



Valente Klaine, P., Zhang, L. and Imran, M. A. (2021) An Implementation of a Blockchain-based Data Marketplace using Geth. In: 3rd Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS 2021), Paris, France, 27-30 Sep 2021, pp. 15-16. ISBN 9781665439244 (doi:[10.1109/BRAINS52497.2021.9569838](https://doi.org/10.1109/BRAINS52497.2021.9569838)).

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Deposited on: 02 July 2021

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# An Implementation of a Blockchain-based Data Marketplace using Geth

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**Abstract**—Nowadays data is one of the most important assets that can be obtained, as many applications rely on data to generate useful services. However, a very few number of companies control, in a centralized manner, a large portion of data. That, combined with inefficiencies in centralized storage and recent data leak scandals, highlights the need for new ways in which data is shared and consumed, in which privacy and access control is guaranteed by design. Based on that, in this paper we present an implementation of a blockchain-based data marketplace utilizing the Go Ethereum (Geth) library. The implementation consists of an IoT node powered by a raspberry pi zero W, which is utilized to collect data from the environment and store it in an InterPlanetary File System (IPFS) external server, a web page that displays the marketplace, and a private blockchain that records transactions. Regarding the private blockchain, three smart contracts are developed in order to: 1) record information about the data in the marketplace; 2) record transactions that occur between users; 3) allow sellers to white/blacklist buyers' access to the data. This implementation shows that a decentralized blockchain-based marketplace is feasible and scalable, and we hope it can serve as an early model for future frameworks.

**Index Terms**—Blockchain, Geth, Marketplace, IoT.

## I. INTRODUCTION

By 2025, it is expected that around 42 billion devices will be connected to the internet, generating around 80 zettabytes of data [1]. However, as the number of devices continues to grow, the communication and transaction between devices in a secure manner is becoming more challenging, as the centralized approaches used today are reaching their limits [2]. This centralization of resources, combined with the huge amount of data that companies gather today, bring several concerns from the users' perspective especially in terms of privacy, as more often than not users do not have control over the data generated by them, nor how these companies store or utilize their data, and for which purpose [3], [4]. Moreover, having a huge amount of data in the hands of a few organizations is also not economically healthy, as there is no proper incentive for data sharing between parties.

Thus, it is clear that novel approaches in how data is collected and shared are needed. From this perspective, a couple of works have investigated the utilization of blockchain for a private and secure data marketplace, such as [5]–[7], in

which all studies considered data collected by IoT devices in different settings. Furthermore, the integration between artificial intelligence, IoT and blockchain is already being investigated by several companies around the world, which clearly shows the importance of novel solutions for data collection and sharing [2].

Based on that, in this paper we demonstrate a real implementation of a blockchain-based data marketplace utilizing the Go Ethereum (Geth) framework [8]. The demonstration of this framework consists of an IoT node powered by a raspberry pi zero W and a DHT11 temperature/humidity sensor, which is responsible for reading data from the environment. This node connects to an InterPlanetary File System (IPFS) private server in order to store the collected data, and a private blockchain deployed via Geth, in order to register transactions, both deployed in the Amazon Web Services (AWS) cloud. The IoT node can also communicate with 2 separate smart contracts, one event-based which is responsible for recording information about the data collected (used as both a record keeping and to allow others to see what data is stored in the marketplace); as well as a regular smart contract, which stores a mapping containing a white/blacklist of users that can/cannot access the data stored in the IPFS server. A web application developed in JavaScript is also built, which is used to browse the data stored in the marketplace, as well as buy/sell the data, which is handled by another event-based smart contract.

## II. IMPLEMENTATION

Figure 1 shows the architecture of the implemented marketplace. It has three main components: an IoT sensor node, a web interface (front-end) and a cloud server, responsible for the backend. The cloud is responsible for storing the private IPFS server, as well as the Private Geth blockchain nodes and its three smart contracts. It consists of 11 steps, which are described as follows:

- Step 1: Whenever an IoT sensor node collects data about its environment it uploads the data to a private IPFS server.
- Step 2: After the upload is complete, a hash of the uploaded file is returned, which can be used to identify the file.

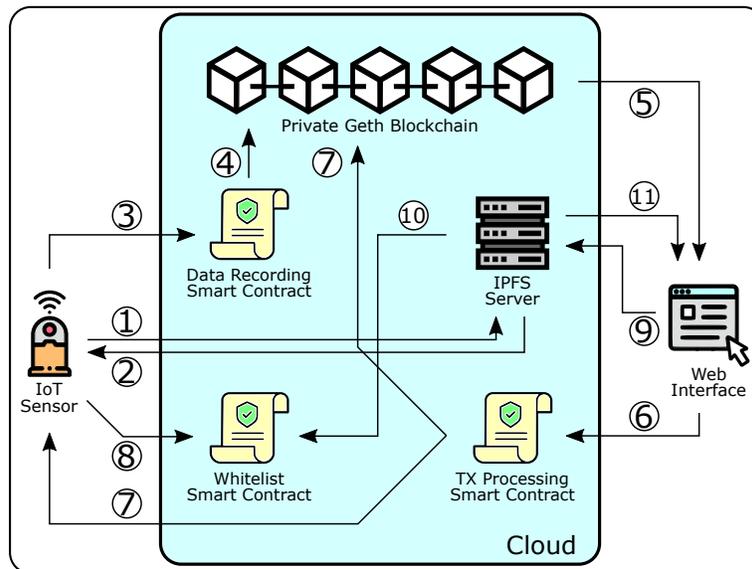


Fig. 1. Architecture of the Blockchain-enabled marketplace

- Step 3: The IPFS hash, together with other metadata, such as what type of data was collected, data tags, timestamp, its owner, etc., are then sent to the data recording smart contract.
- Step 4: The data recording smart contract is an event-based contract, thus no information is stored directly at the contract, but rather its data is stored in the logs property of the blocks of the blockchain, whereas indexed event parameters are stored as topics of the blocks.
- Step 5: By storing certain topics, such as owner address, and data tags, it allows the web interface to query the blockchain for these topics and display the information about the data in the marketplace.
- Step 6: Whenever a user wants to buy a certain data, it sends a request to the transaction processing contract, which then verifies if the minimum amount requested by the seller was met by the buyer.
- Step 7: The contract then transfers the payment to the seller and records this transaction information as an event in the blockchain, which can also be queried to check which transactions were performed by which users.
- Step 8: After the payment is received, the seller updates its whitelist, stored in a regular smart contract, adding the address of the buyer, together with other permissions, such as the number of accesses or time-frame allowed to access the data. As such, this contract is responsible for access control, allowing the seller to revoke any permissions to its data, or even opt-out of the marketplace.
- Step 9: After access is granted, the buyer requests the data to the IPFS server.
- Step 10: The server then checks if the address is stored in the whitelist, together with any other permissions.
- Step 11: If the address is allowed, then the buyer is granted access and downloads the data.

### III. CONCLUSIONS

This paper presents a real implementation of a blockchain-based data marketplace utilizing Geth. This framework guarantees that data sharing is done in a secure and private manner, while also guaranteeing that users keep control of their data, giving them access control over it. The proposed implementation shows that the system is functional and that it can scale up for future applications.

### ACKNOWLEDGEMENTS

This work is supported in part by the Engineering and Physical Sciences Research Council, under PETRAS grant Pristine (EP/S035362/1).

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