SOS IN COMPUTER SCIENCE & APPLICATION
JIWAJI UNIVERSITY

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Topic: Database Security and Threats

Database Security and Threats

- Data security is an imperative aspect of any database system. It is of particular importance in distributed systems because of large number of users, fragmented and replicated data, multiple sites and distributed control.

- **Threats in a Database**
- **Availability loss** − Availability loss refers to non-availability of database objects by legitimate users.
- **Integrity loss** − Integrity loss occurs when unacceptable operations are performed upon the database either accidentally or maliciously. This may happen while creating, inserting, updating or deleting data. It results in corrupted data leading to incorrect decisions.
- **Confidentiality loss** − Confidentiality loss occurs due to unauthorized or unintentional disclosure of confidential information. It may result in illegal actions, security threats and loss in public confidence.

Measures of Control

- **The measures of control can be broadly divided into the following categories −**

- **Access Control** − Access control includes security mechanisms in a database management system to protect against unauthorized access. A user can gain access to the database after clearing the login process through only valid user accounts. Each user account is password protected.

Measures of Control(cont.)

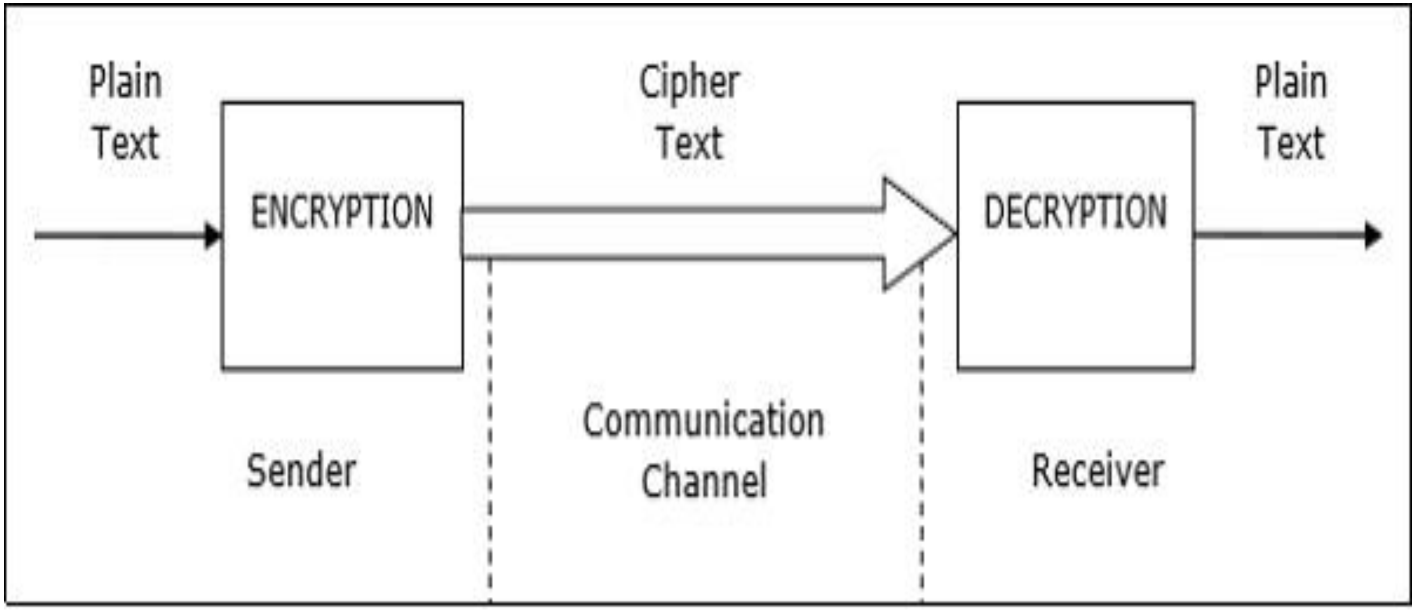
- **Flow Control** − Distributed systems encompass a lot of data flow from one site to another and also within a site. Flow control prevents data from being transferred in such a way that it can be accessed by unauthorized agents. A flow policy lists out the channels through which information can flow. It also defines security classes for data as well as transactions.
- **Data Encryption** – Data encryption refers to coding data when sensitive data is to be communicated over public channels. Even if an unauthorized agent gains access of the data, he cannot understand it since it is in an incomprehensible format.

Measures of Control

- **Cryptography** is the science of encoding information before sending via unreliable communication paths so that only an authorized receiver can decode and use it.
- The coded message is called **cipher text** and the original message is called **plain text.** The process of converting plain text to cipher text by the sender is called encoding or **encryption**. The process of converting cipher text to plain text by the receiver is called decoding or **decryption.**

What is Cryptography?

The entire procedure of communicating using cryptography can be illustrated through the following diagram −



Conventional Encryption Methods

- In conventional cryptography, the encryption and decryption is done using the same secret key. Here, the sender encrypts the message with an encryption algorithm using a copy of the secret key. The encrypted message is then send over public communication channels. On receiving the encrypted message, the receiver decrypts it with a corresponding decryption algorithm using the same secret key.
- Security in conventional cryptography depends on two factors −
- A sound algorithm which is known to all.
- A randomly generated, preferably long secret key known only by the sender and the receiver.
- The most famous conventional cryptography algorithm is **Data Encryption Standard** or **DES**.
- The advantage of this method is its easy applicability. However, the greatest problem of conventional cryptography is sharing the secret key between the communicating parties. The ways to send the key are cumbersome and highly susceptible to eavesdropping.

Public Key Cryptography

- In contrast to conventional cryptography, public key cryptography uses two different keys, referred to as public key and the private key. Each user generates the pair of public key and private key. The user then puts the public key in an accessible place. When a sender wants to sends a message, he encrypts it using the public key of the receiver. On receiving the encrypted message, the receiver decrypts it using his private key. Since the private key is not known to anyone but the receiver, no other person who receives the message can decrypt it.
- The most popular public key cryptography algorithms are **RSA** algorithm and **Diffie- Hellman** algorithm. This method is very secure to send private messages. However, the problem is, it involves a lot of computations and so proves to be inefficient for long messages.

Public Key Cryptography(Cont.)

- The solution is to use a combination of conventional and public key cryptography. The secret key is encrypted using public key cryptography before sharing between the communicating parties. Then, the message is send using conventional cryptography with the aid of the shared secret key.

Digital Signatures

- A Digital Signature (DS) is an authentication technique based on public key cryptography used in e-commerce applications.
- It associates a unique mark to an individual within the body of his message. This helps others to authenticate valid senders of messages.