IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

A Proxy Re-Encryption Approach to Secure Data Sharing in the Internet of Things Based on Blockchain

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Abstract: *The Internet of Things has seen data sharing as one of its most useful applications in cloud computing. As eye-catching as this technology has been, data security remains one of the obstacles it faces since the wrongful use of data leads to several damages. In this article, we propose a proxy re-encryption approach to secure data sharing in cloud environments. Data owners can outsource their encrypted data to the cloud using identity-based encryption, while proxy re-encryption construction will grant legitimate users access to the data. With the Internet of Things devices being resource-constrained, an edge device acts as a proxy server to handle intensive computations. Also, we make use of the features of information-centric networking to deliver cached content in the proxy effectively, thus improving the quality of service and making good use of the network bandwidth. Further, our system model is based on blockchain, a disruptive technology that enables decentralization in data sharing. It mitigates the bottlenecks in centralized systems and achieves fine-grained access control to data. The security analysis and evaluation of our scheme show the promise of our approach in ensuring data confidentiality, integrity, and security*

Keywords: blockchain

I. INTRODUCTION

The Internet of Things (IoT) has emerged as a technology that has great significance to the world nowadays and its utilization has given rise to an expanded growth in network traffic volumes over the years. It is expected that a lot of devices will get connected in the years ahead. Data is a central notion to the IoT paradigm as the data collected serves several purposes in applications such as healthcare, vehicular networks, smart cities, industries, and manufacturing, among others. The sensors measure a host of parameters that are very useful for stakeholders involved. Consequently, as enticing as IoT seems to be, its advancement has introduced new challenges to security and privacy. IoT needs to be secured against attacks that hinder it from providing the required services, in addition to those that pose threats to the confidentiality, integrity, and privacy of data.

A viable solution is to encrypt the data before outsourcing to the cloud servers. Attackers can only see the data in its encrypted form when traditional security measures fail. In data sharing, any information must be encrypted from the source and only decrypted by authorized users in order to preserve its protection. Conventional encryption techniques can be used, where the decryption key is shared among all the data users designated by the data owner. The use of symmetric encryption implies that the same key is shared between the data owner and users, or at least the participants agree on a key.

II. LITERATURE SURVEY

[1] Internet of Things: A survey on enabling technologies, protocols, and applications

AUTHORS: A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash

This paper provides an overview of the Internet of Things (IoT) with emphasis on enabling technologies, protocols, and application issues. The IoT is enabled by the latest developments in RFID, smart sensors, communication technologies,

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and Internet protocols. The basic premise is to have smart sensors collaborate directly without human involvement to deliver a new class of applications. The current revolution in Internet, mobile, and machine-to-machine (M2M) technologies can be seen as the first phase of the IoT. In the coming years, the IoT is expected to bridge diverse technologies to enable new applications by connecting physical objects together in support of intelligent decision making. This paper starts by providing a horizontal overview of the IoT. Then, we give an overview of some technical details that pertain to the IoT enabling technologies, protocols, and applications. Compared to other survey papers in the field, our objective is to provide a more thorough summary of the most relevant protocols and application issues to enable researchers and application developers to get up to speed quickly on how the different protocols fit together to deliver desired functionalities without having to go through RFCs and the standards specifications. We also provide an overview of some of the key IoT challenges presented in the recent literature and provide a summary of related research work. Moreover, we explore the relation between the IoT and other emerging technologies including big data analytics and cloud and fog computing. We also present the need for better horizontal integration among IoT services. Finally, we present detailed service use-cases to illustrate how the different protocols presented in the paper fit together to deliver desired IoT services.

[2] **Divertible protocols and atomic proxy cryptography**
AUTHORS: M. Blaze, G.Bleumer, and M. Strauss
First, we introduce the notion of divertibility as a protocol property as opposed to the existing notion as a language property (see Okamoto, Ohta [OO90]). We give a definition of protocol divertibility that applies to arbitrary 2-party protocols and is compatible with Okamoto and Ohta's definition in the case of interactive zero-knowledge proofs. Other important examples falling under the new definition are blind signature protocols. We propose a sufficiency criterion for divertibility that is satisfied by many existing protocols and which, surprisingly, generalizes to cover several protocols not normally associated with divertibility (e.g., Diffie-Hellman key exchange). Next, we introduce atomic proxy cryptography, in which an atomic proxy function, in conjunction with a public proxy key, converts ciphertexts (messages or signatures) for one key into ciphertexts for another. Proxy keys, once generated, may be made public and proxy functions applied in untrusted environments. We present atomic proxy functions for discrete-log-based encryption, identification, and signature schemes. It is not clear whether atomic proxy functions exist in general for all public-key cryptosystems. Finally, we discuss the relationship between divertibility and proxy cryptography.

[3] **Identity-based cryptosystems and signature schemes**
AUTHORS: A. Shamir
In this paper we introduce a novel type of cryptographic scheme, which enables any pair of users to communicate securely and to verify each other's signatures without exchanging private or public keys, without keeping key directories, and without using the services of a third party. The scheme assumes the existence of trusted key generation centers, whose sole purpose is to give each user a personalized smart card when he first joins the network. The information embedded in this card enables the user to sign and encrypt the messages he sends and to decrypt and verify the messages he receives in a totally independent way, regardless of the identity of the other party. Previously issued cards do not have to be updated when new users join the network, and the various centers do not have to coordinate their activities or even to keep a user list. The centers can be closed after all the cards are issued, and the network can continue to function in a completely decentralized way for an indefinite period.

[4] Public key encryption with keyword search
AUTHORS: D. Boneh, G. Di Crescenzo, R. Ostrovsky, and G. Persiano
We study the problem of searching on data that is encrypted using a public key system. Consider user Bob who sends email to user Alice encrypted under Alice's public key. An email gateway wants to test whether the email contains the keyword "urgent" so that it could route the email accordingly. Alice, on the other hand does not wish to give the gateway the ability to decrypt all her messages. We define and construct a mechanism that enables Alice to provide a key to the gateway that enables the gateway to test whether the word "urgent" is a keyword in the email without learning anything else about the email. We refer to this mechanism as Public Key Encryption with Keyword Search. As

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another example, consider a mail server that stores various messages publicly encrypted for Alice by others. Using our mechanism Alice can send the mail server a key that will enable the server to identify all messages containing some specific keyword, but learn nothing else. We define the concept of public key encryption with keyword search and give several constructions.

III. METHODOLOGY

Data Owner

In Data Owner module, Initially Data Owner must have to register their detail. Then Trusted authority should approve every new data owner. Only if the trusted authority approves the data owner, the data owner can able to login or else it's not possible to login to the system. In every login the data owner should provide the private key apart from username and password. After successful registration data owner can login and upload files into cloud server with the block splitted into 3 various parts and encrypted for more security purpose. He/she can view the files that are uploaded in cloud. Data Owner can approve or reject the file request sent by data users. After request approval data owner will send the secret key and verification object through mail.

Data User

In this module, we develop Data user part. Where the new data user should register the details and then the trusted authority should approve the new data user. Only if the data user is approved by the trusted authority, the data user can able to get the key or login to the system, orelse the data user cannot able to login into the system. In every login the data user should provide the private key apart from username and password. Once the authenticated data user logs in, the data user can able to search the available files, by entering the keyword of the file. To get the access of the file, the data user must provide the request. Only if the request is accepted they data user can able to download the file which the data user requested. These data users must access the shared data from the CSP which is a semitrusted party that offers storage services to the data. It houses the encrypted data from the owner and the data is received through a secure communication channel. They provide data-sharing services without being able to learn anything about the plaintext.

Trusted Authority

The trusted authority is the entity which approves the new data Owner or data user in the system. The blockchain serves as the trusted authority (TA) that initiates the system parameters. The TA also provides secret keys that are bound to the users' identities. By utilizing this distributed ledger, authenticity, transparency, and verifiability are achieved in the network, which enhances the security and privacy of data. Data owners are therefore able to manage their data effectively. The blockchain network registers and issues membership keys to the data owner(s) and user(s). When a user requests data access, the owner generates a re-encryption key by using the identity of the user and sends it to the proxy server. Access rights and policies on the use of the data are instantiated and sent to the blockchain network. A data user is verified before access is granted.

Proxy Server

In this module, we implement the Proxy server. In Proxy re-encryption a User may encrypt his file with his own public key and then store the ciphertext in an honest-but-curious server. When the receiver is decided, the sender can delegate a re-encryption key associated with the receiver to the server as a proxy. Then the proxy re-encrypts the initial ciphertext to the intended receiver. Finally, the receiver can decrypt the resulting ciphertext with her private key. The security of PRE usually assures that (1) neither the server/proxy nor non-intended receivers can learn any useful information about the (re-)encrypted file, and (2) before receiving the re-encryption key, the proxy cannot re-encrypt the initial ciphertext in a meaningful way

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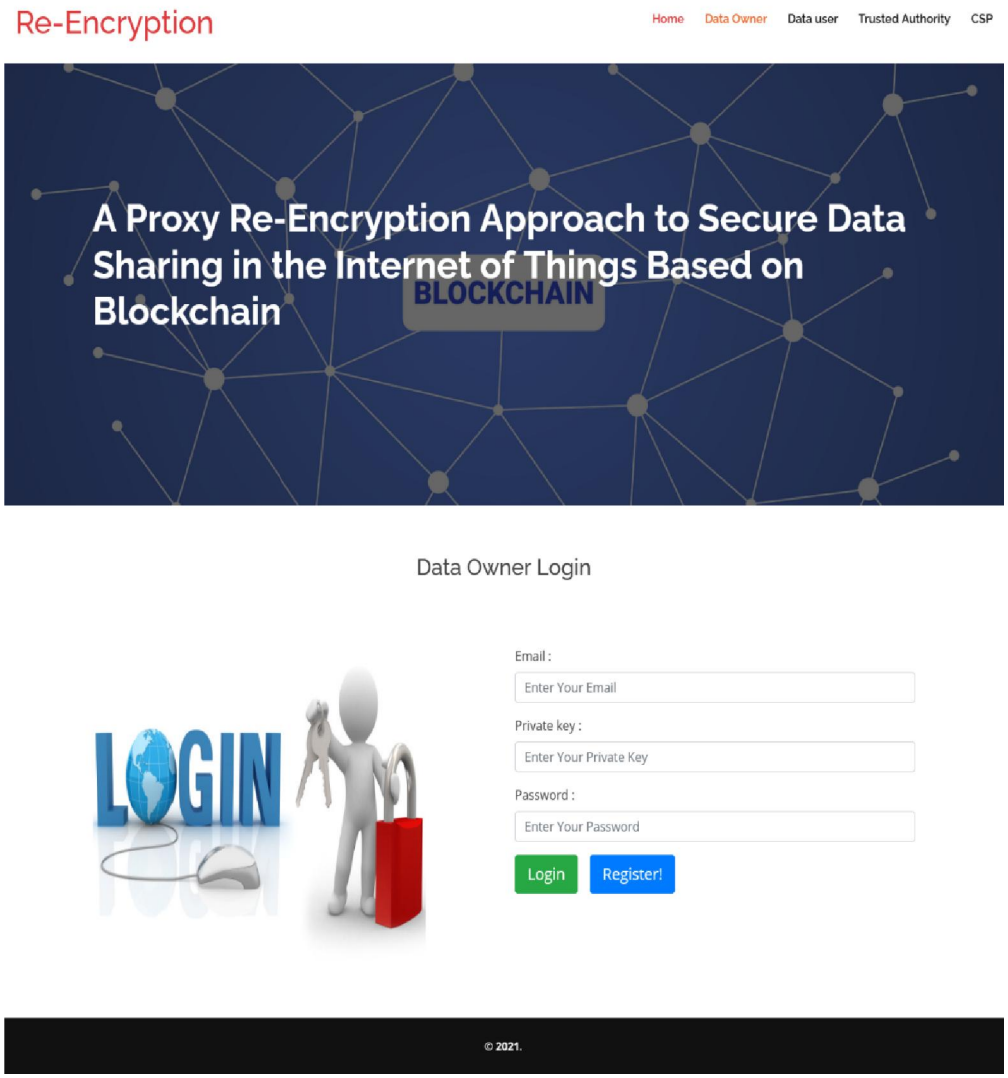

Figure 1: Owner login Page

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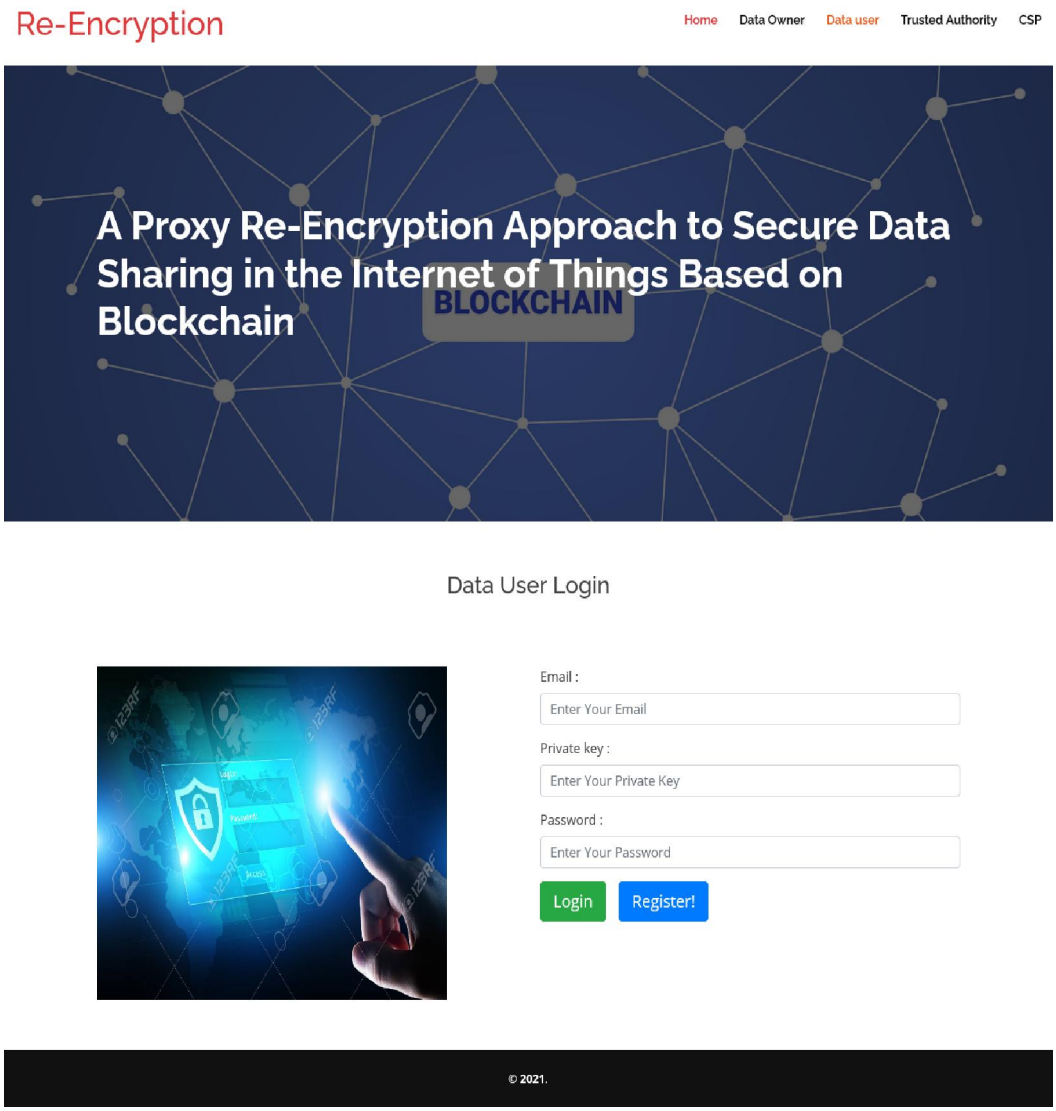

Figure 2: User login

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Figure 3: Trusted details

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Figure 4: Upload

IV. CONCLUSION

Blockchain technology creates a permanent and immutable record of every transaction .This impenetrable digital ledger makes fraud, hacking, data theft and information loss impossible. While blockchain technology has reshaped and decentralized financial institution, its application possibilities are for more robust. Then, we present a block chain-based system model that allows for flexible authorization on encrypted data. Fine grained access control is achieved, and it can help data owners achieve privacy preservation in an adequate way. The analysis and results of the proposed model show how efficient our scheme is, compared to existing schemes.

V. FUTURE ENCHANCEMENT

By enabling detailed user access control in cloud environments, sensitive information stored on cloud servers can be managed more safely. The proposed protocol provides a structure by means of which a large capacity of various data, including users' personal information requiring high confidentiality, can be accessed safely and efficiently. We expect the proposed protocol to be widely and efficiently used in the cloud computing environment. However, a disadvantage of this method is the additional computation in the polynomial equation compared to existing attribute-based encryption methods, since it provides more functions. In the future, we will study more efficient and safer methods based on the proposed method

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