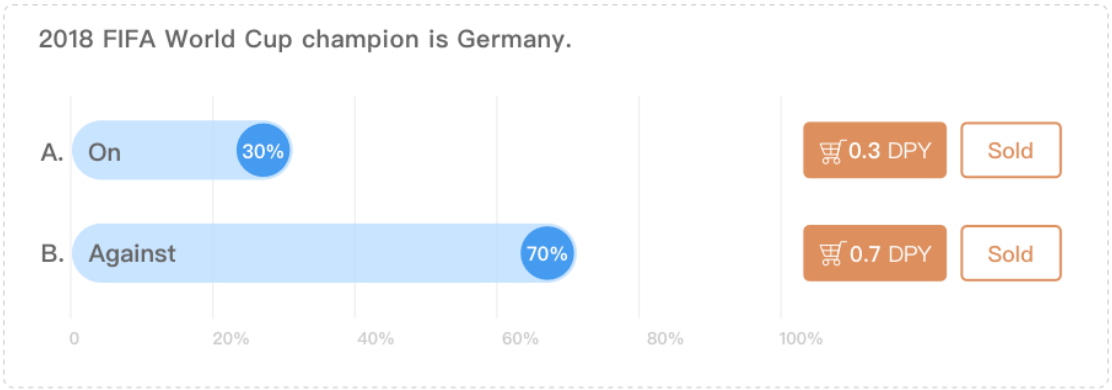


5.7 Sports

Sports betting has a long history. The famous story of "Tian Ji's Horse Racing" strategy in China's Spring and Autumn Period is one of the earliest records about ancient Chinese sports betting. Australia has had legitimate horse racing betting since more than a hundred years ago. In the UK, sports betting was legalized on May 1st, 1961. William Hill, a UK gaming company, is known as the first operator carrying out legal online sports betting business as it started that in 1998.

However, the adoption of centralized prediction market in sports betting is slow. This is because the establishment of such companies has many requirements, and the platform cannot provide open, fair, impartial and credible market environment since it is unable to prove its innocence. Besides, users will face additional risks on centralized platforms, such as theft or other failures, as well as payment processor accidents.

In contrast, decentralized sports prediction market has the advantages of lowering the threshold of establishment and participation, proving the platform's innocence and avoiding the risk of a single point of collapse. In Delphy prediction market, fans can launch their own game prediction according to their preferences, which meets the individual needs and increases the sense of participation.



5.8 Governance Policies

Prediction market can help all organizations to achieve the goal of maximizing the efficiency of its human resources.

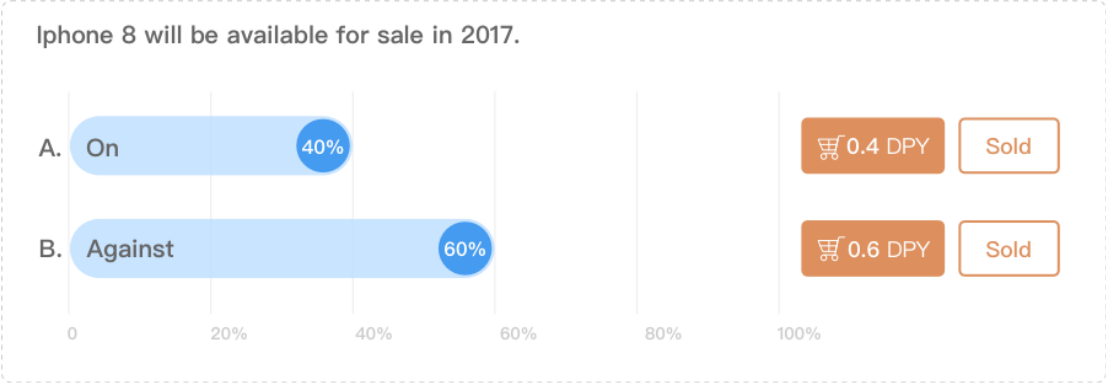
It can help pool the knowledge, wisdom and experience of all stakeholders, enhance the overall competitiveness of the organization, and provide a channel for all employees to express themselves and contribute to the development of the organization. More importantly, it can improve the sense of participation, which means a lot to the millennium generation.

Therefore, the prediction market with the organization can help managers and administrators to better understand employees' ideas and guide the organization's operation.

For example, Microsoft once used a prediction market to forecast whether a software will be delivered on time. Within the first 3 minutes of the transaction, the price of "on time" went down, which manifested that participants had no faith in delivering on time. Then the project manager held a product meeting to discuss how to solve the problems of delay, and the price bounced. However, the product was unable to be delivered on time ultimately because end users were not satisfied with some of its performance.

This example shows that a prediction market collecting all kinds of information can help a lot with the governing policies inside an organization.

The example of Microsoft is not the only company which has ever deployed prediction markets, as for the past 10 years, many Fortune 500 companies, including HP, Best Buy, General Electric, Google and IBM, have been doing the same thing.



Economist David Rothschild believes that the application of prediction market in business decisions mainly has two purposes, one is to inform participants what may happen in the future so that they can collect information and resources more efficiently, and the other is to make them know how the various factors affect prediction results.

In addition, prediction market can also help organizations to manage economic and social risks more effectively, such as a decline of consumer demand, the outbreak of epidemics and environmental disasters.

Chapter 6 Legal Matters and Risk Factors

6.1 Legal Structure of Delphy

A non-profit foundation, Delphy Foundation Limited (**"Delphy Foundation**"), has been established in Singapore with respect to Delphy, which will act as an independent legal entity to organize a core team to develop such a decentralized prediction market platform and application. However, the operation and use of Delphy per se will be fully subject to and dependent on the community's autonomy and the Delphy Foundation will merely be a garden-variety member within the community who may put forward proposals or suggestions on Delphy's self-governance without supreme or distinguishable power of authority.

The Delphy Foundation will sell, in the form of private sale and crowdsale, DPY tokens that are designed to be used on the Delphy platform. DPY will serve as the payment method and unit of account for the users to use Delphy's services. Nobody will be responsible to repurchase or redeem any sold DPY. DPY, as a kind of virtual commodity with practical uses, are not securities or speculative investment instrument. The Delphy Foundation does not guarantee any intrinsic value of or economic return from DPY. DPY do not represent any real-world assets or rights (such as shares, voting rights, and etc. of the Delphy Foundation). The typical target users of DPY are veterans in crypto-tokens and blockchain.

Any US citizens, permanent residents, or green card holders are not allowed to participate in the DPY crowdsale. Thus the Delphy Foundation will not sell DPY to the foregoing persons.

Proceeds from the sale of DPY will be used by the Delphy Foundation at its own discretion, mainly including expenses for technical development, marketing, compliance, financial audit, business development, and etc.

The prediction market within Delphy is completely decentralized on top of Ethereum. Anyone around the world can access, free of geographical restrictions, the designed functions of Delphy by and only by consuming DPY. The Delphy platform neither has any physical presence nor is associated with the territory or fiat currency of any country or region. Nevertheless, Delphy may still be confronted with interrogatories and supervisions from regulatory

authorities in various countries around the world. To satisfy and comply with the local laws and regulations, the Delphy platform may be out of service in certain jurisdictions. The Delphy Foundation and its team will endeavor to seek "sandbox policy" or safe harbor treatment to allow Delphy to better serve the users.

6.2 Disclaimer

The Delphy Foundation does not make, and hereby disclaims, any representation or warranty with respect to Delphy or DPY (such as merchantability or fitness for particular purposes), except those expressly specified herein. Each purchaser's decision to participate in the DPY crowdsale and purchase any DPY shall be made based on his/her own knowledge of Delphy and DPY and the information disclosed in this Whitepaper. Without prejudice to the generality of the foregoing, each purchaser will, upon the launch of Delphy, accept DPY on an "as is" basis, irrespective of the technical specifications, parameters, performance or function thereof.

The Delphy Foundation hereby expressly disclaims its liability, and shall in no case be liable to any person, for:

(1) any person's purchase of DPY in violation of any anti-money laundering, counter-terrorism financing or other regulatory requirements that are imposed in any jurisdiction;

(2) any person's purchase of DPY in violation of any representation, warranty, obligation, covenant or other provision under this Whitepaper, and the resulting failure or inability to make his/her payment or to claim relevant purchased DPY;

(3) early termination of the DPY crowdsale for any reason;

(4) failure or abortion of Delphy development and resulting failure to deliver DPY;

(5) delay or rescheduling of Delphy development and resulting failure to meet any anticipated milestone;

(6) any error, bug, flaw, defect or otherwise of the source code of Delphy;

(7) any malfunction, breakdown, collapse, rollback or hardforking of Delphy or the blockchain of Ethereum;

(8) failure of Delphy or DPY to meet any specific purpose, or unfitness for any specific use;

(9) utilization of the proceeds raised through the DPY crowdsale;

(10) failure to timely and completely disclose any information relating to the development of Delphy;

(11) any purchaser's divulgence, loss or destruction of the private key of his/her crypto-currency or crypto-token wallet (inter alia, the private key of the Delphy wallet used by that purchaser);

(12) any default, breach, infringement, breakdown, collapse, service suspension or interruption, fraud, mishandling, misconduct, malpractice, negligence, bankruptcy, insolvency, dissolution or winding-up of any third party crowdfunding portal of DPY;

(13) any difference, conflict or contradiction between this Whitepaper and an agreement between any purchaser and any third party crowdfunding portal;

(14) trading or speculation of DPY by any person;

(15) listing or delisting of DPY on or from any exchange;

(16) DPY being classified or treated by any government, quasi-government, authority or public body as a kind of currency, securities, commercial paper, negotiable instrument, investment or otherwise that may be banned, regulated or subject to certain legal restrictions;

(17) any risk factors disclosed in this Whitepaper and any damage, loss, claim, liability, punishment, cost or other adverse impact that is caused by, associated with, in connection with, incidental to or consequential to that risk factor.

6.3 Risk Factors

The Delphy Foundation believes that there are numerous risks involved in the development, maintenance and running of Delphy, many of which are beyond

the control of the Delphy Foundation. Each DPY purchaser should peruse, comprehend and consider carefully the risks described below in addition to the other information stated herein before deciding to participate in the DPY crowdsale campaign.

Each DPY purchaser should pay particular attention to the fact that, while the Delphy Foundation is established in the Republic of Singapore, Delphy and DPY lie in cyberspace only without physical presence and hence do not fall within or pertain to any specific jurisdiction.

Participating in the DPY crowdsale campaign shall be an action based upon prudent decision and will be deemed as the relevant DPY purchaser having been fully aware of and agreed to take all the risks below.

(1) Termination of the Campaign

The DPY crowdsale campaign may be early terminated, in case of which a purchaser may only be refunded with part of his/her payment as a result of the Bitcoin / Ether price volatility and/or the expenses incurred by the Delphy Foundation.

(2) Insufficient Information Availability

Delphy is at the stage of development as of the date of this Whitepaper and its philosophy, consensus mechanism, algorithm, code and other technical specifications and parameters could be updated and changed frequently and constantly. While this Whitepaper has contained the then up-to-date key information of Delphy, it is not absolutely complete and is subject to adjustments and updates that the Delphy Foundation might make from time to time for certain purposes. The Delphy Foundation is not in a position, nor obliged, to keep the purchasers closely posted on every detail of Delphy development (including its progress and expected milestones no matter whether rescheduled or not) and therefore will not necessarily provide the purchasers with timely and full access to all the information relating to Delphy that may emerge from time to time. The insufficiency of information disclosure is inevitable and reasonable.

(3) Regulatory Measures

Crypto-tokens are being, or may be, overseen by the regulatory authorities of various jurisdictions. The Delphy Foundation may receive queries, notices, warnings, requests or rulings from one or more regulatory authorities from time to time, or may even be ordered to suspend or discontinue any action in connection with the Campaign, Delphy's development or DPY. The development, marketing, promotion or otherwise of Delphy or the DPY crowdsale campaign may be seriously affected, hindered or terminated as a result. And since regulatory policies

could change from time to time, existing regulatory permission or tolerance on Delphy or the DPY crowdsale campaign in any jurisdiction could be just temporary. DPY could be defined from time to time as virtual commodity, digital asset or even securities or currency in various jurisdictions and therefore could be prohibited from being traded or held in certain jurisdictions pursuant to local regulatory requirements.

(4) Cryptography

Cryptography is evolving and cannot guarantee absolute security at all times. Advances in cryptography, such as code cracking, or technical advances such as the development of quantum computers, could present risks to all cryptography-based systems including Delphy. This could result in the theft, loss, disappearance, destruction or devaluation of the DPY held by any person. To a reasonable extent, the Delphy Foundation will be prepared to take proactive or remedial steps to update the protocol underlying Delphy in response to any advances in cryptography and to incorporate additional reasonable security measures where appropriate The future of cryptography or security innovations is unpredictable while the Delphy Foundation will try its best to accommodate the continuing changes in the domains of cryptography and security.

(5) Development Failure or Abortion

Delphy is still in the process of development, rather than a finished product ready to launch. Due to the technological complexity of the Delphy system, the Delphy Foundation could be faced with unforeseeable and/or insurmountable difficulties from time to time. Accordingly, the development of Delphy could fail or abort at any time for any cause (including insufficiency of funds). The development failure or abortion would result in non-availability of the purchased DPY for Crowdsale to any purchaser.

(6) Theft of Crowdsale Proceeds

There may be attempts to steal the crowdsale proceeds received by the Delphy Foundation (including the fiat currency amount converted therefrom). Such a theft or attempted theft may affect the ability of the Delphy Foundation to fund the development of Delphy. While the Delphy Foundation will adopt cutting-edge technical solutions to keep the crowdsale proceeds safe, certain cyber thefts could be hardly unpreventable.

(7) Flaws in Source Code

Nobody can guarantee the source code of Delphy to be flaw-free. It may contain certain flaws, errors, defects and bugs, which may disable some functionality for users, expose users' information or otherwise. Such flaws,

if any, would compromise the usability, stability, and/or security of Delphy and consequently bring adverse impact on the value of DPY. Open source codes rely on transparency to promote community-sourced identification and solution of problems within the code. The Delphy Foundation will work closely together with the Delphy community to keep improving, optimizing and perfecting the source code of Delphy onwards.

(8) Unpermissioned, Decentralized and Autonomous Ledger

There are three prevailing categories of distributed ledger adopted among the contemporary blockchain projects, namely, unpermissioned ledger, consortium ledger and private ledger. Delphy's underlying distributed ledger is an unpermissioned one, which means it is publicly accessible and useable to everyone on a permission-free basis. While Delphy is initially developed by the Delphy Foundation, it is not owned, operated or otherwise controlled by the Delphy Foundation. The community of Delphy, which is spontaneously formed and is open, decentralized and admission-free to join, is composed of users, fans, developers, DPY holders and other participants worldwide who are mostly not connected with the Delphy Foundation in any manner. Such a community will be decentralized and autonomous as to the maintenance, governance and even evolution of Delphy while the Delphy Foundation will merely be an active player in the community peer to others without supreme or arbitrary authority, irrespective of its earlier efforts and contributions to the genesis of Delphy. As a result, it is not at the mercy of the Delphy Foundation how Delphy would be governed or evolve after the Launch.

(9) Update of Source Code

The source code of Delphy is open and could be updated, amended, altered or modified from time to time by any member of the community of Delphy. Nobody is able to foresee or guarantee the precise result of an update, amendment, alteration or modification. As a result, any update, amendment, alteration or modification could lead to an unexpected or unintended outcome that adversely affects Delphy's operation or DPY's value.

(10) Security Weakness

The blockchain of Delphy rests on open-source software and is an unpermissioned distributed ledger. Regardless of the Delphy Foundation's effort to keep the Delphy system secure, anyone may intentionally or unintentionally introduce weaknesses or bugs into the core infrastructural elements of Delphy which the security measures adopted by the Delphy Foundation is unable to prevent or remedy. This may consequently result in the loss of DPY or any other digital tokens held by a purchaser.

(11) "Distributed Denial of Service" Attack

The Ethereum is designed to be public and unpermissioned and therefore may suffer cyber-attacks of "distributed denial of service" from time to time. Such attacks will adversely affect, stagnate or paralyze the network of the Delphy system and accordingly render the transactions thereon delayed to be recorded or included in the blocks of the Ethereum blockchain or even temporarily unable to be performed.

(12) Insufficiency of Processing Power

The rapid growth of Delphy will be accompanied by a surge of transaction numbers and demand of processing power. If the demand of processing power outgrows how much the nodes of the Ethereum blockchain network can then provide, the network of Delphy could be destabilized and/or stagnated, and there could be fraudulent or false transactions such as "double-spending" to arise. In the worst-case scenario, the DPY held by the purchasers could be lost, and rollback or even hardforking of the blockchain of the Ethereum could be triggered. All these aftermaths would do harm to the usability, stability and security of Delphy and the value of DPY.

(13) Unauthorized Claim of DPY for Crowdsale

Any person who gains access to the DPY purchaser's registered email or registered account by deciphering or cracking the purchaser's password will be able to claim the purchased DPY for Crowdsale in bad faith. As such, the relevant purchased DPY for Crowdsale may be missent to the person whoever claims that the same through the purchaser's registered email or registered account, which sending is not revocable or reversible. Each DPY purchaser shall take care of the security of his/her registered email and registered account throughout by taking such actions as: (i) using a highly secure password; (ii) refraining from opening or responding to any scam emails; and (iii) keeping strictly confidential all the secret or personal information about himself/herself.

(14) Private Key of DPY Wallet

The loss or destruction of a private key required to access DPY may be irreversible. DPY are controllable only by possessing both the relevant unique public and private keys through the local or online DPY wallet. Each purchaser is required to safeguard the private keys contained in his/her own DPY wallet(s). Where such private key of a DPY purchaser is lost, missing, divulged, destroyed or otherwise compromised, neither the Delphy Foundation nor anyone else will be able to help the purchaser access or retrieve the related DPY.

(15) Inflation

Subject to the specific underlying protocol at the launch of Delphy, the total quantity of DPY may slightly increase over time, and could further increase because of the adoption of a patch or upgrade of Delphy source code. The resulting inflation of DPY supply could lead to the drop of market price, and consequently DPY holders (including the purchasers) could suffer economic losses. It is not guaranteed that a purchaser or DPY holder would be compensated or made good somehow for the DPY inflation.

(16) Popularity

The value of DPY hinges heavily on the popularity of the Delphy system. Delphy is not expected to be popular, prevalent or widely used soon after the Launch. The worst-case scenario is that Delphy may even remain marginalized in the long run, appealing to only a minimal portion of the users. By contrast, a significant portion of DPY demand could be of speculative nature. The lack of users may result in increasing volatility of DPY market price and consequently compromise Delphy's long-term development. The Delphy Foundation will not (nor has the responsibility to) stabilize or otherwise affect DPY's market price if there is any such price.

(17) Liquidity

DPY is not a currency issued by any individual, entity, central bank or national, supra-national or quasi-national organization, nor is it backed by any hard assets or other credit. The circulation and trading of DPY on the market are not what the Delphy Foundation is responsible for or pursues. Trading of DPY merely depends on the consensus on its value between the relevant market participants. Nobody is obliged to redeem or purchase any DPY from any DPY holder (including the purchasers). Nor does anyone guarantee the liquidity or market price of DPY to any extent at any time. To divest his/her DPY, a DPY holder would have to locate one or more willing buyers to purchase the same at a mutually agreed price, which attempt could be costly and time-consuming and does not necessarily bear fruit. And there could be no crypto-currency exchange or other marketplace having DPY listed thereon for trading.

(18) Price Volatility

Cryptographic tokens, if traded on public markets, usually have extremely volatile prices. Fluctuations in price over short periods of time frequently occur, which price may be denominated in Bitcoin, Ether, US Dollars or any other fiat currency. Such fluctuations could result from market forces (including speculations), regulatory changes, technical innovations, availability of exchanges and other objective factors and represent changes in the balance of supply and demand. The Delphy Foundation is not responsible for any secondary market trading of DPY no matter whether or

not there would be such markets for DPY. Therefore, the Delphy Foundation neither is obliged to tame the price volatility of DPY nor cares about that. The risks associated with DPY trading price have to be taken by the DPY traders themselves.

(19) Competition

Delphy's underlying protocol is based on an open-source computer software such that nobody claims copyright or any other type of intellectual property right of the source code. As a result, anyone can legally copy, replicate, reproduce, engineer, modify, upgrade, improve, recode, reprogram or otherwise utilize the source code and/or underlying protocol of Delphy in an attempt to develop a competing protocol, software, system or virtual platform or virtual machine, which is out of the Delphy Foundation's control and may consequently compete with or even overshadow or overtake Delphy. Besides, there have been and will be various competing blockchain-based platforms that compete with Delphy. The Delphy Foundation will in no case be capable of eliminating, preventing, restricting or minimizing such competing efforts that aim to contest with or overtake Delphy.

Chapter 7 Roadmap

2017 Q3

1）Developing Delphy-Core

2）Developing Delphy.go

3）Developing Centralized Oracle

2017 Q4

1）Developing Event & Market Editor

2）Developing SWARM-based Storage

3）Developing Mobile Wallet

4）Developing iOS & android App

5）Continuously developing Delphy-Core、Delphy.go and Oracle

2018 Q1

1）Launching Alpha version

2）Integrating RealityKeys

3）Providing API & SDK

4）Security Auditing

5）Delphy Pilot Run

2018 Q2

1）Hackathon

2）Developing decentralized storage and index

3）Developing KYC

4）Developing Event Filter

5）Security Auditing

Chapter 8 Team

Core Team

Bo Wang

Bo obtained his B.S in Information Management in Peking University and his M.S in Information Economics in University of Michigan. He is a serial entrepreneur in both China and USA, and was recently the former Co-Founder and VP of Engineering of Factom. He is considered an expert of blockchain consensus algorithm and P2P networking..

Tllik

Tllik gained his Ph.D in Applied Mathematics in Peking University. A cryptography scientist and information security expert, he focuses on study of Elliptic curve pairings and Elliptic curve discrete logarithms problem. He has more than 10 years of research and development experience in information security.

bill

Shiwu graduated from Zhengzhou University with B.S. degree of Mathematics and is excellent at algorithm and performance optimization. An expert in 3D game engine, he has been a key contributor or founding member to a few successful game companies in China. He is an all-around full-stack engineer currently focusing on smart contract programming with Solidity..

Jerry

He earned a master’s degree in Computer Science from Chinese Academy of Sciences, former principal researcher of loT and cloud computing at Oracle China. He is an expert in JavaCard, N3, JVM & EVM, Hyperledge / Fabric & Ethereum; main enabler of JavaCard, N3 systematic cryptographic algorithm.

Hua Fang (Frank)

.Qinggang gained his Master of Computer Science in Chinese Academy of Sciences. He was a staff engineering in Internet of Things (IoT) and Cloud Computing projects in Oracle China, and a principle contributor to the implementation of National Standard of Cryptography. His main expertise includes JavaCard, N3, JVM & EVM, Hyperledger / Fabric and Ethereum.

Frank

Frank has a Master degree of Communication Engineering in Aachen University of Technology in Germany and is also a Certified Public Accountant. He used to work for the world's leading telecom equipment manufacturer and eCommerce company and has extensive experience in product development and project management. He is a full stack engineer with focus on React.

Xiong Lu (Eda)

Eda obtained her B.S. degree in Information Systems in Beijing Information Science & Technology University, and has rich experience in User Interface (UI) and User Experience (UX) design on mobile devices and 3D game console.

Council & Advisory Board

Bo Shen： Founder of Fenbushi Capital

James Gong： Founder of ChainB.com

Roland Sun： Partner of Broad & Bright

Gang Wu：Founder of Bixin.com

Bibliography：

[1] Ethereum Whitepaper: https://github.com/ethereum/wiki/wiki/White-Paper

[2] TruthCoin Whitepaper: http://bitcoinhivemind.com/papers/truthcoin-whitepaper.pdf

[3] Augur Whitepaper: https://bravenewcoin.com/assets/Whitepapers/Augur-A-Decentralized-Open-Source-Platform-for-Prediction-Markets.pdf

[4] Gnosis Whitepaper: https://gnosis.pm/resources/default/pdf/gnosis_whitepaper.pdf

[5] Protess, Ben Intrade Bars U.S. Bettors After Regulatory Action

[6] Mann, Adam The power of prediction Markets Nature Vol 538, Issue 7625

[7] Kambil, Ajit Predictive Markets: Predicting the rise of prediction Markets Analytics Magazine, March/April 2011

[8] Rice, Andrew The Fall Of Intrade And The Business Of Betting On Real Life

[9] Yeh, Puong Fei Using Prediction Markets to Enhance US Intelligence Capabilities

[10] Hanson, Robin. The Policy Analysis Market - A Thwarted Experiment in the Use of Prediction Markets for Public Policy, innovations： Technology, Governance, Globalization : 73—88

[11] Gelman, Andrew Something's Odd About the Political Betting Markets

[12] Simon de la Rouviere Why & How Decentralized Prediction Markets Will Change Just About Everything.

[13] Hanson, R. Combinatorial Information Market Design[J]. Information Systems Frontiers, 2003, 5(1):107-119.

[14] Hanson, R. Logarithmic Market Scoring Rules for Modular Combinatorial Information Aggregation[J]. Journal of Prediction Markets, 2009, 1(1):3-15.

[15] Arrow K J, Forsythe R, Gorham M, et al. The Promise of Prediction Markets[J]. Science, 2008, 320(5878):877-8.

[16] Hanson R, Oprea R. A Manipulator Can Aid Prediction Market Accuracy[J]. Economica, 2009, 76(302):304–314.

[17] Pennock, David Implementing Hanson's Market Maker, http://blog.oddhead.com/2006/10/30/implementing-hansons-Market-maker/, 2006.

[18] Justin Wolfers, Eric Zitzewitz(2006): Interpreting Prediction Market Prices as Probabilities, Social Science Electronic Publishing

[19] Hanson, Robin (2013) Shall We Vote on Values, But Bet on Beliefs?* Journal of Political Philosophy: 151-178

[20] David Porter, Cary Deck(2013), Prediction Markets in the Laboratory, Journal of Economic Surveys : 589-603

[21] 郑伟（2008）， 地震保险:国际经验与中国思路， 保险研究: 9-14

[22] 万国华， 李铭（2016）: 我国二元期权交易的法律规制路径研究，《金融监管研究》 ：34-50

[23] 张宁， 李国秋（2016）: 企业内部运行的预测市场研究《竞争情报》 :52-58

[24] 童振源、林馨怡（ 2008）： 台湾选举市场预测： 预测市场的运用与实证分析，选举研究: 131-166.

[25] http://consensuspoint.com/

[26] https://www.cultivatelabs.com/
[27] https://www.predictit.org/
[28] https://tippie.biz.uiowa.edu/iem/
[29] http://bitcoinhivemind.com/
[30] https://fairlay.com/
[31] https://github.com/psztorc/Truthcoin
[32] https://en.wikipedia.org/wiki/Prediction_market