Loyalty farming protocol short paper

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Abstract

The revolution of DeFi and the progress of Dapps in their decentralization roadmap introduces many passive earning protocols based on staking and yield farming activities. In this paper, the authors would like to introduce loyalty as a key factor for earning reward calculation. The novel loyalty farming protocol adjusts participants' benefits based on their commitment toward a model. This model can be a DeFi protocol, a blockchain ecosystem, or real-life characters, organizations.

The authors also present three different metrics for evaluating users' loyalty including long-term commitment, activity frequency, and ecosystem contributions. For these metrics, a general formula is provided to concretely calculate the bonus reward. Two use-cases of loyalty farming protocol in DeFi and gaming are analyzed in this paper as the foundation for further implementation.

1 Introduction

In a decentralized world, incentives are utilized for encouraging users to contribute to the security and the operations of systems. Many activities can help users make profits from their tokens such as staking for proof of stake in consensus, voting in DAO government, liquidity providing to DEX, and lending protocol. Maximizing the profit may make users adopt yield farming protocol (or liquidity mining).

In such context, this paper introduces a novel farming protocol that appreciates the long-term and continuous supports of users toward an enlarging ecosystem. These supports do not stay only in speculation but require a profound commitment of users in use-cases of systems.

In this paper, the authors, firstly, introduce the concept of loyalty farming protocol. Three metrics for evaluating loyalty are presented, in which each metric emphasizes a use-case of this protocol. Along with these metrics, a formula for each metric and general formula for reward calculation is provided.

2 Loyalty farming protocol

2.1 General protocol

The total loyalty bonus is expressed as a function of all bonus metrics' values. Each metric value is itself a function of time t and users' staked amount s. Naturally, the bonus amount $Bonus$ should be restraint by s as the staked amount is a critical factor for the anti-inflation mechanism in bonus calculation. Here, we introduce a limit for each bonus metric and the total bonus function, which is equal to s.

$$Bonus(t,s) = f(Bonus_1(t,s), Bonus_2(t,s), .., Bonus_n(t,s))$$

$$0 \leq Bonus(t,s), Bonus_1(t,s), Bonus_2(t,s), .., Bonus_n(t,s) \leq s$$

Since it is calculated in smart contracts, the total bonus function must be as simple as possible for reducing gas cost. However, application developers may desire the capacity to adjust the impact of each metric on their systems. Thus, the authors introduce a total loyalty bonus function using a weighted sum of metric values as a canonical formula of the protocol.

Loyalty Bonus formula:

$$Bonus(t,s) = tB(t,s) \times c_t + eB(t,s) \times c_e + aB(t,s) \times c_a$$

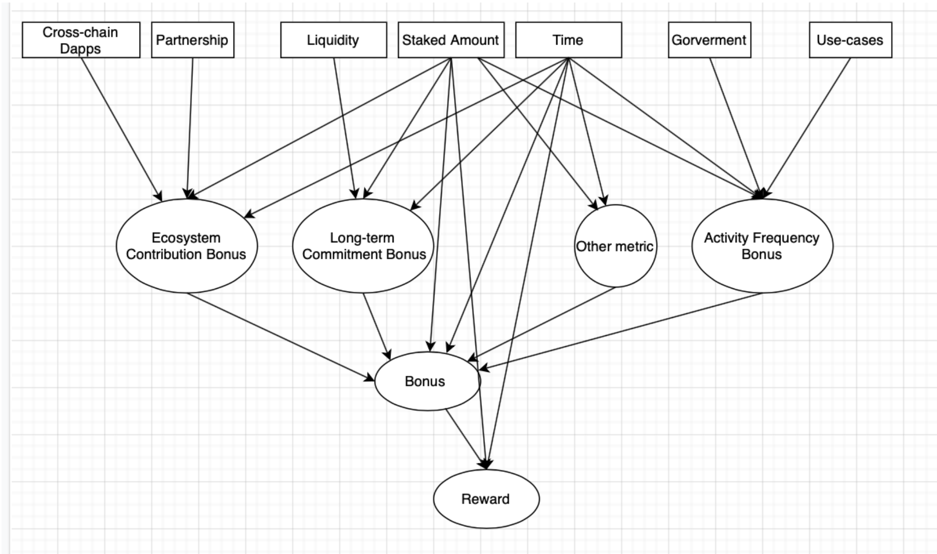

Figure 1: General protocol.

Where t is time, s is staked amount, tB, eB, aB are long-term commitment, activity frequency, ecosystem contributions bonus and c_t, c_e, c_a are coefficients of each bonus.

$$c_t + c_e + c_a = 1$$

2.2 Metric: long-term commitment

The long-term commitment metric emphasizes the long-lasting contribution of users toward the liquidity protocol and the system. Many protocols have the policy of generously rewarding early users and contributors of their system. However, such an approach can only attract many users at the beginning period with huge earning. As a result, these protocols fail to convert the long-term commitment of users into concrete numbers.

In this novel approach, the author would like to extend the impact of being early users into a bonus metric. The users' reward for each future period is adjusted by the time they stay in the system. In a model of continuous-time and modifiable staked amount, the long-term commitment metric should satisfy the following properties:

- Earlier contributors have better bonus rates than later contributors.
- Contributors at the same period have the same bonus rate.
- Contributors, which remove a part of their staked amount, have the bonus rate reduced.
- Contributors that stakes in different periods have a bonus equal to have a bundle of accounts; each account realizes one of their stakings.
  - Staking more will raise the bonus value. The new bonus rate should use a weighted mean of the old and new time factors.
  - If the activity of frequently staking more tokens is considered a bonus factor, this bonus is better handled in the activity frequency metric.

Time Commitment Bonus Formula:

$$tB(t, s) = s - \frac{\sum_i^n s_i \times t_i}{t}$$

where s_i is the Staked Amount in time t_i. We have:

$$\sum_i^n s_i = s$$

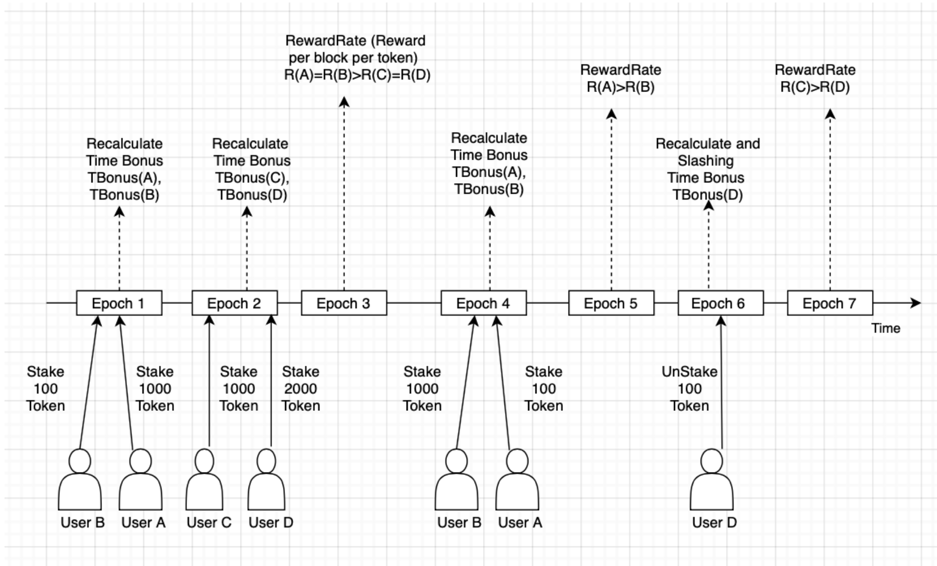

Figure 2: Long-term commitment bonus.

$$0 \le tB(t,s) \le s$$

In a concurrent calculation, we could represent this function as:

$$tB(t,s_{new}) = s_{old} - \frac{s_{old}\times t_{old}}{t} + s_{add} - \frac{s_{add}\times t_{add}}{t} = s_{old} + s_{add} - \frac{s_{old}\times t_{old} + s_{add}\times t_{add}}{t} = s_{new} - \frac{s_{new}\times t_{mean}}{t}$$

Where s_{add} is added amount to stake, t_{add} is the adding moment, $s_{new} = s_{old} + s_{add}$ and $t_{mean} = \frac{s_{old}\times t_{old} + s_{add}\times t_{add}}{s_{old}+s_{add}}$.

In the case of un-staking or removing liquidity, the recursive function could be represented as follows:

$$tB(t,s_{new}) = \frac{s_{old}-s_{rmv}}{s_{old}} \times (s_{old} - s_{old}\times(\frac{t_{old}}{t} + \frac{t_{rmv}-t_{old}}{t}\times r_{slashing})) = s_{new} - \frac{s_{new}\times t_{new}}{t}$$

where s_{rmv} is removed amount to stake, t_{rmv} is the removing moment, $s_{new} = s_{old} - s_{rmv}$, $t_{new} = t_{old} + (t_{rmv} - t_{old}) \times r_{slashing}$ and $0 \le r_{slashing} \le 1$ is the slashing ratio for unstaking.

- If $r_{slashing} = 0$, there is no penalty for un-staking. Hence, users' bonus rate is kept unmodified and users' bonus decreases proportionally to the removed amount.
- If $r_{slashing} = 1$, the reduction in bonus is maximized. This slashing equal to a total un-staking of user following by staking an amount of s_{new}.

2.3 Metric: Ecosystem Contribution

Today, Dapps do not exist independently. They are usually built inside a ready ecosystem. Ecosystems welcome new Dapps which supply more utilities or improve their efficiency. By anchoring themselves to one or some ecosystems, Dapps can gain their first clients for the most challenging period.

There are many types and scales of ecosystems: Dapps built on Ethereum should inherit the Ethereum ecosystem, Dapps that started by an ICO using a launchpad should appreciate the launchpad ecosystem, Dapps from the same team should assist each other. This ecosystem metric provides an efficient way to describe the support of users toward the whole ecosystem.

Dapps also use each other frequently and naturally. Dapps are usually clients for some Dapps and providers for some other Dapps. The synergy between Dapps is most impressive in Defi but also appears in many different sectors. Official partnerships promoted by this bonus can further enhance this relationship.

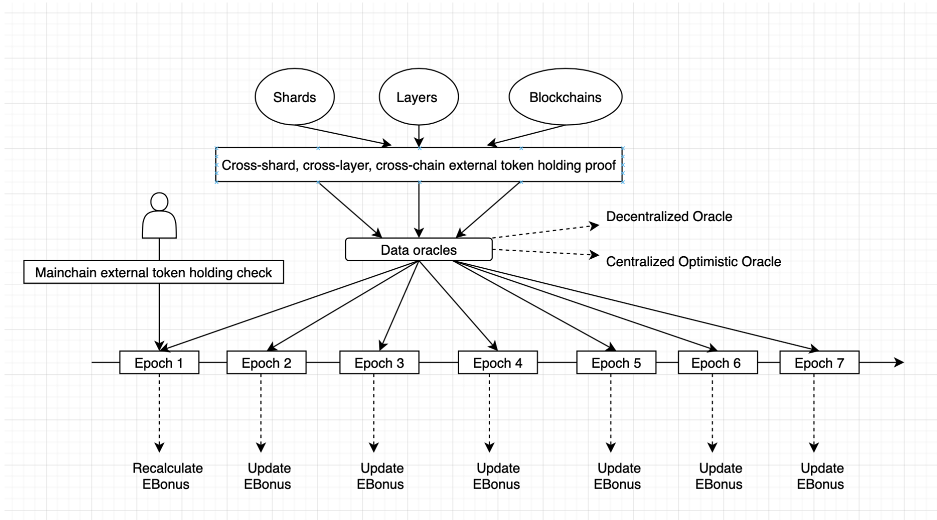

Figure 3: Ecosystem Contribution bonus.

One other remarkable movement of the current blockchain ecosystem is multi-chains Dapps. These Dapps operate in different chains or different shards and layers of a chain. In a multi-chains universe, Dapps should not miss the chance to reach for new opportunities by always staying in a chain. This ecosystem metric can attract existent users to continue to support the Dapps in other chains.

Depend on the Dapps strategy; the ecosystem metric can be used to:

- Attract early contributors from an ecosystem that can be clients or providers for these Dapps.
- Enhance the partnership by economic bond.
- Further appreciate the early contribution toward an ecosystem, a line of product or maybe toward these Dapps themselves but in another chain.

One trivial way to evaluate users' contribution toward an ecosystem is the number of governance tokens, liquidity tokens, system tokens they possess. Hence, the authors introduce in this section a weighted sum of users' balances of ecosystem tokens in different chains. The weight of each ecosystem token is determined based on the relationship of its system toward the targeted system and also based on the price of this token.

This bonus should be limit by the staked amount s to control the inflation of the bonus. Users should keep a suitable ratio between this targeted token and these ecosystem tokens to get the highest efficiency. Ecosystem Contribution Bonus Formula:

$$eB(t,s) = \min\{s, \sum_{i}^{n} e_i \times s_i(t)\}$$

where s_i is the amount of ecosystem token i, of which Influence Coefficient is e_i. We have:

$$0 \leq eB(t,s) \leq s$$

2.4 Metric: Activity Frequency

Activity Frequency Bonus appreciates the participation of users toward the targeted system. Many protocols have rewarded their users by offering system tokens to them in each activity. The loyalty farming protocol would like to extend and generalized this approach by giving users' activity the role to adjust this metric.

The activity scoring smart contract can account for each interaction of users toward the system. By the form of a smart contract, the scoring function can be sophisticatedly built to better describe the whole activity of users. Generally, this activity frequency metric should promote the use-cases of the system.

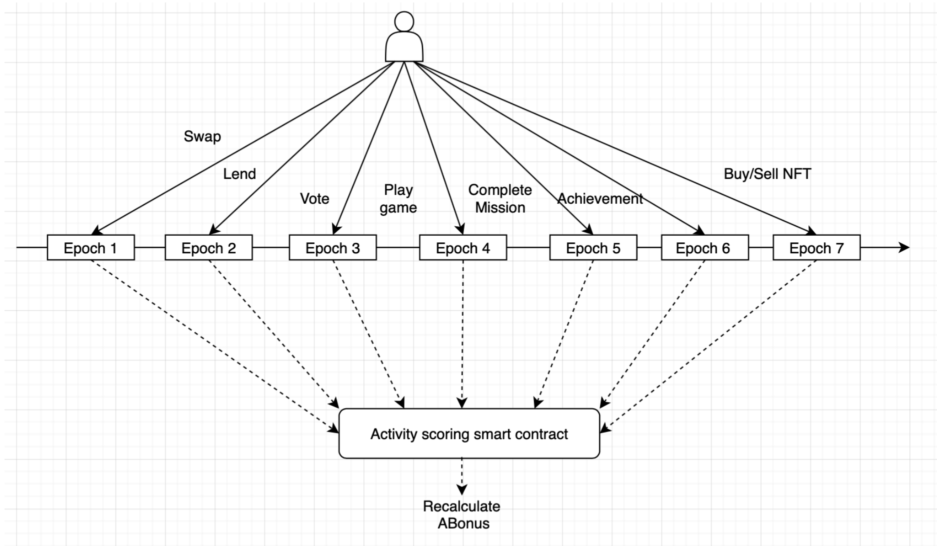

Figure 4: Activity Frequency bonus.

If the targeted system is a DeFi protocol, the scoring sc should consider swapping/lending/liquidity providing as core activities along with the amount used in each call. If the targeted system is a game, the scoring sc could build patterns for a group of activities. These patterns can be further integrated with missions and achievements in games. In all decentralized systems with a DAO, voting activity is also a significant contribution which can be accounting as a bonus factor.

The general formula of activity frequency metric bonus should extend the effect of an activity to a long period and should take into account the frequency. Depend on the use-cases that the system desires users' interaction daily, weekly basis. Therefore, in this paper, the authors introduce a canonical general formula using a time-weighted average. Activity Frequency Bonus Formula:

$$aB(t_{ep}, s) = aB(t_{ep}-1, s(t_{ep}-1)) \times c_f \times \frac{\min(s(t_{ep}-1), s(t_{ep}))}{s(t_{ep}-1)} + activityScoring(t_{ep}, s(t_{ep})) \times (1-c_f)$$

where

- t_{ep} is the epoch number.
- $ss(t_{ep}-1), s(t_{ep})$ are representative staked amounts in epoch t_{ep} and $t_{ep}-1$. $s(t_{ep})$ may not equal to $s(t)$ as the staked amount can be changed during the epoch. We could have $s(t_{ep}) = min(s(t))$ where t is in the period t_{ep}.
- $0 \leq c_f \leq 1$ is the coefficient of time-weighted average.
- $0 \leq activityScoring(t, s) \leq s$ is the pattern for evaluating all users' activity in the system.

We have:

$$aB(t, s) \leq s$$

So:

$$Bonus(t, s) \leq s$$

The activity scoring function is more sophisticated and dedicated to each Dapps. Hence, the paper does not present any canonical form for this formula.

2.5 Reward Formula

There are two types of rewards studied in this paper:

- The limited reward: the system fixes a total reward amount for all contributors. Each contributor gets a reward amount according to the proportion of their reward base.

- The unlimited reward: There is no cap for the reward amount. Each contributor gets a pro-rata reward amount corresponding to their reward base.

Individual Reward Base Formula:

$$b(t, s) = s + Bonus(t, s) \times c_b$$

where c_b is the coefficient of loyalty bonus.

Total Reward Base Formula:

$$tBase(t) = \sum_{i=1}^{m} b_i(t, s_i)$$

where $b_i(t, s)$ is the individual reward base of each user and m is the number of users.

Limited Individual Reward Formula

$$r_i(t) = \frac{r(t) \times b_i(t, s_i)}{tBase(t)}$$

where $r(t)$ is reward amount at time t.

Unlimited Individual Reward Formula

$$rx_i(t) = rx(t) \times b_i(t, s_i)$$

where $rx(t)$ is reward ratio at time t.

3 Conclusion

The paper introduces loyalty farming protocol, a novel concept that encourages long-term and continuous contributions toward an expanding system in the form of liquidity mining and staking bonuses. Users' loyalty is evaluated by different loyalty metrics. This study analyzes three outstanding metrics that represent different aspects of the targeted system.

The long-term commitment metric encourages early investors and long-lasting holders who defend the stability of the system's economy. The ecosystem contribution metric enhances the relationships between the Dapp and its ecosystem, strengthens partnerships' synergies with other clients and providers Dapps, inherits the users of this Ddapp in other chains or layers. The activity frequency metric incentivizes token holders to regularly interact with the system that can further promote the use-cases of the system.

Loyalty farming protocol fuses the role of investors and users by establishing a bonus policy in which the maximum outcome is obtained from holding the system token, contributing to the ecosystem, and using the Dapp simultaneously. In this way, the loyal early investors and users have large perpetual advantages against short-time speculators, and thus, they could continue to keep their loyalty toward the system.