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Wireless LAN Security

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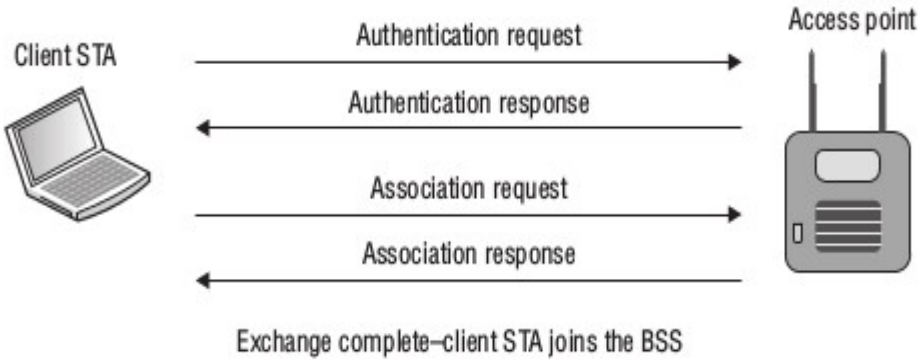
- Four – way Handshake.

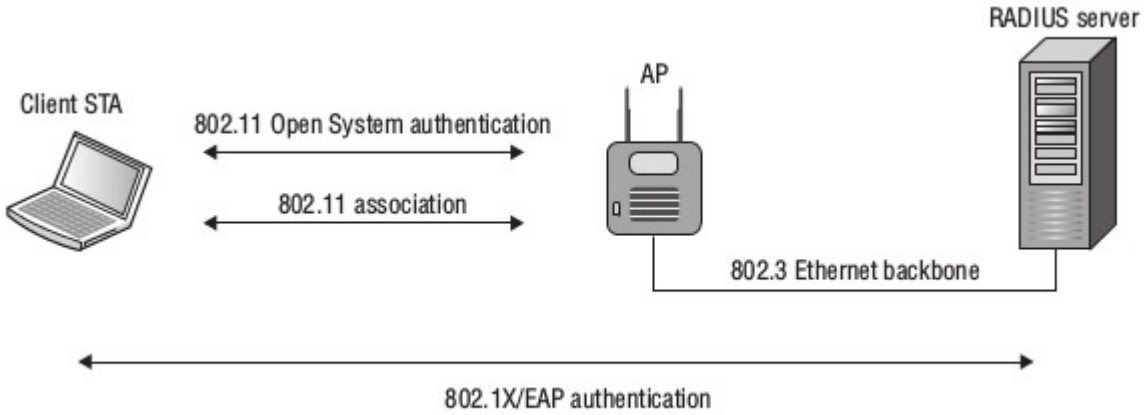
Authentication

- Authentication is the first of two steps required to connect to the 802.11 basic service set.
- The 802.11 authentication merely establishes an initial connection between the client and the access point
- The 802.11-2007 standard specifies two different methods of authentication:
  a)Open system Authentication.
  b)Shared key authentication,

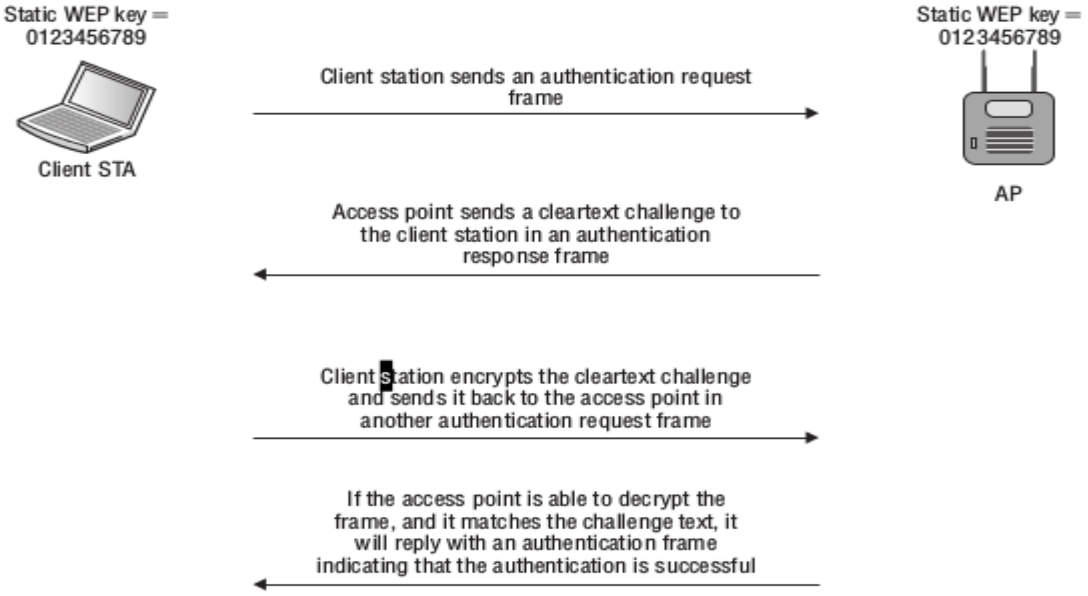
Open system Authentication



Open system and 802.11X/EAP Authentication



Shared Key Authentication



WLAN encryption methods

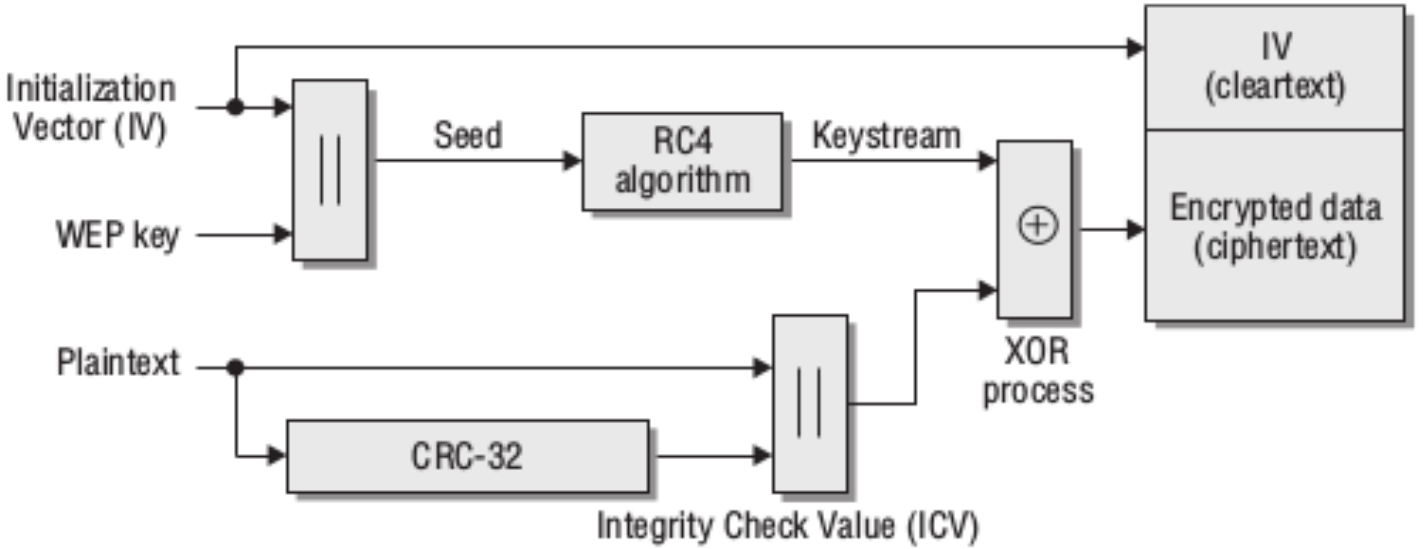
- The 802.11-2007 standard defines three encryption methods that operate at layer 2 of the OSI model:
  - Wired Equivalent privacy(WEP).
  - Temporary Key Integration Protocol(TKIP).
  - CTR with CBC-MAC Protocol(CCMP).

- WEP, TKIP, CCMP are used to encrypt the MSDU payload of an 802.11 data frame.

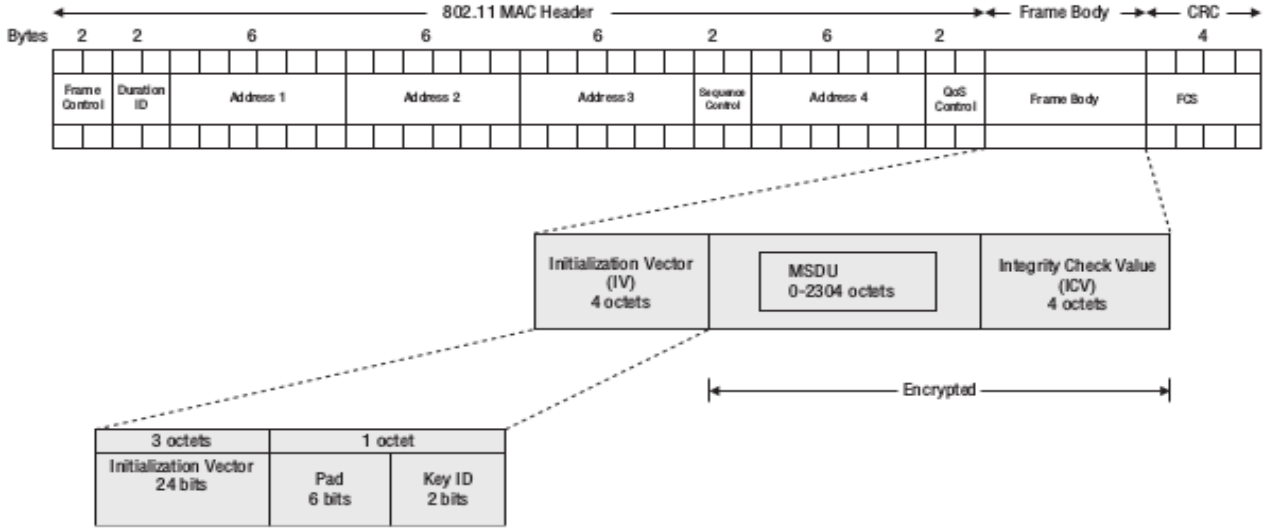
Wired Equivalent Privacy

- Wired Equivalent Privacy is a layer 2 security protocol that uses the RC4 streaming cipher.
- 64-bit WEP uses a secret 40-bit static key, which is combined with a 24-bit number selected by the card’s device drivers.
- This 24-bit number, known as the initialization vector(IV)
- Pseudo random RC4 algorithm is used to generate keystream.
- Keystream then combined with the plain-text data bits by using a Boolean XOR process.

- WEP encryption process



- WEP MPDU Format



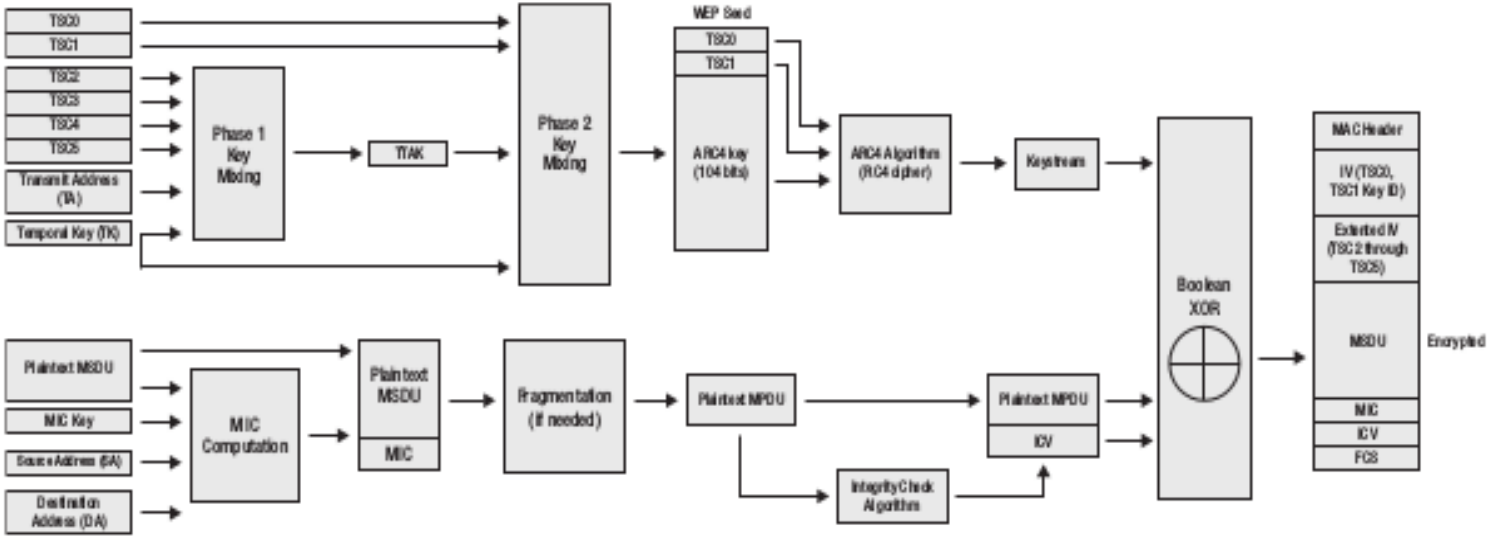
Temporary Key Integration Protocol

- TKIP is an enhancement of WEP.
- TKIP uses the ARC4 algorithm for performing its encryption and decryption processes.
- TKIP uses dynamically created encryption keys as opposed to the static keys.
- Any two radios use a 4-Way Handshake process to create dynamic unicast keys that are unique to those two radios

Temporary Key Integration Protocol

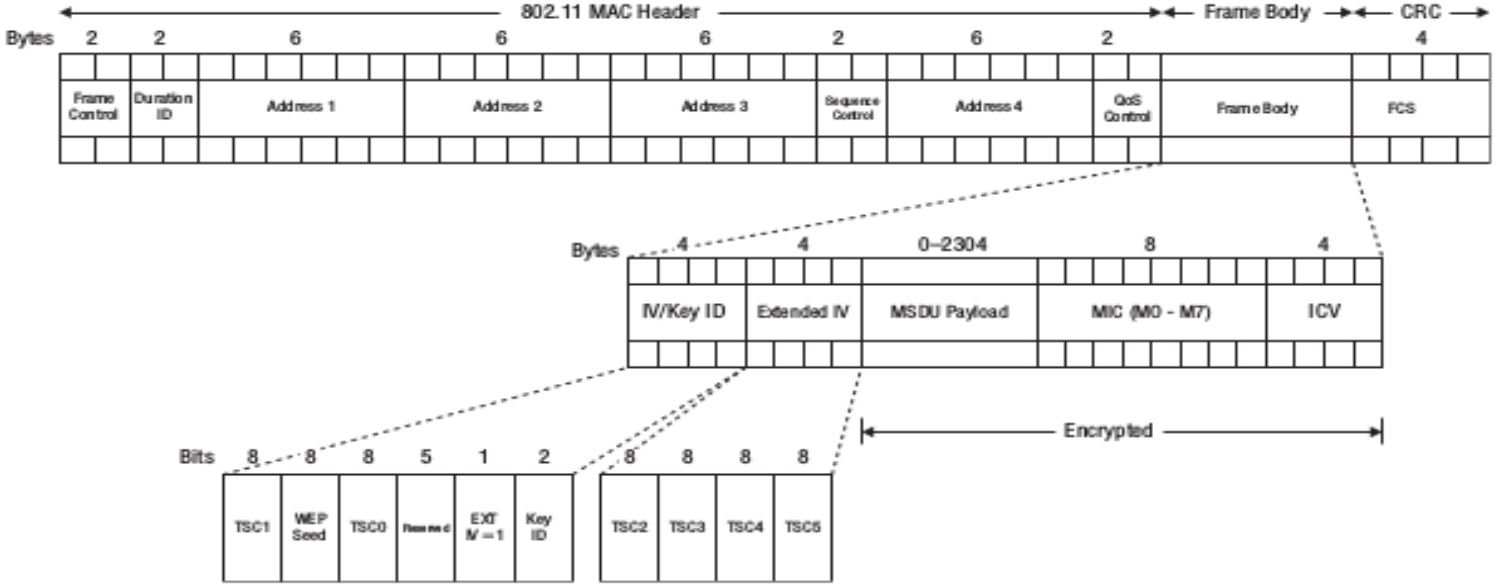
- TKIP starts with a 128-bit temporal key.
- The 128-bit temporal key is a dynamically generated key that comes from a 4-Way Handshake creation process.
- This key is identical on the AP and client pair.
- he 128-bit temporal key can either be a pairwise transient key (PTK) used to encrypt unicast traffic
- or a group temporal key (GTK) used to encrypt broadcast and multicast traffic.

TKIP encryption and data integrity process



Temporary Key Integration Protocol

- TKIP MPDU

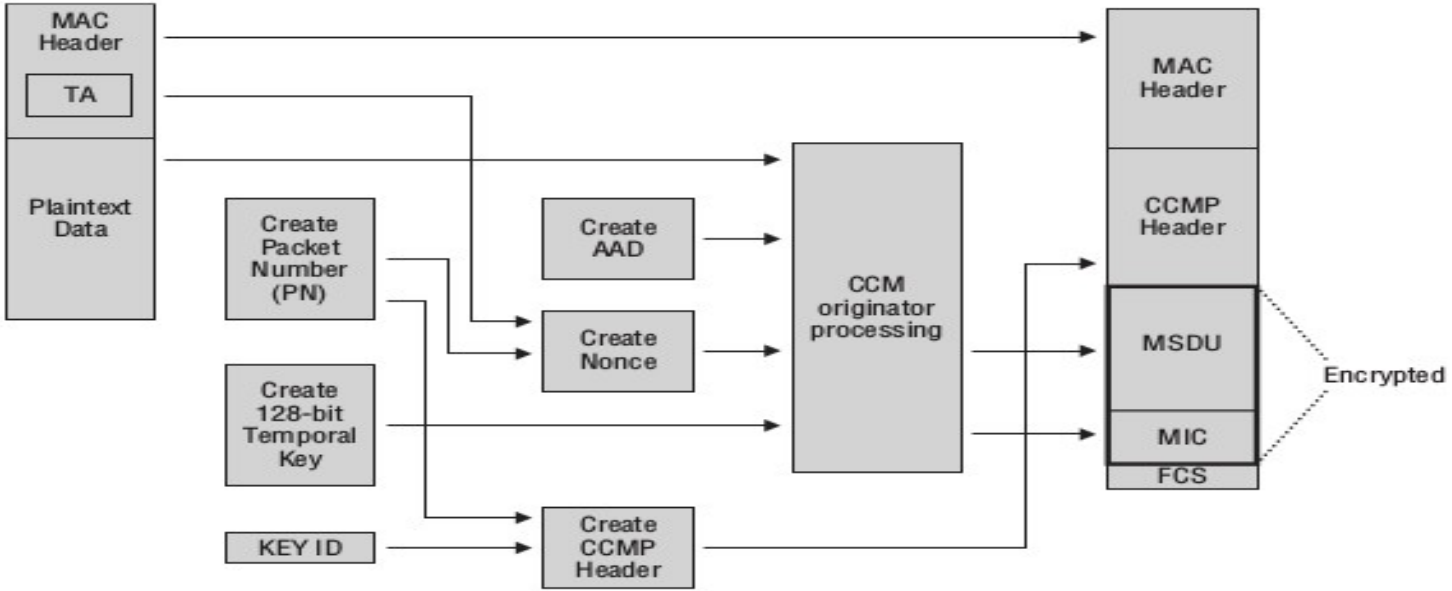


CTR with CBC-MAC Protocol(CCMP)

- The full phrase of counter mode with the Cipher-Block Chaining Message Authentication Code protocol is represented by the acronym of CCMP.
- certain fields in the MPDU header are used to construct the additional authentication data (AAD).
- This information is used for data integrity of portions of the MAC header.
- CTR is used to provide data confidentiality.
- The CBC-MAC is used for authentication and integrity.

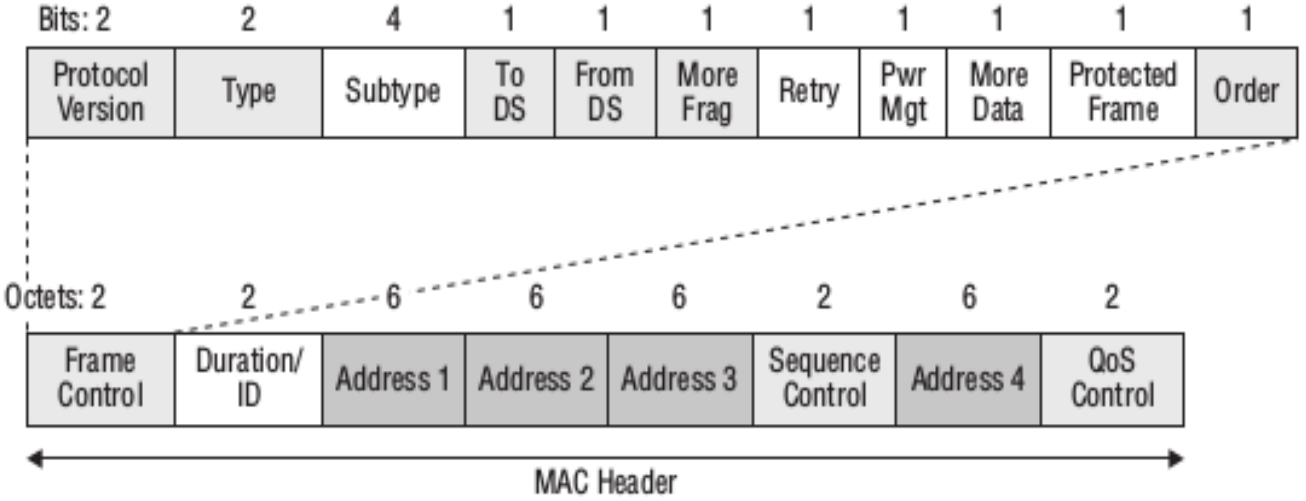
CTR with CBC-MAC Protocol(CCMP)

- CCMP encryption and data integrity process



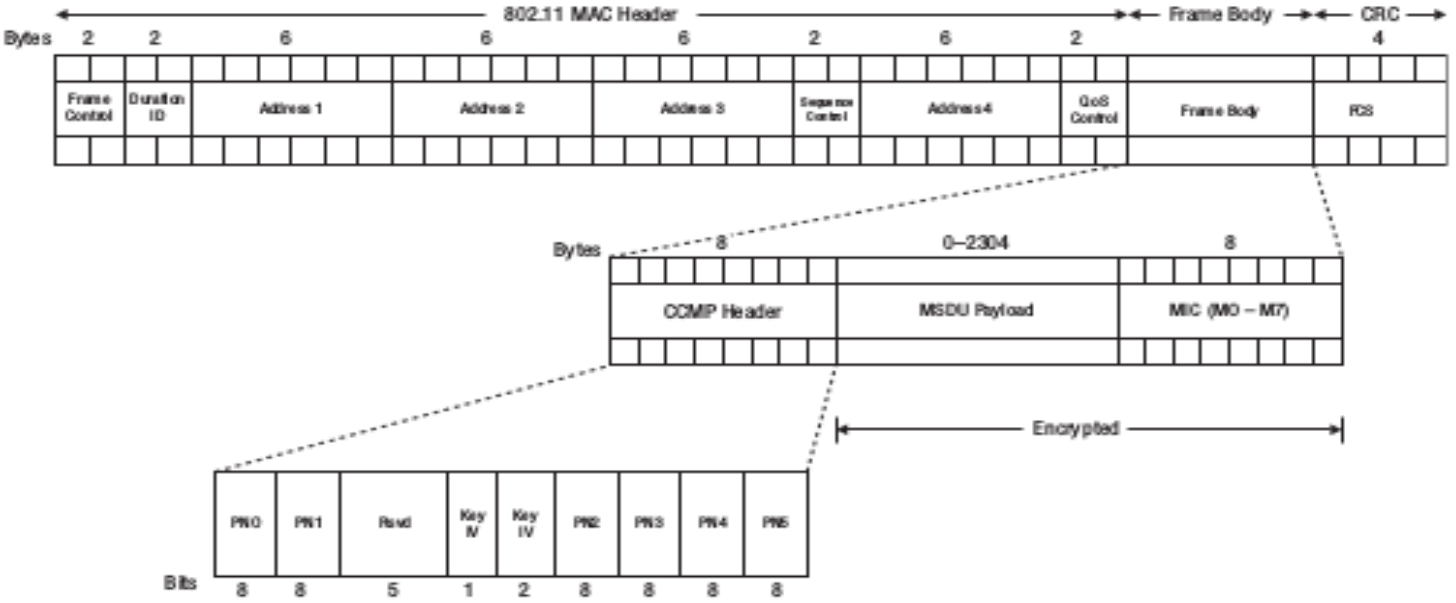
CTR with CBC-MAC Protocol(CCMP)

- Additional authentication data



CTR with CBC-MAC Protocol(CCMP)

- CCMP MPDU



Wifi Protected Access(WPA)

- Temporal Key Integrity Protocol (TKIP) was adopted for WPA.
- WPA also includes a Message Integrity Check.
- WPA2 is the upgraded version of WPA which uses CCMP/AES encryption.
- The various protection mechanisms of WPA are.

  1) WPA-Personal(WPA-PSK(Pre shared key))
  2) WPA-Enterprise(WPA-802.11X mode).
  3) Wifi Protected setup

Robust security networks

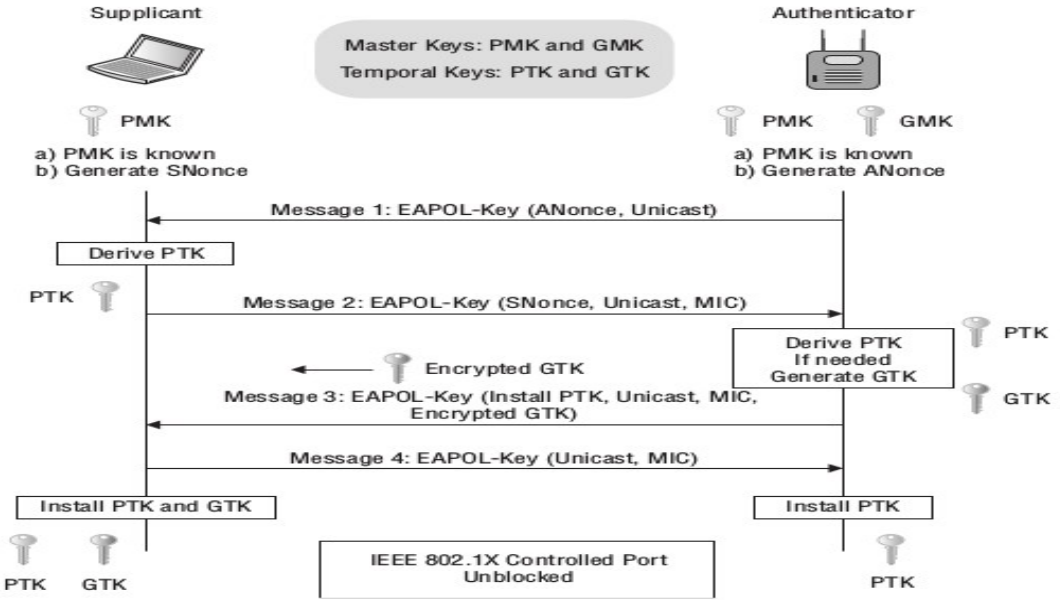
- The 802.11-2007 standard defines what is known as a robust security network (RSN) and robust security network associations (RSNAs).
- A robust security network association (RSNA) requires two 802.11 stations (STAs) to establish procedures to
  - Authenticate
  - Associate
  - create dynamic encryption keys through a process known as the 4-Way Handshake
- CCMP/AES encryption is the mandated encryption method, while TKIP/RC4 is an optional encryption method.

4-WAY HANDSHAKE

- The 4-Way Handshake is a final process used to generate pairwise transient keys for encryption of unicast transmissions
- and a group temporal key for encryption of broadcast/multicast transmissions.
- The 4-Way Handshake uses four EAPOL-Key frame messages between the authenticator and the supplicant
- 802.1X/EAP authentication is completed when the access point sends an EAP-Success frame and the AP can now initiate the 4-Way Handshake

Four way Handshake

- The 4 way handshake



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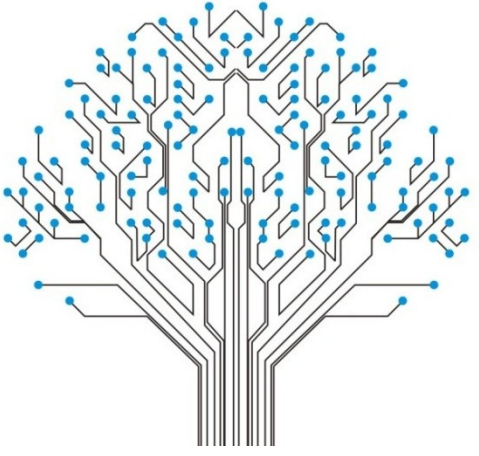
Thank you



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