Herdius cryptoeconomics and HER token overview.

How does it work?

Herdius is a protocol that solves everything on a private key level, allowing it to function as a cross-chain or inter-chain blockchain identity protocol due to the fact that all blockchains work with private-public keypairs. That makes for scalable interoperability at a low level of development effort as Herdius eliminates the need to code communication protocols to connect DLTs.

Who are the Herdius stakeholders defining the HER crypto economics (in short)?

Masternodes:
Maintain the global chain and keep track of transactions that flow through the network. Their job consists of creating an ordering of incoming transactions, creating a copy of the state (account balances) called preliminary state which mirrors the new transactions and how they affected the balances. Once finished, all this information is passed onto the validators.

Validators:
Secure the Herdius chain by staking HER, validating and aggregating the information produced by Masternodes while reaching consensus within their validator subgroups over transaction validity.

Users:
Regular users of our network. They can pay for fees using HER tokens (or the native currency that is being transacted). Such fees include regular transactions and trade.

Supervisors:
Keep validators in check by redoing calculations performed by them. If they detect misbehaviour, a new consensus round kicks in during which the network reaches consensus over the cheating nodes. In the process the bad nodes are punished with their stake being taken away.

Reputation System:
Both validators and supervisors have a reputation score that is associated with their account and respective HER tokens. The reputation system influences whether a node receives a full reward for their work or a reduced one. Reputation can be increased by performing good validation work repeatedly, and it can be reduced by doing the exact opposite.

What’s really going on?

Herdius uses delegated proof-of-stake (dPoS) as consensus algorithm with the HER token being a centerpiece in the system as a whole, but unlike other dPoS systems like EOS, Bitshares, Lisk, Steemit, etc. there are a couple of important differences. These differences are outlined below, but there are some key concepts that are presented beforehand which are crucial to understand the document.

Please note that this is a pre-sale / investor oriented material which means that the goal of it is to make it as easy as possible for the reader to understand key concepts and key differentiators between Herdius and other dPoS & PoS networks. As this document focuses on the HER token itself, we suggest reading the Herdius Overview document before going further.

Staking / Collateral: Staking is the main purpose of the HER token. Essentially HER tokens are used as collateral for each and every transaction that flows through the Herdius network. In order to stake the Herdius token, you have to commit to becoming a validator. In the process the HER tokens you choose to commit for validation are locked in through a smart contract (during and 3 blocks after the validation is over for that particular block). There is no minimum amount of HER needed to stake because the rewards / earned fees for staking are proportionate to the staked HER amount and the validator's respective reputation.

Masternodes: Masternodes inside Herdius are part of the Herdius Flow consensus mechanism. These are nodes who hold at least 0.3% of the total available supply of HER tokens. There are 21 Masternodes rotated depending on who who hold more stake, as a result the minimum of 0.3% HER tokens does not guarantee a node to become a masternode. Masternodes are responsible for keeping track of transactions and assigning them to the different validator groups (transactions batching). Masternodes do not amend the state (account balances) of the Herdius chain and are different from validators to avoid collusion. Instead of amending the state directly they produce a copy of it called a preliminary state. This copy is then passed on to validators who amend it and finalize it making it the global state. The main benefit of this split is that they can lend out their stake at an 80% premium rate. Meaning they would earn the same amount from fees as if they would be actual validators. On top of this they earn their share of 1/21st of the block rewards.

Why is HER locked in for 3-blocks-time into the future? This is a design choice to prevent cheating by validators and to leave enough time to the supervisors of the network to catch misbehaviour by the different nodes.

Fees: When you become a validator, as in you lock HER tokens in, you get assigned to different validator groups that are each responsible for a certain batch of transactions. Each validator subgroup will have 101 validators within. An example is the easiest way to present how this works: Alice locks in 1000 HER tokens worth 1BTC for validation. She is then assigned a batch of transactions by the masternodes containing 101 BTC worth of transactions (in any kind of cryptocurrency). If we calculate a fee of 1% (for easier math) and since everyone in the group has the same share of HER tokens the earned fees by Alice is equal to 0.01BTC.

Separating token price from utility: In order to make Herdius a more viable option to other centralized and decentralized exchanges we want to separate the utility price of HER tokens from the actual token price. In order to do so we aim to utilize Gnosis' (or any other prediction market's) oracle model. Using such an oracle allows us to dynamically set the price for fees inside the network every 8 hours or once a day.

Supervisors & losing stake due to cheating: There are certain nodes inside Herdius which are called the supervisors. Their role is very similar to Polkadot's fisherman as their task is to spot cheating among the different validator groups. It is a high effort, low chance, but high reward job. Running a supervisor node means you recalculate the hashes of transactions and the respective state, skimming through all transactions within a block. If cheating by a validator group is spotted, the supervisors collectively recheck the flagged consensus result. In case there was cheating spotted, the validators who voted the result to be valid lose their staked tokens.

Voting: We want to make it possible to vote using HER tokens in the future but at this point in time we do not feel like any governance system out there is perfect or suitable. At the same time this is critical for us and should be implemented.

Reputation of miners / validators: Validators are to be given a reputation score which determines the fees their HER tokens generate during validation. If your score drops as a validator, your tokens are "colored" and thereby are going to be worth less. Since Herdius is a balance based blockchain it is not possible to color individual HER tokens, the subset of the total balance that was committed to staking will be colored, regardless of the tokens. The reasoning behind such system is simple: 1) it very easy to implement as it is a modification of NXT, 2) it is harder to mess with the system and cheat.

1) NXT was the first PoS system implemented and adopted. It was a DEX for Bitcoin which made it possible to issue colored BTC. It is already implemented, and thereby also easy for us to adopt such a system for the Herdius chain. All takes is adding another field (reputation) to the Merkle tree containing the validators. Adoption also happens at the Herdius protocol level in the sense that the reward for a validator is calculated as: $\#\ of\ HER\ tokens\ staked\ \times\ share\ of\ validator\ group\ x\ reputation$, where the share of validator group is the share of the HER tokens for that specific validator group and reputation is the reputation of the user. Both to be between 0.1-1.0.

2) Colored HER coins and a lower reputation will be worth less which makes it economically ineffective and unattractive to cheat the system. On the other hand imagine that you have 101 or 21 validators that have to reach consensus. In a BFT (byzantine fault tolerant) algorithm you only need ¾ of all nodes which means as long as 75% of nodes agree on an outcome, what the rest of the nodes agreed on is irrelevant. For this reason we make it so that if consensus is reached and there are disagreeing nodes i.e 100 nodes voted on outcome "valid" with 1 node voting "invalid" we punish that particular node.

Key differences between the Herdius dPoS and others:

- Herdius is not a federated system. Although there are 21 masternodes (as in EOS) but these nodes are not elected. They are rotated while also there isn't a single masternode who produces block by itself. Instead, nodes who control a large percentage of HER tokens can become one of the 21 masternodes, it is an open competition with no voting involved. The HER masternodes' tasks does not include validation. Every HER token holder can stake / lock in their respective tokens themselves for validation.

- Delegation of stake inside Herdius is for bigger groups, VCs, holders who own a large number of HER tokens but would not like to or are unable to run nodes or commit computational power to the network. These users can lock in their HER tokens in and delegate them, not to a single user, but to any validator who has a good reputation inside the system and is borrowing stake. The user who delegated their HER receives a lower reward for how much they normally would from trading fees (we estimate this to be around 40-60%). The validator who borrows stake from others receives the other portion of this.

- Herdius has dynamic block minting & inflation built in that is combined with the above reputation system for validators (a version of NXT / colored coins) and the staking system. In case the Herdius network does not function properly (i.e there isn't enough stake locked in for validating transactions) the network automatically issues new tokens. The newly minted tokens are allocated to the different nodes in our network in proportion to how much HER they already hold, if they are validators or not, and their reputation inside the network.

- There is no minimum amount of HER you have to hold to become a validator. The share of fees a node receives is proportionate to the amount of HER it has locked in as well as computational work it performs.