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A Systematic Literature Review Method On AES Algorithm for Data Sharing Encryption On Cloud Computing

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ABSTRACT

Cloud computing is one revolution in information technology (IT) that can share resources, services and data through a network among users. Because users have same rights on the network to transfer data, data are vulnerable to be attacked by unauthorized person. Lately, data security in a system only concentrates on data storage on cloud by utilizing internet security, but a little concentration is found during data transmission. By considering security as a serious problem, an encryption-based proposed system is presented to secure during data transfer. Authors propose an approach to boost system security during data transfer in order to prevent data theft by unauthorized person. To prevent an attack by unauthorized person, Advanced Encryption Standard (AES) will be proposed to secure data transmission and storage in cloud computing. For better future, authors will propose Systematic Literature Review (SLR) to generate suggestions and opportunities in AES cloud computing.

I. Introduction

Cloud computing is an internet-based storage service [1]. The cloud gives services to its user to store data. Because of its services, there is a significant increment in term of storage usage [2]. Wide service and accessible facility are reasons to significant increment effect [3], [4]. Due to high demand on cloud usage [5], every cloud service provider is encouraged to provide data security to its user [6], [7]. To achieve high data safety, there is a proposed model of data security to prevent any unauthorized person from data stealing [8], [9].

Data and information securities are primary challenge in cloud service [10]. Hence, preventive method is encouraged to protect user's data and information [11], [12]. There is a preventive method called encryption to anticipate any intruder [13], [14]. A proposed encryption algorithm involves symmetric cryptographic called key to do encryption and decryption [3], [15], [16]. AES algorithm is proposed for safety during data transfer [17]. The algorithm is believed to be more efficient than other algorithm [17], [18]. There are advantages for applying AES algorithm [19], [8], such as: large scale data to be encrypted and little resource consumption [14]. The algorithm is believed that it can secure on user's data and information [8], [20].

Table 1. Previous Studies of AES Encryption on Cloud Computing

Paper	Year	Research Result
[9]	2015	Secure and resolve data security problem on cloud computing by AES
[20]	2019	Secure data and reduce traffic time by AES encryption
[21]	2018	Heterogeneous model on cloud computing is able to give data security contribution
[22]	2019	Big volumes of private data are collected and need to be secured in cloud
[23]	2019	Security modeling on cloud computing to prevent data theft
[24]	2019	Symmetric encryption scheme is implemented in client before data is uploaded to cloud computing
[25]	2017	Usages of authentication and cryptographic for future security on cloud computing operating system
[26]	2015	Data security problem in distributed data system proposing SHA-1 algorithm to secure data

II. Research Method

This paper will use SLR method. It can be said that it is formal method to review and translate based on specific question [27]. SLR has 3 steps [28], [27]. There are to plan review process, to do review process and to report review process [29], [30]. Authors use several trusted databases for searching relevant paper to support authors' research.

Table 2. Digital Library Journal

No.	Digital Online Library	Website
1.	IEEE Explore	https://ieeexplore.ieee.org/
2.	ScienceDirect	https://www.sciencedirect.com/
3.	Tandfonline	https://www.tandfonline.com/

Table 2 explains some trusted digital library for getting relevant paper. There are "IEEE Xplore"," ScienceDirect"," Tandfonline" from 2014 to 2019. Authors' reason is that those databases have high quality of reputation. Next figure depicts required step in SLR.

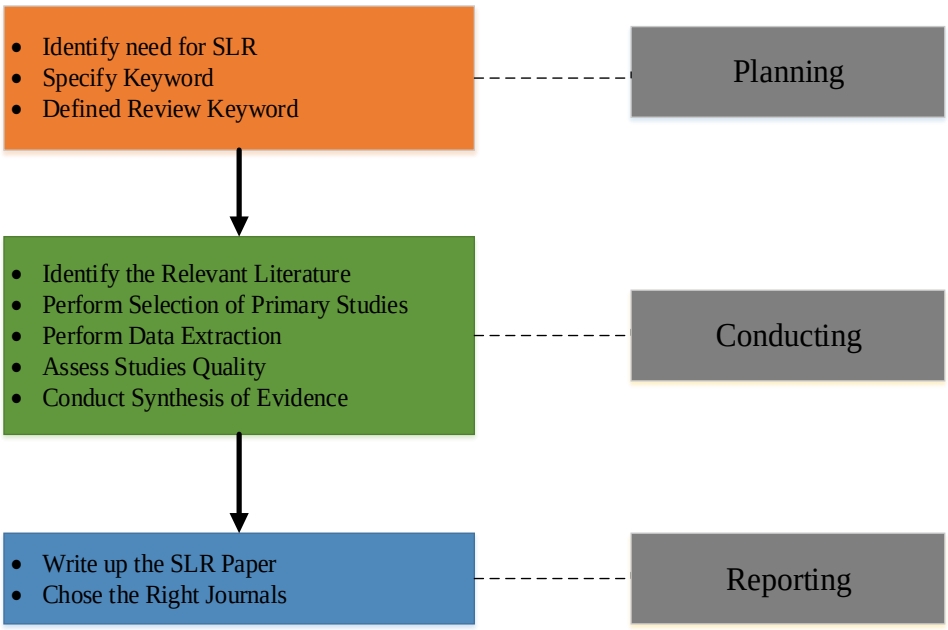


Fig 1. Systematic Literature Review [29]

Before authors process the SLR process in figure 5, it is a need to develop criteria for separating unreliable and reliable papers [31]. To create high rate of paper identification, authors also add some

questions for quality and quantity assessments for high quality papers. Table 3 explains criteria that has been mentioned [32].

Table 3. Criteria of paper identification

ID	Unreliable
U1	The focus of the paper has not been updated with the current conditions
U2	Not English paper
U3	Paper discussion material is not very related to what is sought by researchers
U4	Poor quality of paper by judging
	Reliable
R1	The contents of the paper are still up to date with the current conditions
R2	Paper that discusses the concept of Cloud Computing
R3	Paper that discusses the concept of AES Algorithm
R4	Paper published from 2015 to 2019
	Quality Assessment
QLA1	Results of research?
QLA2	What are strengths of research objectives?
QLA3	Is there enough description in context?
QLA4	Has the paper been reviewed from previous research?
QLA5	Are the methods carried out in accordance?
	Quantity Assessment
QNA1	Is anything measured by numbers?
QNA2	Is there any process to measure?
QNA3	Are there measurement standards?

Based on research criteria in table 3, authors define purposes of SLR research. The criteria can be used to form research question. Question of research is about "AES Algorithm for Data Sharing Encryption On Cloud Computing". Research activity needs to be done in order to find relevant paper with high trusted quality to answer the question. Authors did the research in 2nd March 2020. From the activity, table 4 is the result of paper search.

Table 4. Result of Paper Search in Digital Library

Database Journal	Result Paper
IEEE Explore	22
ScienceDirect	70
Tandfonline	30
Total	122

Table 4 shows research result for “AES Algorithm for Data Sharing Encryption On Cloud Computing”. There are 122 journals for authors’ analysis

III. Research Result and Discussion

Authors create step by step for keyword result. The keyword is obtained based on data encryption in cloud storage.

A. Data Encryption with AES on Cloud Computing Comparison

Authors are interested and encouraged to do SLR because of a need to secure cloud computing. So, this paper resolves problem on cloud data encryption for data sharing. To resolve the problem, authors utilize an approach by determining relevant theme and finding related paper on theme. All collected data are from 3 digital libraries from 2014 to 2019. Authors found related paper regarding

data encryption (30%) and data sharing on cloud computing (10%). SLR comparison for reviewing data encryption on cloud computing can be seen in table 5.

Table 5. SLR Data Encryption on Cloud Computing

No.	Description	Data Encryption AES	Data Encryption AES Cloud Computing
1.	Research Question	Up to 10	Only 2
2.	Search Strategy Paper	Keyword based on authors and keyword theme scope	Keyword specific subject scope
3.	Model of String Keyword	5 Model of string	1 Model of string
4.	Resource to be Search Paper	4 Library Digital online	2 Library Digital online
5.	Paper Selection Criteria	4 in unreliable criteria 4 in reliable criteria 5 in quality assessment 3 in quantity assessment	3 in unreliable criteria 3 in reliable criteria 2 in quality assessment 1 in quantity assessment

Table 5 explains relevant paper finding based on determined criteria. That should be done to get suitable paper for analysis.

B. Data Sources for Selection

Authors utilize 3 trusted digital libraries named "Science Direct", "IEEE Explore" and "Tandfonline". Web address for those libraries respectively are sciencedirect.com and ieeexplore.ieee.org. Paper search was done in 2nd March of 2020. Keywords for searching are "AES Algorithm", "Algorithm Data Sharing", "AES Algorithm Data Sharing Encryption Cloud Computing". All keywords are lowercase with space and without quotation mark.

Authors classify those keywords into 3 parts. First part is called Q1 consisting of keywords (AES Algorithm). Second part is called Q2 containing keywords (Algorithm Data Sharing). Third part is called Q3 having keywords (AES Algorithm Data Sharing Encryption Cloud Computing). Authors only use defined keywords and no filter is applied, except span of year to narrow search process.

C. SLR Result

SLR discussion is about "AES Algorithm for Data Sharing Encryption On Cloud Computing". Question on SLR is done for 2014 to 2019. Table 6 is result of paper search on the latest research about authors' question.

Table 6. Search Keyword Result on Digital Library

Digital Library	Keyword	Result Search
IEEE	AES Algorithm	1404
	Algorithm Data Sharing	54
	AES Algorithm Data Sharing Encryption Cloud Computing	22
ScienceDirect	AES Algorithm	969
	Algorithm Data Sharing	345
	AES Algorithm Data Sharing Encryption Cloud Computing	70
Tandfonline	AES Algorithm	2689
	Algorithm Data Sharing	736
	AES Algorithm Data Sharing Encryption Cloud Computing	30

Table 6 is keyword result to answer authors' question. From table 6, there is still a chance to research on "AES Algorithm for Data Sharing Encryption On Cloud Computing" for data sharing encryption. Figure 2 depicts better view for good analysis.

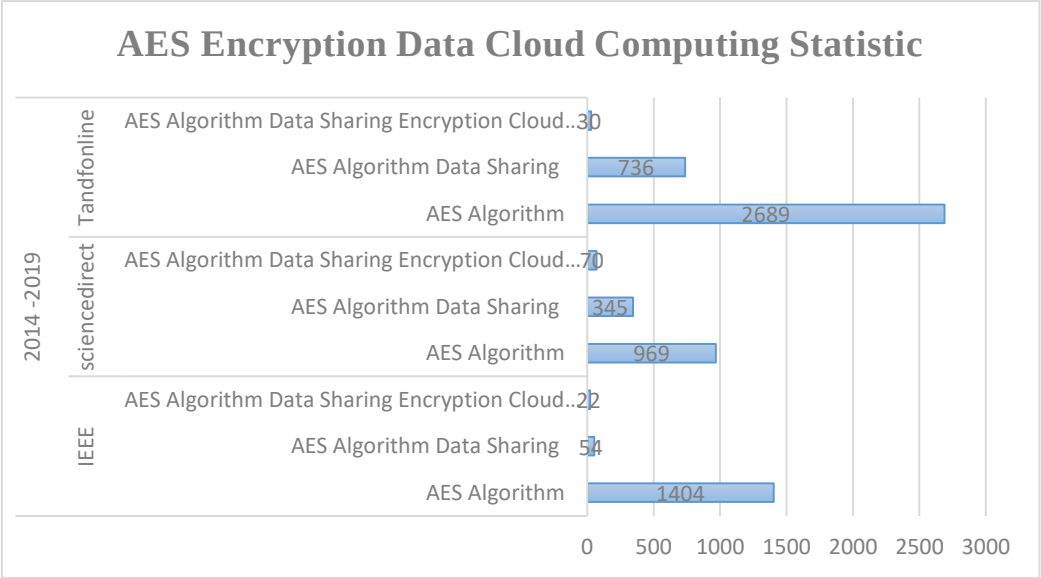


Fig 2. SLR Statistic of AES Encryption on Cloud Computing

D. Encryption Algorithm

To prevent any intruder activity, there is a proposed data security for cloud called encryption [33], [34]. Besides functioning as data security, encryption also concentrates on data transfer [35]. For real-time, all encryption ways are useful, but each encryption has no same pattern to encrypt [13], [36], [37]. For example, Contributory Broadcast Encryption (ConBE) allows a sender to broadcast to any member but require trusted key to decrypt [19], [8], [22]. Group Key Agreement (GKA) protocols enable members to transact common key via internet so that only few members can decrypt data encrypted by shared key [13], [37], [38]. To do that, a sender looking at the public group key can limit decryption to limited members of his choice [36], [39]. Encryption algorithm can be seen in figure 2.

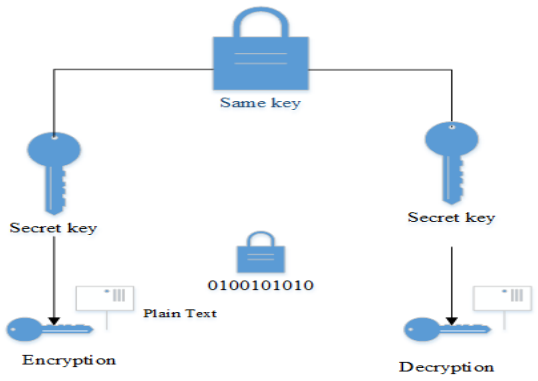


Fig 3. Encryption algorithm [17]

E. Data Sharing on Cloud Computing

Cloud provider has 2 dominant services named data and information services for users [40], [41]. Security on those services creates primary challenges in cloud [42], [43]. Currently, cloud storage is frequently used for data sharing (photo, video, document) in social media [4], [44]. Yet, data sharing in cloud brings another problem for data leakage [10], [45]. To drive the problem, encryption may be applied to each user's data before and after uploading to cloud [13], [7], [46]. Figure 3 describes data sharing.

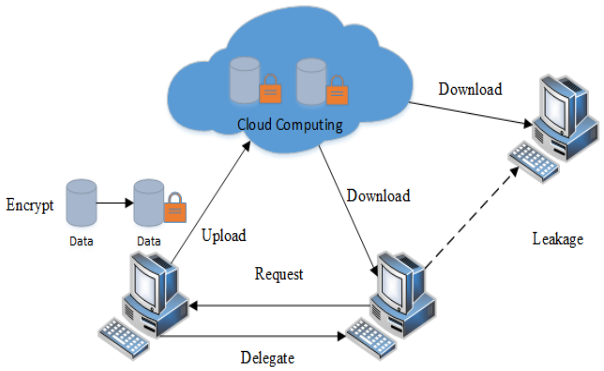
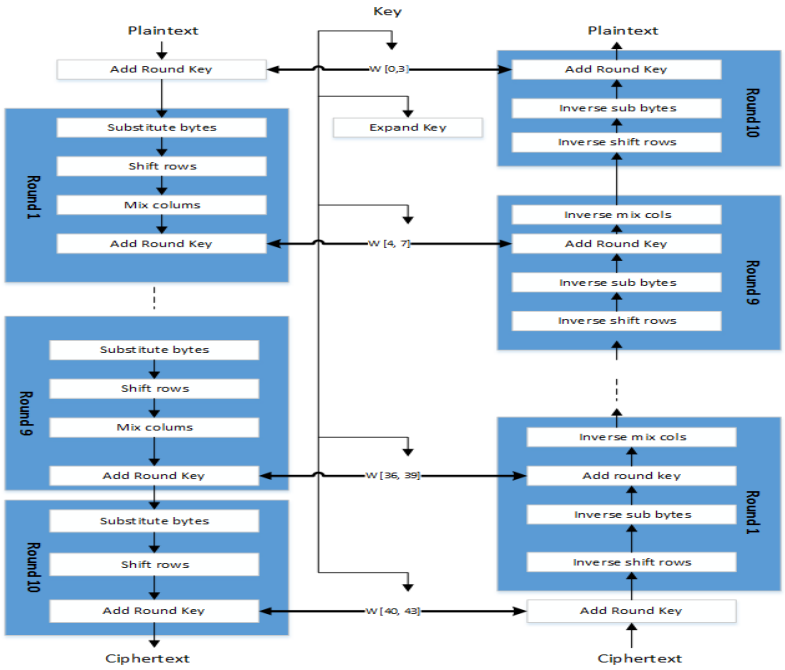


Fig 4. Data Sharing Cloud Computing [42]

F. AES Alogrithm

AES algorithm is commonly used for encrypting data [17]. The algorithm is chosen because it is more secure than IDES or 3DES algorithm. AES itself can be described as symmetrical block encryption. All operations inside the algorithm work on 8-bit or more. Cipher block will take plaintext with size 128-bit, 192-bit and 256-bit [38], [47]. Key for encrypting and decrypting is depicted as square matrix of bytes [48], [49]. Figure 4 explains process of AES encryption.



(a) Encryption (b) Decryption

Fig 5. AES Encryption Process [36]

The algorithm supports 128-bit block and 128-bit key, 192-bit key and 256-bit key. It uses 10 series for 128-bit key, 12 series for 192-bit key, 14 series for 256-bit key [50] . For example, each series may use different key series for 128-bit, then it is called real key for AES [8].

IV. Conclusion and Future Work

Based on keyword for searching relevant paper, authors get interesting result. AES algorithm to secure data sharing on cloud can be explored deeply and then well implemented. From what authors believed on 3 trusted libraries, only few papers discuss on AES algorithm for cloud data security. Those papers discussed that data security on cloud not only could impact to data authenticity, but also could prevent any unauthorized person. The use of SLR can help to get better suggestion for further research. In addition, it may contribute to new science in future.

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