Masterclass : Wi-Fi

GitHub

https://github.com/JulienFink/WiFi-Project

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DE VINCI PARIS

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Summary

- Wi-Fi definition and presentation
- Core mechanism - protocols overview
- Security issues

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Wi-Fi definition and presentation (1/N)

- Radio waves
- Provides local network and Internet access to devices
- 2.4 GHz and/or 5.8 GHz

Designed for :	2.4 GHz	5.8 GHz
Range	✔	✘
Linkrate	✘	✔
Penetration	✔	✘

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Wi-Fi core mechanism (1/N)

IEEE 802.1X

- IEEE 802.1X
- These set of standards allow you to control access to network infrastructure equipments
- Wireless Local Area Networks (WLANs)

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Wi-Fi core mechanism (1/N)

Establishing a secure communication consists of four phases

- Agreeing on the security policy
- 802.1X authentication
- Key derivation and distribution
- RSNA (Robust Security Network Association) data confidentiality and integrity

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Wi-Fi core mechanism (1/N)

Connection to a(n) router/access point - Network authentication and data encryption protocols

Network authentication and data encryption protocols		
Open System Authentication	WEP	WPA/WPA2
unsafe	unsafe/depreceated	safe

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Wi-Fi core mechanism (1/N)

Open System Authentication (OSA)

- In Open System authentication, the WLAN client does not provide its credentials to the Access Point during authentication.
- Any client can authenticate and associate with the Access Point
- Data travels in a clear format, except if other protocols perform encryption (e.g. TLS)

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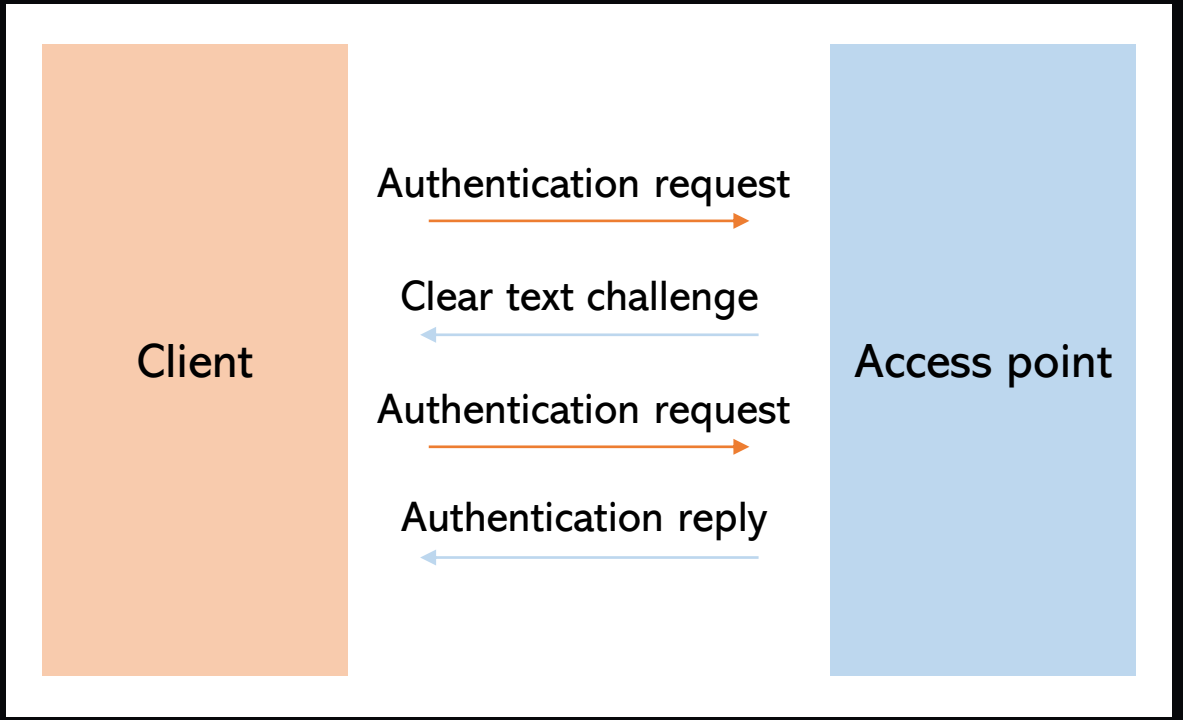
Wi-Fi core mechanism (1/N)

WEP (Wired Equivalent Privacy) (1/2) - Shared Key authentication

In Shared Key authentication, the WEP key is used for authentication in a four-step challenge-response handshake :

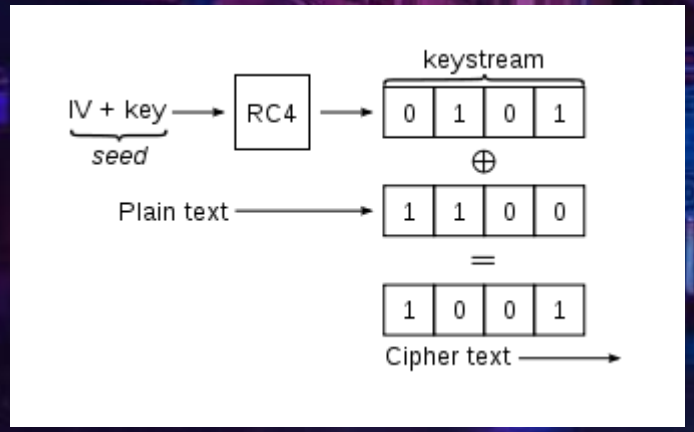


After the authentication and association, the pre-shared WEP key is also used for encrypting the data frames using RC4.

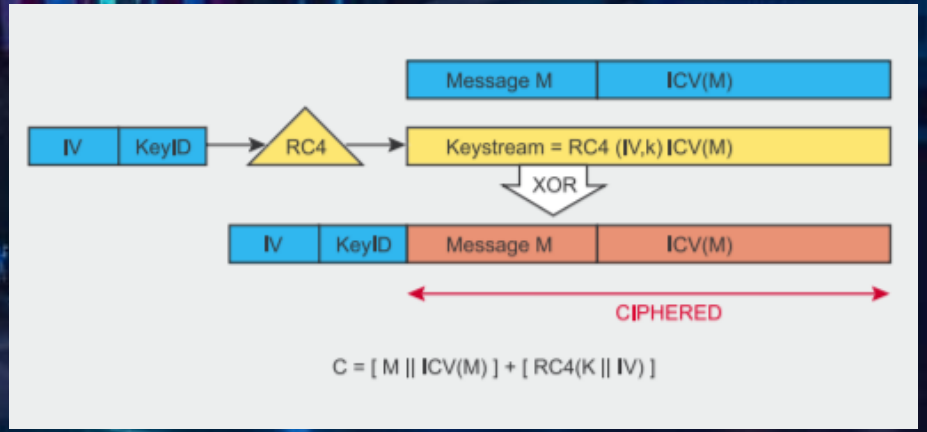
Wi-Fi core mechanism (1/N)

WEP (2/2) - Payload encryption

- Stream cipher RC4
- 40 bits + 24 bits IV = 64-bit WEP key
- C = [M || ICV(M)] ⊕ [RC4(K || IV)]



Basic WEP encryption: RC4 keystream XORed with plaintext



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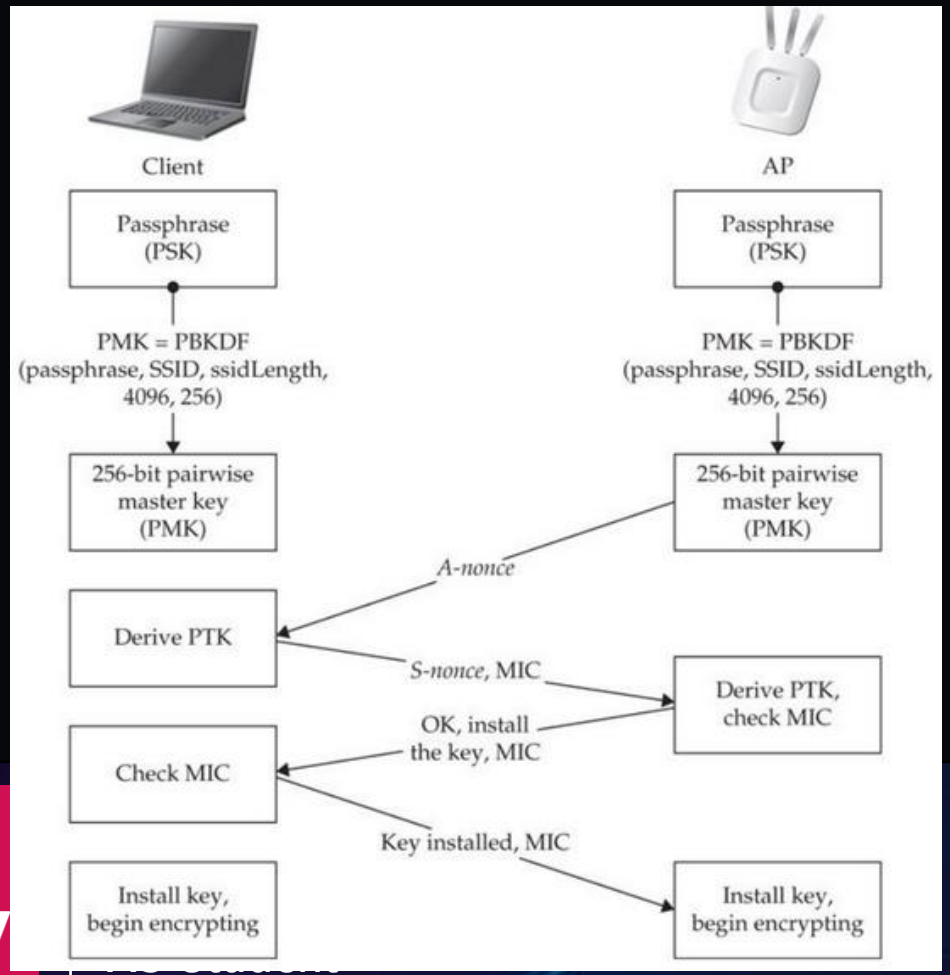
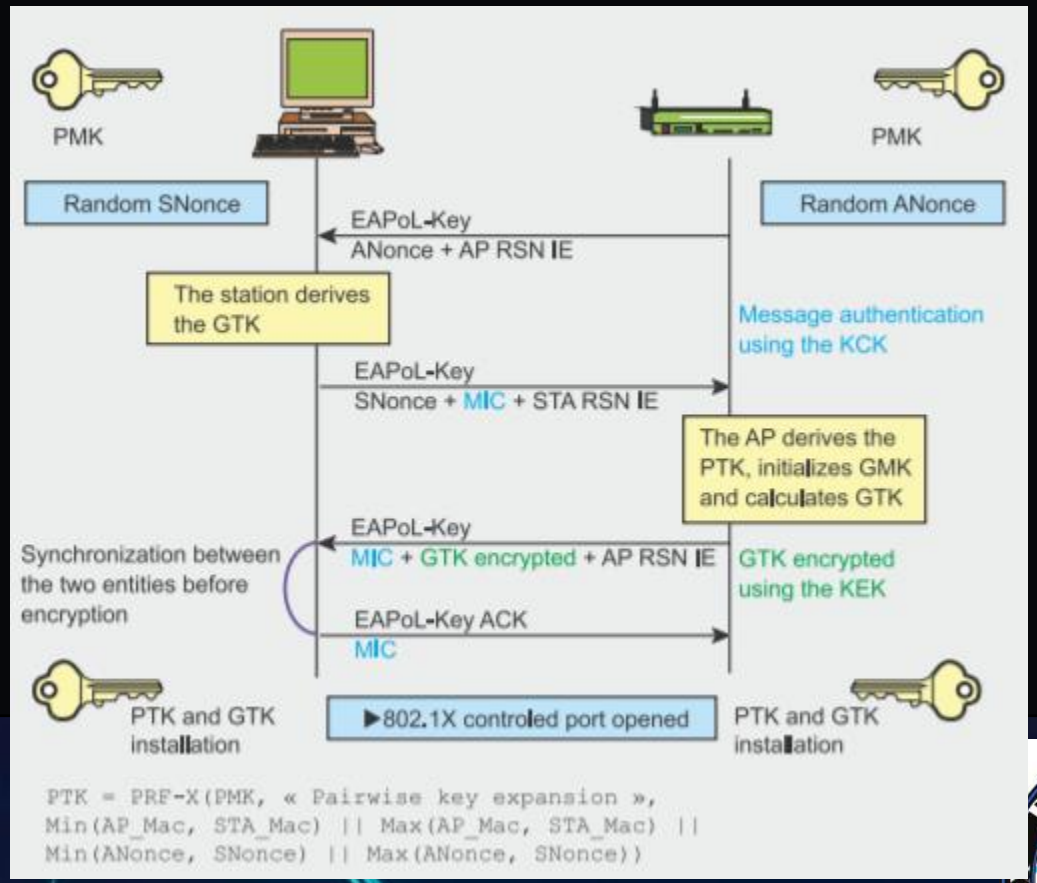
Wi-Fi core mechanism (1/N)

WPA & WPA2 (Wi-Fi Protected Access) - PSK authentication

- PSK (Pre-Shared Key) authentication





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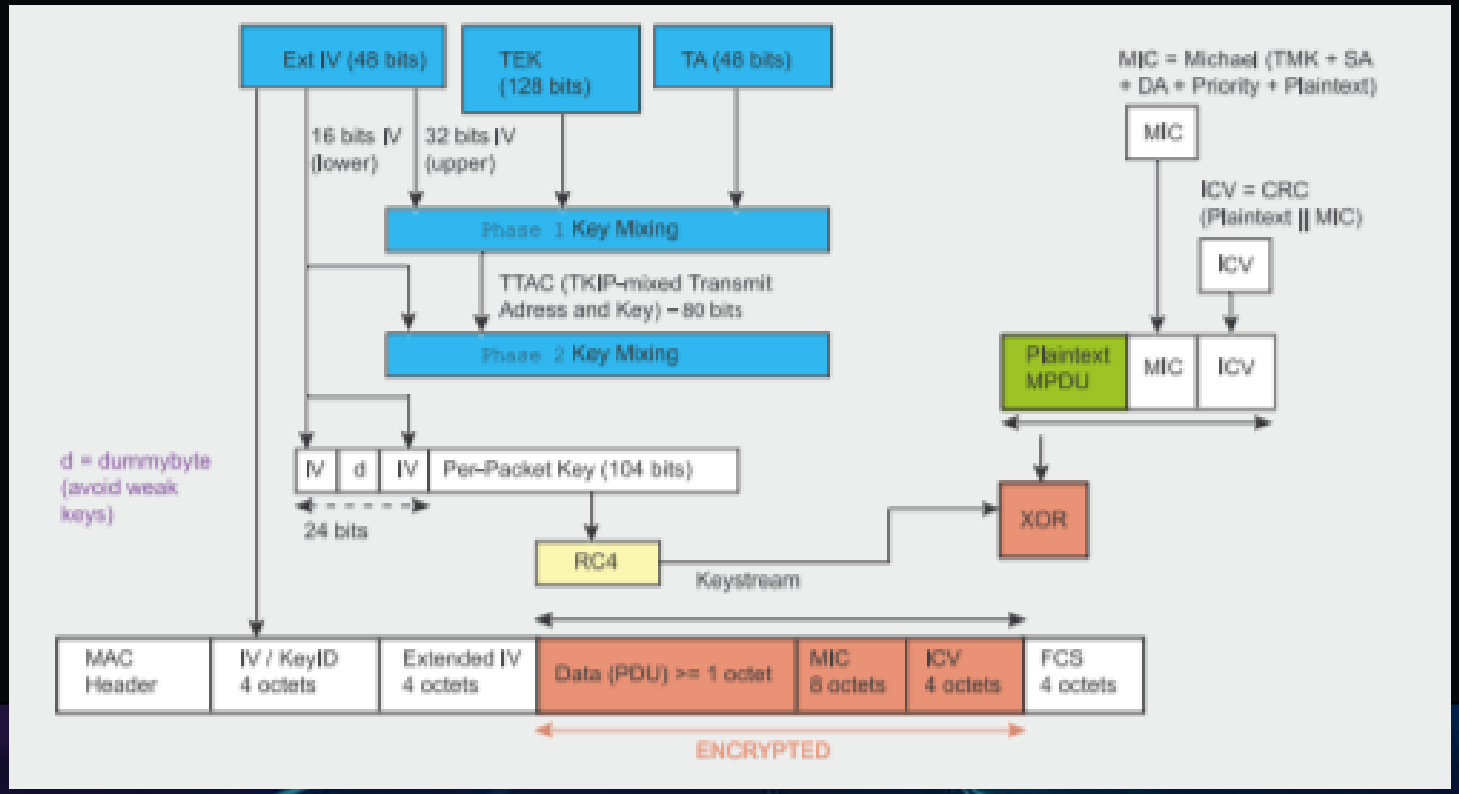
Wi-Fi core mechanism (1/N)

WPA - Payload encryption

- TKIP (Temporal Key Integrity Protocol) encryption



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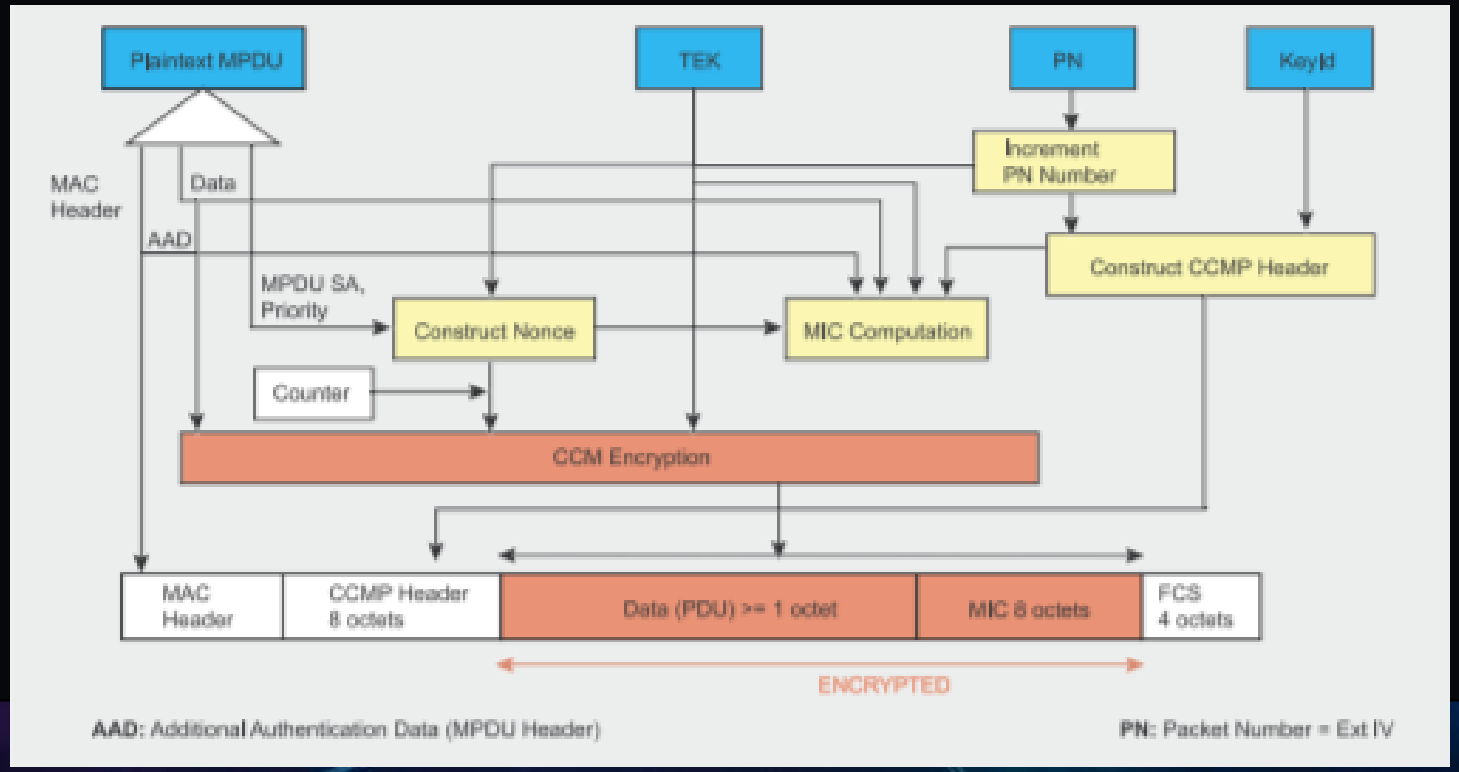
Wi-Fi core mechanism (1/N)

WPA2 - Payload encryption

- CCMP (Counter-Mode/CBC-Mac protocol) encryption



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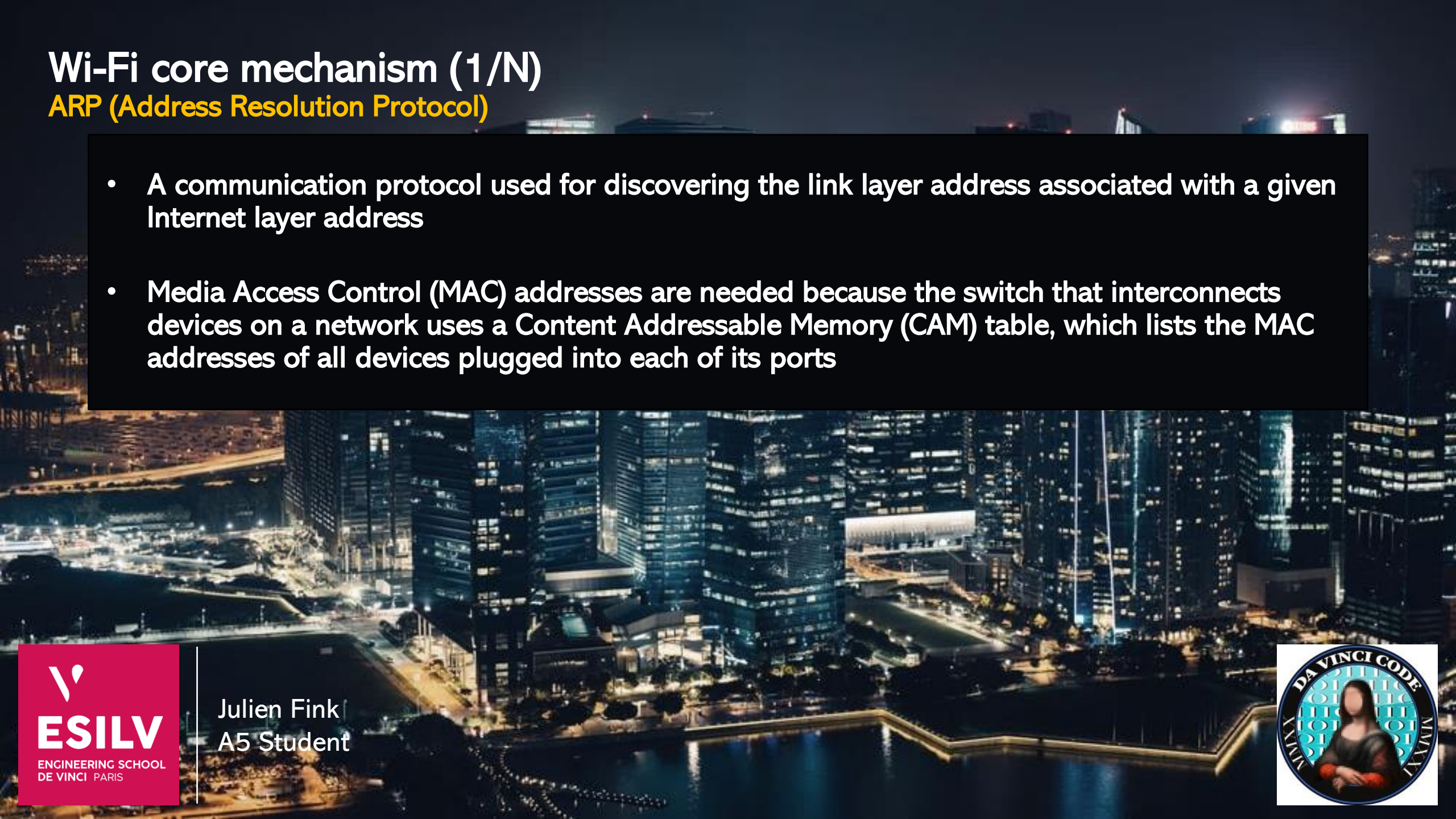
Wi-Fi core mechanism (1/N)

ARP (Address Resolution Protocol)

- A communication protocol used for discovering the link layer address associated with a given Internet layer address
- Media Access Control (MAC) addresses are needed because the switch that interconnects devices on a network uses a Content Addressable Memory (CAM) table, which lists the MAC addresses of all devices plugged into each of its ports



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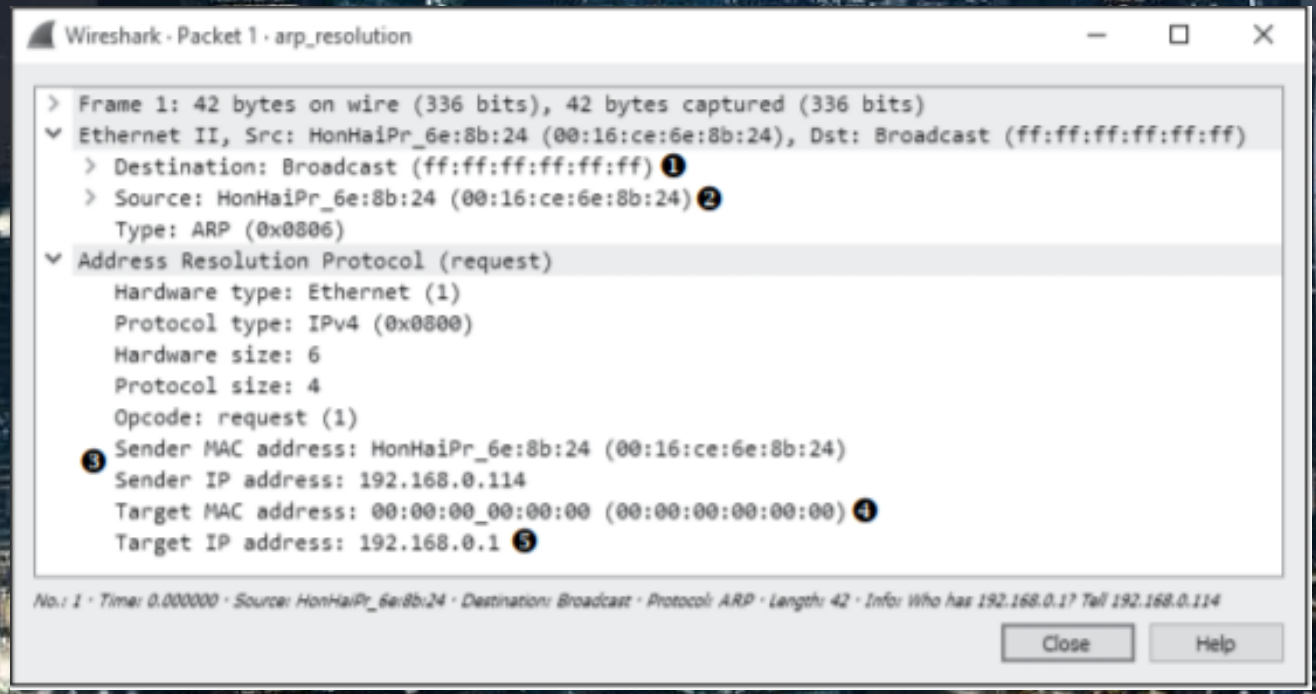
Wi-Fi core mechanism (1/N)

ARP (Address Resolution Protocol) - ARP request



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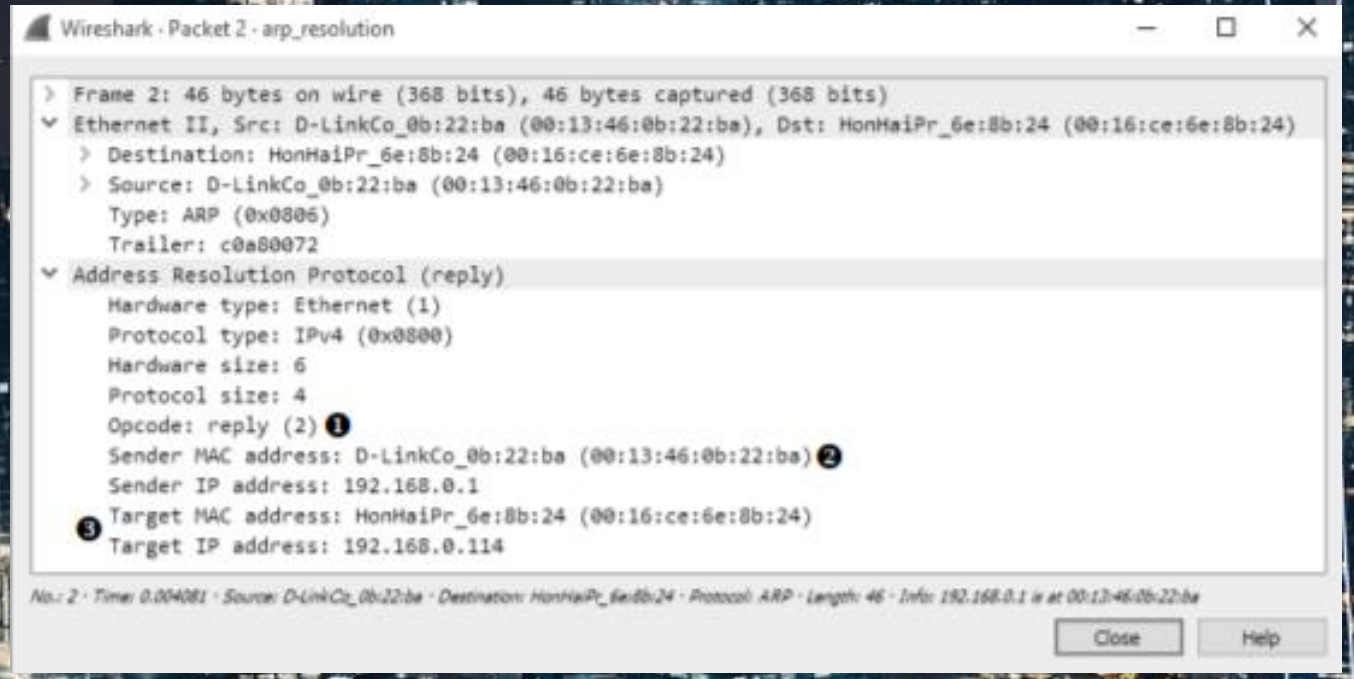
Wi-Fi core mechanism (1/N)

ARP (Address Resolution Protocol) - ARP reply



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Security issues (1/N)

For radio communications in general

- Eavesdropping
- RF Denial of Service (DoS)
- Media Access Control (MAC) address spoofing
- Hijacking
- Man-in-the-Middle attacks
- Encryption Cracking

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Useful links

- https://repository.root-me.org/R%C3%A9seau/EN%20-%20Hacking%20wifi.pdf
- https://github.com/koutto/pi-pwnbox-rogueap/wiki/05.-WPA-WPA2-Personal-(PSK)-Authentication
- http://www.c-jump.com/bcc/common/Talk/WlFIconfig/index.html
- https://cylab.be/blog/32/how-does-wpawpa2-wifi-security-work-and-how-to-crack-it
- https://wifi.pressbooks.com/chapter/securite/

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