Turing Network Token Economics

Sean McGinnis Chris Li

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1 Introduction

TUR is the native token of Turing Network, the canary network of OAK Network. Turing is a delegated proof of stake network with the purpose of serving as a testing ground and proof of concept for OAK Network. Turing is designed to be experimental, meaning that it will be more influenced by the development team in order to test new features and ideas. As the canary network, we expect the Turing network to provide the majority of the services that will be made available on OAK.

The economic structure described in this paper is designed to be a proof of concept system that promotes good faith participation from a wide variety of stakeholders including automation users, stakers, collators, and investors.

2 Token Basics and Initial Distribution

This section will describe some of the basic features of the TUR token including the initial supply, distribution, and uses of the genesis tokens.

The initial supply of TUR will be one billion tokens. These tokens will be minted and placed into circulation over a three year schedule and will be distributed according to the figures below:

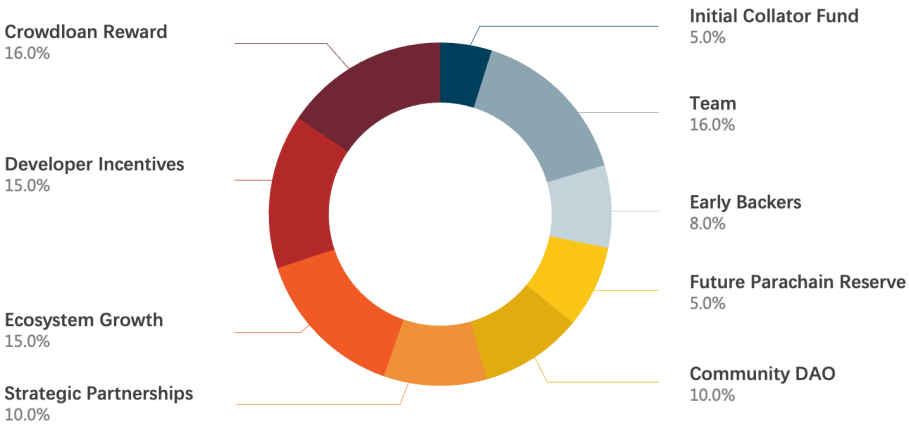

Figure 1: Initial TUR Distribution

Initially, the tokens will be distributed into each of these nine categories, accounting for the full 1 billion TUR supply. Each of these categories are minted and released on a separate schedule that is realized over three years. Vesting details are included in the following table and category descriptions.

Stakeholder	Token Allocation	Vesting Period (months)
Early Backers	8.0%	24
Team	16.0%	36
Collator Fund	5.0%	3
Community	66.0%	
Parachain Crowdloan	16.0%	12
Developer Incentives	15.0%	36
Community Development	15.0%	36
Strategic Partnerships	10.0%	36
Community DAO	10.0%	24
Parachain Slot Reserve	5.0%	18
Total	100.0%	

Figure 2: Token Distribution and Vesting Periods

Category Descriptions:

Early Backers:

- **Purpose:** To compensate the initial investors for supporting the development of the Turing Network.
- **Vesting Schedule:** Distributed in four equal payments at 6, 12, 18, and 24 months.

Team:

- **Purpose:** To incentivize the direct contractual workforce of the Turing Network.
- **Vesting Schedule:** Paid out in six equal payments at 6, 12, 18, 24, 30, and 36 months.

Initial Collator Fund:

- **Purpose:** To be sold in a closed sale to handpicked collators starting in month zero and extending until collators can be selected competitively within the market, approximately two months after launch. This collator onboarding is intended to ensure the stability and security of the network at this early stage.
- **Vesting Schedule:** 20% of the fund will be minted at launch with the remainder minted over the first two months of block production.

Community:

- Crowdloan Reward:
  - **Purpose:** To raise KSM in a crowdloan to secure a Kusama parachain slot.
  - **Vesting Schedule:** 30% of earned tokens will be distributed to loan participants shortly after launch. The remaining 70% will be distributed in three payments at 4, 8, and 12 months from initial launch.
- Developer Incentives:
  - **Purpose:** To boost project and platform adoption among developers through a variety of programs such as open grants, bug bounties, and hackathons.
  - **Vesting Schedule:** These tokens will be minted and distributed in an approximately linear manner over the 36-month vesting period.
- Ecosystem Growth:
  - **Purpose:** To drive ecosystem growth through communication, marketing, and community development. These include initiatives such as Ambassador programs, KOL, meetups, and more.
  - **Vesting Schedule:** These tokens will be minted and distributed in an approximately linear manner over the 36-month vesting period.
- Strategic Partnerships:
  - **Purpose:** To provide free trials for partners, such as trading firms and exchanges, as well as to create initial liquidity pools for cross-chain asset transfer.
  - **Vesting Schedule:** These tokens will be minted and distributed in an approximately linear manner over the 24-month vesting period.
- Community DAO:
  - **Purpose:** To provide the community with some initial resources to help drive feature, network, and community development in a direction of their choosing.
  - **Vesting Schedule:** These funds will be vested in four equal payments at 6, 12, 18, and 24 months.

Future Parachain Slot Reserve:

- **Purpose:** To be reserved for winning future parachain slots on Kusama.

- **Vesting Schedule:** Half of these tokens will be minted and released at six months, the other half is released at 18 months. This fund will also be supplemented through 1.5% annual inflation.

The vesting schedules described above result in the circulating supply curve shown in Figure 3.

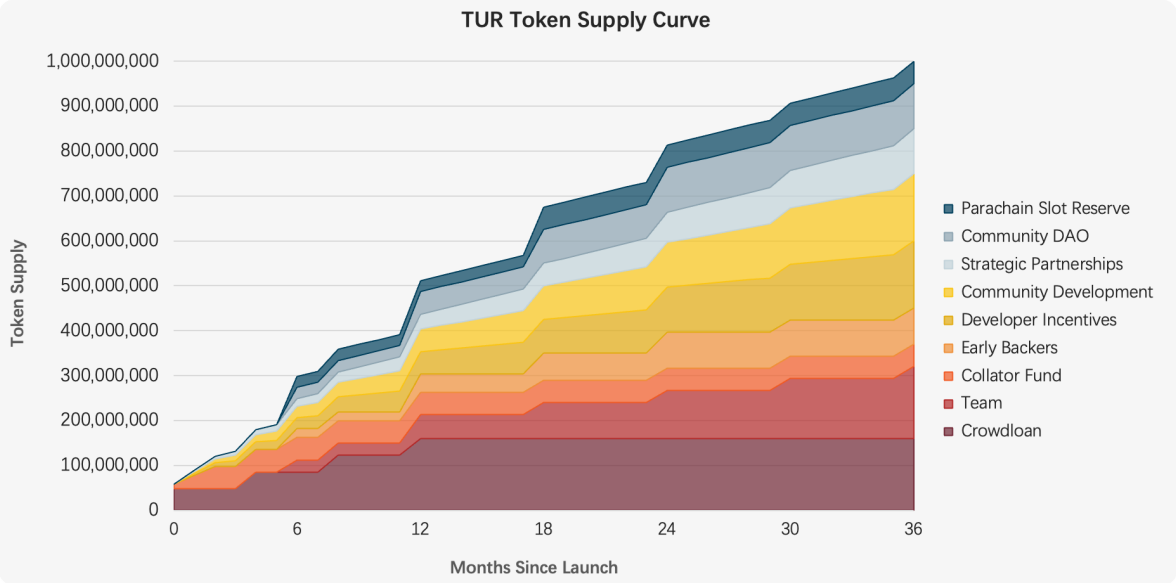

Figure 3: Circulating Supply Curve

3 Token Supply

This section discusses inflationary and deflationary forces, the expected long-term token supply, and burning mechanisms.

3.1 Inflationary Forces

Inflation is expected to follow a model similar to Moonbeam which includes a fixed 5% annual inflation rate divided into 3 components:

This inflationary force will be constant throughout the duration of the network's life except for the first two months. Additionally, it will be counterbalanced through burning of transaction fees and treasury funds which are expected to result in the token becoming slightly deflationary over time.

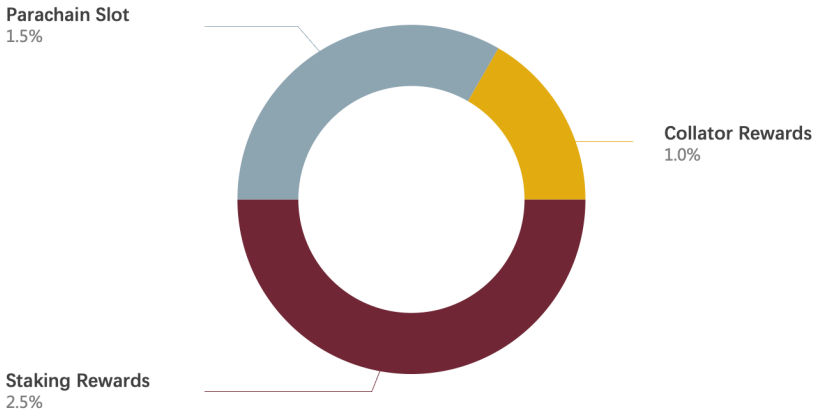

Figure 4: Breakdown of inflationary forces

3.2 Deflationary Forces

The constant 5% annual inflation will be counter balanced through burning a portion of automation fees. At the launch of the Turing Network the burn percentage will be small and will grow over the life of the ecosystem. The lower initial burn rate will allow early revenue to be invested back into the Turing network to pursue positive NPV projects and improve the ecosystem. Overtime, the portion of transaction fees burned will grow to provide a deflationary force that may make the token deflationary overall. The changes in the burn rate will be decided through the governance process and will respond to the abundance of positive NPV projects available to the Turing Network.

In addition, funds in the treasury will also be burned overtime if left unused. Initially, this feature will be turned off in order to make best use of resources in the early stages of the ecosystem but will be activated shortly after launch.

3.3 Vision for Long Term Token Supply

The vision for Turing's long term token supply is to be initially inflationary to allow tokens to be used towards positive net present value (NPV) projects voted on by the community. As the network matures there may come a time when it is more valuable to token holders to pursue development projects selectively and burn a larger portion of transaction fees (returning value to token holders). With sufficient traffic and a large enough burn percentage the token may become deflationary as value is distributed back to token holders. This point, where there is a greater supply of treasury tokens than positive NPV projects, may take many years to arrive or may never be reached if new opportunities are constantly presenting themselves. This transition to burning a larger portion of transaction fees will need to be decided upon by the token holders through participating in the governance process.

Figure 5 displays one example of how the long term TUR circulating token supply is envisioned.

Figure 5: One possible curve for the total token supply over time

4 Staking and Collator Rewards

Staking and Collator rewards will be granted once inflation is activated for the Turing network (at the 2 month mark). These rewards will be evenly paid to collators for each block they successfully author, encouraging collator reliability. Of the 5% of the total inflation, 1/5 (1% inflation) of this token supply will be provided directly to collators. Staking rewards will be granted in a similar manner to the top 300 stakers for each active collator. 1/2 of tokens minted through inflation (2.5% inflation) will be divided among the stakers per block authored. Dividing the token rewards in this way encourages collators to be reliable in order to maximize their rewards and encourages stakers to approximately evenly split themselves among collators with some variation based on collator reliability.

Inflation will consider not just the circulating token supply but the entire token supply at the time meaning that the 5% inflation over the first year will consider that there are approximately 1 billion tokens despite the circulating supply being much less. This allows for outsized TUR returns on collating and staking over the first couple years while the circulating token supply is still low. These larger early returns add stability to the ecosystem when it is younger and riskier and ensures that collating and staking will be an attractive option despite the risk associated with newer and less-established products.

4.1 Staking Returns

Figure 4 shows staking rates of return with 3 different assumptions of the percentage of the circulating supply of TUR staked (10%, 30%, and 50%). This graph displays both the higher rates of return over

the early stages of the ecosystem as well as demonstrates how an equilibrium will be reached for the total supply of TUR staked. Rates of return are higher if total supply staked is low encouraging token holders to increase their stake.

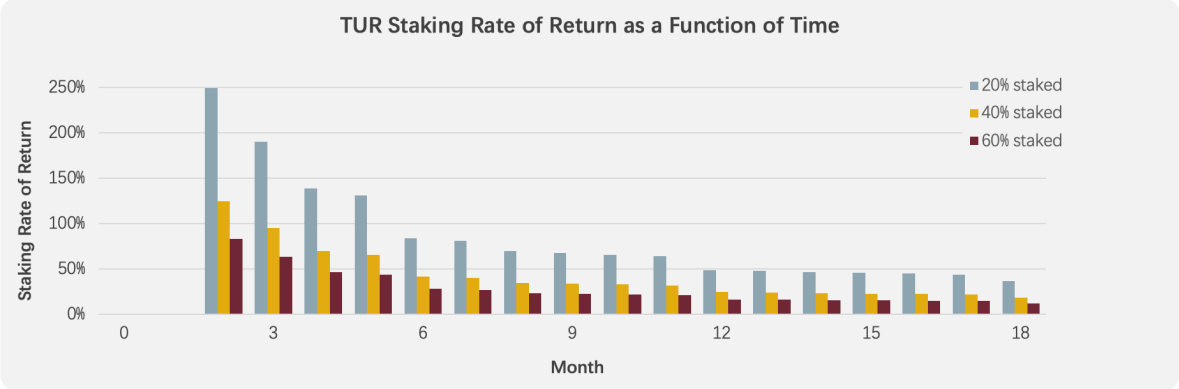

Figure 6: TUR staking annual rates of return as a function of time (differences between graphs assume different percentages of circulating tokens staked)

The average first year staking rates of return for 10%, 30%, and 50% of total circulating supply staked are ∽92%, ∽30%, and ∽18% respectively.

4.2 Collator Rewards

Collators can expect to earn the staking rewards described above for their self-staked TUR. In addition, they will receive collating rewards over a time period according to the following equation:

Collator Rewards = 1% inflation * # of blocks authored by the collator/# of total blocks in that time period

While the total number of collator slots will be capped to avoid exceeding an upper limit, if fewer collators are competing or if they have less staked, the rewards per unit of invested capital increase. This mechanism encourages collator rewards to remain competitive over time.

5 Fees

5.1 Automation Fee

Automation fees power the core functionality of the Turing ecosystem which allows users to set time or price triggers to schedule their future transactions. This functionality requires both inclusion weight (at the time the task is created) and execution weight (at the time that the task is executed). Additionally some resources will be required to store the task on the chain as it awaits execution. The formula for

this fee is as follows:

$$\begin{aligned} Fee(Task) = C_{now} * [BaseFee + InclusionWeight(Task)] + ExpectedRent(Task) \\ + \sum_{n=1}^{k} (CrosschainFees_n + OracleFees_n + C_n * ExecutionWeight\,(tx_n)) \end{aligned} \tag{1}$$

Where:

- C_{now}: Is a traffic multiplier based on the traffic of the previous block
- $BaseFee$: A minimum fee for including any task on the blockchain
- $InclusionWeight(Task)$: A fee that scales linearly with the weight of including the task on the block
- $ExpectedRent(Task)$: A function of the expected space required on the block for the pointer until the execution time is reached.
- K: the number of requested transactions in the task
- n: each specific task is represented by a single integer value of n.
- $CrosschainFees$: The expected required fees to execute the requested task on other blockchains (for example a Polkadot or Ethereum gas fee if transactions are executed on those chains as part of the task).
- $OracleFees$: The expected required fee for oracle inputs that may be required to trigger a task (such as token price data)
- C_n: Is a traffic multiplier based on the expected traffic at the time of execution
- $ExecutionWeight(tx)$: A fee that scales linearly with the execution weight of the requested transaction

This equation describes the automation fees for time or price triggers and can be used for both one time and recurring tasks (for example a task including 12 monthly payments). Ultimately, this equation accounts for the costs of including a task on the blockchain considering task weight and blockchain congestion at that time, as well as the costs of executing the task based on weight, congestion, and the fees of other ecosystems if applicable. If a transaction is made that does not require automation, for example: simply moving funds from one wallet to another, then only the inclusion fee is charged as no rent or execution weight is required.

5.2 Traffic Based Pricing

Traffic multipliers are designed similarly to Polkadot traffic factors. These factors slowly increase or decrease the fees charged for new tasks based on whether block fill rates are above or below a target level. While Polkadot only needs to change their fee based on ecosystem traffic at the time a transaction is made, Turing and OAK need to also consider the expected traffic of the ecosystem at the time that the task is executed. This requires some prediction of future traffic depending on how payment methods are structured. These will be explored in greater depth in future documentation.

These traffic factors prevent customers from experiencing large price changes from one moment to the next, however, fees will still adjust over longer periods of time, approaching a market equilibrium.

6 Related Features and Future Work

The Turing and OAK Networks are designed with many future features and functionalities in mind. Some of these items will be discussed briefly below with more to come in future documentation.

6.1 Fees

This paper only scratches the surface of OAK's fee model which needs to consider changing prices over time as well as ecosystem traffic both today and in the future. When pricing triggers are introduced, enabling stop loss and limit orders, OAK needs to be able to handle processing large numbers of orders that arrive at unpredictable times. These technical considerations affect fees which must ultimately account for risk, managing high traffic events, and responding to/prioritizing customer needs. OAK plans on releasing further documentation on fee design detailing each feature and associated tradeoffs.

Additionally, more work is being done to understand XCMP (cross-chain message passing protocol) fees to allow TUR to interact with other Kusama parachains. Future work will detail the fee structures for interacting with chains both within and outside the Polkadot/Kusama ecosystem.

6.2 Risk Management

Web3 is famous for its volatility, and OAK's event registry model inherently takes on risk as it accepts payments and fees at one time, but executes the transactions at another. OAK plans to build risk management directly into the product through use of insurance and liquidity pools that minimize customer risk exposure. Our end goal is to provide a "set it and forget it" automation experience that is both affordable and reliable regardless of market conditions. OAK will provide additional

documentation detailing what types of risk OAK decides to manage and how that can be done efficiently and reliably.

6.3 Refunds

The OAK team aims to provide the best possible user experience, which would logically include offering refunds for high cost automations that are no longer desired by the user. Refunds with the additional transactions and user flexibility could present arbitrage or security risks if not handled with care. OAK intends to offer secure and customer focused refunds as the product develops. Future documentation will include a comprehensive description of any refund feature we offer including the reasoning and tradeoffs behind those decisions.

7 Conclusion

The Turing Network aims to empower web3 users through easy to use payment automation across ecosystems and provide the testing grounds for new services. The decisions and features discussed throughout this document aim to create a stable and well managed ecosystem that supports both experimentation and affordable automation. Our team will continue to work to improve the technology, economics, and governance of Turing in pursuit of this goal. This evergreen document will continue to be updated as we learn and grow, and further work that explores fees, risk management, and other payment features will be published in the coming months.

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