Cryptography fundamentals and terminology

B Tech CSE- IV Sem

TCS 491

Introduction to Cryptography

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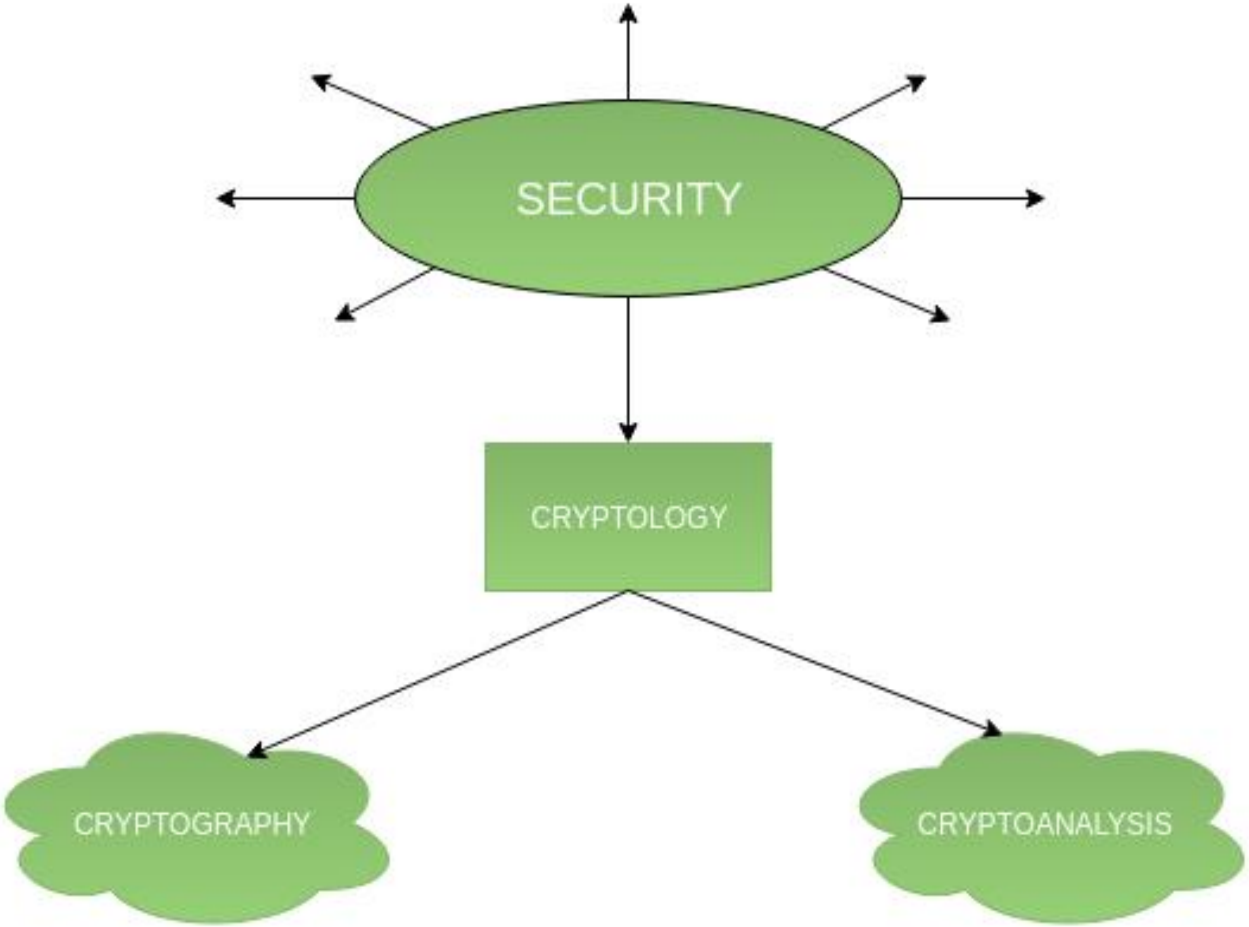
Cryptography

- Cryptography is an important aspect when we deal with network security. ‘Crypto’ means secret or hidden. Cryptography is the science of secret writing with the intention of keeping the data secret. Cryptanalysis, on the other hand, is the science or sometimes the art of breaking cryptosystems. These both terms are a subset of what is called as Cryptology.

Basic Terms

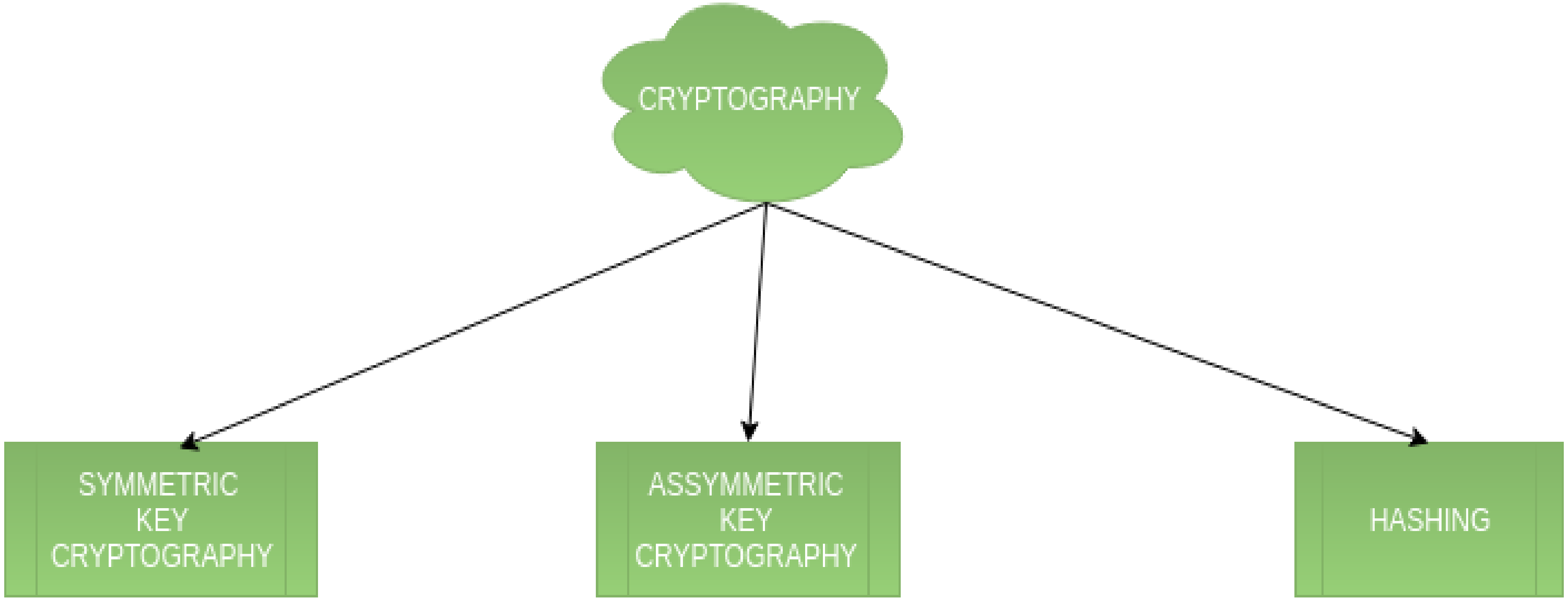
- An original message is known as the **plaintext**, while the coded message is called the **ciphertext**.
- The process of converting from plaintext to ciphertext is known as **enciphering** or **encryption**; restoring the plaintext from the ciphertext is **deciphering** or **decryption**.
- The many schemes used for encryption constitute the area of study known as **cryptography**. Such a scheme is known as a cryptographic system or a cipher.
- Techniques used for deciphering a message without any knowledge of the enciphering details fall into the area of **cryptanalysis**. Cryptanalysis is what the layperson calls “breaking the code.”
- The areas of cryptography and cryptanalysis together are called **cryptology**.


SECURITY
CRYPTOLOGY
CRYPTOGRAPHY
CRYPTOANALYSIS

Cryptology

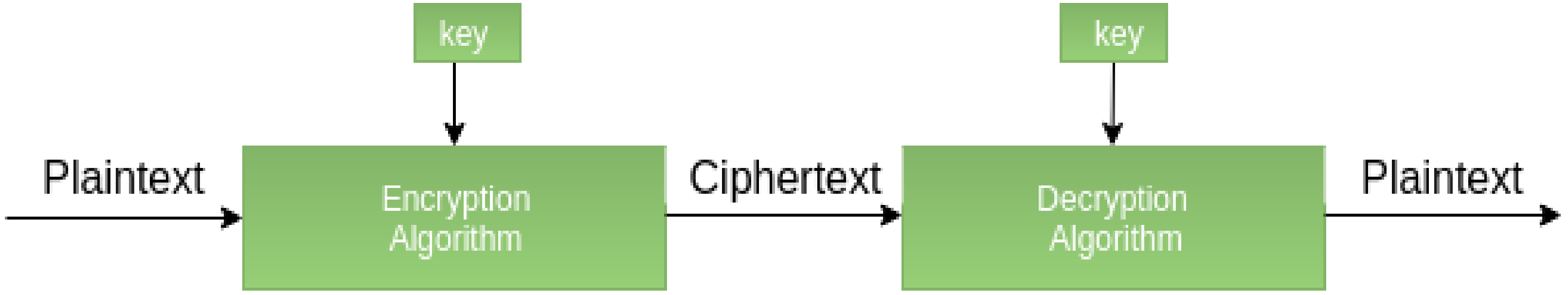
The cryptology is only one of the factors involved in securing networks. It refers to study of codes, which involves both writing (cryptography) and solving (cryptanalysis) them. Below is a classification of the crypto-terminologies and their various types

1. Cryptography –
Cryptography is classified into symmetric cryptography, asymmetric cryptography and hashing.



1.1 Symmetric key cryptography –

It involves usage of one secret key along with encryption and decryption algorithms which help in securing the contents of the message. The strength of symmetric key cryptography depends upon the number of key bits. It is relatively faster than asymmetric key cryptography. There arises a key distribution problem as the key has to be transferred from the sender to receiver through a secure channel.



SYMMETRIC KEY CRYTOGRAPHY

- A symmetric encryption scheme has five ingredients :
- ■ Plaintext: This is the original intelligible message or data that is fed into the algorithm as input.
- ■ Encryption algorithm: The encryption algorithm performs various substitutions and transformations on the plaintext.
- ■ Secret key: The secret key is also input to the encryption algorithm. The key is a value independent of the plaintext and of the algorithm. The algorithm will produce a different output depending on the specific key being used at the time. The exact substitutions and transformations performed by the algorithm depend on the key.

- ■ Ciphertext: This is the scrambled message produced as output. It depends on the plaintext and the secret key. For a given message, two different keys will produce two different ciphertexts. The ciphertext is an apparently random stream of data and, as it stands, is unintelligible.
- ■ Decryption algorithm: This is essentially the encryption algorithm run in reverse. It takes the ciphertext and the secret key and produces the original plaintext.

- There are two requirements for secure use of conventional encryption:
- 1. We need a strong encryption algorithm. At a minimum, we would like the algorithm to be such that an opponent who knows the algorithm and has access to one or more ciphertexts would be unable to decipher the ciphertext or figure out the key. This requirement is usually stated in a stronger form: The opponent should be unable to decrypt ciphertext or discover the key even if he or she is in possession of a number of ciphertexts together with the plaintext that produced each ciphertext.
- 2. Sender and receiver must have obtained copies of the secret key in a secure fashion and must keep the key secure. If someone can discover the key and knows the algorithm, all communication using this key is readable.

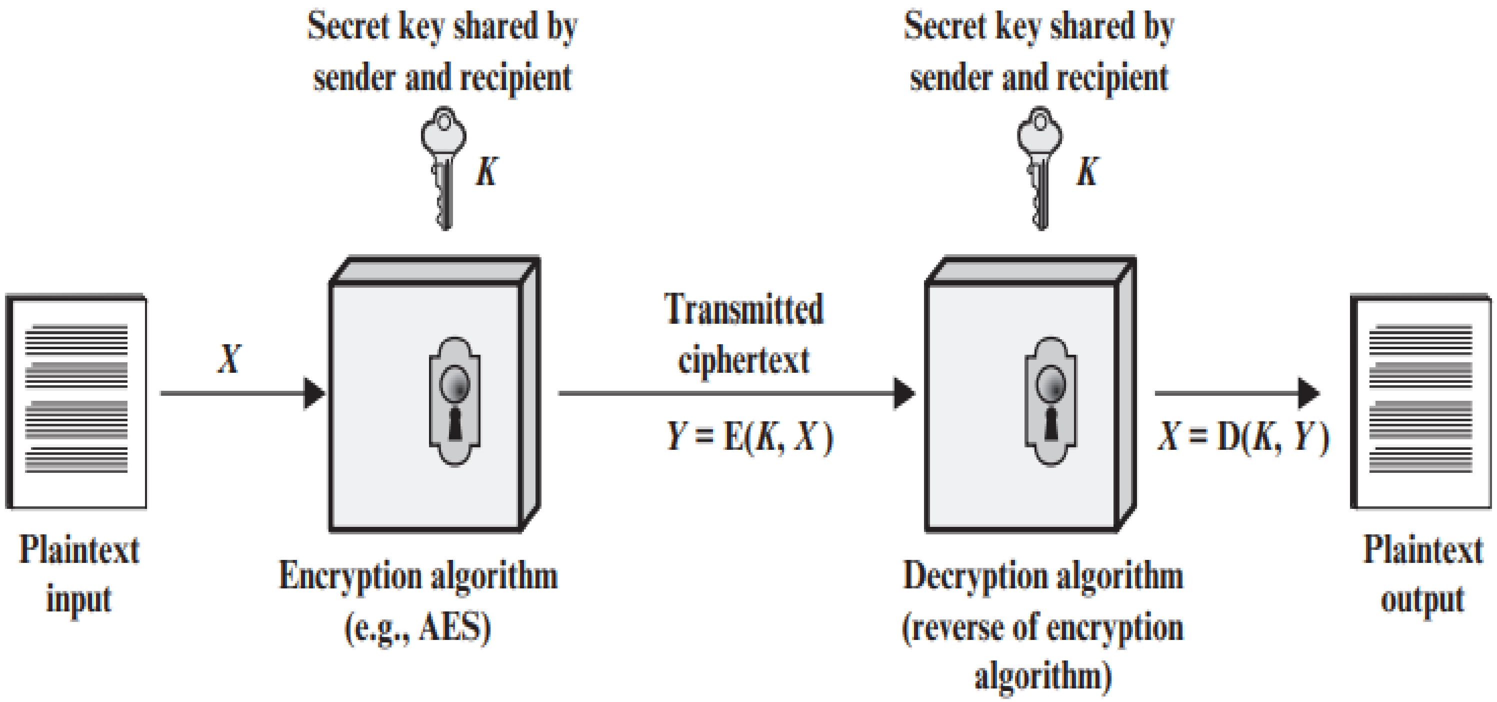
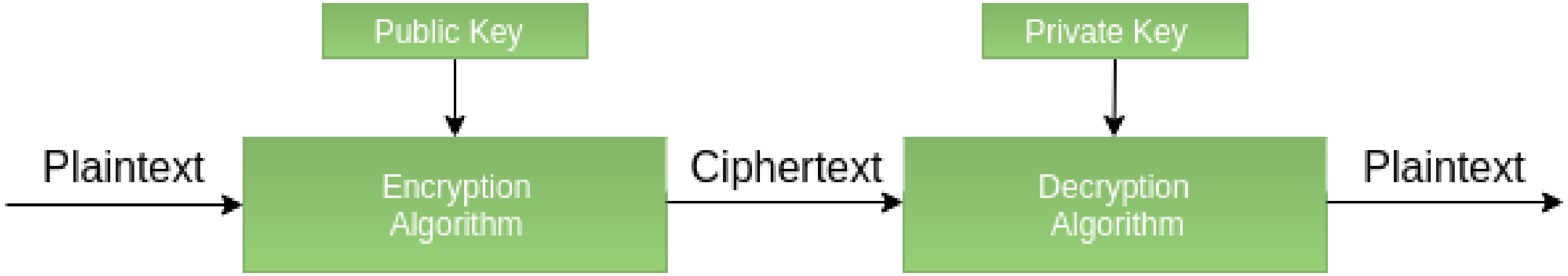

Secret key shared by sender and recipient
K
Secret key shared by sender and recipient
K
X
Transmitted ciphertext
$Y = E(K, X)$
$X = D(K, Y)$
Plaintext input
Encryption algorithm (e.g., AES)
Decryption algorithm (reverse of encryption algorithm)
Plaintext output

Figure 3.1 Simplified Model of Symmetric Encryption

1.2 Assymetric key cryptography –

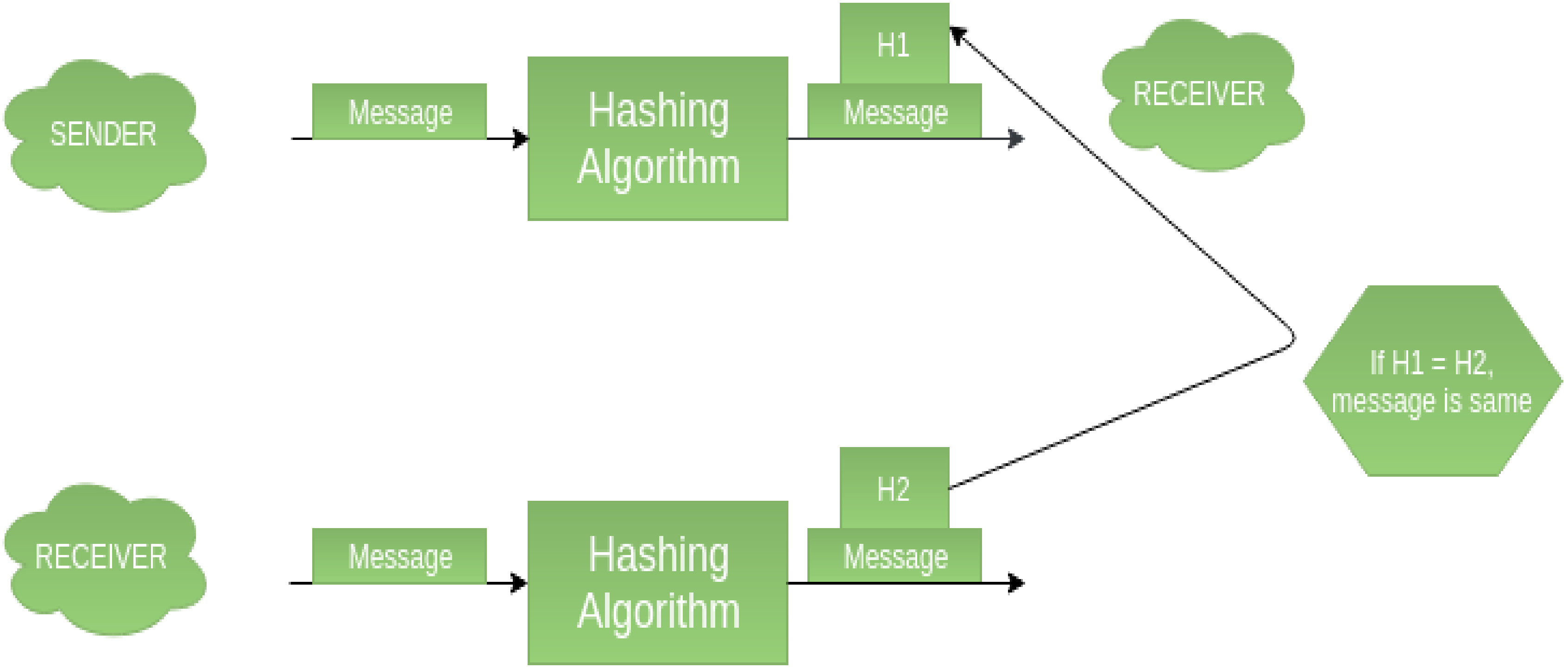
It is also known as public key cryptography because it involves usage of a public key along with secret key. It solves the problem of key distribution as both parties uses different keys for encryption/decryption. It is not feasible to use for decrypting bulk messages as it is very slow compared to symmetric key cryptography.



ASYMMETRIC KEY CRYTOGRAPHY

1.3 Hashing –

It involves taking the plain-text and converting it to a hash value of fixed size by a hash function. This process ensures integrity of the message as the hash value on both, sender\’s and receiver\’s side should match if the message is unaltered



Thank You

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Best Wishes