Application of Data Encryption Standard and Lempel-Ziv-Welch Algorithm for File Security

Ida Bagus Ary Indra Iswara¹, I Ketut Sudarsana², Nurlaidy Joice Simamora³, Vivi Novalia Sitinjak³, Nurhayati Purba³, Citra Kurniawan⁴, Nurul Aziza⁵, Dheasy Herawati⁵, Dian Rianita⁶, Hengki Mangiring Parulian Simarmata⁷, Elita Modesta Br Sembiring³, Ari Riswanto⁸, Rosida Tiurma Manurung⁹, Sofwan Hadi¹⁰, M Mesiono¹¹, Andys-ah Putera Utama Siahaan¹², Wirda Fitriani¹², Diana Suita¹³, Ramadhona Simbolon¹⁴, Robbi Rahim^{15*}

¹STMIK STIKOM Indonesia, Denpasar, Indonesia

²Institut Hindu Dharma Negeri, Denpasar, Indonesia

³Universitas Methodist Indonesia, Medan, Indonesia

⁴Department of Electrical Engineering, Sekolah Tinggi Teknik Malang, Indonesia.

⁵Universitas Maarif Hasyim latif, Sidoarjo, Indonesia

⁶Universitas Lancang Kuning, Pekanbaru, Indonesia

⁷Politeknik Bisnis Indonesia, Indonesia

⁸Economic Education and Management, STKIP PGRI Sukabumi, Indonesia

⁹Graduate Program in Scientific Psychology, Universitas Kristen Maranatha, Bandung, Indonesia

¹⁰IAIN Ponorogo, Indonesia

¹¹Universitas Islam Negeri Sumatera Utara, Medan, Indonesia

¹²Universitas Pembangunan Pancabudi, Medan, Indonesia

¹³Universitas Harapan Medan, Medan, Indonesia

¹⁴Universitas Islam Sumatera Utara, Medan, Indonesia

¹⁵Sekolah Tinggi Ilmu Manajemen Sukma, Medan, Indonesia

*Corresponding author E-mail: usurobbi85@zoho.com

Abstract

The security and speed of data transmission is very important in data communications, the steps that can be done is to use the appropriate cryptographic and compression algorithms in this case is the Data Encryption Standard and Lempel-Ziv-Welch algorithms combined to get the data safe and also the results good compression so that the transmission process can run properly, safely and quickly

Keywords: Security, Data Transmission, Data Encryption Standard, Lempel-Ziv-Welch

1. Introduction

Security and confidentiality issues are an important aspect of data, messages and information[1]–[5]. Delivery of a message, data and information of great importance requires a high level of security. With the development of today information is so fast where everyone will be easy to get a message, data and information, it make various ways people do to get the data and information[6]–[11]. Starting from the easy level to the more complicated ways, and many people also try to protect the message so that it cannot be known by people who do not have rights to the message or data[12]–[16].

Addition to the process of securing the data or information also needs to be done the process of measuring the size of a data (Compression)[17], [18]. The purpose of this compression is to speed up the transmission of data or information[19]. Data compression also aims to reduce the size of data and can be stored on storage media that has a relatively small size. Security and speed are important in communication using computers and computer networks[20], [21].

Data Encryption Standard (DES) algorithm are one of the most widely used encryption algorithm in the world[9], [22]. In general, the data encryption standard is divided into three groups, namely key processing, 64 bit encryption and 64 bit data description in which each group will interact with each other. Because DES algorithm has been widely used then here the authors will do a merger of the DES algorithm and LZW algorithm[20], [23], so that the level of security obtained higher and expected data or information cannot be read easily by irresponsible parties.

2. Methodology

A. Cryptography

Cryptography has an important role in the world of computers. This is caused because the number of confidential information that is stored and sent through computer media[24], [25]. This information usually contains document documents important financial

data from an agency that do not want to be read by unauthorized person on the information.

In general, Cryptography is an information security technique that is done by processing plaintext by using a certain encryption algorithm and producing ciphertext that cannot be read directly.

Cryptography has a very long and amazing history. Most of the history of Cryptography is part of classical cryptography, which is a cryptographic method that uses paper and pencil or uses simple mechanical aids to date that already use mathematical calculations like the DES (Data Encryption Standard) algorithm.

DES is a block cipher algorithm that belongs to a cryptographic system of symmetry[26]. DES operates on a 64 bit block size. DES encrypts 64 bits of plaintext into 64 bit ciphertext using 56 bits of internal keys. The internal keys on the DES Algorithm are generated from external keys that are 64 bits long[27].

B. Compression

Data compression is the science or art of representing information in a more compact form. The purpose of data compression is to represent a digital data with as few bits as possible, but retain the minimum requirement to reshape the original data (decompression)[28].

The Lempel-Ziv-Welch (LZW) algorithm, developed by Abraham Lempel, Jacob Ziv, and Terry Welch. This algorithm reduces the number of tokens required to 1 symbol only[23], [28]. This symbol refers to the index in the dictionary, LZW fills this dictionary with all required alphabet symbols. In the general case, the first 256 index of the dictionary will be filled with ASCII characters from 0-255. Because the dictionary has been filled with all possible characters first, the first input character will always be found in the dictionary. This is why the token in LZW requires only 1 symbol which is a pointer to the dictionary.

3. Results and Discussion

Application of file security by implement DES and LZW algorithm is made by using Embarcadero Delphi XE5 programming language with windows operating system 10 64 bit, here is the result of testing perform.

Fig 1. Main Application

Experiment were performed on several document files of different sizes with non-cryptographic DES testing as well as with the DES algorithm, figure 2 and 3 are the result experiment.

Table 1. Encryption and Compression Result

No	Filename	Original (KB)	Compress(KB)	Ratio
1	Chapter_1.doc	1587	1412	11.03 %
2	MOA.txt	78	17	78.20%
3	License.txt	30	5	83.33%
4	Full_theses.docx	6712	5390	19.69%
5	Order.txt	104	29	72.11%

Fig 2. Experiment Result 1

Fig 3. Experiment Result 2

Figures 2 and 3 are examples of file security testing using DES algorithm and also compression process using LZW algorithm, testing is done on 2 different files with different sizes but on the results obtained different result which in the file of ratio of security and compression of 9.46 % while in the text file reached 63.10%, table 1 show few result from encryption and compression.

Table 1 shows the results of encryption and compression of three doc file types, docx and txt, from testing by DES and LZW algorithm is good for securing data type text not for data or information containing images, xml information or type BLOB.

4. Conclusion

The combination of DES and LZW algorithm on file security can be done well on various file types, but on compression result obtained highest ratio is in text file because do not have image or XML data as in Microsoft word file, based on this test got result of combination of DES and LZW whether used transactions or communication in the form of text.

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