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A Review Paper on Cryptography for Data Security

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Abstract*: Cryptography is the technique with which we can convert the message into secret text which is not understandable to unauthorized users. It is the technique for hiding data and information from unauthorized users. When we send simple message from one location to another then this message called plain text is visible to anybody. We can use one of numerous cryptography methods for converting the plain text into cipher text. There are number of applications where such techniques are used in real life. In this paper we provide review of various types of cryptography techniques.
Keywords: Cryptography, plain text, cipher text, cryptanalyst, Decryption

I. INTRODUCTION

Cryptography, then, not only protects data from theft or alteration, but can also be used for user authentication. Cryptography can be divided into following three categories depending upon the types of key used: secret key (symmetric) cryptography, public key (asymmetric) cryptography and hash functions. The rapid continuous increase in exchange of multimedia data over protected and unprotected networks such as the worldwide available internet and local networks such as shared networks and local area networks etc has encouraged activities such as unauthorized access, illegal usage, disruption, alteration of transmitted and stored data. This widely spread use of digital media over the internet such as on social media, on cloud storage systems etc and over other communication medium such as satellite communication systems have increased as applications and need for systems to meet current and future demands evolved over the years.

Security concerns with regards to such data transmission and storage has been a major concern of both the transmitters and receivers and hence the security of critical cyber and physical infrastructures as well as their underlying computing and communication architectures and systems becomes a very crucial priority of every institution.

Cryptography is the fundamental platform in which modern information security, which involves the use of advanced mathematical approaches in solving hard cryptographic issues, has gained its grounds in the digital world. This has evolved from classical symmetric, in which shifting keys are normally used as well as substitution methods, ciphers to modern public key exchange cryptosystems, which aims to make cryptanalysis a difficult approach to deciphering ciphers.

A. In Cryptography there are some Important Terms and are given below (figure 1):

1) *Plain Text:* It is the original text which has to be encrypted.
2) *Cipher Text:* It is the encrypted text. The text obtain after encoding the data with the help of a key is known as cipher text.
3) *Key:* It is a word or value that is used to encrypt the plain text or decrypt the cipher text.
4) *Encryption:* The method of converting the data into coded form with the help of key is called encryption [4].
5) *Decryption:* The method of converting the encoded data to the original form is called decryption [37].
6) *Crypto Analyst:* A crypto analyst is a person who is an expert in analyzing and breaking codes [3].

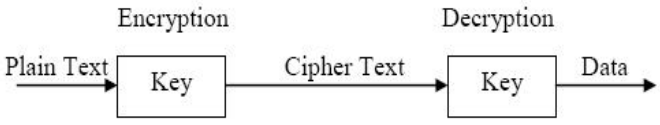

Figure 1: Cryptographic Model [2]

When we send simple message from one location to another then this message called plain text is visible to anybody. If we want to codify the message called cipher text so that no one can easily understand the meaning of message then we use cryptography techniques. The work presented in this paper is to study the existing encryption algorithm used for data security.

II. LITERATURE SURVEY

There are huge amount of work done by the various researchers in the field of cryptographic algorithm for data security. Some of these work done by the researchers are explain in this chapter.

Neal Koblitz*et al*. [4] proposed an elliptic curve cryptosystems for protecting the communication in unsecure network. Elliptic curves over finite fields of public key cryptosystems use the multiplicative group of a finite field. These elliptic curve cryptosystems were more secured because the analog of the discrete logarithm problem on elliptic curves harder than the classical discrete logarithm problem. Limitation of this scheme it was mainly based on the structure either of the multiplicative group or the multiplicative group of a finite field.

Hugo Krawczyk *et al.* [5] worked on the order of encryption and authentication scheme for protecting the communications. They composed a symmetric encryption and authentication scheme for building secured channels for the protection of communications over insecure networks. They also proved that the other method of composing encryption and authentication which includes the authentication encryption method was not so much secured against random attackers. Limitation of this was only forty bit key size can use in this scheme.

Laurent Eschenauer *et al*. [6] proposed a key based scheme for distributed sensor networks. Key management scheme designed to satisfy both operational and security requirements of distributed sensor networks. This scheme requires cryptographic protection of communications, sensor capture detection, key revocation and sensor disabling. So they present a key management scheme designed to satisfy both operational and security requirements of distributed sensor networks.

Jung.Wen Lo *et al.* [7] proposed an efficient key management scheme in a large leaf class hierarchy for access control. In which users were divided this into different security classes. They also proposed a new key assignment scheme for controlling the access right in a large partially ordered set hierarchy and reduce the required computation for key generation. Information retrieval and the number of leaf classes which were substantially larger than the number of non leaf classes.

BharatB. Madan *et al*. [8] worked on various methods used for modelling and quantifying the security attributes of intrusion tolerant systems**.** Various issues related to quantifying the security attributes of an intrusion tolerant system were also addressed. Response of a security intrusion tolerant system to an attack was modelled as a random process. They facilitate the use of stochastic modelling techniques to predict the attacker behaviour.

Tariq Jamil *et al.* [9] worked upon Rijndael method/algorithm for protecting sensitive unclassified government information. This algorithm was the new advanced encryption standard algorithms recommended by the US national institute of standards and technology. The performance of Rijndael algorithm based on speed of encryption, decryption process and keyset up time.

Ho Won Kim *et al.* [10] worked on Design and Implementation of a private and public key crypto processor and its application for security system. They present the design and implementation of a crypto processor. This special purpose microprocessor optimized for the execution of cryptography algorithms. This crypto processor can be used for various security applications such as storage devices, embedded systems, network routers, security.

Prosanta Gope*et al.* [11] proposed a new block cipher cryptographic symmetric key algorithm named TACIT encryption technique for secure routing. It used an independent approach with suitable mathematical which was assumed to be computationally secured. Key distribution system was being applied on a secure policy based routing. It was limited to conversion of text file.

Ismail .I.A *et al.* [12] worked on how to repair the hill cipher. This technique adjusts the encryption key to form a different key for each block encryption. This algorithm provides a method for adjusting the encryption key, thereby significantly increasing its resistance to various attacks such as a known plaintext attack and statistical attack. The proposed algorithm called HillMRIV cipher.

Yogesh Karandikar *et al*. [13] proposed on effective key management approach for differential access control in dynamic environment. In group communication each user accesses multiple resources and multiple users can access each resource. Each resource encryption key needs to be distributed to all subscribers of the resource and each subscriber must get the entire key. So they developed a new approach of keys management to enforce differential access control in highly dynamic environments for secure group communication framework.

Yancho Zhang *et al*. [14] worked on Location-Based Compromise-Tolerant Security Mechanisms for Wireless Sensor Networks. They worked on the notion of location-based keys by binding private keys of individual nodes to both their IDs and geographic locations. They developed LBK-based neighbourhood authentication scheme to localize the impact of compromised nodes to their vicinity.

N. R. Potlapally *et al.* [15] worked on energy consumption characteristics of cryptographic algorithms and security protocols. They present a comprehensive analysis of the energy requirements of a wide range of cryptographic algorithms that form the building

blocks of security mechanisms such as security protocols. They also discuss varios opportunities for realizing energy efficient implementations of security protocols.

Darpan Anand *et al.* [16] explored identity based cryptography techniques and applications. They reviewed the identity based encryption applications in the field of various networks as ad-hoc networks. The scheme also used in mobile networks and other wireless networks. They also discussed that under what parameters identity based cryptography was used with its benefits and limitations. The main limitation was that the available methods were restricted to fixed output block, which was a trace for crackers.

Septimiu Fabian Mare *et al.* [17] worked on secret data communication system using steganography, AES and RSA. They show new secret data communication system that employs the use of two cryptographic algorithms RSA and AES together with steganography. The joining of these three techniques builds a robust steganography based communication system capable of withstanding multiple types of attacks. The key used for the data encryption uses a combination between a random generated sequence and a hash function.

Kundankumar Rameshwar Saraf et. al. [18] wrote a paper "Text and Image Encryption Decryption Using Advanced Encryption Standard". In this paper they described that images have large data size and also has real time constrain problem hence similar method cannot be used to protect images as well as text from unauthorized access. However with few variations in method AES can be used to protect image as well as text. They had implemented encryption and decryption for text and image using AES.

Smita Desai et. al. [19] wrote a paper "Image Encryption and Decryption using Blowfish Algorithm". This paper was about encryption and decryption of images using a secret-key block cipher called 64-bits Blowfish designed to increase security and to improve performance. This algorithm would be used as a variable key size up to 448 bits. It employs Feistel network which iterates simple function 16 times. The blowfish algorithm was safe against unauthorized attack and runs faster than the popular existing algorithms.

III. CLASSICAL CRYPTOGRAPHY TECHNIQUES

The technique enables us to illustrate the basic approaches to conventional encryption today. The two basic components of classical ciphers are substitution and transposition [3]. Then other systems described that combines both substitution and transposition.

A. Substitution Techniques

In this technique letters of plaintext are replaced by or by numbers and symbols. If plaintext is viewed as a sequence of bits, then substitution involves replacing plaintext bit patterns with cipher text bit patterns.

B. Caesar Cipher

Caesar Cipher replaces each letter of the message by a fixed letter a fixed distance away e.g. uses the third letter on and repeatedly used by Julius Caesar.

For example:

Plaintext: I CAME I SAW I CONQUERED

Cipher text: L FDPH L VDZ L FRQTXHUHG

Mapping is:

ABCDEFGHIJKLMNOPQRSTUVWXYZ

DEFGHIJKLMNOPQRSTUVWXYZABC

Can describe the Cipher as:

Encryption: C = E (P) = (P + 3) mod 26

Decryption: P = D(C) = (C - 3) mod 26

C. Mono Alphabetic Ciphers

With only 25 possible keys, the Caesar cipher is far from secure. A dramatic increase in the key space can be achieved by allowing an arbitrary substitution. Recall the assignment for the Caesar cipher:

plain: a b c d e f g h i j k l m n o p q r s t u v w x y z

cipher: D E F G H I J K L M N O P Q R S T U V W X Y Z A B C

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If, instead, the "cipher" line can be any permutation of the 26 alphabetic characters, then there are 26! possible keys. This is 10 orders of magnitude greater than the key space for DES and would seem to eliminate brute-force techniques for cryptanalysis. Such an approach is referred to as a mono alphabetic substitution cipher, because a single cipher alphabet (mapping from plain alphabet to cipher alphabet) is used per message.

D. Playfair Cipher

The Playfair is a substitution cipher bearing the name of the man who popularized but not created it. The method was invented by Sir Charles Wheatstone, in around 1854; however he named it after his friend Baron Playfair. The Playfair Cipher was developed for telegraph secrecy and it was the first literal digraph substitution cipher.

The best-known multiple-letter encryption cipher is the Playfair, which treats digrams in the plaintext as single units and translates these units into ciphertext digrams. The Playfair algorithm is based on the use of a 5 * 5 matrix of letters constructed using a keyword.

Here is an example:

M	**O**	**N**	**A**	**R**
C	**H**	**Y**	B	D
E	F	G	I/J	K
L	P	Q	S	T
U	V	W	X	Z

In this case, the keyword is monarchy. The matrix is constructed by filling in the letters of the keyword (minus duplicates) from left to right and from top to bottom, and then filling in the remainder of the matrix with the remaining letters in alphabetic order. The letters I and J count as one letter. Plaintext is encrypted two letters at a time, according to the following rules:

1) Repeating plaintext letters that would fall in the same pair are separated with a filler letter, such as x, so that balloon would be enciphered as ba lx lo on.

2) Plaintext letters that fall in the same row of the matrix are each replaced by the letter to the right, with the first element of the row circularly following the last. For example, ar is encrypted as RM.

3) Plaintext letters that fall in the same column are each replaced by the letter beneath, with the top element of the row circularly following the last. For example, mu is encrypted as CM.

4) Otherwise, each plaintext letter is replaced by the letter that lies in its own row and the column occupied by the other plaintext letter. Thus, hs becomes BP and ea becomes IM (or JM, as the encipherer wishes).

The Playfair cipher is a great advance over simple monoalphabetic ciphers. For one thing, whereas there are only 26 letters, there are 26 * 26 = 676 diagrams, so that identification of individual diagrams is more difficult. Furthermore, the relative frequencies of individual letters exhibit a much greater range than that of diagrams, making frequency analysis much more difficult.

Despite this level of confidence in its security, the Playfair cipher is relatively easy to break because it still leaves much of the structure of the plaintext language intact. A few hundred letters of ciphertext are generally sufficient.

E. Transposition Techniques

All the techniques examined so far involve the substitution of a ciphertext symbol for a plaintext symbol. A very different kind of mapping is achieved by performing some sort of permutation on the plaintext letters. This technique is referred to as a transposition cipher.

The simplest such cipher is the rail fence technique, in which the plaintext is written down as a sequence of diagonals and then read off as a sequence of rows. For example, to encipher the message "meet me after the toga party" with a rail fence of depth 2, we write the following:

m e m a t r h t g p r y
e t e f e t e o a a t

The encrypted message is:
MEMATRHTGPRYETEFETEOAAT

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This sort of thing would be trivial to crypt analyze. A more complex scheme is to write the message in a rectangle, row by row, and read the message off, column by column, but permute the order of the columns. The order of the columns then becomes the key to the algorithm. For example:

```
Key:          3 4 2 1 5 6 7
Plaintext:    a t t a c k p
              o s t p o n e
              d u n t i l t
              w o a m x y z

Ciphertext:   TTNAAPTMTSUOAODWCOIXKNLYPETZ
```

A pure transposition cipher is easily recognized because it has the same letter frequencies as the original plaintext. For the type of columnar transposition just shown, cryptanalysis is fairly straightforward and involves laying out the ciphertext in a matrix and playing around with column positions. Digram and trigram frequency tables can be useful.
The transposition cipher can be made significantly more secure by performing more than one stage of transposition. The result is a more complex permutation that is not easily reconstructed. Thus, if the foregoing message is re-encrypted using the same algorithm:

```
Key:          3 4 2 1 5 6 7
Input:        t t n a a p t
              m t s u o a o
              d w c o i x k
              n l y p e t z

Output:       NSCYAUOPTTWLTMDNAOIEPAXTTOKZ
```

To visualizethe result of this double transposition, designate the letters in the original plaintext message by the numbers designating their position. Thus, with 28 letters in the message, the original sequence of letters is:

01 02 03 04 05 06 07 08 09 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28

After the first transposition we have
03 10 17 24 04 11 18 25 02 09 16 23 01 08
15 22 05 12 19 26 06 13 20 27 07 14 21 28

which has a somewhat regular structure. But after the second transposition, we have
17 09 05 27 24 16 12 07 10 02 22 20 03 25
15 13 04 23 19 14 11 01 26 21 18 08 06 28

This is a much lesstructured permutation and is much more difficult to crypt analyze.

IV. CONCLUSION

Data security is an essential component of an organization in order to keep the information safe from various competitors. It helps to ensure the privacy of a user's personal information from others. Secured and timely transmission of data is always an important aspect for an organization. Strong encryption algorithms and optimized key management techniques always help in achieving confidentiality, authentication and integrity of data and reduce the overheads of the system. Cryptography is a technique used to avoid unauthorized access of data. It has two main components; a) Encryption algorithm, and b) Key. Sometime, multiple keys can also be used for encryption. In this paper we studied the existing encryption algorithm used for data security.

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REFERENCES

[1] W. Stallings; "Cryptography and Network Security" 2nd Edition, Prentice Hall,1999
[2] Bruce Schneir: Applied Cryptography, 2nd edition, John Wiley & Sons, 1996
[3] A. Kakkar and P. K. Bansal, "Reliable Encryption Algorithm used for Communication", M. E. Thesis, Thapar University, 2004.
[4] N. Koblitz, "Elliptic Curve Cryptosystems", Journal of Mathematics of Computation. Published by American Mathematical Society, Vol. 48, No. 177, pp. 203-209, 1987.
[5] H. Krawczyk, "The Order of Encryption and Authentication for Protecting Communications, http://eprint.iacr.org/2001.
[6] L. Eschenauer, V. D. Gligor, "A Key Management Scheme for Distributed Sensor Networks", ACM conference on Computer Security, Vol.2, pp. 41-47, 2002.
[7] Jung. W. Lo, M. S. Hwang, C. H. Liu, "An efficient key assignment scheme for access control in a large leaf class hierarchy", Journal of Information Sciences Elsevier Science, Vol. 4, pp. 917-925, 2003.
[8] B. B. Madan, K. G. Popstojanova, K. Vaidyanathan and K.S. Trivedi, "A Method for Modeling and Quantifying the Security Attributes of Intrusion Tolerant Systems", Journal of Performance Evaluation, Elsevier Science Publishers, Vol. 56, No. 1, pp. 167-186, 2004.
[9] T. Jamil, "The Rijndael Algorithm", IEEE Potential, Vol.1, pp. 1-4, 2004.
[10] H.W. Kim, S. Lee, "Design and Implementation of a Private and Public Key Crypto Processor and Its Application to a Security System", IEEE Transactions on Consumer Electronics, Vol. 50, No. 1, pp. 214-224, 2004.
[11] P. Gope, A. Singh, A Sharma, N. Pahwa, "An Efficient Cryptographic Approach for Secure Policy Based Routing", IEEE Journal on Selected Areas in Communications, Vol. 1, pp. 359-363, 2013.
[12] I. I. A, A. Mohammed, D. Hossam, "How to repair the Hill cipher", Journal of Zhejiang University Science, Vol. 1, pp. 2022-2030, 2006.
[13] Y. Karandikar, X. Zou, Y. Dai, "An Effective Key Management Approach to Differential Access Control in Dynamic Environments", Journal of Computer Science, Vol. 1, pp. 542-549, 2006.
[14] Y. Zhang, W. Liu, W. Lou, Y. Fang, "Location Based Compromise Tolerant Security Mechanisms for Wireless Sensor Networks", IEEE Transactions Selected Areas in Communications, Vol. 24, No. 2, pp. 1-14, 2006.
[15] N. R. Potlapally, S, Ravi, A. Raghunathan, N. K. Jha, "A Study of the Energy Consumption Characteristics of Cryptographic Algorithms and Security Protocols", IEEE Transaction on Mobile Computing, Vol. 5, No. 2, pp. 128-143, 2006.
[16] D. Anand, V. Khemchandani, R. K. Sharma, "Identity Based Cryptography Techniques and Applications", International Conference on Computational Intelligence and Communication Networks, Vol. 1, pp. 343-348, 2013.
[17] S. F. Mare, M. Vladutiu, L. Prodan, "Secret data communication system using Steganography, AES and RSA", International Symposium for Design and Technology in Electronic Packaging, Vol. 2, pp. 339-344, 2011.
[18] K. R. Saraf, V. P. Jagtap, A. K. Mishra, "Text and Image Encryption Decryption Using Advanced Encryption Standard", International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) Volume 3, Issue 3, May – June 2014.
[19] S. Desai, C. A. Mudholkar, R. Khade, P. Chilwant, "Image Encryption and Decryption using Blowfish Algorithm", International Journal of Electrical and Electronics Engineers IJEEE, Volume 07, Issue 01, June 2015.