Turing Network: a high-performance blockchain implementation prioritizing true decentralization and censorship-resistance

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Abstract. Turing Network is a project encompassing a novel blockchain implementation and its surrounding ecosystem. Turing Network's blockchain implementation, as set forth in this white paper, prioritizes performance while ensuring true decentralization and censorship-resistance. This is achieved via a novel consensus mechanism that is able to balance high throughput while remaining genuinely egalitarian with respect to the participation of prospective constituent nodes.

Introduction:

Turing Network is a project that addresses certain existential issues with current high-performance blockchain implementations by introducing a novel consensus mechanism that delivers high performance at low costs, while achieving true decentralization.

Projects such as the Binance Smart Chain and Polygon Network have demonstrated the necessity of performance and low transaction cost for the success and usability of so-called decentralized applications. In reality, however, these and similar blockchain implementations sacrifice decentralization to achieve such ends. For instance, both projects depend on a small quorum of effectively centralized (i.e. managed at an arms-length, despite a contrary portrayal) "elected validators" to achieve performance at low cost, sacrificing true decentralization and censorship-resistance. Though touted as solutions to this issue, projects such as Ethereum - both in its present proof of work (PoW) implementation and also in its forthcoming proof of stake (PoS) implementation (also known as Ethereum 2.0 or Eth2) - exhibit comparatively inferior performance, high fees, and arguably some degree of centralization as well, despite the efforts of the protocol authors to mitigate these issues in various ways.

The authors of Turing Network, having had deep experience in the implementation of both simple blockchains and more advanced smart contracts platforms with various consensus mechanisms, propose a novel architecture that achieves genuine decentralization and censorship-resistance at scale, while retaining the high performance demonstrated by the essentially centralized blockchain implementations referenced above.

Ensuring performance

As explained in the foregoing, the platforms that currently achieve high performance while preserving low transaction costs do so through degrees of centralization (i.e. in most cases have a glorified “proof of authority” consensus mechanism masquerading as proof of stake).

We, the authors of Turing Network, consider decentralization perhaps the most important philosophical cornerstone of blockchain technology as originally conceived, and would argue that to relinquish it poses substantial social risk. Turing Network therefore implements a novel consensus mechanism to deliver low transaction costs and ensure security while maintaining high performance and true decentralization. Furthermore the protocol does not gatekeep in respect to any prospective network participant’s ability to function as a validator.

Implementation:

Performance aims are met via twice-daily “proof of performance” sprints, and a subsequent lottery among candidate validators (those which have satisfied the network’s present performance threshold, i.e. difficulty). The proof of performance utilized for this purpose in the initial protocol implementation is a RandomX proof of work sprint, with difficulty adjusted to target completion by an adequate number of validator candidates within 2 minutes. Following the sprint, validator slots are randomly allocated (i.e. the lottery referred to in the title to this section) among the candidates which have submitted valid proofs before the conclusion of the sprint. Both the difficulty and the number of available slots are adjusted by the protocol every 48 hours to maintain network performance. RandomX was elected as the proof of performance algorithm for these purposes due to its strong ASIC resistance, which is critical to select for general purpose performance among validator candidates, and to thereby satisfy the goals of the network and its users.

In order to appropriately incentivize validators, Turing Network encourages (but doesn't require) pooling. Pooling is the simplest way to ensure consistent income for those validating on the network as the number of validator slots adjusts to maintain the performance target.

A cross-chain ecosystem:

It is a conviction of the authors of Turing Network that de-facto centralization often occurs with naive implementations of cross-chain asset bridges (especially when they are centrally administered). To mitigate this issue, Turing Network's team is allocating resources toward the development of several community-driven, efficient, decentralized asset bridges. In further service of cultivating a rich cross-chain ecosystem, Turing Network fully implements the Ethereum Virtual Machine (EVM). The Turing Network Team views a high performance EVM implementation as essential to incentivizing a broad ecosystem of decentralized applications within the platform.

Conclusion:

Turing Network proposes a blockchain architecture that incorporates a novel consensus mechanism to achieve both high performance and true decentralization. The architecture fully implements the EVM to encourage a diverse ecosystem of decentralized applications. The philosophical cornerstones of the Turing Network are true decentralization and censorship-resistance. Through its novel consensus mechanism, Turing Network aims to honor its philosophical underpinnings while also delivering high performance at low cost.