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SECURITY ON DATA PROCESSING IN EHR USING RECONSTRUCTION OUTSOURCING METHOD

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Abstract:

Electronic Health Record is a digital version of a records maintenance systems in hospitals and healthcare organizations. EHRs allows only the licensed people can access the records. EHR ensure high-quality care. EHR contain treatment histories of patients, ,doctors diagnoses, treatment plans, radiology images, and laboratory a test results. Treatments and guidance from doctors to patients mostly through e-mails, also many parties store and run computation while keeping the sensitive health data private.so cipher attack may cause heavy damage from the patients side therefore data may be secure .In order to address this issue this paper presents a patient healthcare data management system using reconstruction outsourcing mechanism to attain privacy in HC.

Keywords — **Electronic Health Record, BlockChain, HealthCare.**

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1 INTRODUCTION

An electronic health record (EHR) is a digital version of a records maintenance systems in hospitals and healthcare organizations. EHRs allows only the licensed people can access the records. EHR contain treatment histories of patients, ,doctors diagnoses, treatment plans, radiology images, and laboratory a test results. EHR allow doctors to know about the patient's medical history and the health of the patients .Doctors or authorized persons can access the EHR data's from anywhere in the world through cloud-based-HER-Systems (CBES). One of the key features of an EHR is that patients health information can be created and managed by licensed providers in a digital format through wallet or smart devices. EHR allows the authorized persons can share the authorized information with other health care providers and health care organizations such as laboratories, pharmacies, medical emergency facilities, emergency facilities, and institutions and workplace organizations so they contain data's from all clinicians involved in a patient's care. EHR Ensure high-quality care. With EHRs, healthcare providers can give patients full and correct data's concerning all of their medical evaluations. This can be achieved through smart devices or health care smart watches. With EHRs, HCP can manage appointments electronically and communicate with patients through e-mails. The communication between patients and HCP may help providers find the symptoms easily. HCP can also provide information to their patients through patient portals tied into their EHR system. patient data protection and electronic EHI(Electronic Health Information) is a shared responsibility. Following the privacy and security standards was patient trust. It gives assurance to the patients that their electronic health information will remain confidential, accurate, and secure

2. RELATED WORK

Users, individuals and medical institutions consider a flexible way to manage their EHRs. Since EHRs are most sensitive and it contain patients confidential data's, cloud-assisted eHealth systems also suffer from challenging privacy and security threats toward outsourced EHRs. To protect patients' privacy against internal adversaries and external adversaries, EHRs are encrypted before outsourcing. Few papers proposed a cryptographic key management solution for protection of patients' EHRs. However, this scheme employs a trusted server to process all secret keys of patients. As a consequence, the trusted server is able to retrieve the patients' EHRs, and the privacy of patients is not well protected. Many paper proposed a secure EHR system to protect patients' privacy without introducing any trusted entity. The system model of this scheme is not permanent with current cloud-assisted systems. The above two schemes, patients' EHRs are outsourced by the patients themselves, and before outsourcing the doctor needs to send EHRs to the patients .This brings heavy burden in terms of communication and computation costs. In recent studies says that the integrity of outsourced data has also attracted. These schemes mainly focus on ensuring that the outsourced data would not be lost, and the data owners generate and outsource the data to the cloud server, the doctor is only trusted during the treatment period, if the malicious doctor incentivizes the cloud server to tamper with outsourced EHRs generated by himself, it is hard to detect such misbehaviour. Moreover, existing schemes do not consider the timeliness of EHRs. We stress that it is also important to know when EHRs were generated in eHealth systems, since the correctness and fairness of conclusions drawn from EHRs in judgements and dispute resolutions in medical malpractices is based on the correctness and timeliness of EHRs.

3. PROPOSED METHOD

The proposed cloud storage scheme for EHRs consists of four phases, namely the Data Processing phase, the issuing phase, the reconstruction phase, and the checking and recovering phase. first we give the definition of reconstruction outsourcing. Reconstruction outsourcing is a method of reutilization of the cloud storage solution based on secret sharing. In this way, the reconstruction of stored data in different cloud service providers is outsourced to a cloud service provider, so that the computing resources of client hosts can be saved. In the proposed method, the reconstruction outsourcing of pre-processed EHRs must ensure the outsourcing cloud service provider cannot obtain any content of the EHRs during the reconstruction. For accounting legitimate , we assume Health Care X is the generator of an EHR. We will show how the proposed cloud storage scheme works by taking the EHR generated by HC->X as an example. HC->X the storage and retrieval of the EHR before uploading it to the healthcare system. And the policy is used to guide the CPs for the distribution and reconstruction of the EHR. For instance, the values of n and t are decided by the policy.

1) Data Processing Phase

The Data processing operation of EHRs is executed by a healthcare system. After Health Care X uploads the EHR, denoted as a file Z and uploaded in to the Healthcare Systems(HS). The HS generate the unique ID for the EHR and computes the hash value for Z. Both ID and H(Z) are stored in the EHR systems. Then EHR systems perform Data processing by doing bitwise OR operation for Z of each block and results stored in the separate file .

$$\mathbf{Z=(X_1||\ldots\ldots\ldots\ldots||C_M)\{C_1,\ldots\ldots\ldots C_M \sum Y_P\}}$$

after performing bitwise OR operation each block results modified as

$$[\ S_1 \ldots\ldots S_m\ ]$$

2) Data Issuing Phase

The Electronic Healthcare System EHS is responsible for the distribution of Data Processed EHR. First EHS computes m polynomials . Then the healthcare system computes n shares and distributes them to CP_1------CPn respectively. The shares and the identifier of the EHR are uploaded to CP by healthcare system. The identifier can be used to retrieve the processed data of EHR when a reconstruction is needed.

$$\begin{bmatrix} a_{11}, \ldots, a_{1t-1} \\ \cdots \\ a_{m1}, \ldots, a_{mt-1} \end{bmatrix} \in Z_p$$

3) Reconstruction Phase

The reconstruction phase requires huge amount computational knowledge because it involves solving a large-scale system of linear equations. The client side computational workload creates extra burden for client. To make client easy handling and to improve the efficiency on the client side, we propose the reconstruction outsourcing scheme. The detailed process is discussed as follows:

Let us assume another healthcare provider HC→ Z. The healthcare system first verifies the truthfulness of HC→ X to check if it is legitimate to requested EHR. If it true, healthcare system outsources the reconstruction to a cloud service provider CP_{RE}. Notice that here we consider the CP_{RE} to be a curious and dishonest party, This is the strongest threat . In other words, the cloud server may return wrong computation results or steal useful information from the inputs. CP_{RE} gets no less than t shares from CP_1---------CPn to reconstruct the Processed data in EHR, cannot reveal any information useful on the original EHR.Thus, reconstruction outsourcing process is secure against the curious cloud server.

$$\begin{bmatrix} s_{11}, \ldots, s_{m1} \\ \cdots \\ s_{1k}, \ldots, s_{mk} \end{bmatrix} (k \geq t)$$

4) Checking and Recovering Phase

After getting n shares from Healthcare Systems and receiving hash of Z ,ie.,H(Z) blocks HC→ Z , recover the answers from each block of Z' and then arranging it in series. The EHR is recovered as,

$$\mathbf{Z' = b'_1||.....b'_m}$$

Then HC→X, Checks the equation H(R')=H(R). If it contain the recovered Z' is true , otherwisethe recovered Z' is not real in EHR.The verification process ensures that both the cloud service providers to store the HER and the cloud service provider to execute the reconstruction outsourcing behave honest.

Table 1. Proposed Scheme Notations.

Notation	Meaning
P	Prime
t	threshold of HER
n	Number of CSP
Z	Data processing result
HC	HealthCare
EHR	Electronic Health Record

4. PERFORMANCE EVALUATION

In our proposed scheme, we developed an application with a user-friendly interface, and conducted experiments that simulate the outsourcing process. The experiment was carried out on the Windows 10 on Intel Pentium processor of 2.70 GHz with 4 GB memory. We implemented our proposed scheme in Python, MD-5 is used as the hash function. We conducted the proof of concept experiments to show the effectiveness of the proposed scheme.In our developed application, users are allowed to define the number of servers n that the secret is distributed to, which ranges from 20-300. The threshold t is set by users as well, which ranges from 20 to 300. The experimental

results are calculated as the average value of 8 executions of the algorithms.

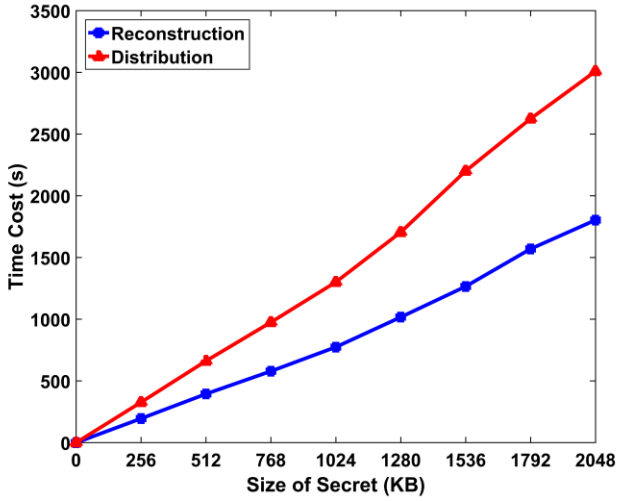

Figure 1 : The time cost comparison between reconstruction and distribution phases with variational file

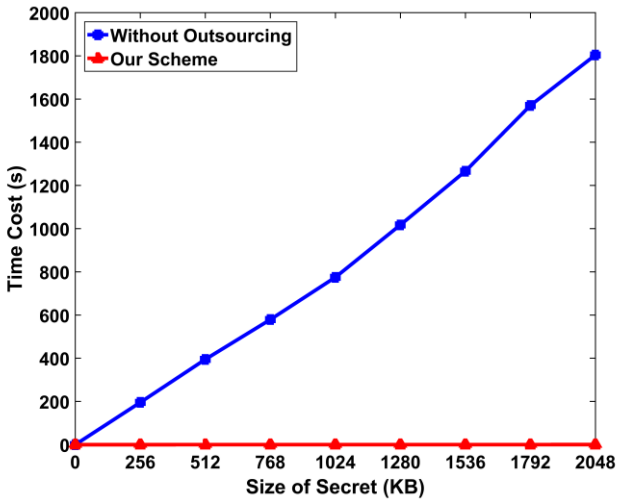

Figure 2 : The time cost comparison between our scheme and reconstruction without outsourcing with variational file size

5. CONCLUSIONS

In this paper, we proposed a privacy-preserving cloud-based EHR storage scheme for electronic health records based on Shamir's Secret Sharing. To highlight the problem HER to reconstruction is shared that reduce the difficulties for a healthcare center or a patient in a real-world , we proposed a secure and secret reconstruction of shared EHR for a powerful computational cloud service provider. In theoretical analysis, the previous schemes ensure the security but this schem satisfies the security requirements. We also conducted experiments on real documents, and the results show that, when our proposed reconstruction outsourcing approach is in place, the operation cost for healthcare centers and patients can be reduced significantly.

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