Optimisation of Ethereum Transaction and Block Delivery Performance

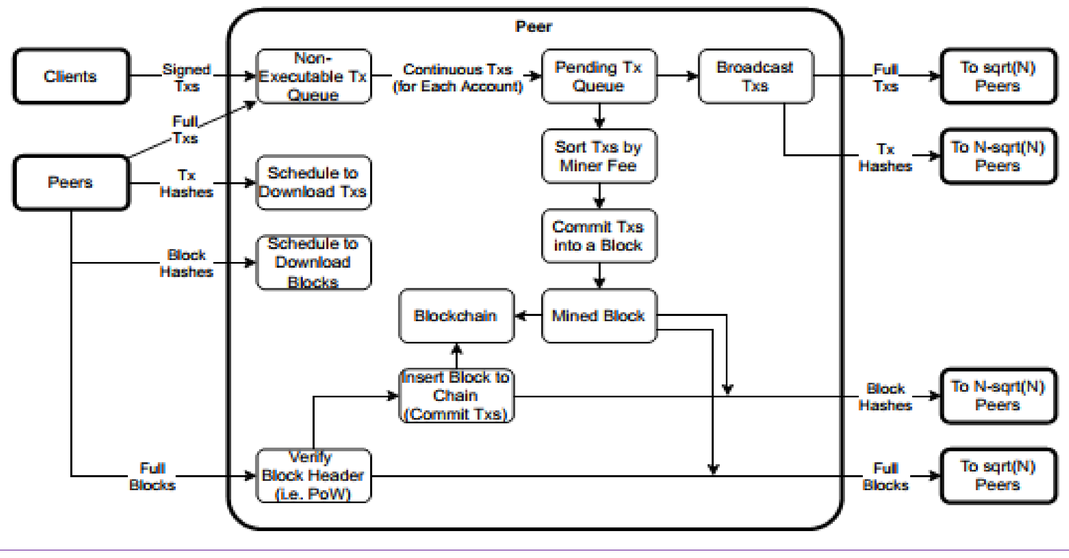
Lin Zhang, Brian Lee, Yuansong Qiao
Software Research Insititute, Athlone Institute of Technology, Dublin Road, Athlone, Co. Westmeath, Ireland
Email : {lin.zhang, ysqiao} @research.ait.ie, blee@ait.ie

Introduction

Blockchain is a type of distributed ledger. It is a chain of blocks. Each block contains a series of transactions. Each transaction is for a value transfer or a smart contract execution. The main purpose of the blockchain system is to achieve consensus on transaction sequence without a controller. The transaction processing capability of the blockchain is influenced by the propagation time of a block in the network -- the shorter the block propagation time, the better the transaction processing capability of the blockchain system, and the easier that system can reach consensus. Ethereum is the second-generation blockchain. It supports Turing complete smart contracts. Although many factors will affect the performance of the Ethereum system, the planned future work of the project is to optimise the transaction/block broadcasting process in the Ethereum peer-to-peer network.

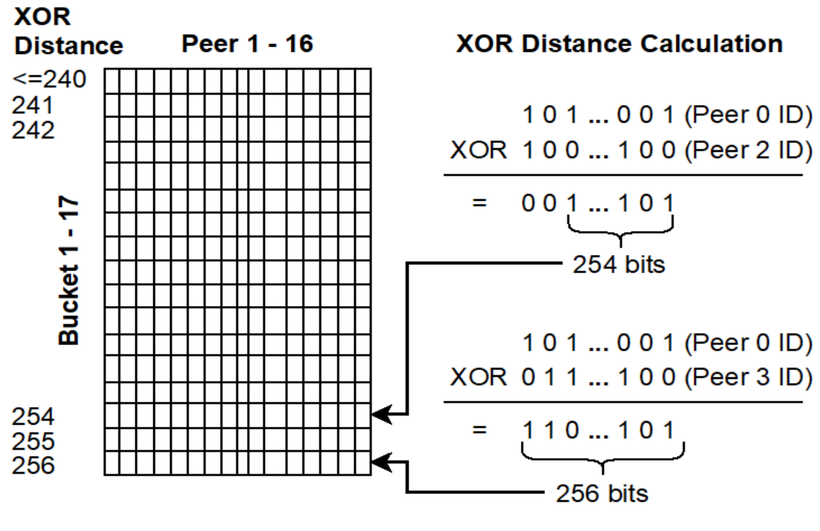
Ethereum Tx/Block Broadcasting Process

A peer has two ways to receive the TXs: clients and other peers. The received Txs will be placed into a temporary queue. These Txs are firstly organized by their correspondent accounts and then ordered by their nonce values. The Txs with continuous nonce values will be moved into pending Tx queue. Two actions will be performed to these Txs at this stage: 1) broadcasting the Txs. The peer will use a gossip policy to broadcast the Txs. The idea is to broadcast the full Tx to a small portion of the peers and broadcast the Tx hash to the rest of the peers. When a peer receives a Tx hash, it will wait for a while and then decide if it needs to download the full Tx from the peer because it may receive the full tx from other peers.2) performed to the txs is to package the Txs into a block. The tx will be ordered by the tx fees and put into a block. At this moment, the txs will be executed and the correspondent account state will be changed based on the execution results. When the block is full, the miner will start the mining process. If it found the answer to the PoW puzzle. It will attach the block into the blockchain and broadcast the block to other peers. Block broadcasting process is like Tx broadcasting process.



Ethereum Peer Selection process

In Ethereum, each peer maintains a peer table, the table consist of 17 rows, and each row includes 16 peers. Each row contains the peers with the same XOR distance to the current peer. The example on how the XOR distance is calculated. Support Peer 0 is the current peer and peer 2 and 3 are the neighbours. we perform bitwise XOR to the IDs from peer 0 and peer 2 or peer 3. The number of zeros in the results decides which row a peer should be put in. The peers with the same leading zeros are put into the same row.



Problems in the Current Ethereum Broadcasting Process

- The peers are randomly selected
- The peer characteristics are not considered
- The network topology is not considered
- The message priorities are not considered during broadcasting

Future Work

Optimising the Ethereum P2P network message broadcasting performance by:

- Design and develop a peer selection scheme for Ethereum
- Design and develop transaction/block broadcasting algorithm