A Blockchain-based Word-of-mouth Platform

Connecting People by Trust

coomi.io

Whitepaper

V1.0

coomi.io

Table of Contents

1.Abstract

1.1. About Coomi

Coomi is a blockchain-based decentralized platform of word-of-mouth (WOM) contents. It is a community with reward system to all the contributors, a realization of Six Degree of Separation theory and a guide to all consumers on decision making. The meaningful contents about a certain product from one user will be conveyed to other users through the database network. In this whitepaper, it will be elaborated how Coomi creatively combines blockchain technology and Six Degree of Separation theory. The neural network algorithm will also be introduced to sort and identify positive contributions from the users. In Coomi, the contents are produced, conveyed and valued.

1.2. Introduction

The story begins with Nami, our team member, who often asks her friends with similar skin type for help when looking for new cosmetics. Such exclusive information is hard to obtain online at the moment, while the need is huge, and has potential commercial value. The influence of these contents from friends are valued by trust in our daily life.

Tsuki, our another team member, once went to a high reputation restaurant after spending hours searching Google and relevant APPs. Unfortunately, the dinner is terrible. Such experience is common and it reveals that the current online reputation system does not always work. Ads and inaccurate contents are prevailing everywhere. From here, we start to think about what is the Word-of-mouth marketing in the new era of information age. At the same time, our another colleague, Erichin joined the founding of ALIS (STEEM in Japan). His work on designing smart contracts inspired us to combine the Word-of-mouth marketing with the cutting edge blockchain technology.

※ ALIS (https://alismedia.jp/) ※ STEEM (https://steeem.io/)

1.3. Word-of-mouth Marketing

Word of mouth, originally referred to the passing of information from person to person by oral communication, now covers a wide range communication media online, like posting stories, adding comments and starting a vote et al., is popular online all over the world. It plays an important role in daily life and influences the decision making of all consumers. People take these information as useful reference when looking for a restaurant or hotel. Successful products like Pinterest, Yelp and Booking have accumulated millions of users. Even further, more and more users start to read these contents as daily news and follow the high-rank contributors in consumption. In 2017, such online websites and APPs have become billion dollar industries and the market is still growing in both China and Japan.

2.Major Challenges

In China, Jack Ma (Alibaba) said on 2017 World Internet Conference that today's cyberspace needs more objective, rational and real contents. In the U.S., Elon Musk also plans to create a journalist-rating site for news online. The internet is under rapid developing but some fundamental problems are coming out. One of them is what should we believe on the internet? This is also our target in Coomi. From the previous survey, we have summarized five major challenges of online WOM, listed as follows,

1. How to shorten consumer's time on searching and reading contents, from 30 min to 30 s?

2. How to solve the management problems in current centralized online WOM platform?

3. How to make the public voice also heard on the platform and help contributors benefit from their positive contributions (compared to key opinion leasers)?

4. How to change the existing zero-sum situation between platform and merchants?

5. How to improve the user-traffic aimed advertising model, while the users actually don't want to see ads?

These challenges and problems are unsolved until the emerging of blockchain technology.

3.Potential Solutions

In the previous section, six major challenges of current online WOM are listed. Here, Coomi will try to solve these problems on our own platform. The key to solving these problems is the combination of WOM, blockchain technology and social network.

(1) How to shorten consumer's time on searching and reading contents, from 30 min to 30 s? The development of online WOM has benefited many consumers. While the existing of SEO and listing techniques is able to intentionally bring the users to certain products and confuse the users. Thus, the users have to spend a large amount of time judging whether to trust the platform or not.

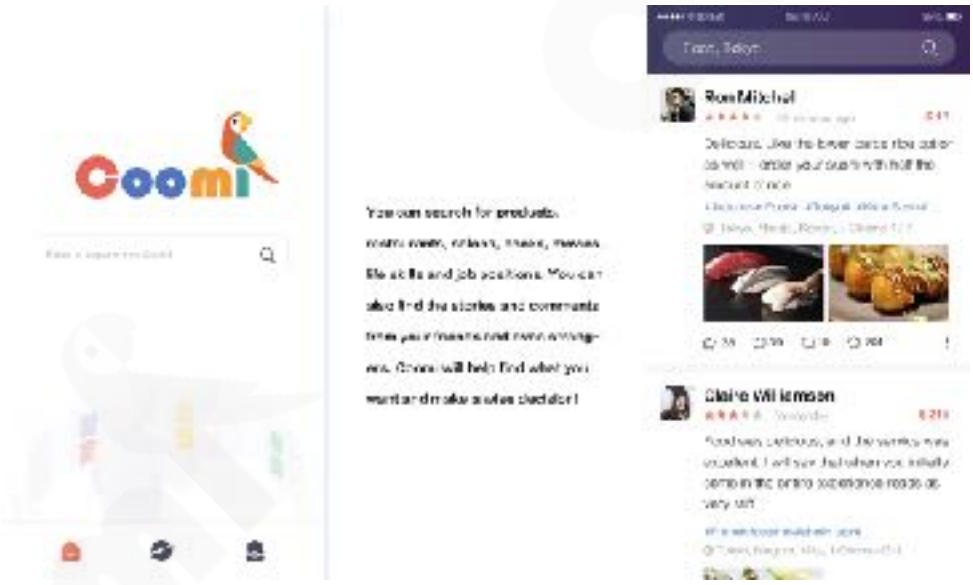
After market investigation and needs analysis, Coomi solves this problem in two aspects. First, to change the sequence for information display and search process. Take finding a restaurant as example, the current sequence is,

Enter search condition> Go to restaurant 1> Read comment 1> Make decision1> Go to restaurant 2>...> Read comment n> Make decision n.

Here we adopt a new sequence which is already proved by Instagram and Xiaohongshu.

Enter search condition> Read comment 1> Read comment 2> Make decision.

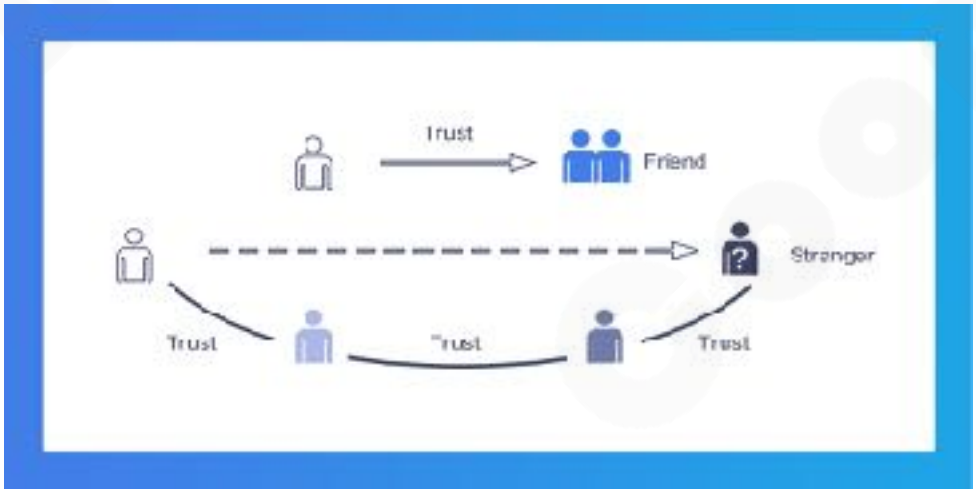
The scheme is shown in the following image.



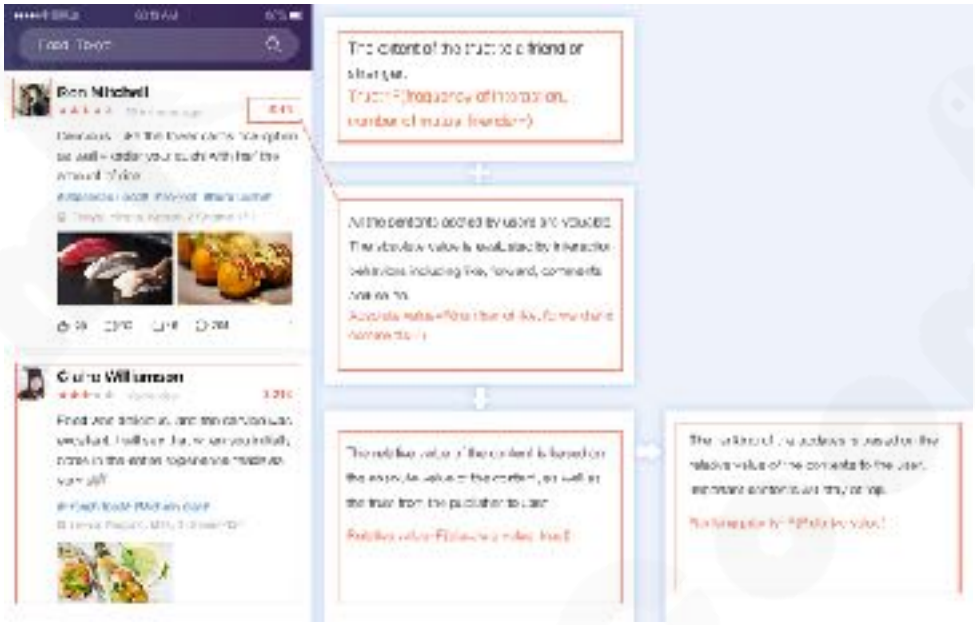
Second, Coomi will automatically search for meaningful contents and reviews and send to other users. The value of the contents is judged by following aspects.

(1) are trusted publishers (shown in the figure); (2) are properly-written contents. A detailed description can be found in section 6. The first aspect is simple but important. We trust information not only because of the information itself, but also because of the publisher. Based on Six Dimension Separation theory, the social network in Coomi could bring

the content from a stranger to you, but also show you six users in the trust chain between you and the stranger. The user is likely to trust a friend of his/her friend rather than a complete stranger. Therefore, users can find reliable publisher and their contents through the social network.



Such social network has been proved successful in Japanese website Retty. Here, Coomi will break through the first layer of friends and extend more levels. This could improve the trust between two strangers and increase the influence of meaningful contents. The second aspect is the objective value of the contents. How to quantify the value? Here we are using a common practice in the field, that is to calculate from the user's behavior data from database. These data include the number of contents the user write, forward and save, as well as the frequency of clicks on photos and so on. The value of contents is calculated and then sorted for the user. These reliable and meaningful contents will help increase the efficiency of decision making for consumers.



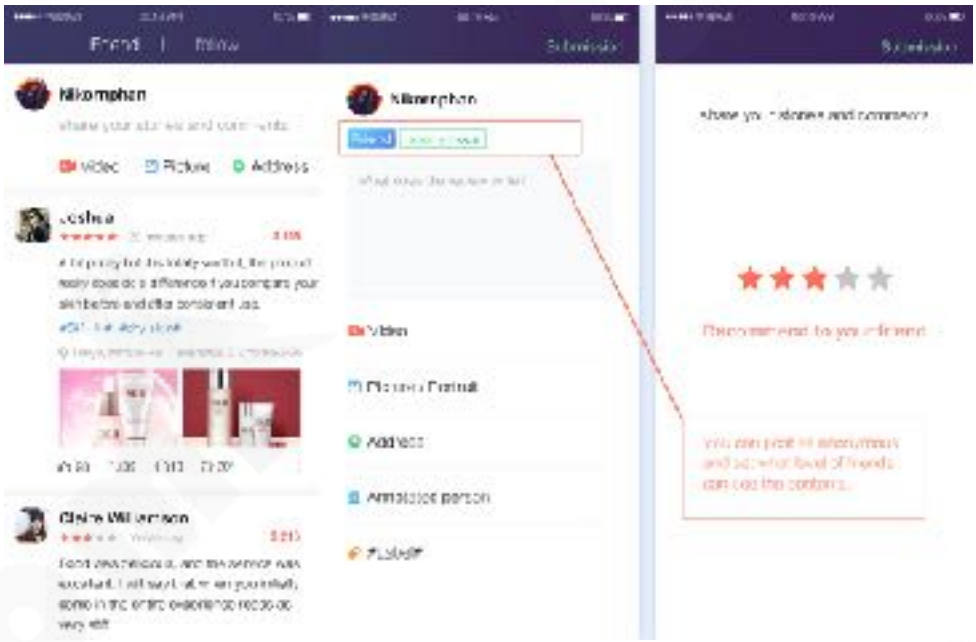
In Coomi, the search and sort of contents will be our feature function, just like Google in webpage search. We also have a unique algorithm on internal logical process and Token distribution. The algorithm will be introduced in section 6 in detail and it is at the moment in the application for patent protection in Japan.

(2) How to solve the management problems in current centralized online WOM platform?

It is notable that the algorithm is based on objective reference. The fake contents will be ranked low and excluded in Coomi. Only reliable contents will be provided to the users.

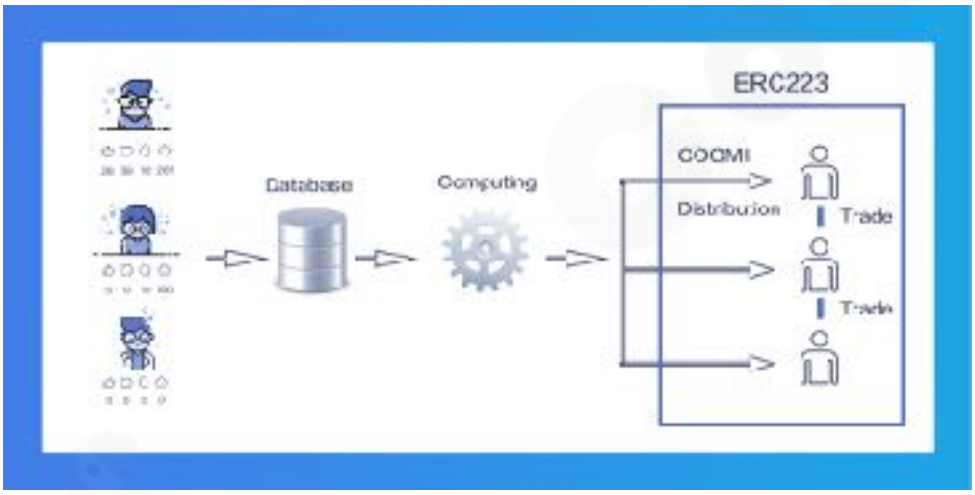
(3) How to make the public voice also heard on the platform, compared with the impact of key opinion leaders?

In Coomi, there are three essential elements to keep the fairness and democracy. (i) the fairness of algorithm; (ii) the fairness in relations of production; (iii) the participation of the public First of all, whether the content is from key opinion leaders or ordinary users, the algorithm is same to value it in reliability. In terms of relations of production, things are simple here in Coomi. Every user can share his/her shopping experience and contents to others and let either friends or strangers see the content. The reward system is based on the direct and transparent distribution of Token.



Compared with the review mode from Amazon, sharing shopping experience in Coomi is simple and friendly. There are no regulations on contents like Yelp or Dianping. We are devoted to increasing the diversity of the community, like Google and Twitter. Users can use # to mark their contents by themselves. The open and diverse community is our advantage.

The participation of the public is important in Coomi. Users may ask, why should we write contents? What are the benefits? If users only write contents when they have an extreme experience (either good or bad), the community is not sustainable. The Token economy is a good solution to this. We adopt an efficient algorithm to distribute Tokens and use cryptocurrencies to reward content producers. The mass participation is the key for blockchain community. Just like steem, both publisher and readers are rewarded by Tokens under certain rules.



What's more, in order to reduce the risk for the users, we will use a more secure Token system, ERC223, rather than the common ERC20.

4.Business Model

Here we will discuss our business model and try to solve the last two problems.

(4) How to change the existing zero-sum situation between platform and merchants?

(5)How to improve the user-traffic aimed advertising model, while the users actually don't want to see ads?

The previous sections have mentioned the relationship between platform and merchants. In Japan, the platform lowers rank of the

merchants who have not subscribed the advertising package, ruining their reputation. In China, it is even more cruel that the platform directly removes the merchants who also appear in the rival platforms. Above examples are happened when the business model of the platform is simply on advertising revenue. For Coomi, we plan to use a new business model and write the distribution rules in the smart contract and store the smart contract in the blockchain. The contract on the blockchain has the characteristics of being transparent and unchangeable, so as to build consensus and completely change the original zero-sum situation. All participants in the ecosystem are also the builder and owner of Coomi. On the contrast, the existing business model of online WOM, either based on advertising revenue or commission revenue, will finally lead to inequality between platform and merchants. This is also the important reason for us to introduce Token economy and blockchain technology.

In terms of the business model in Coomi, there are three essential elements, which are,

(1) Cash flow

After the users read the contents and click on product #A, we will direct the user to the seller list for product A with the purchase links from different merchants on same page. While facilitating the user shopping experience, we can make profits from the merchants due to the network traffic.

(2) Monetization of added value

We can generate reputation data for different merchants based on user's behavior and contents. From the reputation, we can further make rankings and set different awards. The data and copyright of the rankings and awards are important added value to Coomi. The

COSME in Japan has achieved great success in cosmetics industry using this mode.

(3) Token ecology and the platform value

We will create different scenario for using COOMI (Coomi Token). For example, special membership will be charged in COOMI for those users who want to have access to some advanced ranking and contents. At some designated merchants, COOMI can be used for payment and discounts. At the same time, some part of the profits from first two models will be used to buyback COOMI and maintain a healthy rate.

5.Platform Design

At present, the operation of different blockchain based platform is under different stage. Compared to Steem and Alis, Coomi has lower threshold for content producers and every user is welcomed to publish their own contents.

In our plan, there are four steps to establish the platform.

1. 100-person test. We will invite 100 people as the early users from the friends of Coomi founders. Through testing, we will adjust some parameters in the model and algorithm and improve the platform.

2. 1000-person test. The content quality at this stage is significant to the growth of Coomi. We will invite some good content producers to join Coomi and write down their experience and contents as examples for future users. Here, we will also connect Facebook API to improve the social network of Coomi. Like Steem, there early users should be interested in bolckchain products. Therefore, we will start with blockchain-related topics, i.e., the cryptocurrencies, blockchain projects, and wallets. They can publish opinions on a specific blockchain projects or even comment on the project founders. We will also invite outstanding media partners in the field to produce early contents and help form the community. This would make Coomi an important entrance to the whole blockchain industry.

3. Controlled expansion stage. The user number of the platform will increase at this stage based on introduction and invitation of existing users. The expansion speed will be carefully controlled to maintain a healthy social network.

4. Rapid expansion stage. We will work closely with our strategic partners like TokenPocket to acquire more users to the platform.

6.Token Design

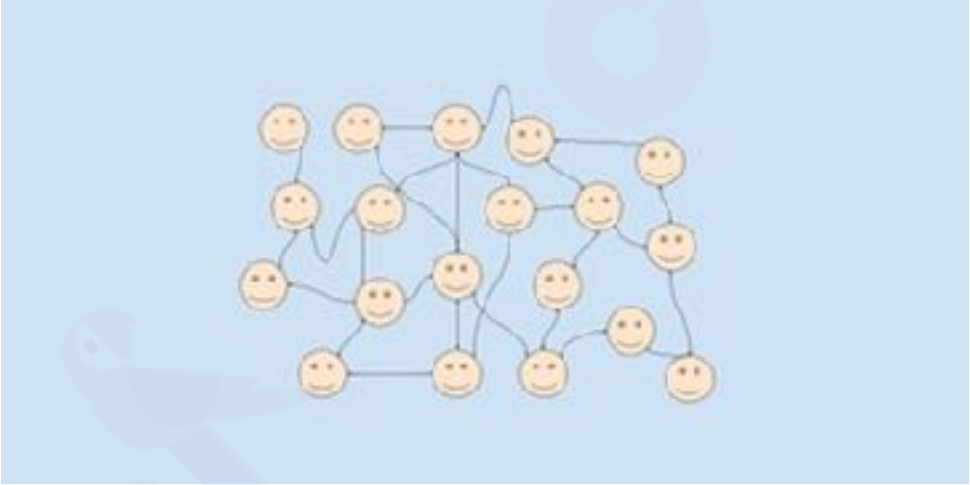
At present, most blockchain platforms like ALIS, STEEM and PRIMAS are restricting the user activity either directly or indirectly, to prevent click farming behaviors. For example, Alis sets a limit for the number of user's "like" action in one hour; Primas monitors user's activity by using HP values. For Coomi, our feature is to give user absolute freedom

within the scope of law. So we don't set limitation on user's behavior. In order to prevent click farming, we introduce a new method called "self-accomplishment".

Above all, some important concepts in Coomi platform are listed here,

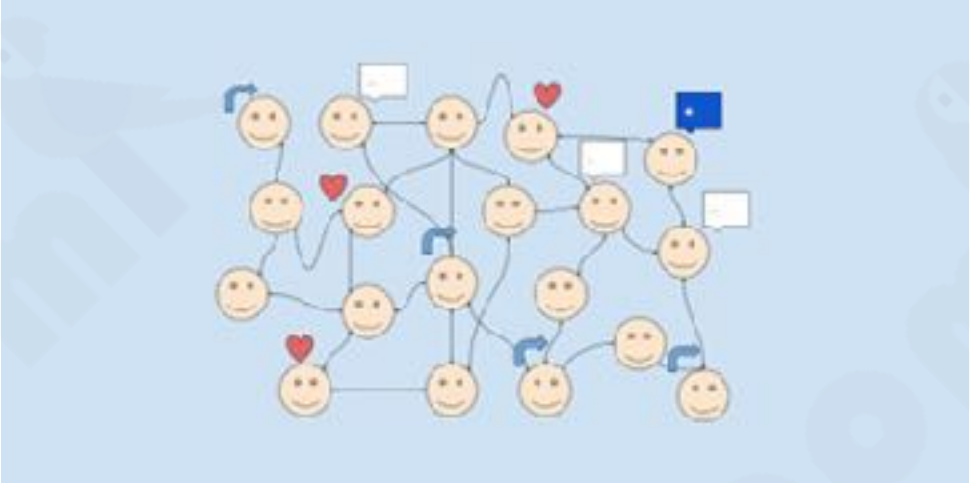
(1) Social network

Coomi is a relation-based platform. The database maintains all the relation data between different users. Users can add friend to each other or follow someone in one way. Facebook data can be imported into Coomi in the future.



(2)Trust

Trust is like a vector in Coomi's database. The trust from A to B is different to from B to A, which is apparent in real life. Here, the extent of trust is inversely proportional to the length of the vector. If one node is referred to a user, the trust between A and other users can be visualized and the closer nodes means stronger trust. The trust is determined by frequency of interactions between users, interaction behaviors, the number of common friends, and so on.



(3) Absolute value of the contents

All the contents posted by users are valuable, including both absolute value and relative value. The absolute value is determined the quality of the contents, which is evaluated by interaction behaviors including like, forward, bookmark, browsing time and so on.

(4) Relative value of the contents

To each user, the relative value of the contents is also important, because people tend to believe the contents from friend and reliable people. Thus, the content would have different relative value to different users.

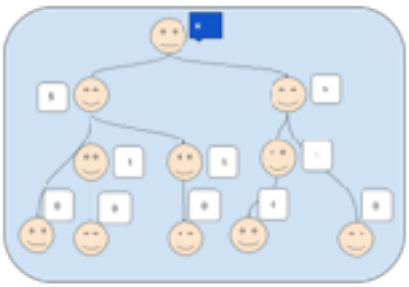
(5) Reward mechanism

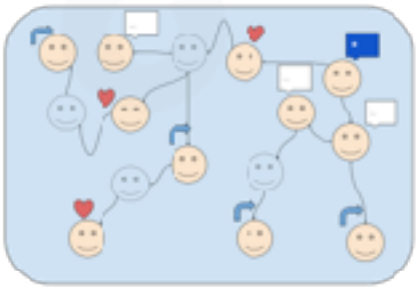
Coomi will give tokens as reward to all the meaningful content producers.

(6) Contribution evaluation

First the contributor's sub social network is extracted from the Coomi database. In this sub network, a shortest path tree can be constructed by using contributor's node as top node. There may exist more than one shortest path tree to the contributor, then we need to use Dijkstra

algorithm to determine the shortest path length by relation operations. The node with the smaller ID is preferentially selected if the length is equal. The path tree refers to the largest possible path for the dissemination of the contents. Each node of the tree is a contributor and the bytes of the node is used as the contribution of this node. The contribution value determines the Token reward that each contributor can obtain. In this way, since the last node has no child nodes, the contribution of the last node is zero. This prevents the user from click farming through a large number of random like behaviors.





(7) Calculation of absolute value

The absolute value of the content is the sum of the contribution value from all the contributors to this content, i.e., the sum of all contribution values from the above shortest path tree. The value is reasonable and prevent click farming and multi-account abuse. This is the neural network algorithm we adopted in Coomi.

(8) Calculation of relative value

The relative value of the content is based on the absolute value of the content and the trust from the publisher to user, which can be written as,

Relative value=F(absolute value, trust)

(9) Ranking of contents

In Coomi, you can browse the updates of direct friends and the friend of friends. The rank of these updates are based on the relative value of the contents to the user. Important contents will stay at top.

Rank=F(Relative value)

With the introduction of social network relationship strength model, Coomi can evaluate the value of the contents in a more reasonable way to each user and prevent click farming and other fraud behaviors.

7. Mathematical Model

User social network is a key factor in Coomi, and it is involved in the calculation of trust, Token reward, absolute value and relative value of contents. Therefore, the accuracy of the social network modelling determines the reliability of the platform in contents production and reward mechanism. In this section, a detailed mathematical model of user social network is proposed.

(1) Fundamentals

The multi-mode social behavior includes many factors, but the factor that determines the decision is the strength of relationship. It is a hidden variable and is an amount that cannot be directly observed. The basis of the relationship strength implicit variable model is the homogeneity theory in sociology, that is, people tend to form relationships with people of similar characteristics. Just like the old saying, “birds of a feather flock together”. The higher the degree of similarity is, the stronger the social relationship will be formed.

Relational intensity hidden variable model is an unsupervised learning model whose core idea is to isolate the user's personalized configuration (likes, concerns, etc.) from the user's communication activities (messages, likes, forwards etc.). It is the strength of the relationship that connects people and serves as an intermediary bridge, which is affected by the individual configuration and at the same time affects the communication activities.

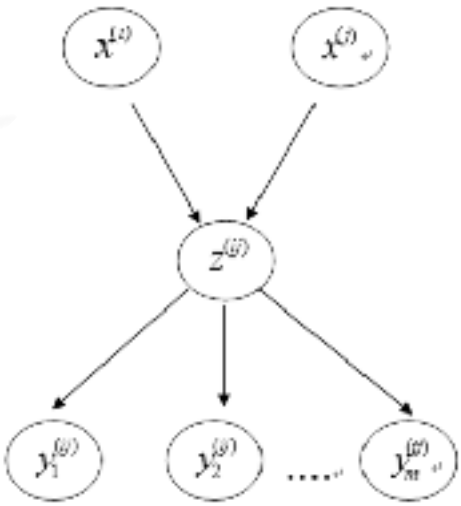
(2) Model setup

Because people can only use limited resources to maintain the relationship, such as time and information. It is natural that we will leave more time to people who feel more important to us. We assume that the strength of the relationship directly affects the intensity of social behavior among friends, that is, the stronger the relationship strength, the greater the intensity of social behavior, and vice versa. Here, $x^{(i)}$ and $x^{(j)}$ refer to two friends i and j, $y_t^{(ij)}, t = 1, 2, ..., m$ is the interaction between i and j, m is the number of times. Then, we define $z^{(ij)}$ as the strength of the relationship between i and j, which is affected by $x^{(i)}$ and $x^{(j)}$, and at the same time will affect $y_t^{(ij)}, t = 1, 2, ..., m$. A scheme of the variables is shown below. The model can be viewed as the combination of discriminant model (conditional probability model) and generative model (joint probability model). The upper structure $(p(Z \mid X))$ is a discriminative model, and the lower structure $(p(Y \mid Z))$ is a generated model. This model turns the causal relationship between variables into conditional dependence, so the joint distribution can be written as,

$$P(z^{(ij)}, \mathbf{Y}^{(ij)} \mid x^{(i)}, x^{(j)}) = P(z^{(ij)} \mid x^{(i)}, x^{(j)}) \prod_{t=1}^{n} P(y_t^{(ij)} \mid z^{(ij)}) \quad (1)$$

$$P(z^{(ij)} \mid x^{(i)}, x^{(j)}) = \mathbb{N}(W^T S(x^{(i)}, x^{(j)}), V) \quad (2)$$

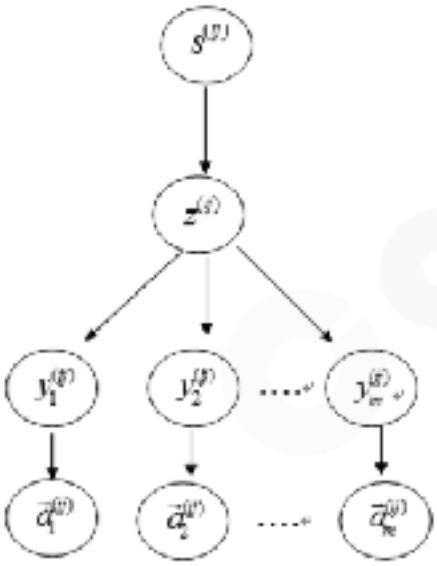
Although the strength of relationship describes the similarity between friends and social behaviors, its value cannot be directly observable. Thus, z needs to be treated as a latent variable, and additional auxiliary parameters are added, then we can use the observed data and maximum likelihood estimation to find the value z. Here, we use the widely accepted Gaussian distribution to describe the conditional probability of the strength under a given configuration for similarity. $s_k(z^{(ij)} \mid x^{(i)}, x^{(j)})(k = 1, 2, ..., n)$ is the similarity of the kth component between friend i and j, then the dependency of $z^{(ij)}$ and $x^{(i)}, x^{(j)}$ can be expressed as follows,



S is a similar column vector calculated according to x^i and x^j, W is a vector of the weights with n dimension. V is the variance in the Gaussian model. In the above model, each given $z^{(ij)}$ is conditionally independent. Here to simplify the solution process, we use binary variables to represent social activities, for example, y_1^{ij} indicates whether a user i interacts with his/her

friend j. $\vec{a}_t = (a_{t1}^{(y)}, a_{t2}^{(y)}, \ldots, a_{tk_t}^{(y)}), t = 1, 2, \ldots, m$ are represented separately for $y_1^{(y)}, y_2^{(y)}, \ldots, y_m^{(y)}$. These parameters make the model more accurate.

The model is also shown in the scheme below.



These auxiliary variables are used to describe the influencing factors of each social behavior. They are independent of the strength of the relationship. For example, y_1^{ij} indicates whether a user i interacts with a friend j, and $\vec{a}_i = (a_1^{ij}, a_2^{ij})$ are the auxiliary variables. a_1^{ij} represent the total number of interactions that represent i->j, a_2^{ij} indicating that for j ->i. These auxiliary variables can express the trend of interaction between friends. We can use logistic function to describe the conditional probability given by $z^{(y)}$ and $\vec{a}_i^{(y)}$,

$$P(y_i^{(y)} = 1 \mid z^{(y)}, \vec{a}_i^{(y)}) = \frac{1}{1 + e^{-(\theta_{i0}a_{i1}^{(y)} + \theta_{i1}a_{i2}^{(y)} + \ldots + \theta_{ik}a_{ik}^{(y)} + \theta_{i,k+1}z^{(y)} + b)}} \quad (3)$$

$\theta_i = [\theta_{i0}, \theta_{i2}, \ldots, \theta_{ik}, \theta_{i,k+1}]^T$ are the estimated parameters, if

$$\vec{u}_t^{(ij)} = \begin{bmatrix} \vec{a}_t^{(ij)} \\ z^{(ij)} \end{bmatrix}$$

Then we can have

$$P(y_t^{(ij)} = 1 \mid \vec{u}_t^{(ij)}) = \frac{1}{1 + e^{-(\vec{\theta}_t^T \vec{u}_t^{(ij)} + b)}}$$

Finally, in order to avoid over-fitting, we can introduce constraints on w and θ, and assume they meet Gaussian prior,

$$P(w) \propto e^{-\frac{\lambda_w}{2} \vec{w}^T w}$$

$$P(\theta_t) \propto e^{-\frac{\lambda_\theta}{2} \vec{\theta}_t^T \vec{\theta}_t}, t = 1, 2, \ldots, m$$

$D = \{(i_1, j_1), (i_2, j_2), \ldots, (i_N, j_N)\}$ refers to N samples. In the process, $\vec{x}^{(ij)}, \vec{y}^{(ij)}$ and $\vec{a}^{(ij)}, ((ij) \in D, t = 1, 2, \ldots, m)$ are observable. The degree of similarity of attributes can be calculated according to x. If $s^{(ij)} = s(\vec{x}^i, \vec{x}^j)$, we can take all observables into Equation (1) to get the joint distribution probability.

$$\begin{aligned} & P(D \mid \vec{w}, \vec{\theta}) P(\vec{w}, \vec{\theta}) \\ &= \left(\prod_{(i,j) \in D} P(z^{(ij)}, \vec{y}^{(ij)} \mid x^{(i)}, x^{(j)}, \vec{w}, \vec{\theta}) \right) P(\vec{w}) P(\vec{\theta}) \\ &= \left(\prod_{(i,j) \in D} \left(P(z^{(ij)} \mid x^{(i)}, x^{(j)}, \vec{w}) \prod_{t=1}^{m} P(y_t^{(ij)} \mid z^{ij}, \vec{\theta}_t) \right) \right) P(\vec{w}) P(\vec{\theta}) \qquad (4) \\ &\propto \prod_{(i,j) \in D} \left(e^{-\frac{1}{2\sigma^2} (\vec{w}^T \vec{x}^{(ij)} - z^{(ij)})^2} \prod_{t=1}^{m} \frac{e^{-(\vec{\theta}_t^T \vec{u}_t^{(ij)} + b)(1 - y_t^{(ij)})}}{1 + e^{-(\vec{\theta}_t^T \vec{u}_t^{(ij)} + b)}} \right) e^{-\frac{\lambda_w}{2} \vec{w}^T \vec{w}} e^{-\frac{\lambda_\theta}{2} \vec{\theta}_t^T \vec{\theta}_t} \end{aligned}$$

(3) Solution

There are generally two different methods for solving a hidden variable model. In the first method, we first infer the joint distribution probability of hidden variables z and find the point estimate for $\vec{w}, \vec{\theta}$. This method often requires the use of an iterative EM algorithm. The second method takes a hidden variable as a parameter, that is, it is constructed a likelihood function

$P(\vec{y},\vec{z},w,\theta\,|\,\vec{x})$, and use the maximum likelihood estimation to find the point estimate for $\vec{z},w,\theta$. Here, we will use the second method because it can avoid iterative process in the EM algorithm, which are often difficult to control. After taking the logarithm on both sides, we obtain the following equation,

$$
\begin{aligned}
&L\left(z^{(i)},\vec{w},\vec{\theta}_i\right)\\
&=\sum_{(\vec{x},y)\in D}-\frac{1}{2v}\left(\vec{w}^{T}\vec{s}^{(x)}-z^{(y)}\right)^2+\sum_{(\vec{x},y)\in D}\sum_{i=1}^{m}-(1-y_i^{(x)})(\vec{\theta}_i^{T}\vec{u}^{(x)}+b)-\log(1+e^{-(\vec{\theta}_i^{T}\vec{u}^{(x)}+b)}) \qquad (5)\\
&\quad-\frac{\lambda_w}{2}\vec{w}^{T}w-\frac{\lambda_\theta}{2}\vec{\theta}_i^{T}\vec{\theta}_i+C
\end{aligned}
$$

Note that in the above equation, the quadratic function is a convex function, and the logistic function is also a convex function. The sum of the convex function is still a convex function, so there is only one extreme point of the function L. Therefore, we use the gradient descent algorithm to find $z^{(i)},\vec{w},\vec{\theta}_i(i=1,2,\ldots,m)$, which makes the maximum value of the function L.

Take partial derivative of $z^{(i)},\vec{w},\vec{\theta}_i$ on function L, we can obtain the following equation,

$$
\begin{cases}
\dfrac{\partial L}{\partial z^{(i)}}=\dfrac{1}{v}\left(\vec{w}^{T}\vec{s}^{(x)}-z^{(y)}\right)+\displaystyle\sum_{i=1}^{m}\left(y_i^{(y)}-\frac{1}{1+e^{-(\vec{\theta}_i^{T}\vec{u}^{(x)}+b)}}\right)\theta_{i,i_{n+1}} & (6)\\
\dfrac{\partial L}{\partial\vec{\theta}_i}=\displaystyle\sum_{(\vec{x},y)\in D}\left(y_i^{(y)}-\frac{1}{1+e^{-(\vec{\theta}_i^{T}\vec{u}^{(x)}+b)}}\right)\vec{u}_i^{(y)}-\lambda_\theta\vec{\theta}_i & (7)\\
\dfrac{\partial L}{\partial\vec{w}}=\left(\dfrac{1}{v}\displaystyle\sum_{(\vec{x},y)\in D}\left(z^{(y)}-\vec{w}^{T}\vec{s}^{(x)}\right)\vec{s}^{(x)}\right)-\lambda_w\vec{w} & (8)
\end{cases}
$$

The gradient descent algorithm will iterate $z^{(i)},\vec{w},\vec{\theta}_i$ until the likelihood function value converges. For $z^{(i)}$ and θ_i, the roots of equations (6) and (7) cannot be solved directly. Combined with the gradient algorithm, $z^{(i)},\vec{w},\vec{\theta}_i$ are updated with the Newton-Raphson method in each iteration,

$$\begin{cases} z^{(ij)new} = z^{(ij)old} - \dfrac{\partial L}{\partial z^{(ij)}} / \dfrac{\partial^2 L}{\partial \left(z^{(ij)}\right)^2} & (9) \\ \vec{\theta}_i^{new} = \vec{\theta}_i^{old} - \dfrac{\partial L}{\partial \vec{\theta}_i} / \dfrac{\partial^2 \Omega}{\partial \vec{\theta}_i \partial \vec{\theta}_i^T} & (10) \\ \dfrac{\partial^2 L}{\partial \left(z^{(ij)}\right)^2} = -\dfrac{1}{v} - \sum_{i=1}^{n} \left(\dfrac{\theta_{i,j_{(ij)}}^2 e^{-(\vec{\theta}_i^T \vec{w}^{(ij)} + b)}}{\left(1 + e^{-(\vec{\theta}_i^T \vec{w}^{(ij)} + b)}\right)^2} \right) & (11) \\ \dfrac{\partial^2 \Omega}{\partial \vec{\theta}_i \partial \vec{\theta}_i^T} = -\sum_{(ij) \in D} \dfrac{e^{-(\vec{\theta}_i^T \vec{w}^{(ij)} - b)}}{\left(1 + e^{-(\vec{\theta}_i^T \vec{w}^{(ij)} - b)}\right)^2} \vec{u}_i^{(ij)} u_i^{(ij)T} - \lambda_2 \vec{I} & (12) \end{cases}$$

The root of $w^{'}$ can be obtained directly by ridge regression.

$$w^{new} = (\lambda_1 \vec{I} + S^T S)^{-1} S^T \vec{z} \quad (13)$$

$$S = \left[s^{(1,1)} \quad s^{(1,2)} \quad \cdots \quad s^{(n,n-1)} \right]^T, Z = \left[z^{(1,1)} \quad z^{(1,2)} \quad \cdots \quad z^{(n,n-1)} \right]^T$$

The scheme of the algorithm is shown as below.

While not converged:
Step1:For each Newton-Raphson step:
For $i = 1, \ldots, m$:
Update $\vec{\theta}_i$ according to equation(10).
Step2:For each Newton-Raphson Step:
For $(i,j) \in D$:
Update $z^{(ij)}$ according to equation(9)
Step3:Update W according to equation(13)

In the calculation procedure, there are two different circumstances in this model according to the sample of friends (i,j). For the first circumstance, if friends $\vec{x}^{(i)}, \vec{x}^{(j)}$ and their social behavior $y_1^{(ij)}, \cdots, y_t^{(ij)}$ are known, then we can use Step2 in the algorithm to estimate $z^{(ij)}$; For the second circumstance, if the social behavior data is not available, then we can directly use equation (2) to estimate that, which is often

because the data of social behavior are sparse, or are difficult to obtain. Thus, the second circumstance is actually more common in online social networks. Once the model learns the parameter determination of w', the hidden variables can be directly calculated with the upper-level variables for the new data. In addition, because the additional parameters $\bar{\theta}_i$ in learning algorithm are also determined by w', we can also use it to calculate the rules of social behaviors offline and make relevant predictions about social behaviors.

8. AI-based Ranking Algorithm

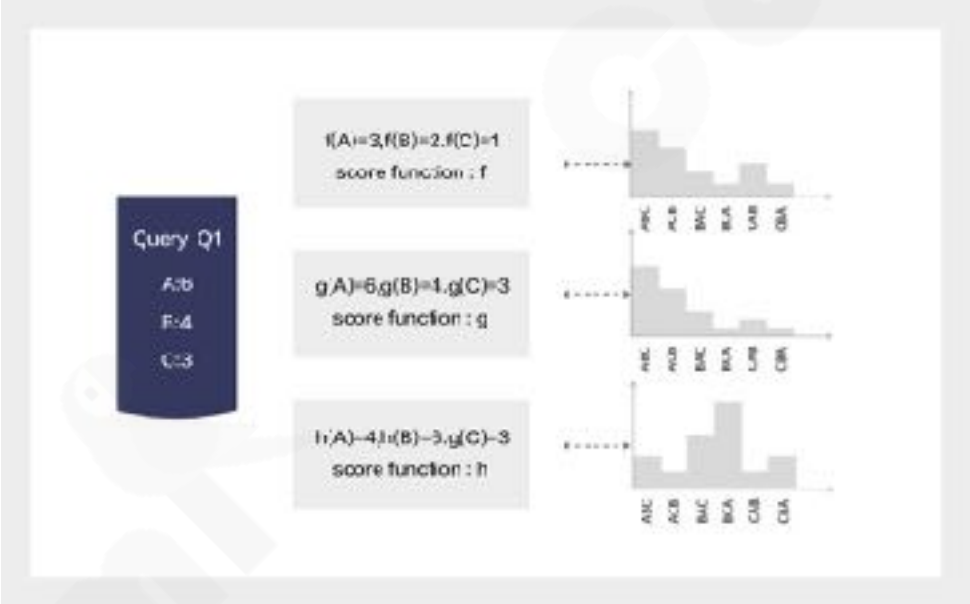
In the previous chapter, we proposed a ranking model, which is determined by the strength of trust and the absolute value (the strength of the relationship and the quality of the content). The publicity is described as,

G=F(R(a,b),X)

R refers to the strength of relationship between a and b. X is the vector about the quality of the content, including the COSINE similarity of query, the Proximity value of the query, the number of citations for contents and the number of citations. The key of the ranking algorithm is to learn the score function F through machine learning. This score function should be very close to the artificial scoring result, and the scores of each result are obtained by QUERY through the F function. Then the sorting results are finally achieved. The key question is how we prepare training data and how to train the algorithm to get the best scoring function. For the data set problem, we have five levels of relevance {Perfect, Excellent, Good, Fair, Bad}, training data format, category labels, query, feature 1, feature 2, feature 3, feature 4 and etc.

Category	Query	Feature1	Feature2	Feature3	Feature4
Perfect	1	0.2	3	2	1
Bad	1	0.9	1	0	3

For the training problem, we adopt the classic ListWise method, which is based on the permutation and combination probability of the search results.



First, to explain the meaning of the search result ranking and combination probability, we suppose that we have 3 result documents ABC for a certain similar query. There are 6 possible search result sequences, ABC, ACB, BAC, BCA, CAB, CBA. Assuming G is the ideal scoring model (obtained by manually labelling and sum-up). We can use Bayesian learning, SVM and many other learning methods to get the learning function. We also use the KL divergence function to measure the similarity of the two probability functions.

As shown in the above figure, F and H are two functions learning through data. The best scoring function is obtained by calculating the KL divergence of G function from F and H functions.

9. Token Distribution

Fund raising: soft cap at 20000 ETH, hard cap at 30000 ETH.

More details about token distribution will be released in next version of whitepaper.

10. Vision and Roadmap

11. Team Member

Team background

The founding members of Coomi come from China and Japan, and most of them have been working at the Japanese Internet giant Recruit Group. Recruit is Japan's highest market value and largest Internet company. Therefore, we have a common working background and culture.

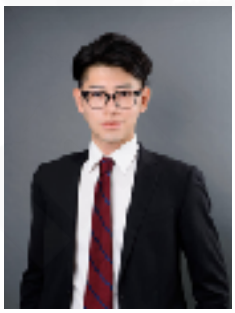
Heming | Cofounder | CEO

Heming studied internet user behavior in Japan under Rotary scholarship. In 2014, he established an online platform for food delivery service. Now he works at Recruit. He has rich experience in digital marketing, customer training, team management and project promotion. Heming is a passionate advocate for blockchain 3.0 and striving for a better society with the power of new technology and business.

Nami | Cofounder | COO

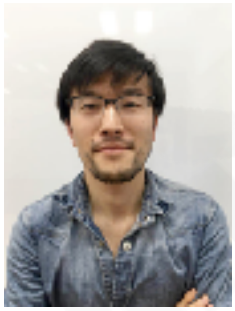
Nami is the leader of the reputation platform in Recruit. With a deep understanding of the industry, she is seeking for new technology and solutions. She believes blockchain technology is the game changer and Coomi has the potential to become next Google and bring the industry to new era.

Tsukikawa Yuu | Cofounder | CMO



Tsuki is the co-founder of Ink. He received his bachelor's degree from both Peking University and Waseda University. He is an early investor in blockchain technology. At 2010-2012, he was the host of a famous TV program. After that, he worked for Recruit as a strategy planner. At the end of 2016, he became the strategic partner of Zaif, the second largest exchanger in Japan. In 2017, he served as adviser for Sora Venture. Now Tsuki is in charge of Ink's global strategy and leads Asian market research in Ziggurat.

Erichin | CoFounder | CTO



Erichin graduated from Tsinghua university and currently works at Recruit as a senior engineer. He is a founding member of ALIS, a famous Japanese blockchain media platform, and is the core founder of TokenPocket, one of the most popular Ethereum wallet in Japan. Erichin is a strong advocate and experienced developer of blockchain technology.

Koan | Founder | Algorithm developer

Koan graduated from the Institute of Computing Technology, Chinese Academy of Sciences, and was working in Sina Mail department. He is now a senior engineer at Indeed (Recruit subsidiary). He has rich experience in algorithms, back-end design, operation and maintenance, search engine

marketing and user growth strategy.

Haruchern | Founder | Full stack developer

Haruchern graduated from the Department of Social Information in Kyoto University, and was working in Baidu Mobile Cloud Division. He is now an advertising system engineer at Indeed (Recruit subsidiary). He has great passion for front-end technology and design, and has rich experience in online advertising ecology and services.

Belle | Founder | Marketing

Belle was working in Japan's largest human resources company and has 6 years' experience in headhunting. She has participated in the recruitment of about 500 international and domestic well-known companies including Amazon, LINE, Metaps, Sony, SAMSUNG, GSK, Pfizer and L'ORÉAL, and helped more than 1,000 employees find their new jobs. Belle now works at the largest B2B headhunter company in Japan and is in charge of the development strategy planning for the fund over 2 billion Yen.

Alaric | Founder | UI/UX designer

Alaric has 7 years' experience in Internet industry. He used to work for several listed companies such as AsiaInfo, Storm and Ronglian. He served as the chief designer and designing director for education, OTO, VR/AR, communications, vehicles and financial

products. Alaric has two independent entrepreneurial experience. He started to focus on blockchain technology since 2016.

Yichen | Founder | Researcher

Yichen received his PhD and Bachelor's degree from Tsinghua University. He now works at CARES, a Cambridge research center located in Singapore. He has rich experience in mathematical modelling and computing. Yichen is also an active member of the local blockchain technology community and focuses on their application scenario in Southeast Asia.

Information about advisors, investors and collaborators will be updated in the second version of the whitepaper.

12. Coding

Our coding part will be open to public in next version of the whitepaper.

13. Declaimer

This document is only for conveying information and does not constitute an opinion on transaction of project shares or securities. Any proposal or request for offer to such effect will be made under credible terms in accordance with the permission of applicable security laws and other related laws. The above information or analysis does not constitute any investment decision or concrete advice. This document does not constitute any investment proposal, investment intent or investment solicitation on securities. This document does not constitute and shall not be construed as a transaction offer or an

invitation to transact any form of securities, neither is it a contract or promise in any form.
All the examples of returns and profits in this document are for demonstration purpose only or represent the industrial average, and do not constitute a guarantee for the result of user's participation.

Coomi clearly states that users with relevant intent shall have clear knowledge of risks on Coomi platform. By making investment, investors confirm their knowledge and acceptance of the project risks, and are willing to personally take responsibility for all corresponding results or consequences.

Coomi clearly states that it will not take responsibility for any direct or indirect losses arising from the participation in Coomi project, including: (i) reliability of all information provided in this document; (ii) any resulting mistake, negligence, or information inaccuracy; (iii) or any subsequent behaviour.

COOMI is a digital Token used, besides other scenarios, on Coomi platform.
COOMI is not an investment target and we cannot guarantee the value addition of COOMI, whose value may decrease under certain conditions. Due to unpredictable factors, targets listed in this White Paper may change. While our team will make its best efforts to realize all targets stated in this White Paper, all individuals and groups purchasing COOMI shall shoulder the risks on their own.

COOMI does not represent a right of ownership or control. Controlling COOMI does not mean ownership of Coomi or Coomi applications.

COOMI does not confer any right on any individual to exercise participation in, control over or decision making on Coomi and Coomi applications.

14. Risk Warning

As a new model of investment, investment in digital asset involves various risks. Potential investors shall discreetly assess the investment risks and their own risk tolerance.

Risks on Token Sales Market

The environment of Token sales market is closely associated with the situation of the whole digital currency market. In case of sluggish overall market situation or existence of other uncontrollable factors, the price of Token may be underestimated over a long period of time, in spite of their own good prospect.

Supervision Risks

Since Blockchain is still in the early stage of development, there are still no laws and regulation across the world, including in China and Japan, that stipulate requirements for precondition, transaction, information disclosure, and locking, etc. Also it's still unclear as to how the current policies will be implemented. All these factors may bring uncertainty to project investment and liquidity. Blockchain technology has become the main target of supervision in major countries of the world. If there is any intervention or exertion of influence by supervising authorities, Coomi application or COOMI may be affected. For example, if there is legal limitation on the use and sale of Token, COOMI may suffer

restriction and obstruction, or the development of Coomi application and COOMI may be directly terminated.

Competition Risks

With advancement of information technology and mobile Internet, digital assets with “Bitcoin” as a representative are gradually prospering and various decentralized applications are continuously emerging, heating up industrial competition. With the steady appearance and expansion of other application platforms, the community will face constant operation pressure and certain risks from market competition.

Risk of Talent Loss

Coomi has gathered a technical team and expert consultants with leading advantage and profound experiences in their respective professional sectors, including professionals with lasting engagement in the Blockchain industry and core team with rich experience in development and operation of Internet product. The core competitiveness of Coomi in the industry lies in its stable core team and consultant resources, the loss of which may affect stable platform operation or its future development.

Risk of Development Failure Due to Fund Shortage

In case of dropping price of Token raised by the founding team or prolonged development time, the team may face a shortage of development fund and possibly even suffer subsequent serious shortage of fund for all activities. In such case, there will be a risk that the intended targets will not be realized.

Risk of Private Key Loss

After the digital wallet address of COOMI is extracted by the buyer, the only means to operate content contained in the address is by his/her associated secret key (private key or wallet passcode). Users are personally responsible for protecting the associated secret keys which will be used to sign transactions and prove their asset ownership. Users understand and accept that if his/her private key document or passcode are respectively lost or stolen, his/her COOMI associated with his/her user account (address) or passcode will be unrecoverable and permanently lost. The best method for secure storage of log-in document is to store the secret key separately at one or several places and avoid using a shared computer for this purpose.

Risk of Hacking or Theft

There is a possibility that hackers, other entities or nations may attempt to interrupt Coomi application or COOMI function with any methods, including but not limited to DoS attack, Sybil attack, guerrilla-style attack, malware attack and homogeneity attack, etc.

Risk of Absence of Loss Insurance

Unlike bank account or accounts with other financial institutions, Coomi account or related Blockchain network are generally without any insurance guarantee. For losses under any conditions, no public individual or public entity will provide insurance.

Risks of Core Protocols

Currently Coomi platform is developed on the basis of Ethereum. In case of any defect, unexpected malfunction or attack to Ethereum,

COOMI or Coomi platform may suffer a stop or loss of function in a manner hard to expect.

System Risk

There are risks related to neglected critical defects in open source software or large-scale failure of global network infrastructure. Though some of the risks may drop over time due to bug fixes and breakthroughs in computation bottleneck, other risks are still unpredictable, such as political factors or natural disasters that may interrupt part of the Internet or the global Internet as a whole.

Risks Due to Bugs or Cryptography Development

Rapid cryptography development and advancement of science and technology such as quantum computer may bring the risk of cracking to Coomi platform, leading to possible COOMI loss.

Risks of Insufficient Attention

There is a possibility that Coomi application may fail to be used by a large number of individuals or entities. This means that the public do not have enough interest in developing and improving the relevant distributed applications. Such lack of interest may bring negative impact to COOMI and Coomi application.

Risk of Poor Acceptance or User Shortage

First of all, COOMI shall not be deemed as an investment target. Even if COOMI may have some value after some time, such value can be very small if Coomi is not accepted by the market and is therefore short of users. There is a possibility that due to any possible reasons, including but not limited to failure in business relations or marketing

strategy, Coomi platform and all the future marketing efforts supported with the raised fund may fail to achieve success. In such case, there will be few or no follow-up supporters for the platform. Of course, this will be very unfavourable to this project.

Risk of Application Defect

Coomi platform may fail to provide normal service due to defects caused by known or unknown reasons (e.g. large-scale Node crash), and may even suffer loss of user COOMI in a serious situation.

Risk of Application or Product Failing to Reach Their Expectation or Buyer's Expectation

Coomi application is still under development stage, and major changes may be made before the launch of official version. The expectation or imagination by COOMI itself or by buyers for the function or manner (including behaviours of participants) of Coomi application or COOMI may not be satisfied. Such situation may be caused by any analysis mistake or change of a single design, etc.

Other Unpredictable Risks

Token which is based on cryptography is a fully new technology that has not be tested. In addition to risks already described in this White Paper, there are other risks that are not yet mentioned or not anticipated by the founding team. Also, other risks may come suddenly, or several risks mentioned above may occur in combination.