EPR-ereum
bridging different worlds

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Overview

Proof-of-Work mining successfully secures Ethereum, however it does not allow the computational power of Ethereum to scale as more full nodes join the network.

We present an overlay protocol to scale the capacity of decentralised applications on public Ethereum. Our solution manages all value on Ethereum and provides an on-chain marketplace for pooling computational resources of full nodes allowing them to contribute and earn gas rewards linearly from the execution power they provide to Ethereum.

The solution does not modify the scaling properties of Ethereum directly, rather it aims to get more computational *gas mileage* out of a single transaction by minimising the verification burden put on the Proof-of-Work miners. To this end we introduce a Byzantine fault-tolerant, staked meta-consensus mechanism. This mechanism allows us to scale computational capacity with the number of groups of nodes available. By moving the verification burden away from the Proof-of-Work miners we bypass the Verifiers Dilemma while retaining the full replay history of Ethereum.

We detail the protocol and discuss an early analysis of attack vectors. We imagine possible use-cases and review the gains by enabling Eprereum for the application. We place this proposal in relation to existing work on scaling Ethereum.

1 It's all about gas

In Ethereum gas accounts for every execution step. A transaction includes a *gas price* and a *gas limit*. The gas limit sets the maximum gas that can be burnt during the execution of this transaction. When the execution completes the total gas used is deducted from the account balance of the transaction *sender* at the set gas price[1].

In late spring of 2017 a steep increase in the number of transactions processed on the Ethereum blockchain has been registered. All the while the average gas used per transaction has remained in first approximation constant. The accompanying higher market valuation of Ether had the price per transaction skyrocket. In response the average gas price has started a correction downwards at the time of this writing. [graph]

This demonstrates that the Ethereum protocol has scaled successfully under an increase of the number of transactions. The events have raised new questions though:

1. How can a demand for high-gas transactions be supported?
2. Can a market mechanism be conceived that drives the gas cost down to the actual computational cost?

The underlying question is, however, *why do we not see an upward trend in the gas used per transaction?* Plenty of projects have ambitious goals

[1] The gas price is set in Ether per gas [ETH], where gas is a number.

2 Bridging different worlds

3 Connecting the wires

4 Steering network health