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Midterm Report

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Preface

This thesis is made as a completion of the bachelor education in SUSTech. The thesis is the product of the bachelor period, which is the last part of the Computer Science study at SUSTech, Computer Science and Engineering Department.

Several persons have contributed with support to this bachelor thesis. Firstly, I would like to thank my supervisor Zhang Jin and co-supervisor Richar Ma at NUS for their time, valuable suggestions and support throughout the period.

Furthermore, I would like to thank Shi Lianjie at NUS for his big help through the entire process.

Finally, I would like to thank my family, friends, and girlfriend for being helpful and supportive during my time studying Computer Science at SUSTech.

Tian Runxin

March, 2020 at SUSTech

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摘 要

无线网带宽分配服务是根据每个用户所需的网络带宽以及整个 Wi-Fi 系统下的总带宽，通过用户的竞价来对用户的网络带宽进行分配的一种服务。本文用到的竞价分配机制为 Kelly 资源分配机制。这个机制能够很公平的根据用户竞价分配给用户应得的带宽。

一般来说，竞价系统运行在一个中心化的服务器上，这可能存在很多安全隐患，如竞价记录可以被篡改,竞价系统以及带宽分配机制不透明等问题。为了避免这些安全隐患,我准备使用区块链智能合约设计并实现一个高效的无线网络带宽分配服务。

并且，为了实现高效的无线网络带宽分配服务，竞价行为的响应时间大大决定着整个系统的运行效率。而现有大部分区块链使用 Proof of Work（工作量证明）的共识算法，这是一种常用但是响应慢且耗资源（矿工挖矿所耗算力资源）的一种共识算法。本文为了选择一个高效且省资源的共识算法，对比分析了多个共识算法。最后选择了 Proof of Authority（权威证明）的共识算法。

关键词： 资源分配, 区块链，智能合约，共识算法

ABSTRACT

The wireless connection service differentiation calculates the price of network bandwidth according to the user's demand and the usage of network system bandwidth and carries out the negotiation and allocation of bandwidth resources through the user's price parameters through centralized bidding. And the idea of differentiation is based on the Kelly mechanism, which allows users to acquire bandwidth according to their demand.

Normally, a bidding system is running on a centralized server, which may have many hidden security risks. To avoid some risks and temperable properties that a centralized system may have, we intend to design and implement an effective wireless connection service differentiation system using blockchain smart contracts.

Moreover, to implement effective wireless connection service differentiation, the response time of bidding events represents the effectiveness of the overall system. But most modern blockchain use Proof of Work consensus algorithm, which is a common but slow and resource taking consensus algorithm. To choose a effective and resource saving consensus algorithm, after comparing multiple consensus algorithms, Proof of Authority algorithm is chosen for its good properties.

Keywords: resource allocation, blockchain, smart contract, consensus algorithm

Notations

$\mathbb{Q}$	rational number field

Chapter 1 Introduction

Chapter 2 System Overview

Chapter 3 Resource Allocation

3.1 Kelly Mechanism

Chapter 4 Blockchain

4.1 Smart Contract

4.2 Consensus Algorithm

Chapter 5 Implementation

Chapter 6 Evaluation

Conclusions

Appendix A Experiment Results

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Serveral persons have contributed with support to this bachelor thesis. Firstly, I would like to thank my supervisor Zhang Jin and co-supervisor Richar Ma at NUS for their time, valuable suggestions and support thoughout the bachelor these writing period.

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