MODULE-3: MAC HMAC CMAC

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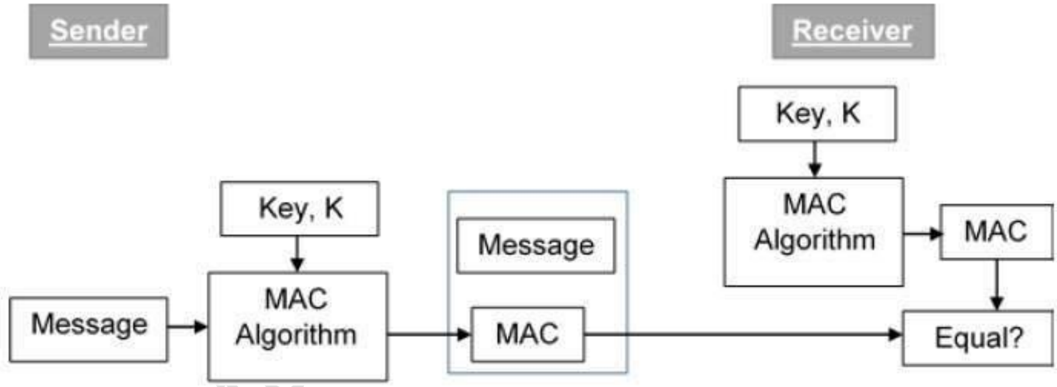
Message Authentication Code

MAC algorithm is a symmetric key cryptographic technique to provide message authentication. For establishing MAC process, the sender and receiver share a symmetric key K.

Essentially, a MAC is an encrypted checksum generated on the underlying message that is sent along with a message to ensure message authentication.

The process of using MAC for authentication is depicted in the following illustration



The sender uses some publicly known MAC algorithm, inputs the message and the secret key K and produces a MAC value.

Similar to hash, MAC function also compresses an arbitrary long input into a fixed length output. The major difference between hash and MAC is that MAC uses secret key during the compression.

The sender forwards the message along with the MAC. Here, we assume that the message is sent in the clear, as we are concerned of providing message origin authentication, not confidentiality. If confidentiality is required then the message needs encryption.

On receipt of the message and the MAC, the receiver feeds the received message and the shared secret key K into the MAC algorithm and re-computes the MAC value.

The receiver now checks equality of freshly computed MAC with the MAC received from the sender. If they match, then the receiver accepts the message and assures himself that the message has been sent by the intended sender.

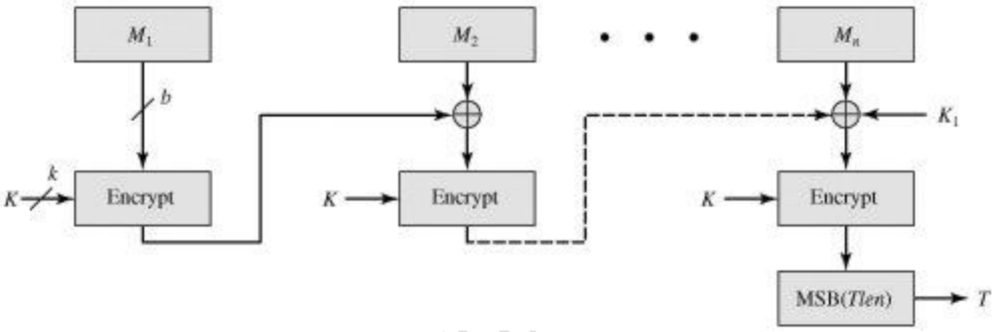
If the computed MAC does not match the MAC sent by the sender, the receiver cannot determine whether it is the message that has been altered or it is the origin that has been falsified. As a bottom-line, a receiver safely assumes that the message is not the genuine.

HMAC

HMAC (Hash-based Message Authentication Code) is a type of a message authentication code (MAC) that is acquired by executing a cryptographic hash function on the data (that is) to be authenticated and a secret shared key. Like any of the MAC, it is used for both data integrity and authentication. Checking data integrity is necessary for the parties involved in communication. HTTPS, SFTP, FTPS, and other transfer protocols use HMAC. The cryptographic hash function may be MD-5, SHA-1, or SHA-256. Digital signatures are nearly similar to HMACs i.e they both employ a hash function and a shared key. The difference lies in the keys i.e HMACs use symmetric key(same copy) while Signatures use asymmetric (two different keys).

Cipher-based message authentication code (CMAC)

Cipher-based message authentication codes (or CMACs) are a tool for calculating message authentication codes using a block cipher coupled with a secret key. You can use an CMAC to verify both the integrity and authenticity of a message.



First, let us consider the operation of CMAC when the message is an integer multiple n of the cipher block length b. For AES, b = 128 and for triple DES, b = 64. The message is divided into n blocks, M1, M2,...,Mn. The algorithm makes use of a k-bit encryption key K and an n-bit constant K1. For AES, the key size k is 128, 192, or 256 bits; for triple DES, the key size is 112 or 168 bits. CMAC is calculated as follows

References

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