The Constellation Token Model

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Abstract

We propose the Constellation Token Model, a distributed consensus protocol governed by a model that achieves equilibria irrespective of speculative market fluctuations. The model is inspired by generative economies and aimed at producing inherent utility value for the token in the network. The generation and perpetuation of true utility can be likened to the production of a real-world commodity. $DAG as a digital commodity therefore opens the opportunity to well established and known market dynamics. In that manner we propose a solution to a sustainable token utiltiy in a reputation governed $DAG protocol.

Introduction

A Generative Economy is a living economy that is designed to generate the conditions for life to thrive, an economy with a built-in tendency to be socially fair and ecologically sustainable [1]. This definition could be paraphrased as essentially a game where the rules of play enforce certain invariants, the result of which is emergent stabilization. Essentially, the act of playing the game itself is what enforces the invariant. Distributed consensus protocols, and the currencies they support, can be modeled as generative economies. Network stability is governed by an eventually consistent equilibrium. Equilibrium is defined in terms of invariant measures (we want to enforce that something doesn't change, or can be relied upon) that are maintained. Why do we need this? It allows for the the enforcement of real world performance specifics that are decoupled from external market dynamics (gas/exchange prices) which allows for technology focused adoption while also providing an external speculation market similar to traditional commodities markets.

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[1] Kelly, Marjorie, "Toward A Generative Economy" https://www.opendemocracy.net/ourkingdom/marjorie-kelly/toward-generative-economy

Constellation Economics

Consensus protocols exist to provide a utility and that utility is the basis of a generative economic game. In Constellation, that utility is throughput. Like all consensus protocols, access to rewards is governed by delegate selection. In turn delegate selection is governed by a seeder/leacher ratio of transactions validated vs transactions submitted. We will use the term 'utility ratio' to describe the throughput a potential delegate has provided vs the throughput used. As nodes participate they get ranked based on their utility ratio. Based on ranks they get access to rewards. Fees are charged relative to the scarcity of the utility that the protocol provides and are only charged if an account breaches its allotted utility ratio. The $DAG token acts as an inflation mechanism like cash, which can be used to pay transaction fees when an account has not or can not maintain their required utility ratio. $DAG is injected into the pool of validator rewards, and there is an incentive to validate transactions that have an accompanying fee attached. In other words the utility ratio acts as a self governed rate limit and sending transactions in excess of the rate limit needs to be paid for. Therefore holders of the token assume the role of the central bank, deploying $DAG capital with the understanding that the free market dynamics of the protocol will ensure their account gets access to the network utility when capital is deployed.

The Constellation consensus mechanism is a non proof work consensus which is called PRO (proof of reputable observation). As mentioned it uses a node score to facilitate delegate selection. The unit that represents the node score is Reputation. A Reputation unit represents a 'stake' of total network utility (throughput). It is a perishable good in the constellation economy as accounts that leave the network will watch their reputation recede until 0 and they are replaced by a new player. Accounts' reputation is varying and falls according to various tiers which follow our definition of rank along with a branching factor.

Emergent Dynamics

Constellation's $DAG value can be thought of as a stake within a total computational space. Constellation's data model was designed to follow combinatorial models in distributed computing, where network state can be described in terms of symplectic geometry and transitions are defined in terms of a discreet gradient. Therefore, the value of our network derives from the total computational space available for verifying transactions i.e. its maximum throughput. We can loosely model the total computational space as the volume of 'space' across nodes with respect to rank r

$$\int_M d_1 \wedge \cdots \wedge d_r$$

where M is a manifold and r is the maximal rank. Within our model this would be explicitly defined as the numerical summation over the vector space of our cohomological definition[2]

$$\sum_{1...r} \Omega^1 \oplus \cdots \oplus \Omega^r$$

where each Ω is a graded abelian group corresponding to a rank in the differential form above. For our study, we can make a very simple approximation. We define the total computational space as the sum of all available resources $f(n)$ each node n provides

$$\Delta(n) = \sum_{i=0}^{r} e^{\beta f(n)} dn$$

where dn is a differential over the sorted set of all n by instance size, such that $f(n-1) \leq f(n)$, β is a branching factor, the maximum number of nodes in a rank and $f(n)$ is a distribution of computational resources. The relationship between \$DAG and our network's value is that $\Delta(n) = VR_{\$DAG}$ where VR represents the rate of validator rewards distribution. Rewards will eventually disburse 40% of the total \$DAG modeled after a decaying function. Let's call this the \$DAG reserve and the portion owned by investors the supply S. The VR is effectively 'locked' into the total space of $\Delta(n)$ and there is a conversion rate C that converts \$DAG into some subset of compute space (stake) of Δ such that total \$DAG is conserved. Thus, since $VR - C * S = 0$

$$\Delta(n) = C * IR$$

which we can use to relate the influx of value with respect to nodes joining/leaving

$$\frac{\partial \Delta}{\partial n} = C * \frac{\partial S}{\partial n}$$

where c is our equilibria condition, a 'maximum conversion rate' for spending \$DAG for a subset of Δ. When capital is injected from S the validator rewards increase by a factor of $C * s$ where s is the subset of total supply injected to Δ.

[2]https://arxiv.org/abs/1805.07047

Analysis and Results

As the network grows in a self-similar incentivized fashion, the question is how the utility value of the network projects into the future and how value interacts with the liquidity injected by the reserve and the supply.