

Wifi-Protocol-1

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Plan

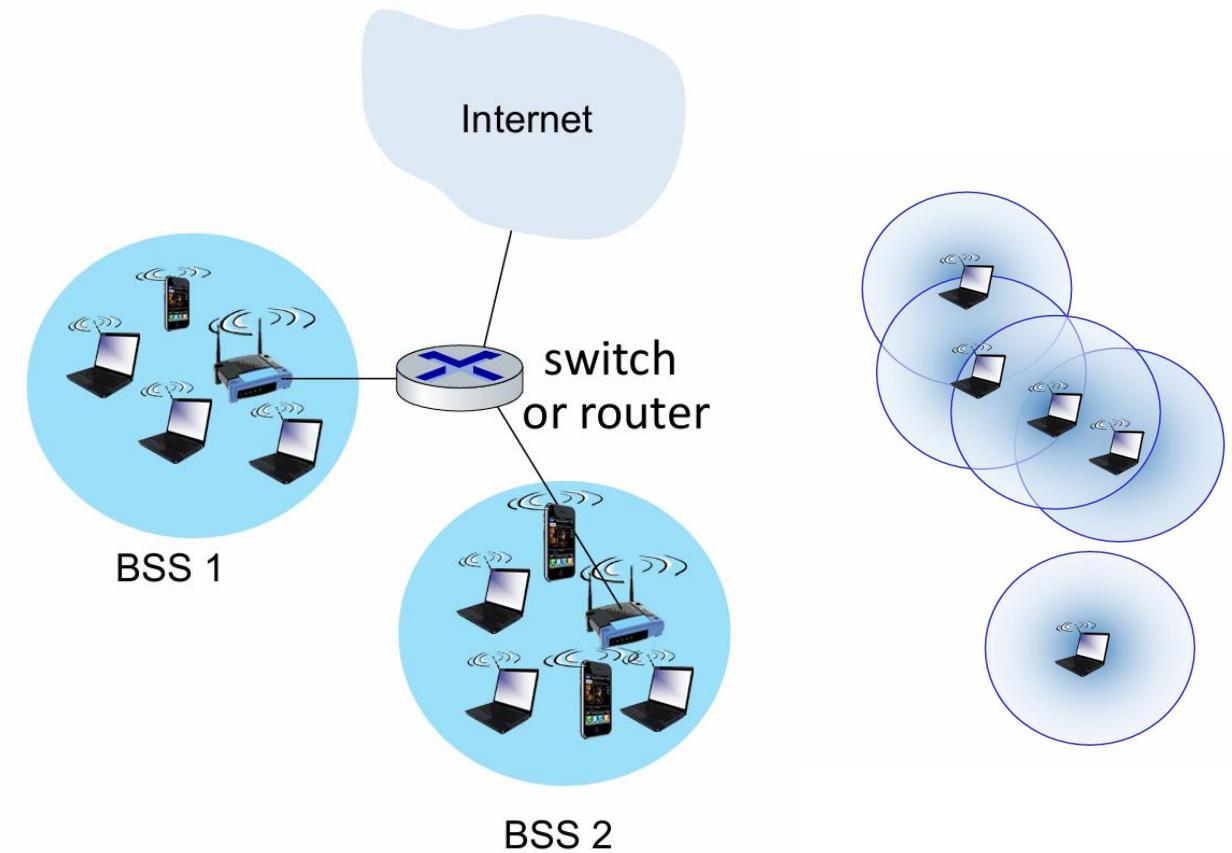
- Contents of Wifi-protocol (week 1)
- Wireshark + Security Vulnerability of Wifi-protocol (week 2)
- Security Vulnerability Attack practice with online platform (week 3)

IEEE 802.11 Wireless LAN (Wi-Fi)

- Technical Standard for Wireless LAN
- Started from 1997, currently revising
 - ex) Wifi 6E (802.11ax)
- Layer
 - Data Link Layer
 - Physical Layer

IEEE 802.11 Architecture

- Infrastructure mode
 - Access Point (Base station)
 - Basic Service Set (or cell)
 - cf. ESS
- Ad hoc mode



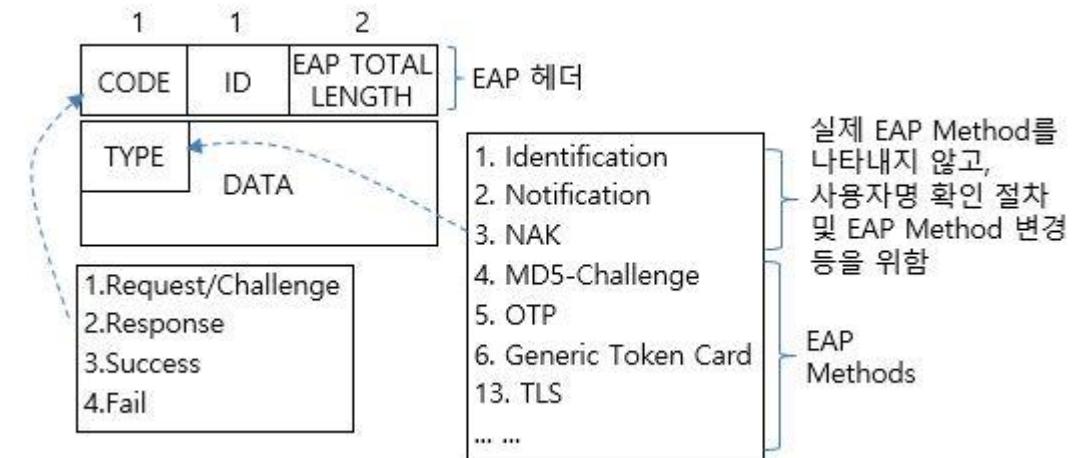
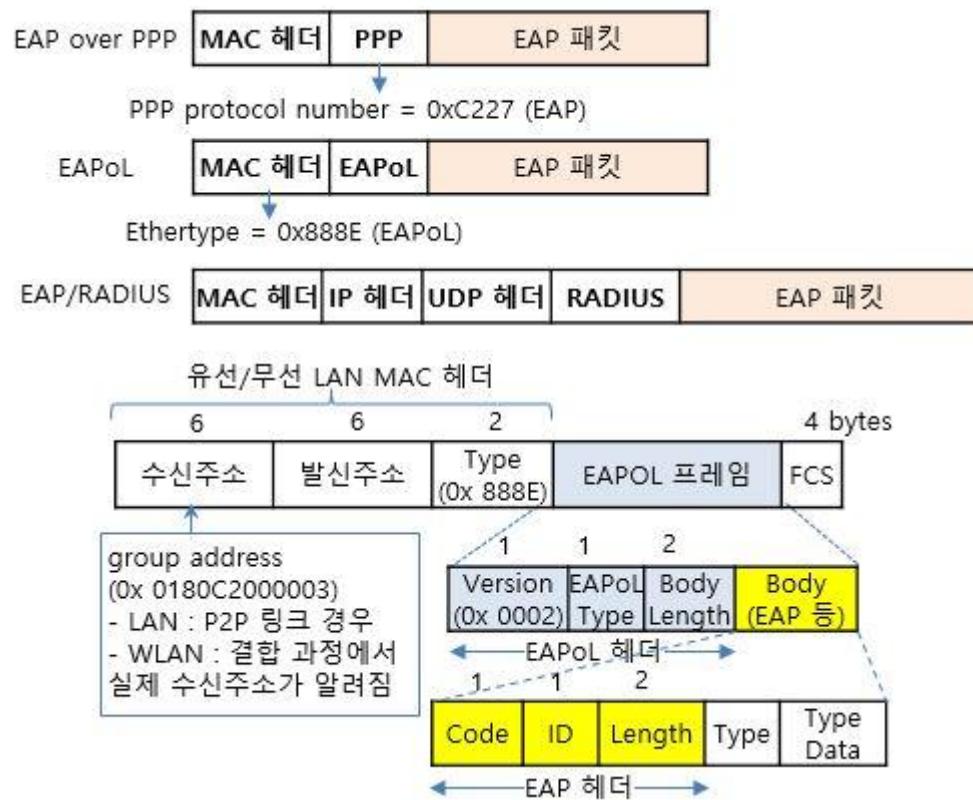
IEEE 802.11 Association

- Host scans channels & listening for Beacon Frames
 - Beacon frames: SSID(AP's name) + MAC address
- Select AP for authentication
 - EAPoL
- AP-Host association
- DHCP (host gets IP address)



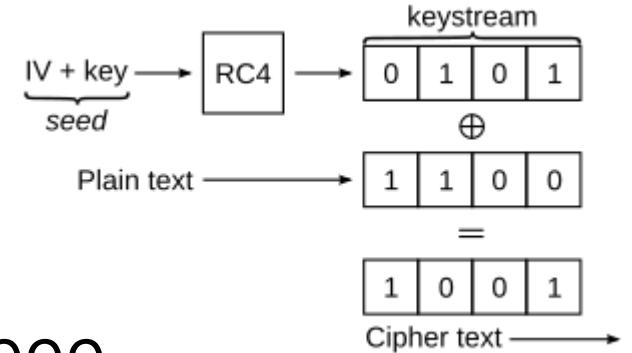
IEEE 802.11 EAPoL

- EAP(Extensible Authentication Protocol) Encapsulation over LAN
- Authentication Framework



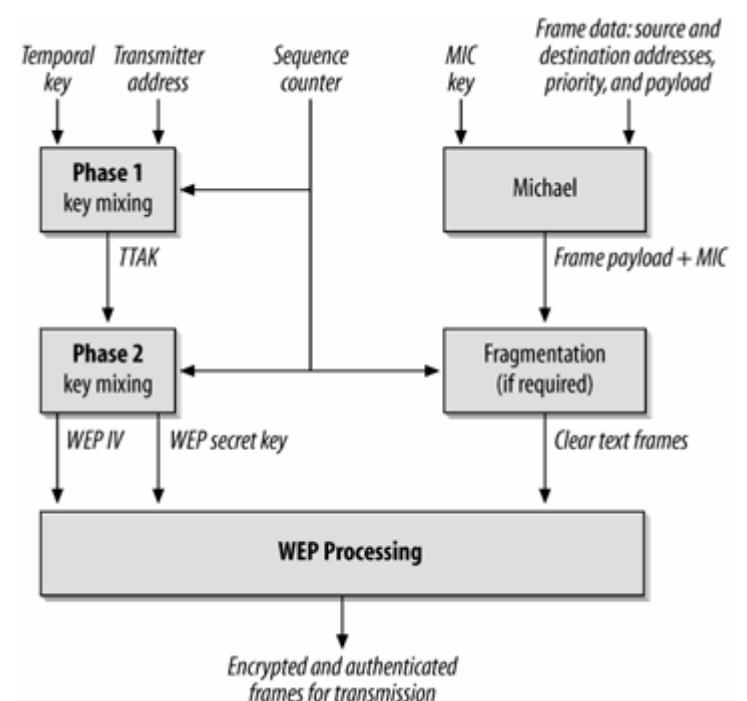
Encryption Method: WEP

- WEP: Wired Equivalent Privacy, Developed in 1999
- 4-step challenge and response
 - Client sends authentication request to AP
 - AP sends clear-text challenge to client
 - Client encrypts the text with WEP key and send it to AP
 - AP decrypts the response
- Weak security: Stream-Cipher with static key



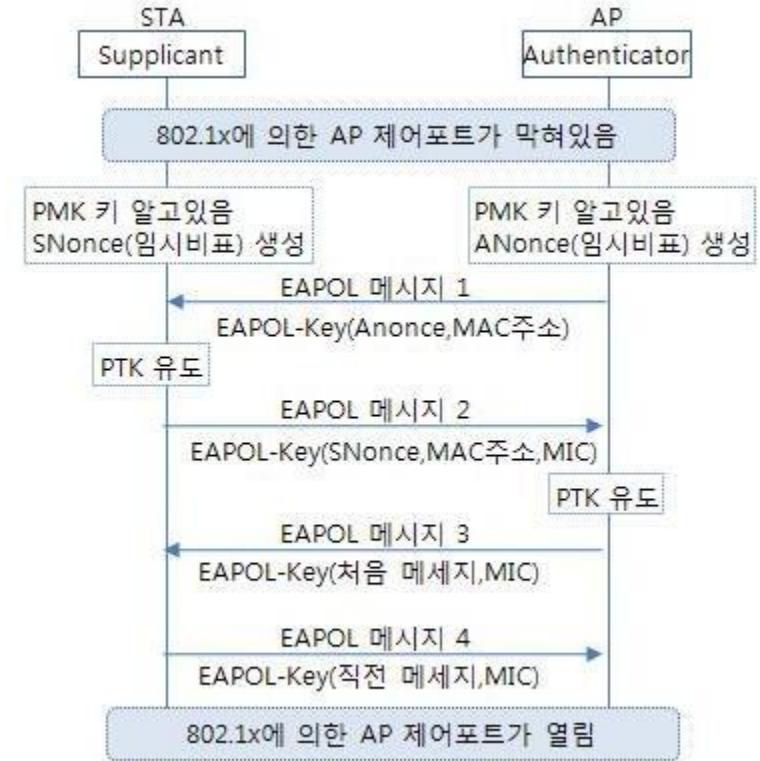
Encryption Method : WPA

- WPA: Wi-Fi Protected Access, also based on RC4
- WPA implements TKIP(Temporal Key Integrity Protocol)
 - key mixing function
 - Sequence counter
 - Message Integrity Check (replaces CRC)
- Weak security: Stream Cipher, MIC



PSK (Pre-Shared Key)

- Used in WPA/WPA2
- Authentication + PTK generation
- 4-way Handshake
 - AP sends a random number (ANonce) to client
 - Client responds with its random number (SNonce)
 - AP calculates PTK and sends an encrypted message to client.
 - Client decrypts the message with PTK



Encryption Method : WPA2

- WPA2 is enhanced version of WPA
- AES based Counter mode with CBC-MAC
- Weak security: MIC (4-way handshake)
- KRACK(Key Reinstallation Attack) (M3), PMKID offline dictionary attack(M1)

Encryption Method : WPA3

- 192-bit encryption in WPA3-Enterprise mode
- SAE(Simultaneous Authentication of Equals) instead of PSK (Pre-Shared Key) exchange
- Safe and personalized encryption
- Fragattack (WEP~WPA3)

SAE (Simultaneous Authentication of Equals)

- Password-authenticated key exchange (PAKE)
- Dragonfly handshake
- Forward secrecy guaranteed
- Dragonblood attack(Downgrade attack, Timing/Cache-based side-channel attack, DoS attack)