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Prime Staking - Rewards

Introduction

Prime Network has introduced several tuned parameters to optimize financial incentives for both delegators and stake pool operators. This guide explains the financial incentive structure with the relevant equations, focusing on the unique parameters of the Prime Network.

Key Parameters

- Saturation Point is dynamic and equal to outstanding supply of APEX tokens divided by k

- k-Parameter (Optimal Number of Pools): 1,000

- Total Supply of APEX Tokens: 3 billion

- rho parameter: 0.0038

Delegators

Delegators contribute their APEX tokens to a stake pool to earn rewards. The financial incentives for delegators depend on several factors:

Reward Calculation for Delegators

The rewards for delegators can be calculated using the following formula:

$$R_d = \left(\frac{S_d}{S_p}\right) \times R_p \times (1 - F_p)$$

Where:

- R_d is the reward for the delegator.

- S_d is the amount staked by the delegator.

- S_p is the total stake in the pool.

- R_p is the total reward allocated to the pool.

- F_p is the percentage fee set by the stake pool operator (expressed as a fraction, e.g., 0.03 for a 3% fee).

Factors Influencing Delegator Rewards

1. Amount Staked: The more APEX tokens a delegator stakes, the higher their share of the rewards.

2. Pool Saturation: If a pool exceeds the saturation point (3 million APEX tokens), the rewards per token decrease. Delegators should aim to stake in pools that are close to but not exceeding the saturation point.

3. Pool Performance: Pools with higher performance metrics (e.g., uptime, block production) will receive higher rewards, indirectly benefiting the delegators.

Stake Pool Operators

Stake pool operators (SPOs) are responsible for maintaining the nodes and ensuring the network's security and efficiency. They are rewarded based on their performance and the total stake in their pool.

Reward Calculation for Stake Pool Operators

The rewards for SPOs can be calculated using the following formula:

$$R_{spo} = R_p \times F_p + F$$

Where:

- $Rspo$ is the reward for the stake pool operator.

- Rp is the total reward allocated to the pool.

- Fp is the percentage fee set by the stake pool operator (expressed as a fraction, e.g., 0.03 for a 3% fee).

- F is the fixed fee set by the network.

Factors Influencing SPO Rewards

1. Fixed Fee (F): The fixed fee set by the network directly impacts the rewards of the SPO. This fee is subtracted from the total pool rewards before the percentage fee is applied.

2. Percentage Fee (Fp): The percentage fee set by the SPO affects their share of the pool's rewards. This fee is deducted from the total pool rewards after the fixed fee is subtracted.

3. Pool Performance: Higher performance results in more rewards for the pool, benefiting both the SPO and the delegators.

4. Pool Saturation: Managing the pool's stake to remain below the saturation point ensures optimal rewards.

By understanding these factors, stake pool operators can strategically manage their pools to maximize their rewards and attract more delegators.

Pledging and Rewards

Pledging is a crucial mechanism that encourages the growth of a healthy ecosystem within the Prime Network. When registering a stake pool, operators can choose to pledge some or all of their APEX tokens to the pool to make it more attractive to delegators. A higher pledge generally results in higher rewards, as defined by the $a0$ protocol parameter.

Reward Distribution Formula

The reward distribution formula used in Prime Network, adapted from Cardano's model, is as follows:

$$f(s, \sigma) := \frac{R}{1+a_0} \cdot \left(\sigma' + s' \cdot a_0 \cdot \frac{\sigma' - s' \frac{z_0 - \sigma'}{z_0}}{z_0} \right)$$

Where:

- R is the total available rewards for the epoch.
- $a0$ is the pledge influence factor.
- $z0$ is the relative pool saturation size.
- σ is the stake delegated to the pool (including both pledged and delegated stake).
- $\sigma'=\min(\sigma,z0)$ is the delegated stake capped at the saturation point.

- s is the stake pledged by the pool operators.

- $s'=\min(s,z0)$ is the pledged stake capped at the saturation point.

Key Considerations

1. Saturation Point: Rewards increase with σ, but stop increasing once σ reaches $z0$ (saturation point).

2. Pledge Influence: If $a0$ is zero, rewards are simply proportional to the pool's stake up to the saturation point. For larger $a0$ values, the pledge s becomes more important.

Reward Adjustment for Pool Performance

The rewards calculated using the above formula are adjusted based on the pool's performance:

$$R_{adjusted} = f(s,\sigma) \cdot \frac{\beta}{\sigma_a}$$

Where:

- β is the fraction of blocks produced by the pool during the epoch.

- σ_a is the stake delegated to the pool relative to the active stake.

Conclusion

Staking on the Prime Network involves strategic delegation and effective pool management to maximize rewards. By understanding the financial incentives and the impact of the tuned parameters, both delegators and stake pool operators can optimize their participation in the network.

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