Cryptography and Network Security Principles

In present day scenario security of the system is the sole priority of any organisation. The main aim of any organisation is to protect their data from attackers.
In cryptography, attacks are of two types such as Passive attacks and Active attacks. Passive attacks are those that retrieve information from the system without affecting the system resources while active attacks are those that retrieve system information and make changes to the system resources and their operations.

The Principles of Security can be classified as follows:

1. **Confidentiality:**
   The degree of confidentiality determines the secrecy of the information. The principle specifies that only the sender and receiver will be able to access the information shared between them. Confidentiality compromises if an unauthorized person is able to access a message.
   For example, let us consider sender A wants to share some confidential information with receiver B and the information gets intercepted by the attacker C. Now the confidential information is in the hands of an intruder C.

2. **Authentication:**
   Authentication is the mechanism to identify the user or system or the entity. It ensures the identity of the person trying to access the information. The authentication is mostly secured by using username and password. The authorized person whose identity is preregistered can prove his/her identity and can access the sensible information.

3. **Integrity:**
   Integrity gives the assurance that the information received is exact and accurate. If the content of the message is changed after the sender sends it but before reaching the intended receiver, then it is said that the integrity of the message is lost.

4. **Non-Repudiation:**
   Non-repudiation is a mechanism that prevents the denial of the message content sent through a network. In some cases the sender sends the message and later denies it. But the non-repudiation does not allow the sender to refuse the receiver.

5. **Access control:**
   The principle of access control is determined by role management and rule management. Role management determines who should access the data while rule management determines up to what extent one can access the data. The information displayed is dependent on the person who is accessing it.

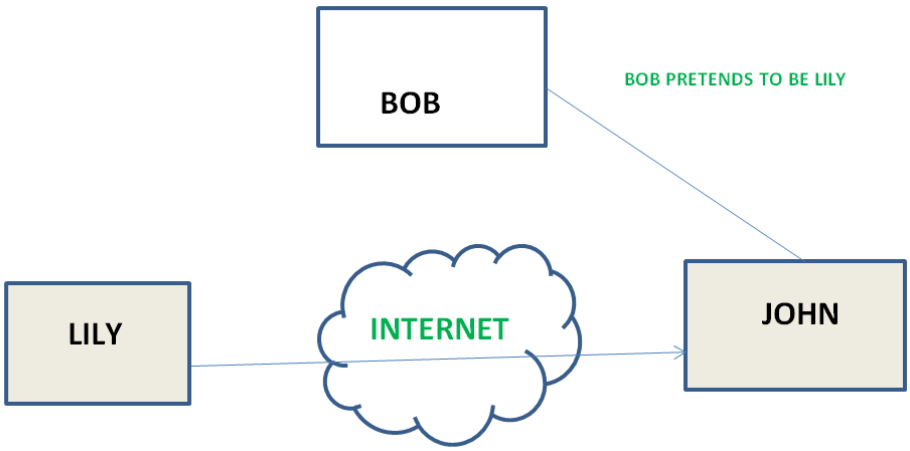
6. **Availability:**
   The principle of availability states that the resources will be available to authorize

party at all times. Information will not be useful if it is not available to be accessed. Systems should have sufficient availability of information to satisfy the user request.

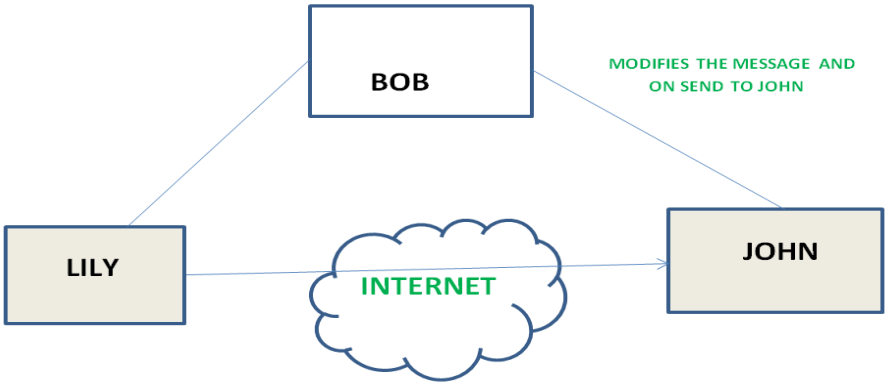
Active and Passive attacks in Information Security

Active attacks: An Active attack attempts to alter system resources or effect their operations. Active attack involve some modification of the data stream or creation of false statement. Types of active attacks are as following:

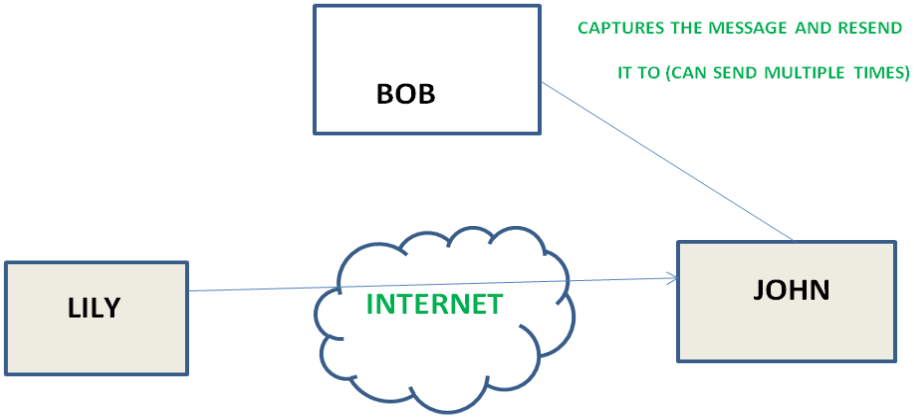
1. **Masquerade –**
   Masquerade attack takes place when one entity pretends to be different entity. A Masquerade attack involves one of the other form of active attacks.



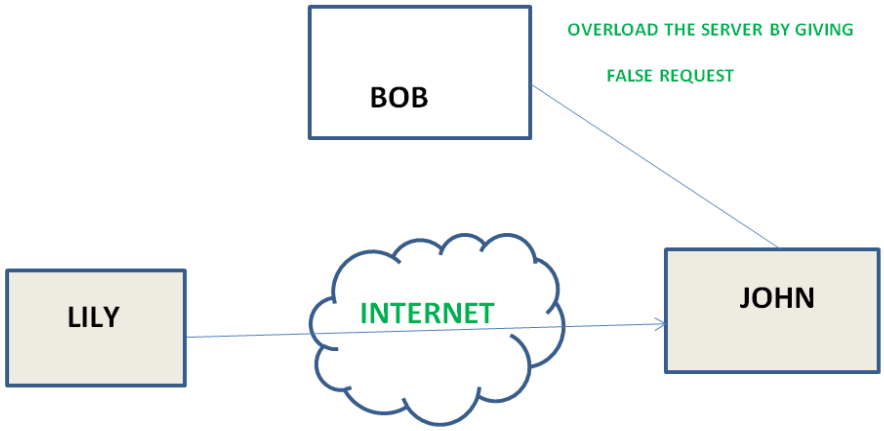
2. **Modification of messages –**
   It means that some portion of a message is altered or that message is delayed or reordered to produce an unauthorised effect. For example, a message meaning "Allow JOHN to read confidential file X" is modified as "Allow Smith to read confidential file X".



3. **Repudiation –**
   This attack is done by either sender or receiver. The sender or receiver can deny later that he/she has send or receive a message. For example, customer ask his Bank "To transfer an amount to someone" and later on the sender(customer) deny that he had made such a request. This is repudiation.
4. **Replay –**
   It involves the passive capture of a message and its subsequent the transmission to produce an authorized effect.

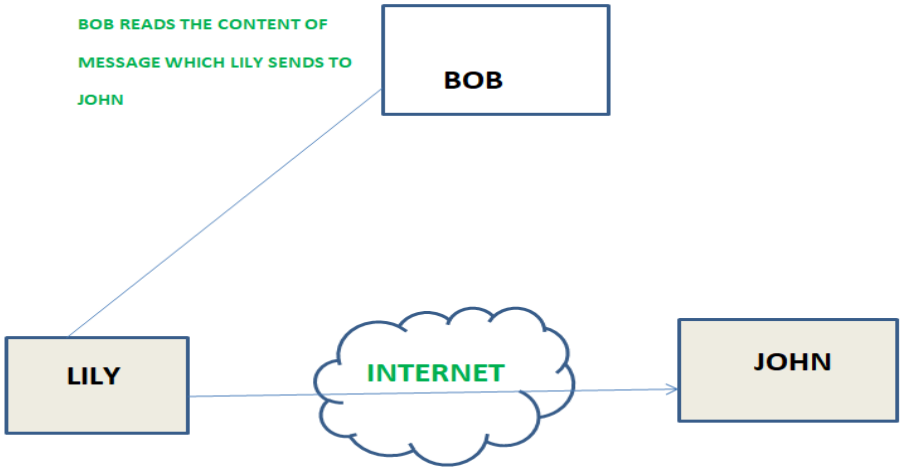


5. **Denial of Service –**
   It prevents normal use of communication facilities. This attack may have a specific target. For example, an entity may suppress all messages directed to a particular destination. Another form of service denial is the disruption of an entire network wither by disabling the network or by overloading it by messages so as to degrade performance.

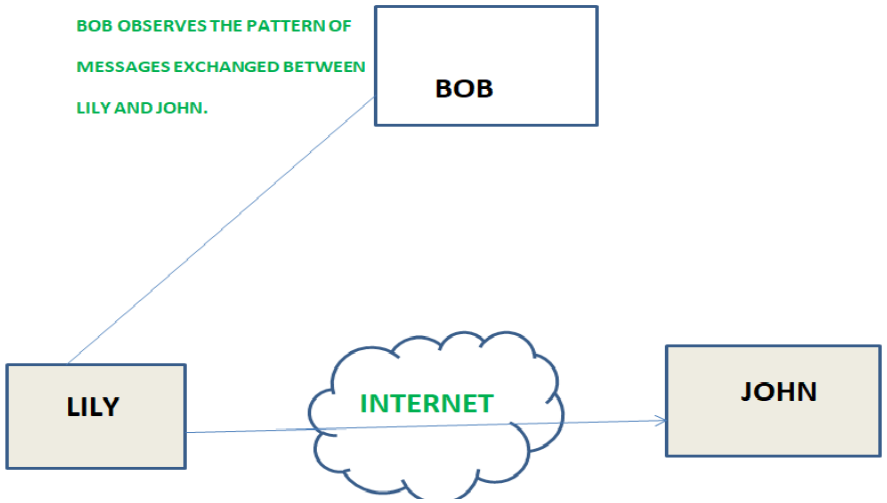


Passive attacks: A Passive attack attempts to learn or make use of information from the system but does not affect system resources. Passive Attacks are in the nature of eavesdropping on or monitoring of transmission. The goal of the opponent is to obtain information is being transmitted. Types of Passive attacks are as following:

1. **The release of message content –**
   Telephonic conversation, an electronic mail message or a transferred file may contain sensitive or confidential information. We would like to prevent an opponent from learning the contents of these transmissions.



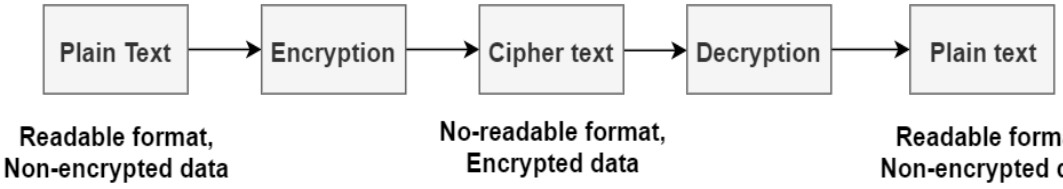
2. **Traffic analysis –**
   Suppose that we had a way of masking (encryption) of information, so that the attacker even if captured the message could not extract any information from the message.
   The opponent could determine the location and identity of communicating host and could observe the frequency and length of messages being exchanged. This information might be useful in guessing the nature of the communication that was taking place.



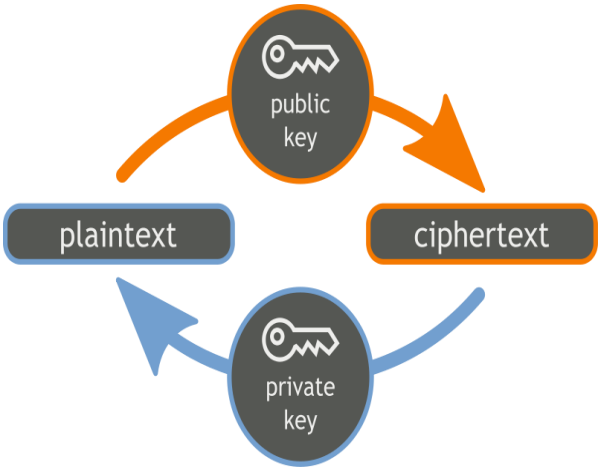
Cryptography and its Types

Cryptography is technique of securing information and communications through use of codes so that only those person for whom the information is intended can understand it and process it. Thus preventing unauthorized access to information. The prefix "crypt" means "hidden" and suffix graphy means "writing".
In Cryptography the techniques which are use to protect information are obtained from mathematical concepts and a set of rule based calculations known as algorithms to convert messages in ways that make it hard to decode it. These algorithms are used for cryptographic key generation, digital signing, verification to protect data privacy, web browsing on internet and to protect confidential transactions such as credit card and debit card transactions.

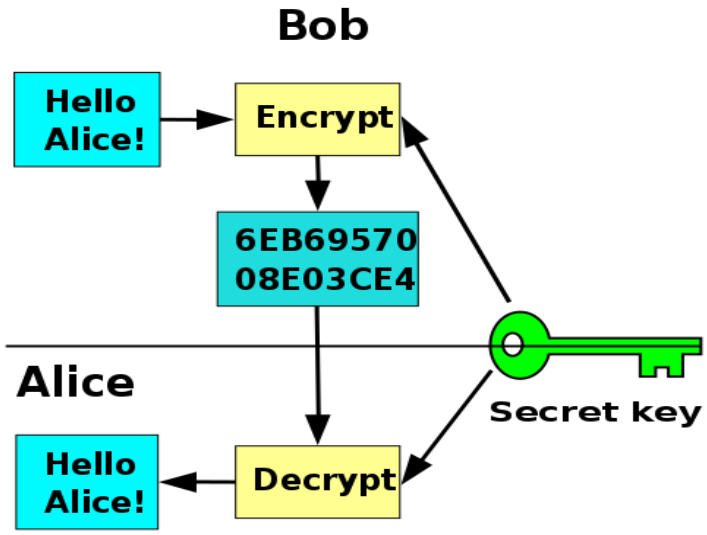
Techniques used For Cryptography:
In today's age of computers cryptography is often associated with the process where an ordinary plain text is converted to cipher text which is the text made such that intended receiver of the text can only decode it and hence this process is known as encryption. The process of conversion of cipher text to plain text this is known as decryption.



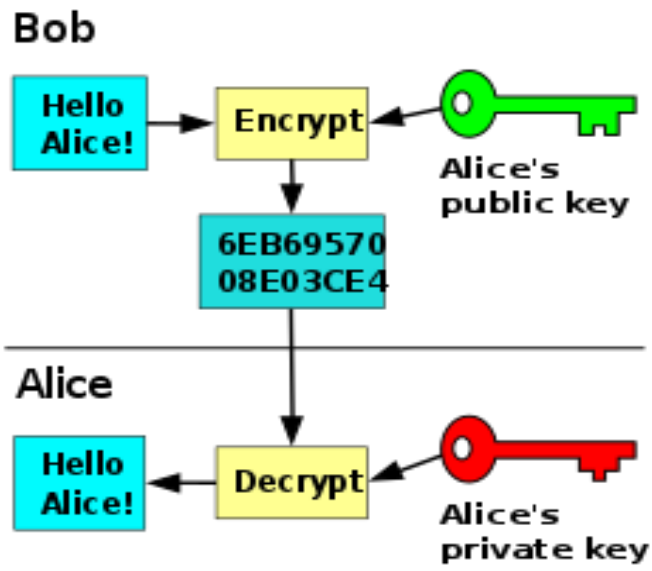
The **main difference** between public key and private key in cryptography is that the **public key is used for data encryption while the private key is used for data decryption.**
The public key and private key are two locking mechanisms used in asymmetric encryption of cryptography. Public key is a type of lock used with an encryption algorithm to convert the message to an unreadable form. Private key is a type of lock used with a decryption algorithm to convert the received message back to the original message. Both these keys help to ensure the security of the exchanged data. In brief, a message encrypted with the public key cannot be decrypted without using the corresponding private key.



Symmetric Key Encryption:
Encryption is a process to change the form of any message in order to protect it from reading by anyone. In Symmetric-key encryption the message is encrypted by using a key and the same key is used to decrypt the message which makes it easy to use but less secure. It also requires a safe method to transfer the key from one party to another.



Asymmetric Key Encryption:
Asymmetric Key Encryption is based on public and private key encryption technique. It uses two different key to encrypt and decrypt the message. It is more secure than symmetric key encryption technique but is much slower.



DIFFERENCE BETWEEN:

SYMMETRIC KEY ENCRYPTION	ASYMMETRIC KEY ENCRYPTION
It only requires a single key for both encryption and decryption.	It requires two key one to encrypt and the other one to decrypt.
The size of cipher text is same or smaller than the original plain text.	The size of cipher text is same or larger than the original plain text.
The encryption process is very fast.	The encryption process is slow.
It is used when a large amount of data is required to transfer.	It is used to transfer small amount of data.
It only provides confidentiality.	It provides confidentiality, authenticity and non-repudiation.
Examples: 3DES, AES, DES and RC4	Examples: Diffie-Hellman, ECC, El Gamal, DSA and RSA