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4020 - A

Information Security

Assignment Submission

MSc. [CA & IT]

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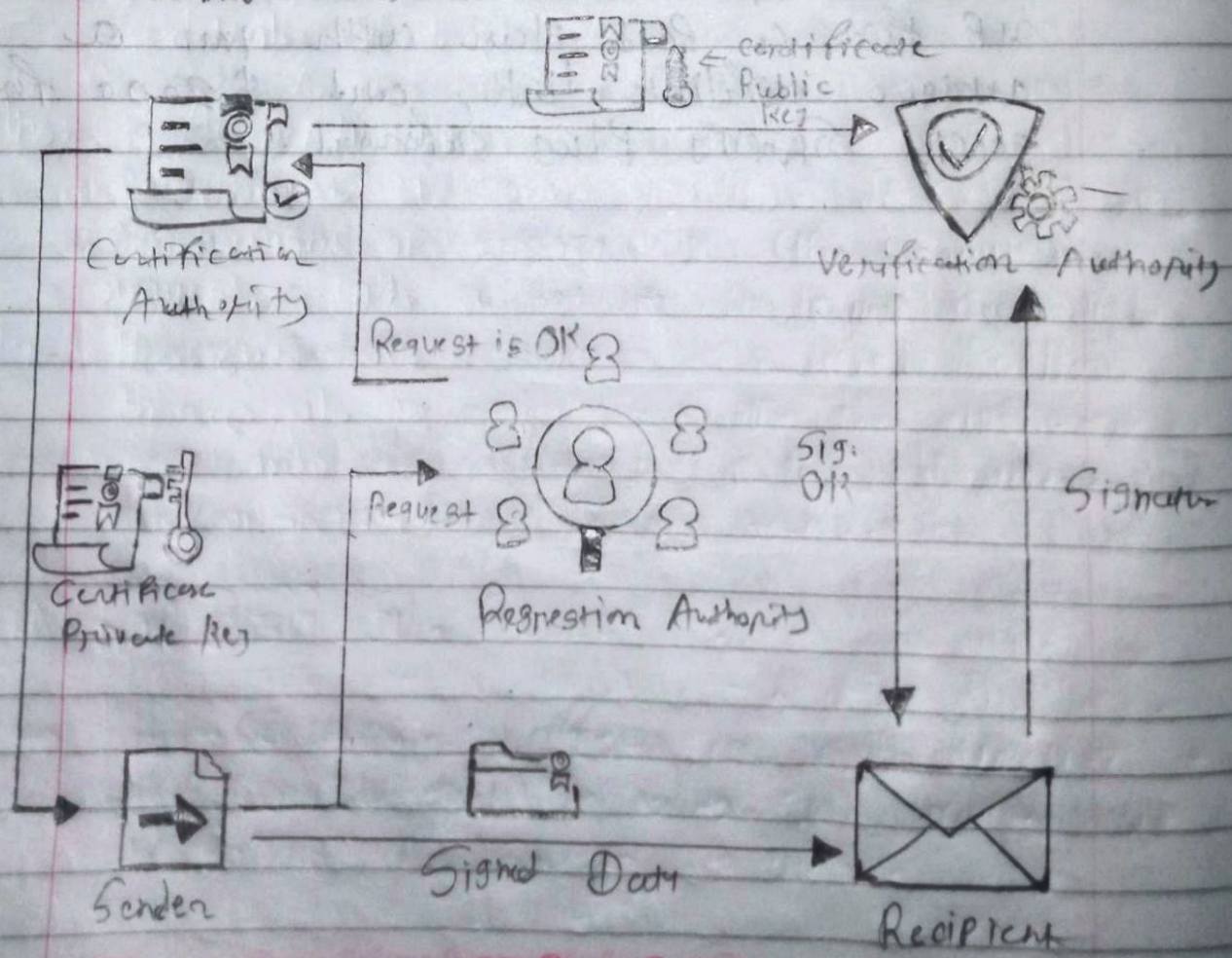
Information Security

Q.1 What is digital certificate ?
Explain Public Key infrastructure.

→ "A Digital Certificate is an electronic 'Password' that allows a Person, organization to exchange data securly over the Internet using the Public Key infrastructure (PKI). Digital Certificate is also known as a Public Key certificate or identity certificate."

Public Key Infrastructure



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* Public Key Infrastructure:

* Identification / Authentication:

The Persons / entities with whom we are communication are really who they say they are.

* Confidentiality:

The information with the message or transaction is kept confidential. It may only be read & understood by the intended sender and receiver.

* Integrity:

The information ~~with~~ within the message or transaction is not tampered accidentally or deliberately with ~~xx~~ en route without all parties involved being aware of the tampering.

* Non-Repudiation:

The sender can't deny sending the message or transaction, and the receiver can't deny receiving it.

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* Access Control:

Access to the Protected information is only realized by the intended person or entity.

→ All of the above Security Properties can be achieved and implemented through the use of Public Key Infrastructure.

Q.2 What Authetication? Explain KERBEROS in detail.

Ans: Authentication is the Process of recognizing a user's identity. It is the mechanism of associating an incoming request with a set of identifying credentials. The credentials Provided are compared to those on a file in a database of the authorized user's info. on a local operating System or within an authentication Server.

* KERBEROS :-

→ Kerberos Provides a centralized authentication Server whose function is to authenticate users to Servers and Servers to users.

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→ In Kerberos Authetication Server and database is used for client authentication.

→ Kerberos runs as a third-Party trusted Server known as the Key Distribution Center (KDC). Each user and service on the network is a Principal.

- The main Components of Kerberos are:

* Authentication Server :
The AS Performs the initial authentication & ticket for Ticket Granting Service.

* Database :
The Authentication Server verifies access rights of users in database.

* Ticket Granting Server (TGS) :
The Ticket Granting Server issues the ticket for the Server.

Step 7: User logon & request services on host. Thus user req. for ticket granting-service.

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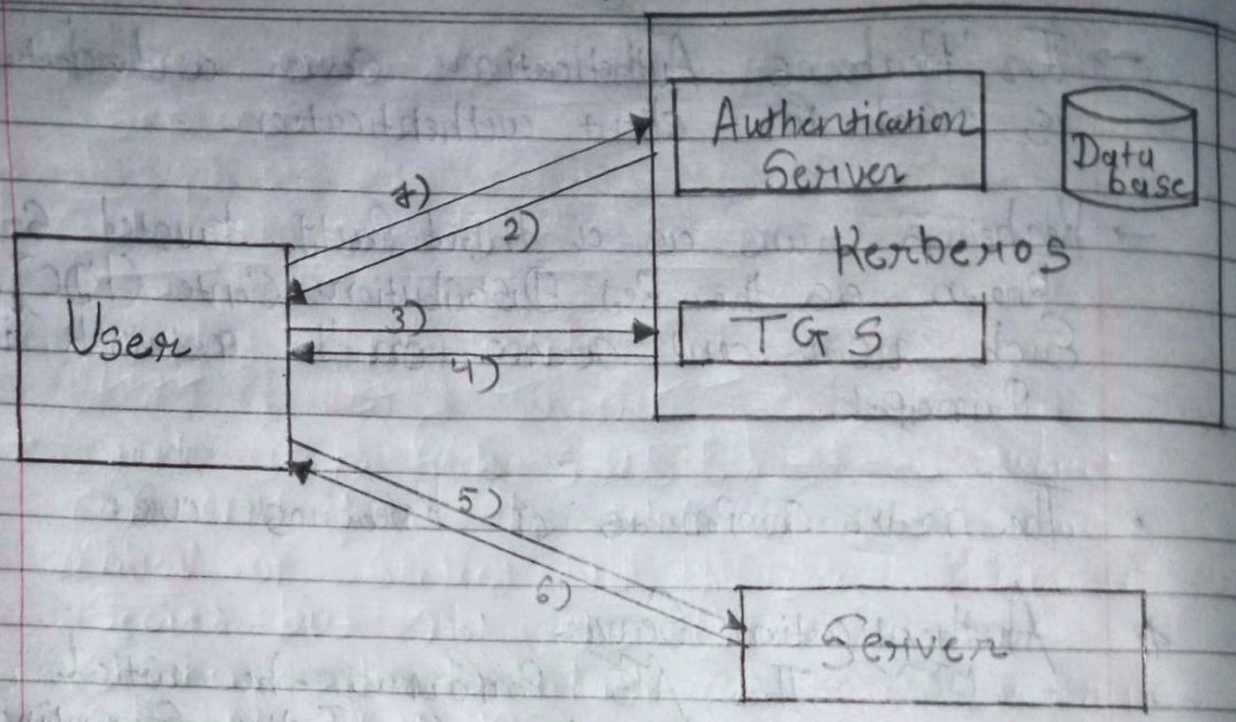

Step:2 AS verifies user's access right using database & then gives ticket-granting-ticket & session key. Results are encrypted using Password of user.

Step:3 Decryption of msg. is done using the Password then send the ticket to Ticket Granting Server. The Ticket contain authentications like user name & network address.

Step:4 Ticket Granting Server decrypts the ticket send by User & Authenticator verifies the req. then creates the ticket for Req. Services from the Server.

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Step. 5: User send the Ticket and Authentication to the Server.

Step. 6: Server verifies the Tickets & authenticating then generate the access to the Service. After this User can access the Services.

Q.3 Diff. Types of Information Security Model.

Ans: These models are used for maintaining goals of security, i.e. Confidentiality, Integrity, & Availability. In Simple words, it details with CIA Triad maintenance.

- There are 3 main types of Classic Security Models.

(1) Bell - LaPadula :

→ This Model was invented by Scientists David Elliot Bell and Leonard J. LaPadula.

→ Thus this model is called the Bell-LaPadula Model. This is used to maintain the Confidentiality of Security.

→ Here, the classification of Subjects (Users) & Objects (Files) are Organized in a non-discretionary

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fashion, with respect to different levels of secrecy.

→ It has mainly 3 Rules:

- Simple Confidentiality Rule:

→ Simple Conf. Rule states that the Subject can only Read the files on the same Level of Secrecy and the Lower Level of Secrecy but not the Upper Level of Secrecy, due to which we call this rule as No READ-UP.

- Star Confidentiality Rule:

→ This rule states that the subject can only write the files on the same Level of Secrecy & the Upper Level of Secrecy & the Upper Level of Secrecy but not the Lower Level of Secrecy, due to which we call this rule as NO WRITE-DOWN.

- Strong Star Confidentiality Rule:

→ Strong Star Confidentiality Rule is highly secured and strongest which states that the Subject can Read and write the files on the same Level of Secrecy only

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and not the Upper Layer of Secrecy or the Lower Layer of Secrecy, due to which we call this rule as NO READ WRITE UP DOWN.

② Bibo :-

→ This Model invented by Scientist Kenneth. J. Bibo. This is used to maintain the Integrity of Security. Here, the classification of Subjects & Objects are organized in a non-discretionary fashion, with respect to diff. layers of Secrecy.

→ This works the exact reverse of the Bello-LaPadula Model.

* 3 Rules:

• Simple Integrity Rule:

Integrity Rule states that the Subject can only Read the files on the Same Layer of Secrecy and the Upper Layer of Secrecy but not the Lower Layer of Secrecy, due to which we call this rule as NO READ DOWN.

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- **Star Integrity Rule:**

→ Star Integrity Rule states that the Subject can only Write the files on the Same Layer of Secrecy & the Lower Layer of Secrecy but not the Upper Layer of Secrecy, due to which we call this rule as NO WRITE-UP

- **STRONG STAR INTEGRITY RULE.**

③ **Clarke Wilson Security Model :-**

→ This Model is a highly Secured model. It has the following entities.

- **SUBJECT:** It is any user who is requesting for Data Items.
- **CONSTRAINED DATA ITEMS:** It can't be accessed directly by the Subject. These need to be accessed via Clarke Wilson Security Model
- **UNCONSTRAINED DATA ITEMS:** It can be accessed directly by the Subject.

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Q.4. What is Tunneling ? Explain IP Sec.

→ "In the physical world, tunneling is a way to cross terrain or boundaries that could not normally be crossed."

→ Similarly, in networking, tunnels are a method for transporting data accrossed a network using protocols that are not supported by that network.

→ Tunneling works by encapsulation packets: wrapping packets inside of other packets.

→ Tunnelling is often used in virtual private networks. It can also set up efficient and secure connections between networks, enable the usage of unsupported network protocols, and in some cases allow users to bypass firewalls.

IP Sec :

→ IP Sec is a suite of protocols and algorithms for securing data transmitted over the internet or any public network.

→ The internet Engineering Task Force, or IETF, developed the IPSec protocols

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in the mid-1990s to Provide Security at the IP layer through authentication and encryption of IP network Packets.

* The following are key IPsec Protocols :-

- **IP AH** :- AH is specified in RFC 4302. It Provides data integrity and transport Protection Services.
AH was designed to be inserted into an IP Packet to add authentication data and Protect the contents from modification.

- **IP ESP** :- Specified in RFC 4303, ESP Provides authentication, integrity and confidentiality through encryption of IP Packets.

- **IKE** :- Defined in RFC 7296, IKE is a Protocol that enables two system OR devices to establish a secure communication channel over an untrusted network.

- **Internet Security Association and Key Mgt. Protocol (ISAKMP)** :-

ISAKMP is specified as Part of the IKE Protocol and RFC 7296. It is a framework for key establishment, authentication

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and negotiation of an SA for a secure exchange of Packets of the IP layer.

→ There are five key steps involved with how IPsec works.

(1) Host Recognition:
(2) Negotiation, or IKE Phase 1
(3) IP Sec circuit, or IKE Phase 2
(4) IPSec transmission.
(5) IP Sec termination.

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Q.5. Explain SSL Protocol in detail.

Ans: "Secure Sockets Layer is a security Protocol that Provides Privacy, authentication, & integrity to Internet Communication. SSL eventually envolved into Transport Layer Security (TLS).

→ SSL is an encryption-based internet Security Protocol. It was first developed by Netscape in 1995 for the Purpose of ensuring Privacy, authentication, and data integrity in Internet communication.

→ SSL is the Predecessor to the modern TLS encryption used today.

→ A Website that implements SSL has "HTTPS" in its URL instead of "HTTP".

- How does SSL work?

→ In order to Provide a high degree of Privacy, SSL encrypts data that is transmitted across the web. This means that anyone who tries to intercept this data will only see a garbled mix of chareters that is nearly impossible to decrypt.

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→ SSL initiates an authentication Process called a handshake between two Communicating devices to ensure that both devices are really who they claim to be.

→ SSL also digitally signs data in order to Provide data integrity, verifying that the data is not tampered with before reaching its intended recipient.

• **SSL Certificate :**

→ SSL can only be implemented by websites that have an SSL Certificate. An SSL Certificate is like an ID card or a badge that Proves Someone is who they Say they are. SSL Certi. are Stored and displayed on the Web by a website's or application's Server.

→ The Public key makes encryption Possible. A user's device views the Public key and Uses it to establish secure encryption keys with the web Server.

→ Certificate Authorities (CA) are responsible for issuing SSL Certificates.

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* Types of SSL Certificates :

(1) Single-Domain
(2) Wild Card
(3) Multi-Domain
(4) Domain Validation
(5) Organization Validation
(6) Extended Validation..

→ Cloudflare offers free SSL Certi.. for any business. A website protected by Cloudflare can activate SSL with a few clicks. Websites may need to set up an SSL certificate on their origin server as well: this article has further instructions.

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Q.6 Secure Electronic Transaction [SET] :-

Ans. → SET is a System which Ensures Security and integrity of electronic transaction done using Credit cards in a Scenario.

→ SET is not some System that enables Payment but it is a Security Protocol applied on those Payments.

→ It uses diff. encryption and hashing techniques to Secure Payments over internet done through Credit Cards.

- SET Protocol was supported in development by major organizations like Visa, Mastercard, Microsoft which Provided its ~~Secure Trans~~ Secure Transaction Technology (STT) & Netscape which provided technology of Secure Socket Layer (SSL).

• Requirement in SET :-

→ It has to Provide mutual authentication i.e., Customer authentication by confirming if the customer is intended user or not and merchant authentication.

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→ It has to keep the PI & OI confidential by appropriate encryptions.

→ It has to be resistive against messages modifications i.e, no changes should be allowed in the content being transmitted.

→ SET also needs to provide interoperability and make use of best security mechanisms.

- Participants in SET:

→ In the general scenerio of online transaction, SET includes similar participants:

(1) Card Holder => Customer
(2) Issuer => Customer financial institution
(3) Merchant
(4) Acquirer => Merchant financial
(5) Certificate Authority => Authority which follows certain standards & issues certificates (like X.509V3) to all other participants.

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☆ SET functionalities :-

(1) Provide Authentication :-

(a) Merchant Authentication

(b) Customer / Cardholder Authentication

(2) Provide Message Confidentiality :-

(3) Provide Message Integrity :-

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Q.7. Explain Handling User Input in core defence mechansim in webapplication.

→ We can not guess user mind or methodology while inputting. So, we should use approach will "RKB" method which is "Reject Know Bad".

* Reject Known Bad :-

- This, method consists of a blacklist according to which characters are blocked. In general, this is regarded as the least effective approach to validating user input, for two main reasons.

- First, a vulnerability in a web application can be exploited using a wide variety of input, and Second, techniques for exploitation are at a constant change.

→ Black-list filters can be bypassed as:

(1) If SELECT is blocked, try SeLeCt
(2) If or 1 = 1 -- is blocked, try or 2 = 2 --

(3) If alert ('xss') is blocked, try Prompt ('xss')

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→ Filters designed to block specific keywords can be bypassed by using nonstandard characters b/w expressions to disrupt the tokenizing performed by the application.

Ex:

SELECT /* foo */ username, Password /* foo */
FROM /* foo */ users

→ NULL byte bypassing example,
ex. %00 alert (1)

☆ Accepts Known Good (AKG):-

- This approach is reciprocal of "RKB" approach in which we can not reject the bad inputs. Instead, we can create a white-list. So, application can only accept only listed inputs and all other inputs are rejected by the applications.

- This is more secured than the reject bad known scheme.

☆ Sanitization:-

- In this approach data received must be sanitized. Malicious characters may be removed from the data, only safe characters are left,

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Or they may be suitably encoded or "escaped" before further processing is performed.

- For ex. the usual defence against cross-site scripting attacks is to HTML-encode dangerous characters before these are embedded into pages of the application.

- But it may be bypassed if attacker understand the sanitization mechanism.

Multi-Step Verification:

- We all are using many secure services these days like gmail etc, which provides us two step or we can say multi-step verification. But all these verification is for user identification rather than data verification.

Semantic Checks:

Safe Data Handling:

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Q.8 Explain Handling attacker in core defence mechanism in Web application.

Answer :- We must consider these points while handling errors : Handling errors, Maintaining audit logs, Alerting administrators, and Reacting to attacks are explained as following below.

[1] Handling Error :-

-> In short term attackers first trying to collect information about application. So, all the error mechanism in application must not provide any descriptive, i.e., it must not leak any info. about database, system architecture, or path details etc.

[2] Maintaining Audit :-

-> Audit logs are important while investigate events such an incident, effective audit logs should enable the application's owners to understand exactly what has taken place, which vulnerabilities were exploited, whether the attacker gained unwanted access to data or performed any unauthorized actions, & as far as possible, provide evidence of the intruders identity.

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→ All events relating to the authentication functionality, key transaction, Any requests containing known attack strings that indicate overtly malicious intentions.

[3] Alerting Administration :-

→ There may be some mechanism which may alert admin of the applications, about any unusual activity in the application like high ping request from a particular IP.

[4] Reacting to Attack :-

→ Many Security-Critical applications contain built-in mechanisms to react defensively to users who are identified as potentially malicious.

→ Because most applications are different and attackers have to perform different test to find vulnerability and we will identify many of these requests as potentially malicious and block them.

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→ For this reason, some web applications take automatic reactive measures to frustrate the attacker who is working in this way.

→ ~~For this reason, some web applications take an~~

→ For an instance, they might respond increasingly slowly to the attacker's requests or terminate the attacker's session, requiring him to log in or perform other steps before continuing the attack.

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Q.9. Explain Database Security in detail.

Answer: Database Security means to keep Sensitive information safe & Prevent the loss of data.

→ Security of data base is controlled by Database Administrator (DBA).

• The following are the main control measures are used to Provide Security of data in database :

1. Authentication :-

→ Authentication is the Process of confirmation that whether the user log in only according to the rights Provided to him to Perform the activities of data base.

→ A Particular user can login only up to his Privilege but he can't access the other Sensitive data.

→ The Privilege of accessing Sensitive data is restricted by using Authentication.

→ By using these authentication tools for biometrics such as retina & figure Prints can Prevent the data base from

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unauthorized / malicious users.

2. Access Control :

→ The Security mechanism of DBMS must include some Provisions for restricting access to the data base by unauthorized users.

→ Access control is done by creating user accounts and to control login Process by the DBMS.

→ So, that database access of sensitive data is Possible only on those People who are allowed to access such data and to restrict access to unauthorized Persons.

→ The database system must also keep the track of all operations Performed by certain user throughout the entire login time.

3. Inference Control :-

→ This method is known as the countermeasures to statistical database Security Problem.

→ It is used to Prevent the user from Completing any inference channel.

→ This method Protect the Sensitive Info. from indirect ~~disclow~~ disclosure.

→ Inferences are of two types, ~~Or~~ identity disclosure Or attribute disclosure.

4. Flow Control :-

→ This Prevents info. from flowing in a way that it reaches unauthorized users,

→ Channels are the Pathways for information to flow implicitly in ways that violate the Privacy Policy of a company are called covert channels.

5. Database Security applying Statistical Method:

→ Statistical database security focuses on the Protection of confidential individual values stored in and used for statistical Purposes and used to retrieve the summaries of values based on categories.

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→ They do not Permit to retrieve the individual information.

→ This allows to access the database to get Statistical info. about the number of employess in the Company but not to access the detailed confidential / Personal info. about specific individual employee.

6. Encryption :

→ This method is mainly used to Protect Sensitive data and other sensitive numbers.

→ The data is encoded using some encoding algorithms.

→ An unauthorized user who tries to access this encoded data will face difficulty in decoding it, but authorized users are given decoding keys to decode data.