

Cloud Computing For Electronic Health Records

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Abstract

Nowadays, many insurance companies and healthcare providers use Electronic Health Records (EHR) in one form or another, most of which save data in centralized databases. Sharing information across administrative boundaries improves communication between these sectors since patients frequently interact with several healthcare providers and may have different health insurance policies. Cloud infrastructure, in particular Infrastructure as a Service (IaaS), provides users with access to processing, storage, networking, and other computational resources. With this approach, customers can install and utilize selected software, including operating systems and apps. Although they cannot manage or control the underlying infrastructure, cloud infrastructure customers retain control over the operating system, storage, installed apps, and certain network components. Under this Cloud Infrastructure plan, healthcare software developers are in charge of protecting patient data's security and privacy.

Keywords: electronic health record (EHR), cloud computing, advantages, capabilities

INTRODUCTION

The health care companies today are customer-focussed by virtue of improved technology, primarily in the science of medicine. Without having immediate access to good quality data, the goal of quality enhancement of these enterprises cannot be envisioned [1]. The defined as an electronic repository that enables multiple authorized people to safely keep, share, and retrieve a patient's data. This data consists of the patient's previous, current, and future medical records. EHR's primary objective is to facilitate easy upkeep of coordinated, effective, and high-quality healthcare [2]. Additionally, an EHR includes all of a person's health-related data from before birth (including information about prenatal and postnatal conditions, including in vitro conception) until after death (including information gathered from autopsies and other sources) [9]. Since this data is continuously and electronically preserved over time, authorized staff can access all or a piece of it whenever needed, regardless of location or time constraints. All individuals in society are generally stakeholders of integrated EHR systems, and all healthcare providers are both clients and stakeholders. By minimizing errors and maximizing the overall effect of healthcare services, the implementation of EHR has revolutionized the delivery of healthcare to an extent that is unforeseen. [3][13]. It is necessary to monitor the heart rate, temperature and blood pressure of a person in order to see that he/she is healthy. The thermometer is employed to ascertain the body temperature and the sphygmomanometer is employed to keep track of the blood pressure. On the other hand, the heart rate can be checked in two manners, including manually taking the pulse either from the wrist or neck and through a heartbeat sensor [10]. IoT was conceptualized with the use of different sensors and modules with a cloud for different purposes. Typically, IoT is referred to as a set of objects surrounding us that are linked to the internet using network communication, which can be controlled and monitored by the applications on smartphones, tablets, etc. Over the past few days, there has been increased use of IoT in research at universities in various fields of science and technology. Also, the extensive use of IoT has been observed in healthcare services, where it is used to monitor patients' health parameters. Cloud computing is typically a middle between objects and programs that conceals all the complexity and activities from the point of view of distribution systems' goals. Nevertheless, cloud computing cannot be critically controlled in real time. There is a need for a system that can continuously monitor and report the health status of the patients; this can be achieved by the use of fog computing technology. Fog computing can enhance the computational capabilities of the cloud-to-edge devices of

the IoT systems and allows numerous smart devices to provide services such as data storage and data retrieval to the users.

LITERATURE REVIEW

Network topology-level concerns pertaining to preserving data confidentiality, integrity, and appropriate authentication/authorization in public cloud settings were covered by Yazhe et al. [5]. Resource availability is a major issue in public cloud systems, especially the susceptibility to BGP hijacking, in which attackers alter network layer reachability data in order to interfere with or take advantage of cloud services. This typically takes place as a result of a configuration error and can impact the availability of cloud resources. Misconfigurations and malicious assaults, such as DNS and DoS/DDoS attacks, pose a threat to availability in public cloud systems [4]. It is difficult to prevent these risks, thus research focuses on practical mitigation strategies. As cloud architecture develops, virtual entities and layer domains with improved security in data centers are replacing conventional network models. According to Shaun et al., cloud service providers can reduce network-level access threats and safeguard cloud infrastructure by utilizing firewalls and network intrusion detection systems [11] have also discussed the following primary data security issues in cloud-based environments. Data-at-rest, data-in-transmit, data lineage, and data provenance are among its concerns. Cloud computing offers a wide range of data security safeguards, including non-repudiation, confidentiality, integrity, authorization, and access control [6].

MATERIALS AND METHODS

A desired feature of a process, network, or system that helps reduce burdens. Scalability, for example, refers to a system's ability to improve overall performance as more hardware or other resources are added [7]. The significance implementation of large, intricate systems, cannot be overstated. Because they can allocate resources as needed, users do not need to plan for times when resource usage is high. This property is particularly relevant to cloud computing and electronic health records [12]. Interoperability, which refers to a recognized framework or open protocols that enable smooth server integration and data sharing among cloud service providers, is a major challenge in this context. The goal is to eliminate worries about infrastructure, development processes, or implementation details by guaranteeing that services are easily available through defined models and protocols [8]. Patient care is enhanced by the interoperability of electronic health record systems, which enable the effective retrieval and interpretation of clinical data from various sources. Processes are accelerated and unnecessary testing and prescriptions are reduced when patient information is automatically transferred across care facilities.

Result and discussion

The implementation of cloud computing allows for the use of various databases such as SQL, ORACLE, and CASH, while also providing the flexibility to install applications that are not solely reliant on Windows and can be utilized on mobile devices.

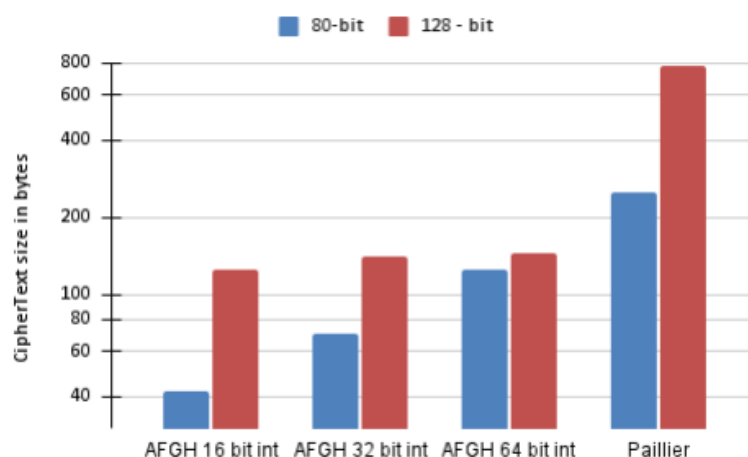


Figure 2: Generation of Cipher Text in Bytes

The ten main domains that cover the benefits and capabilities of cloud computing in the implementation of Electronic Health Records are expenses, privacy and security, flexibility, mutually beneficial performance and seamless integration, platform independence, search and exploration capabilities, enhancement of quality and decrease in errors, fundamental flexibility, and sharing capabilities.

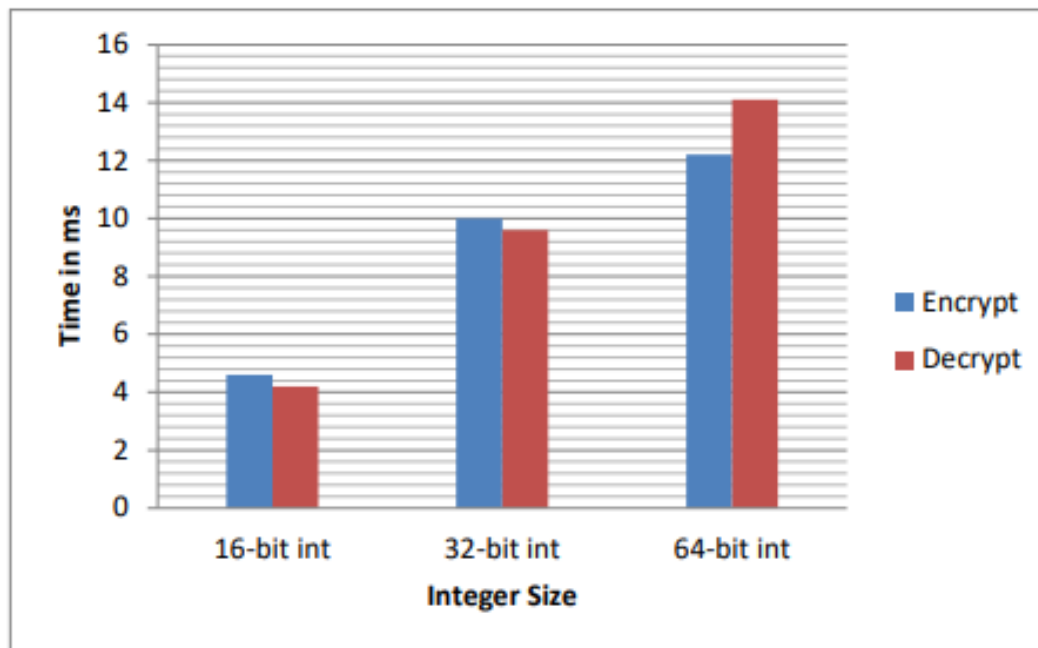


Figure 3: Encryption/Decryption Process – 80-bit Security

Electronic health records will benefit immensely from this technology. The capabilities and advantages of cloud computing can be employed by programmers to create safer, cheaper, and improved applications—such as ones that are economically scalable.

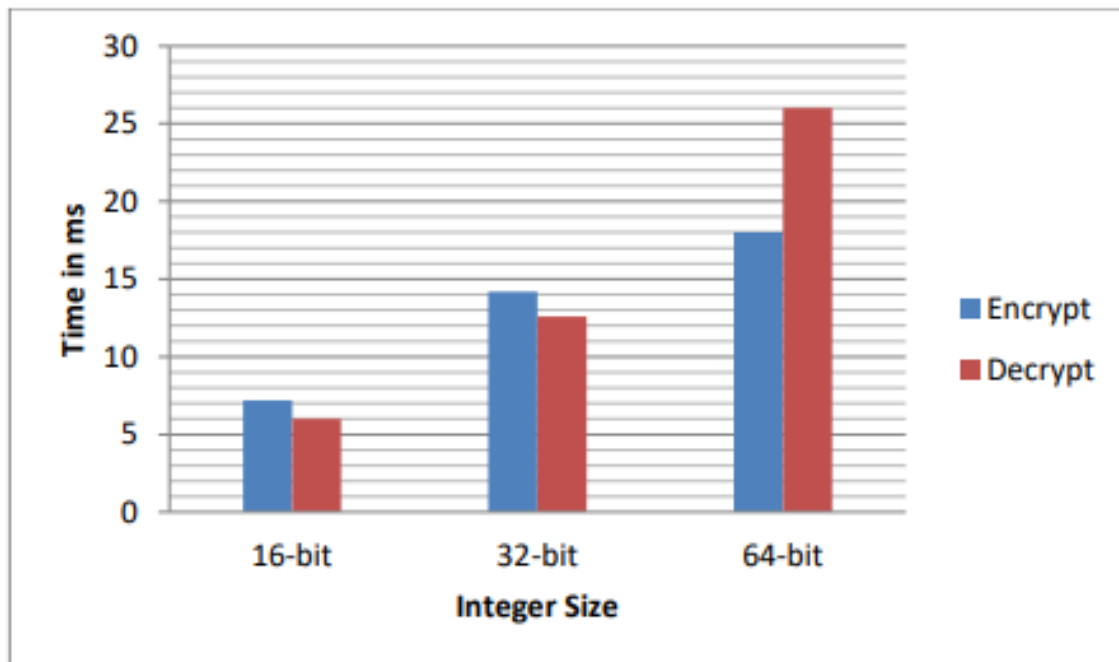


Figure 4: Encryption/Decryption Process – 128-bit Security

Because every application running on any given computer in the company can be updated individually, updating these programs is simpler than updating older programs. This technology facilitates this process to be rapid and efficient. This research aimed at systematizing [14].

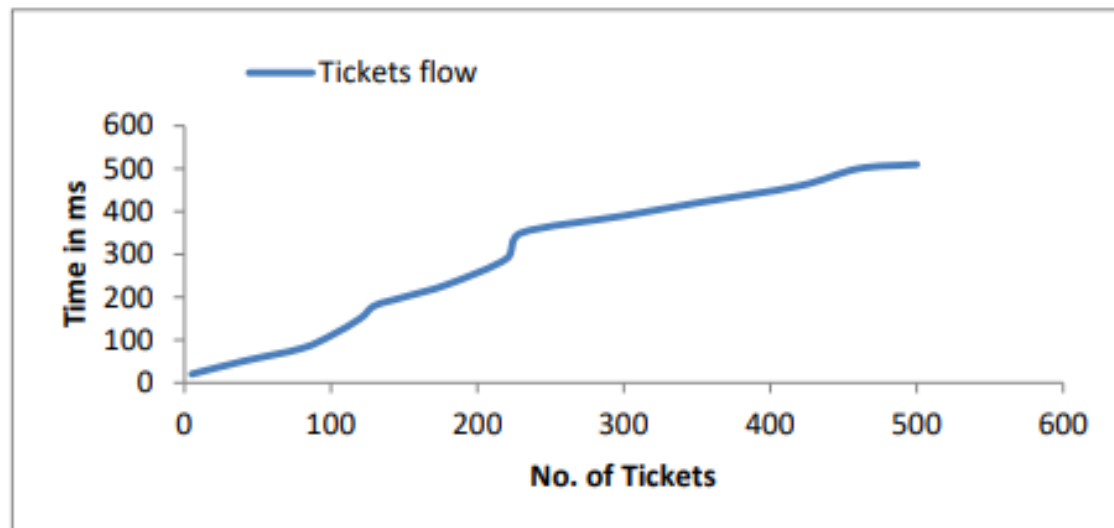


Figure 5: Ticket Generation for Re-encryption (using 4 Threads)

Healthcare service providers' (HSPs') changing security requirements and laws provide difficulties for cloud service providers (CSPs). Ensuring data privacy and confidentiality in cloud infrastructure is one of the main problems. To offer strong protection, CSPs need to effectively answer queries about cloud security [15].

CONCLUSION

Cloud computing enables customers to lower expenses related to hardware, software, and services, while also eliminating costs associated with software installation and maintenance. Furthermore, by enhancing data access speed and improving healthcare through EHR, overall healthcare costs are reduced. Ensuring data privacy and security during transmission and storage in cloud environments is a significant concern for Electronic Health Records (EHRs), necessitating strong security measures to safeguard private health data. To preserve the privacy of health data and adhere to HIPAA security regulations, cloud environments employ a variety of encryption approaches, including symmetric encryption, digital signatures, public-private key encryption, and more.

REFERENCES

1. Chen, Shyh-Wei, Dai Lun Chiang, Chia-Hui Liu, Tzer-Shyong Chen, Feipei Lai, Huihui Wang, and Wei Wei. "Confidentiality protection of digital health records in cloud computing." *Journal of medical systems* 40 (2016): 1-12.
2. Kang, M. (2020). The Study on the Effect of the Internet and Mobile-Cellular on Trade in Services: Using the Modified Gravity Model. *Journal of Internet Services and Information Security*, 10(4), 90-100.
3. Mourya, Ashish Kumar, and Sheikh Mohammad Idrees. "Cloud computing-based approach for accessing electronic health record for healthcare sector." In *Microservices in big data analytics: Second international, ICETCE 2019, Rajasthan, India, February 1st-2nd 2019, revised selected papers*, pp. 179-188. Singapore: Springer Singapore, 2019.
4. Eldardiry, H., Sricharan, K., Liu, J., Hanley, J., Price, B., Brdiczka, O., & Bart, E. (2014). Multi-source fusion for anomaly detection: using across-domain and across-time peer-group consistency checks. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 5(2), 39-58.
5. Ishaq, Ayesha, Bilal Qadeer, Munam Ali Shah, and Nimra Bari. "A comparative study on securing electronic health records (EHR) in cloud computing." In *2021 26th International Conference on Automation and Computing (ICAC)*, pp. 1-7. IEEE, 2021.
6. Kong, Y., Suntrayuth, S., & Lin, F. (2024). Construction of Cross-Border E-Commerce Supply Chain of Agricultural Food Products based on Blockchain Technology. *Natural and Engineering Sciences*, 9(2), 145-163. <https://doi.org/10.28978/nesciences.1569226>
7. Mirza, Hebah, and Samir El-Masri. "Cloud computing system for integrated electronic health records." In *Proceedings of the International Conference on Bioinformatics & Computational Biology (BIOCOMP)*, p. 382. The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp), 2012.
8. Singhal, P., Yadav, R. K., & Dwivedi, U. (2024). Unveiling Patterns and Abnormalities of Human Gait: A Comprehensive Study. *Indian Journal of Information Sources and Services*, 14(1), 51-70. <https://doi.org/10.51983/ijiss-2024.14.1.3754>

9. Amanat, Amna, Muhammad Rizwan, Carsten Maple, Yousaf Bin Zikria, Ahmad S. Almadhor, and Sung Won Kim. "Blockchain and cloud computing-based secure electronic healthcare records storage and sharing." *Frontiers in Public Health* 10 (2022): 938707.
10. Karimov, N., Sarybaev, M., Kaipnazarov, A., Djumageldiev, N., Reymbaev, R., & Kholdarova, F. (2024). Historical Development of Construction Techniques: from Ancient Architecture to Modern Engineering. *Archives for Technical Sciences*, 2(31), 36–48. <https://doi.org/10.70102/afts.2024.1631.036>
11. Tyagi, Amit Kumar, and S. U. Aswathy. "Autonomous Intelligent Vehicles (AIV): Research statements, open issues, challenges and road for future." *International Journal of Intelligent Networks* 2 (2021): 83-102..
12. Ahmadi, Maryam, and Nasim Aslani. "Capabilities and advantages of cloud computing in the implementation of electronic health record." *Acta Informatica Medica* 26, no. 1 (2018): 24.
13. Bahga, Arshdeep, and Vijay K. Madiseti. "A cloud-based approach for interoperable electronic health records (EHRs)." *IEEE journal of biomedical and health informatics* 17, no. 5 (2013): 894-906.
14. Mehta, A., & Singh, R. K. (2025). Targeting Tumor Microenvironment in Metastatic Cancer. In *Medxplore: Frontiers in Medical Science* (pp. 1-18). Periodic Series in Multidisciplinary Studies.
15. Hariprasath, S., Senthilkumar, P., & Singaravel, G. (2022). Artificial Intelligence in Medicine Application and its Security Process A Review Methodology. *International Journal of Advances in Engineering and Emerging Technology*, 13(2), 193–197.