COCO white paper

November 18, 2021

Abstract

COCO is a decentralized, autonomous, anonymous / named, open-source, for-profit, platform for online collaborative projects based on virtual shares.

Contents

1 Background of the problem

- I first got in touch with computers in the early 1980's, witnessed the growth and change of the programmer / hacker culture
- Writing code is a fascinating, creative process
- Then came the split between proprietary Windows versus open-source Linux
- From the beginnning, open source has lacked a good **reward mechanism**, developers have to make "selfless sacrifice", hard to expect compensation commensurate with their efforts
- Recently appeared **License Zero** which is both for-profit and open-source, perhaps can solve the problem of earning money

1.1 What does COCO try to solve?

- A company's **stock prices** are determined externally by the free-market ("invisible hand")
- How the company distributes its **shares** are decided internally; This is where COCO tries to innovate

2 Real-name vs anonymous

- All contributors are anonymous by default; They can use their real names optionally
- All contribs can be traced to their contributors; This information can be seen publicly, although the identity of the contributor may be unknown

2.1 Uniqueness of intellectual properties

We decide to adopt an **anonymous** policy because:

- Contribs are creative, informational items that can be easily recognized (seems impossible to to conceal)
- Thus it would be easy for a contributor to disclose his authorship of the contrib, outside of our platform
- Once this is known, the author's friends can cast biased votes on his contrib
- There is no way to prevent such 'collusions' except to make all the work open to public scrutiny
- Whereas, by allowing anonymity, some contributors will be less likely to suffer from negative bias (such as racism or sexism)

3 Shares

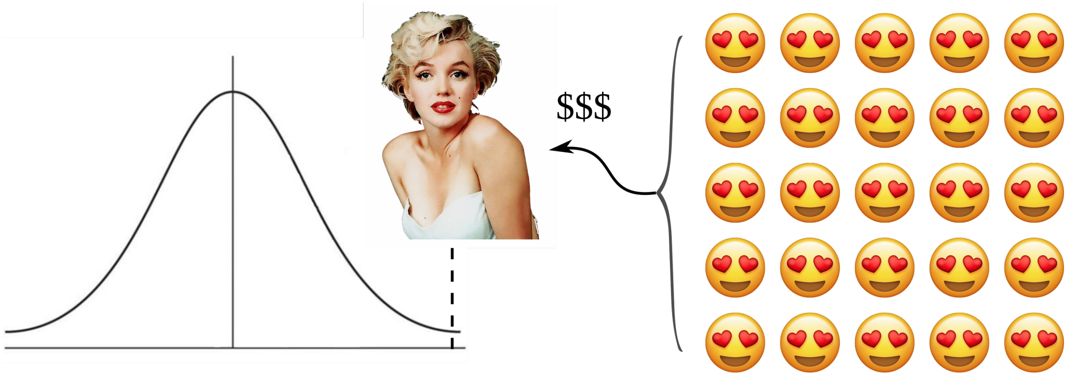
- Contributors get shares automatically when peers bid-vote on their **contribs**
- When an outside **investor** puts money into the company, his contrib is treated just like any other contrib. His investment earns him an amount of shares determined by existing shareholders in the project. This price may vary depending on the investor's outlook for the project.

4 VCS (version control system) and branching

- COCO will be built on top of a VCS (version control system) such as Git or Bazaar
- COCO provides a graphical interface to display the "history graph" of the project
- Each "contrib" in our terminology corresponds to a single or a set of commits in the VCS

- Contributors are free to create branches (alternatives)
- Branching occurs when there is a dispute whether to include a contrib or not
- After branching, all previous contribs up to that point are included in the new branch. New contributors decide which branch they want to contribute to

5 Exponential attenuation of votes



(1)

6 Bid-vote combination scheme

- We consider a mixed voting-bidding scheme, the rationale being that a member's voluntary contribution cannot be **retracted**
- If we rely solely on voting, contributors are in a passive position
- Contributors would be more in touch with the value of their own contributions, which s/he claims in the bidding
- If there is a big difference between bid and voted values, it may indicate an inaccurate assessment or a disagreement.
- The bidding can be of the form of:

  - % shares, or
  - cash amount

- Voters can respond to the bidding by:
  - agreeing
  - disagreeing, or
  - suggesting a new value
- All votes are visible for public scrutiny.
- If some features (contribs) are seen to be voted unfairly, share-holders may initiate new branches.

7 User-side voting

- This is a new feature that has never existed in traditional software products
- Users (ie, buyers of the software) are entitled to vote on features (contribs) that they like, the same as when members vote on contribs
- User input can help COCO more accurately to estimate which contribs are useful
- Buyers pay for the entire project, which includes all its branches / features; They can choose to deploy any branch for usage
- By paying for the product, buyers automatically become share-holders; So they have the right to up/down-vote features (contribs) just like other share-holders

8 Use of AI or default values to automate voting and reduce "voting fatique"

Too much voting events would be detrimental to productivity. We need to reduce the number of votings and simplify the voting process. This can be achieved by default values either designed by humans or recommended by AI.

As to AI recommendation of default votes, we need to decide what is the objective for recommending such votes, given the AI's limited intelligence (assuming it does not yet understand users' contents).

9 Potential problems and possible solutions

- "Reputation" may be inaccurate when members have small # of contribs (but we focus on contribs without regard to who contributed them)
- Branching is automatic – you don't need to care about how others vote, as long as your branch works / someone buys it
- Bad voting should be penalized, but if a contributor is already low-score, the most we can do is to reduce his score to 0. But since each score is earned either by money or work, the penalty may still make sense.
- How to prevent the possibility of a significant contributor spawning fake contribs? But if all the votes are visible, the significant contributor may risk losing his reputation (in the project) even if he is anonymous.

There may be a problem with basing reputation upon voluntary votes. Voting for someone does not benefit the voter; This is a management task traditionally done by managers. If we want to replace such a role, we need an adequate mechanism. The traditional manager gets paid, and his responsibility is to control tasks, monitor work, and give rewards. The question is whether this job can be decentralized?

9.1 The problem of free-riders

In principle, if a founder hoards shares without performing useful work, his shares in the company should be reduced. But how could we distinguish between lazy free-riders and someone who has high standards for other people's work?

A possible solution is via **branching** when founders disagree with each other.

The essence of branching is: to preserve both options in a disagreement.

1. branch A accepts new contrib X
    (a) X is a good contrib
    (b) X is a bad contrib
2. branch B rejects new contrib X
    (a) X is a good contrib
    (b) X is a bad contrib

In cases (1b) and (2a), branch 1 and 2 should be penalized respectively.

Obviously, there should exist users who can determine which branches are better, but in practice there may be too many branches to consider. Users may be unable to tell which branches are contaminated with free-riders.

However, if all votes are openly visible, then statistically we may believe that good branches will win out eventually.

9.2 Insider collusion

Typical scenario: a sub-group of insiders systematically up-vote themselves and down-vote outsiders. They share their identities and contribs among themselves, contrary to COCO's anonymity intention.

Solution: If some users see their contribs are not voted fairly, they may file complaints or initiate new branches.

On our platform, we can examine every vote to see if they are fair. If there is systematic bias it can be detected by people or AI algorithms. This is definitely an improvement over secret ballot.

It is clearly against Coco's policy to form off-platform "alliances" to try to influence voting. Such collusions can only be conducted in secret and would be hard to maintain for large numbers of people.

We may have an additional feature to penalize bad voting?

10 Calculation of shares (draft)

Assume that **initially**, $A, B, ...$ shares the company by the ratio $A : B : ...$. The new-comer X wants to join.

We use the same symbol A to denote the user as well as the "value" (**equity**) she owns in the company.

Before bidding, the fraction $\frac{A}{A+B+...}$ is the % shares of A in the company $A + B + ...$.

In practice, the equity values cannot be known internally, we can only measure their % percentage shares. In other words, we always have the normalization

$$A + B + ... = 1 \tag{2}$$

and the quantities $A, B, ...$ are regarded as percentages.

The actual equity-value of these shares is **market-determined**. This is how the traditional stock market works.

10.1 Scenario 1: New-comer X offers a contrib and bids (suggests) a share amount

Each prior member (A, B, ...) would respond with the % percentage shares she thinks X may own. This respond is denoted $\sigma_i \in [0, 1]$, from 0% to 100%, where i is the **member index** ($A, B, ...$ etc).

The amount of shares X will get is given by:

$$\frac{X}{A + B + ...} = \sigma_A(\frac{A}{A + B + ...}) + \sigma_B(\frac{B}{A + B + ...}) + ... \tag{3}$$

In other words, it is the **weighted-average** of assigned shares.

Question: if A refuses X's contrib, ie, $\sigma_A = 0$, would A's original shares be **diluted**? Under the current scheme, the answer is yes, but the dilution may be reasonable / acceptable.

10.2 Scenario 2: Prior member offers a job with a share amount

In this case, all prior members need to collectively decide if the new-comer has accomplished the task, which is a **binary** decision (“yes” or “no”).

10.3 After-bidding shares adjustment

After bidding, prior members’ shares must decrease to create X’s new shares.

The shares assigned to X is given by (2). So the prior members must split the **remaining** shares among themselves:

$$\boxed{\text{remainder}} \quad r = 1 - X/Z \tag{4}$$

where $Z = A + B + ...$, *ie*, the normalization factor.

Each prior member’s shares can be renewed via this formula:

$$A = r \cdot \frac{\sigma_B + \sigma_C + ...}{\sum \sigma_i} \tag{5}$$

11 Some economic-theoretical background

- When a group of people creates a **product**, its **price** is determined by the **market**. This idea, first articulated by Adam Smith in 1776, is one of the foundational principles of all economics. It can be said that free-market competition is also congruent with the idea of biological **evolution**, posited by Charles Darwin, later in 1859. We assume here that the conditions of free-market economics are satisfied.
- Around 1859-60’s, Karl Marx published *Das Kapital*, in which he posited the now-famous theory of **surplus values**. According to this view, the value of a commodity is construed as a function of the input of **capital** and **labor**. Currently, this assumption is thrown into great doubt because the value of a product may depend on input labor in highly complex and non-linear relations.

- Economists would agree that the notion of **joint-stock companies** is one of the greatest inventions of capitalism. While prices are determined externally by markets, the shares of a company that a participant owns can be decided internally by the company. The goal of COCO is to provide a (hopefully) better method of distributing shares for online companies.