ARP, DHCP, WPA

slides
bit.ly/cs161-disc

feedback
bit.ly/bridge-feedback

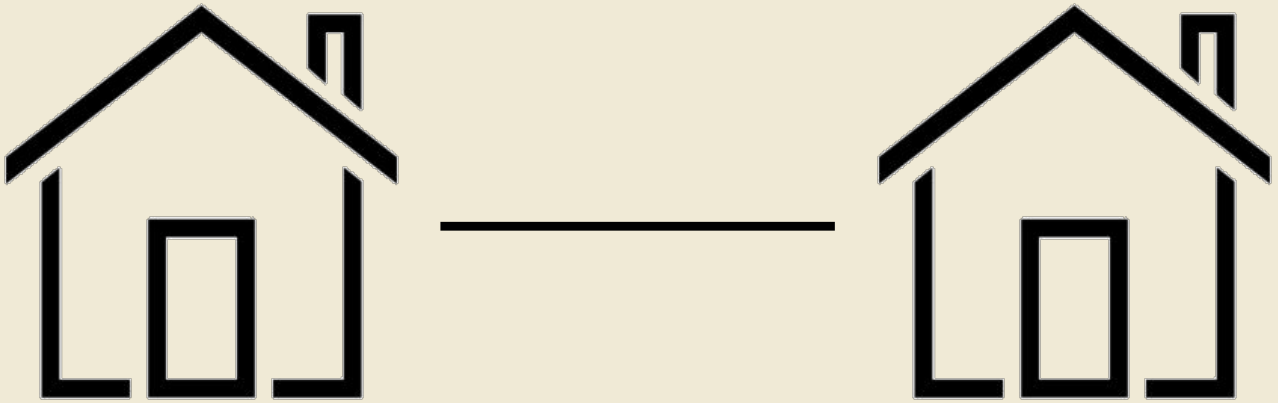
general questions, concerns, etc.

hack of the day

https://krausefx.com/blog/announcing-inappbrowsercom-see-what-javascript-commands-get-executed-in-an-in-app-browser

- in-app browsers track you aggressively!
- try opening inappbrowser.com through Facebook/TikTok/Instagram
- “TikTok iOS subscribes to every keystroke (text inputs) happening on third party websites rendered inside the TikTok app”

building the internet



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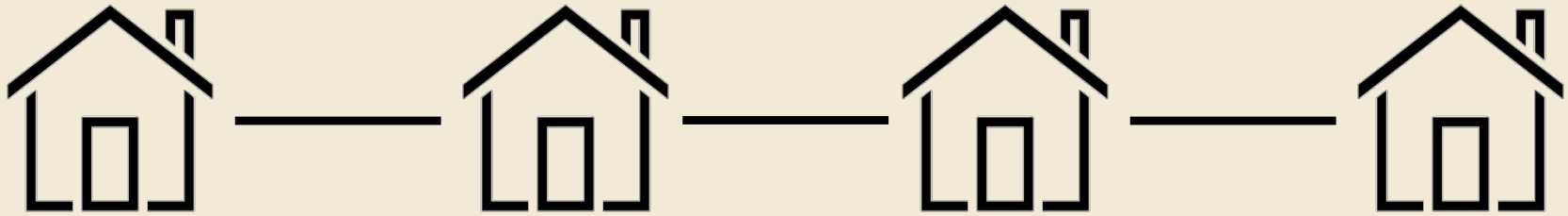

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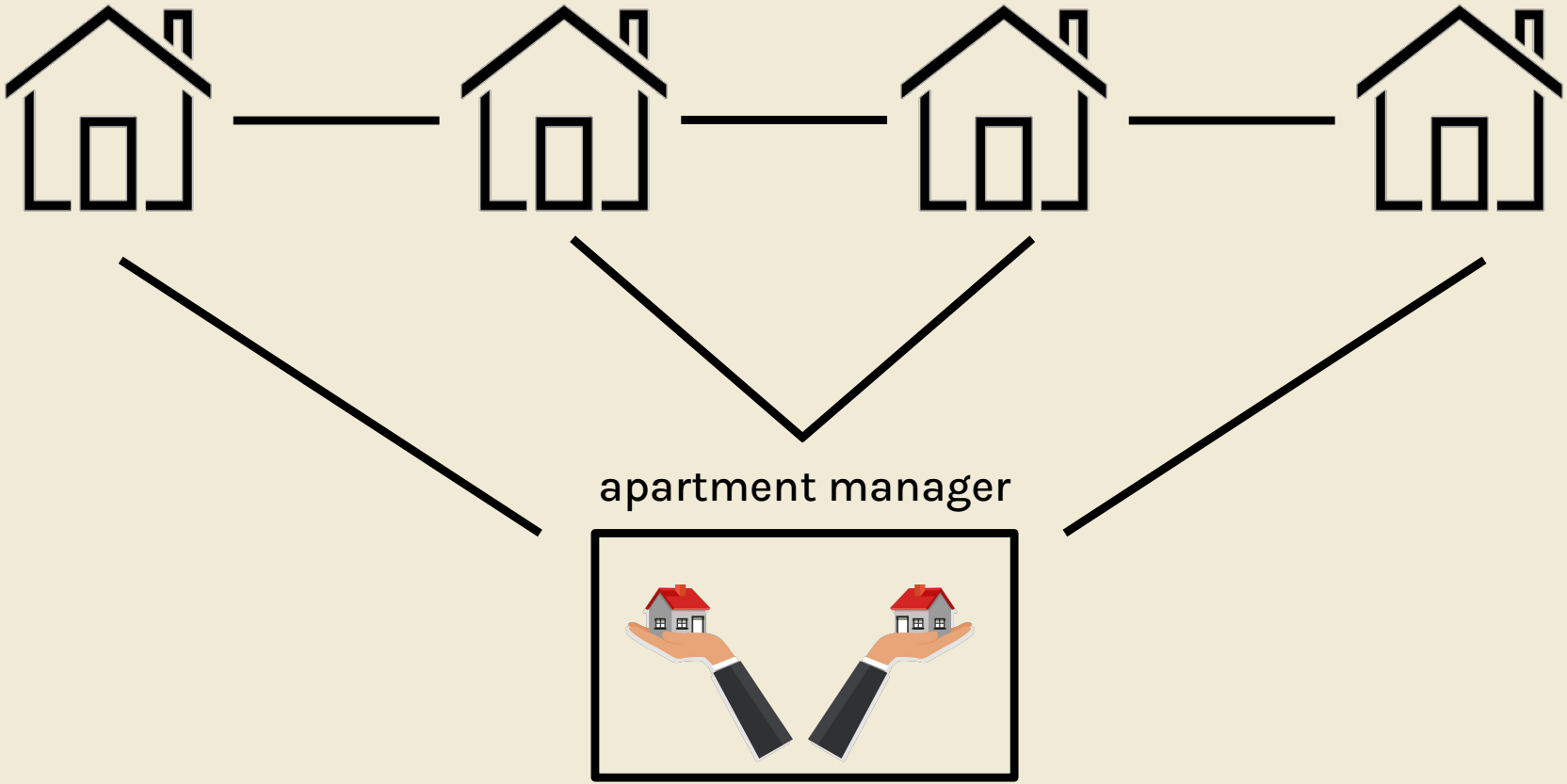

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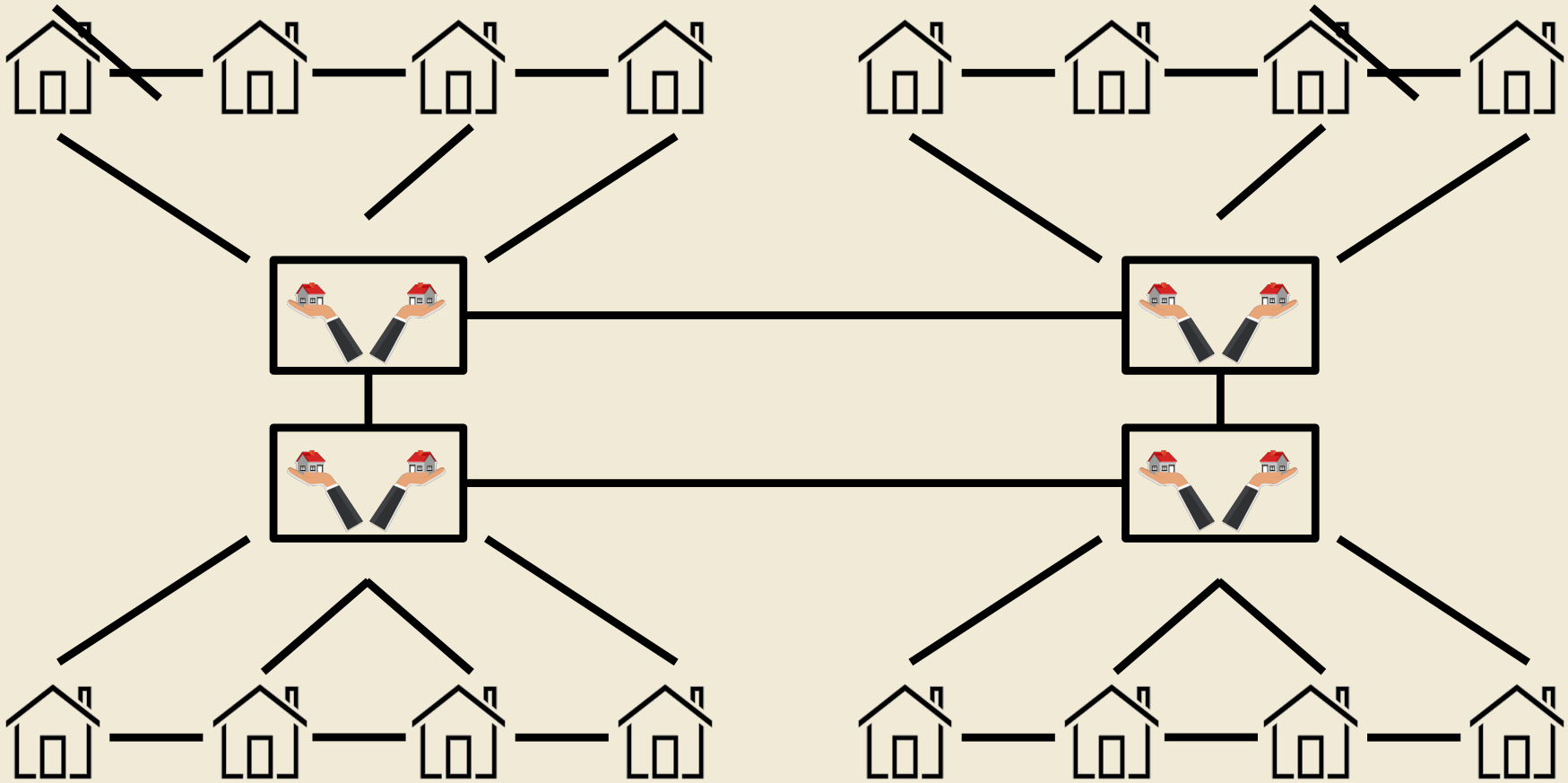
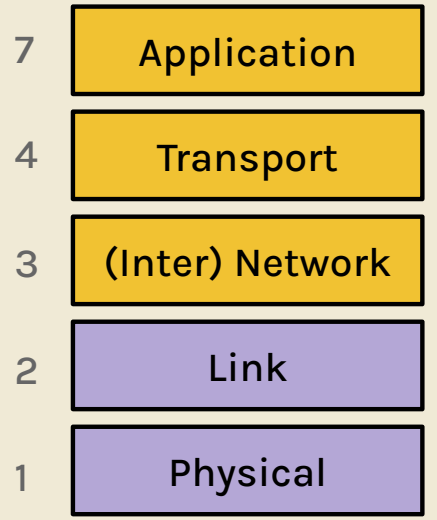


the OSI model



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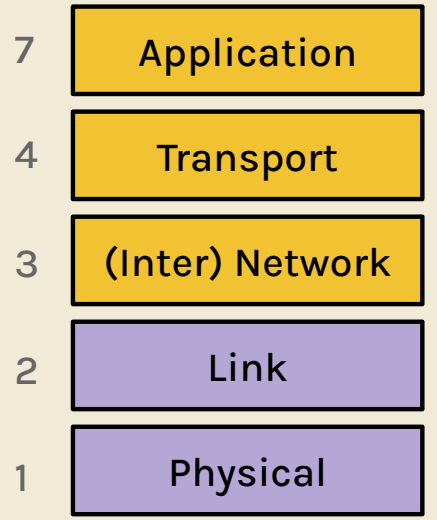

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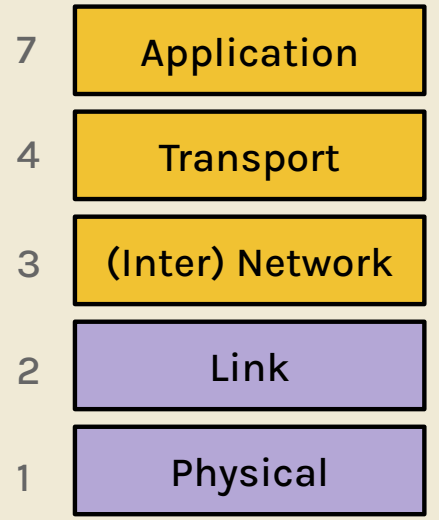

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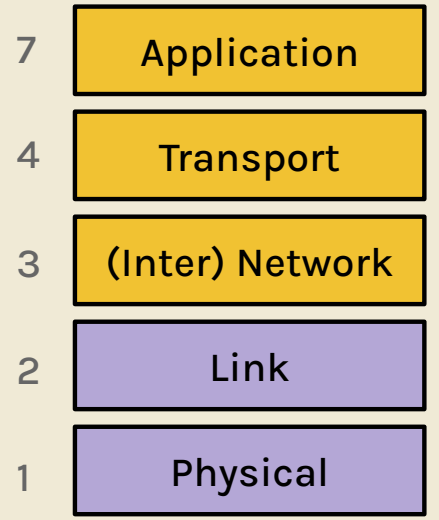

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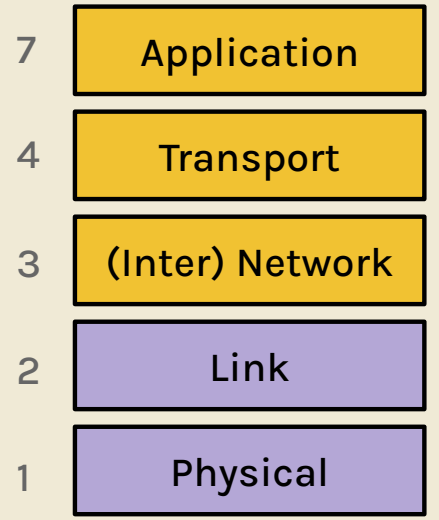

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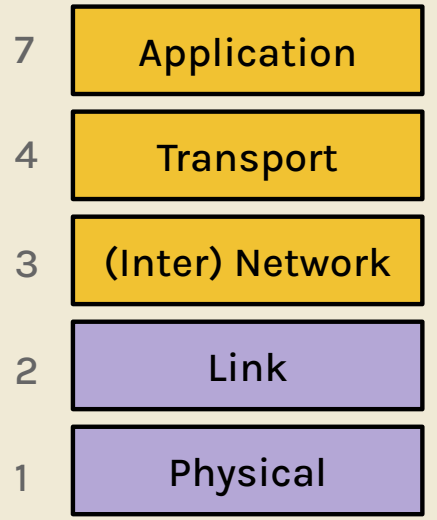

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- layer 7: applications and services (the web)

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- MITM: can see, modify, or drop packets

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  - the IP address of the router (gateway) so the user can contact machines outside the LAN

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4) DHCP: “cool, acknowledged.” — the DHCP server

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worksheet

(on 161 website)

wireless networks

Wi-Fi & WPA-2

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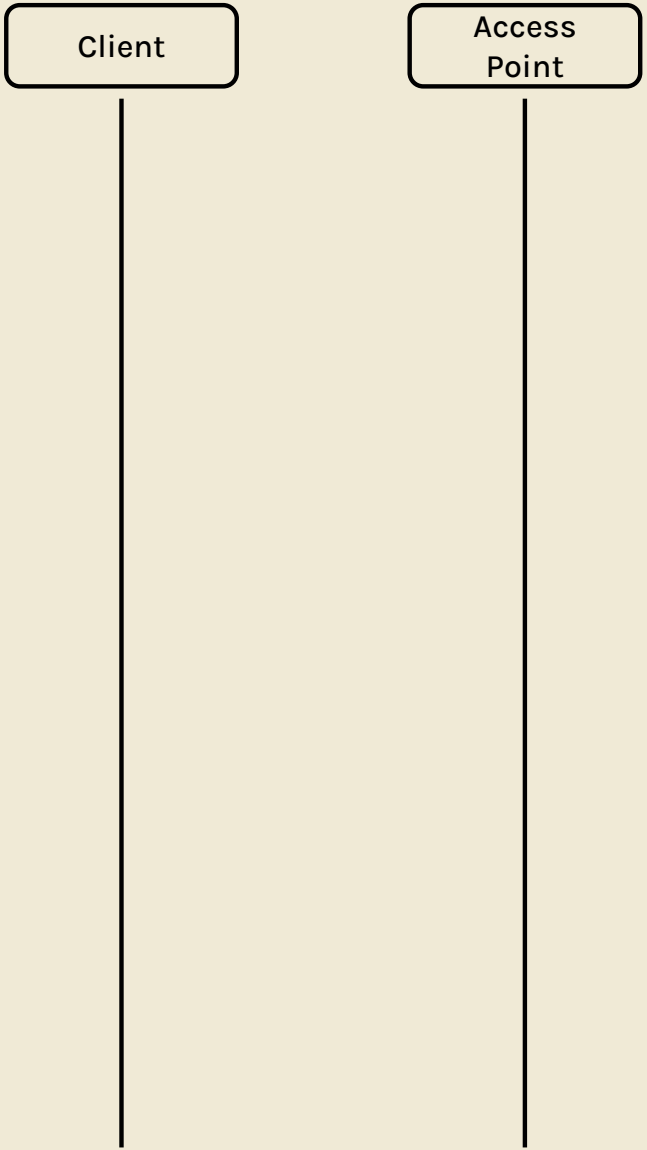
  - everyone with Wi-Fi password can join network
  - message sent over network encrypted
  - attacker without Wi-Fi password can’t learn keys

WPA Handshake



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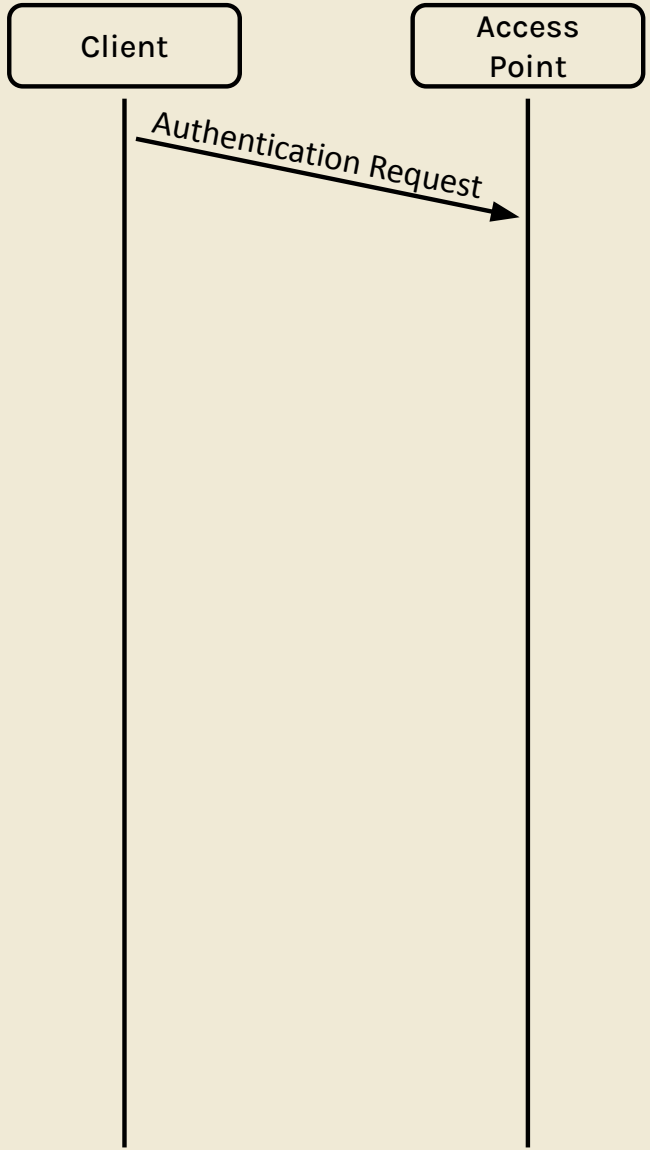

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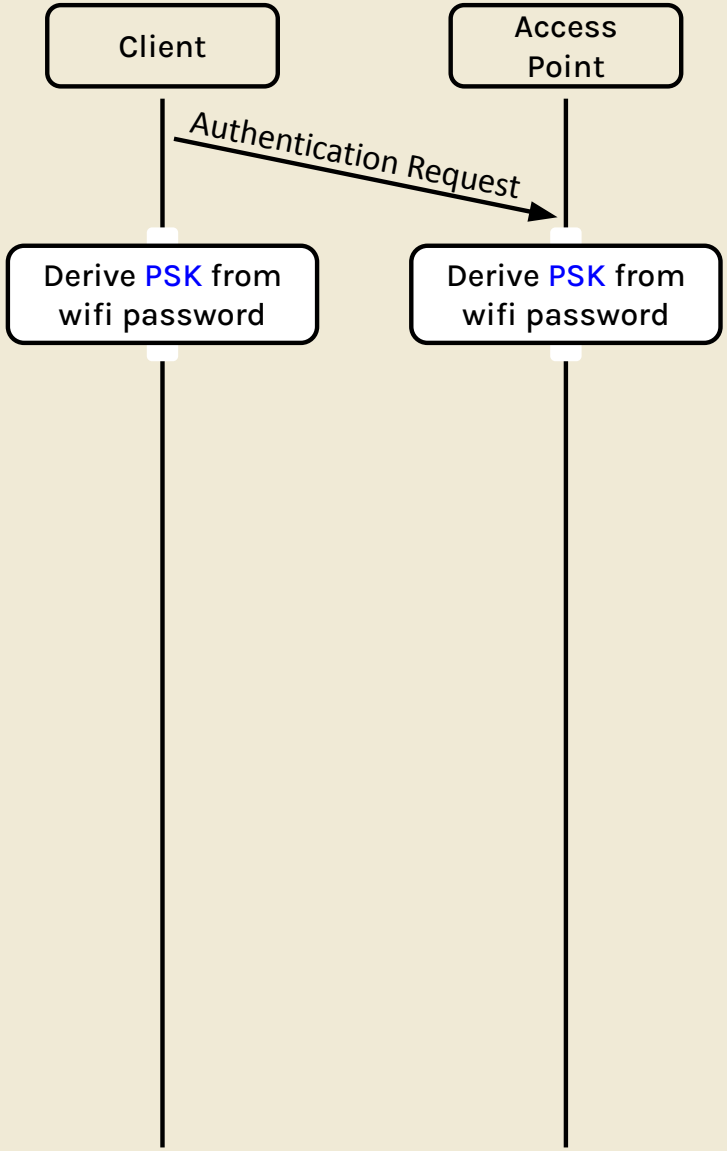

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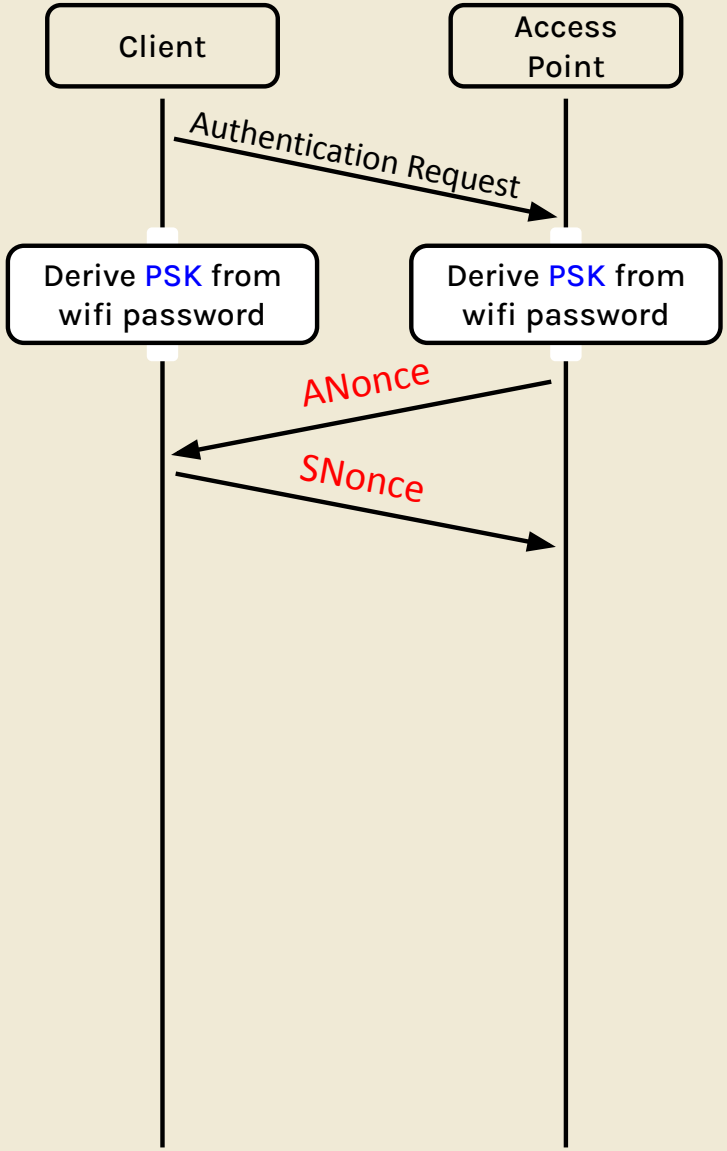

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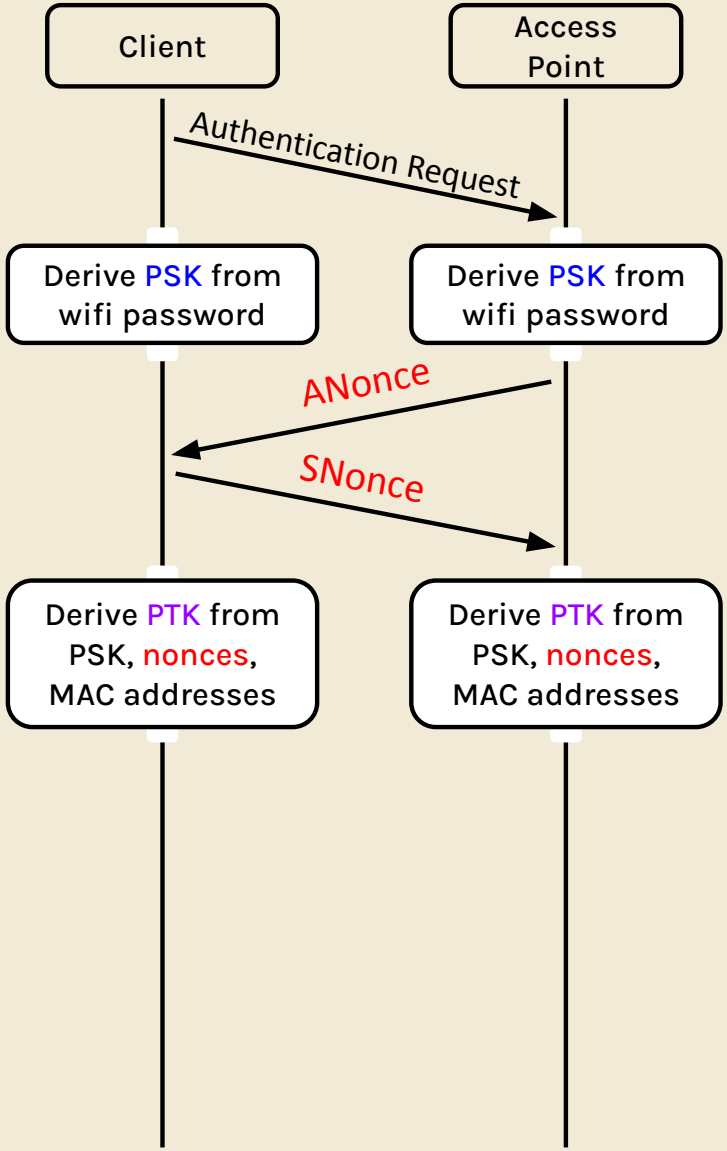

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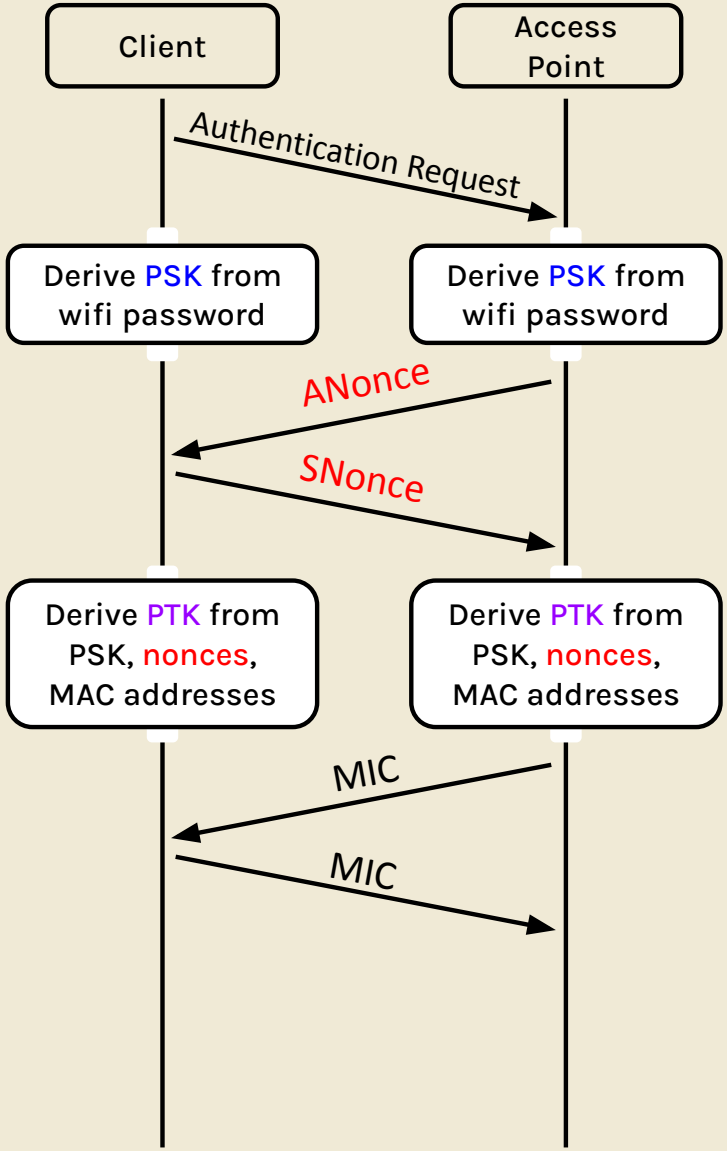

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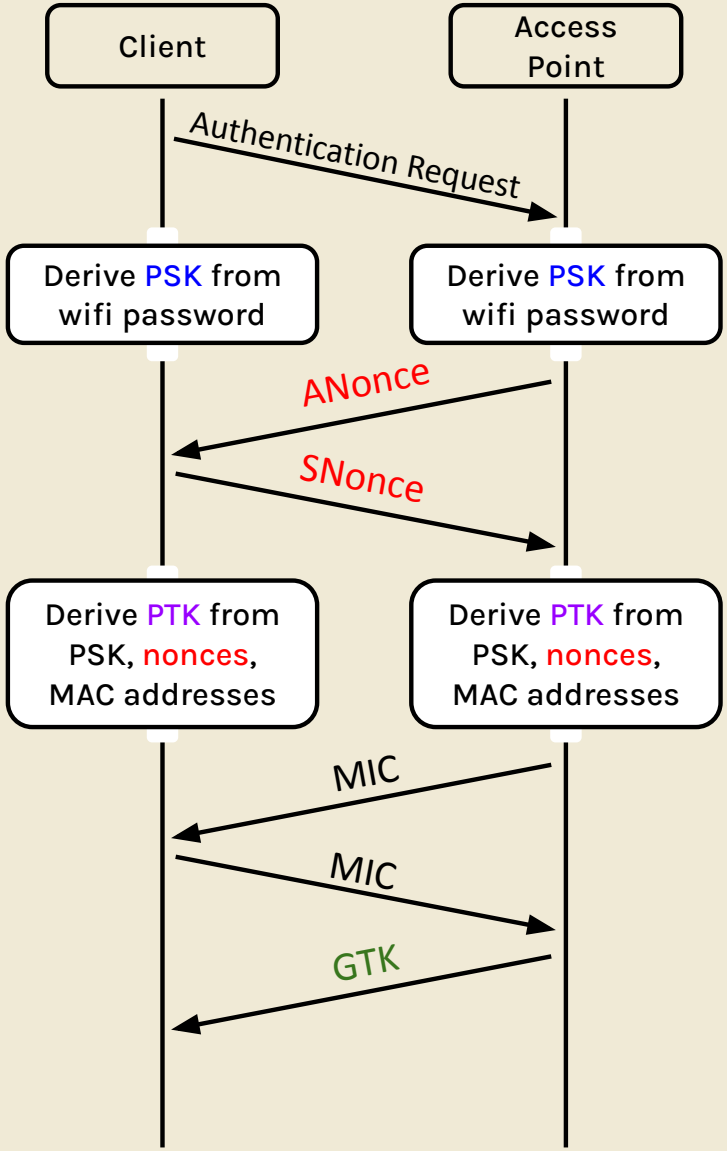

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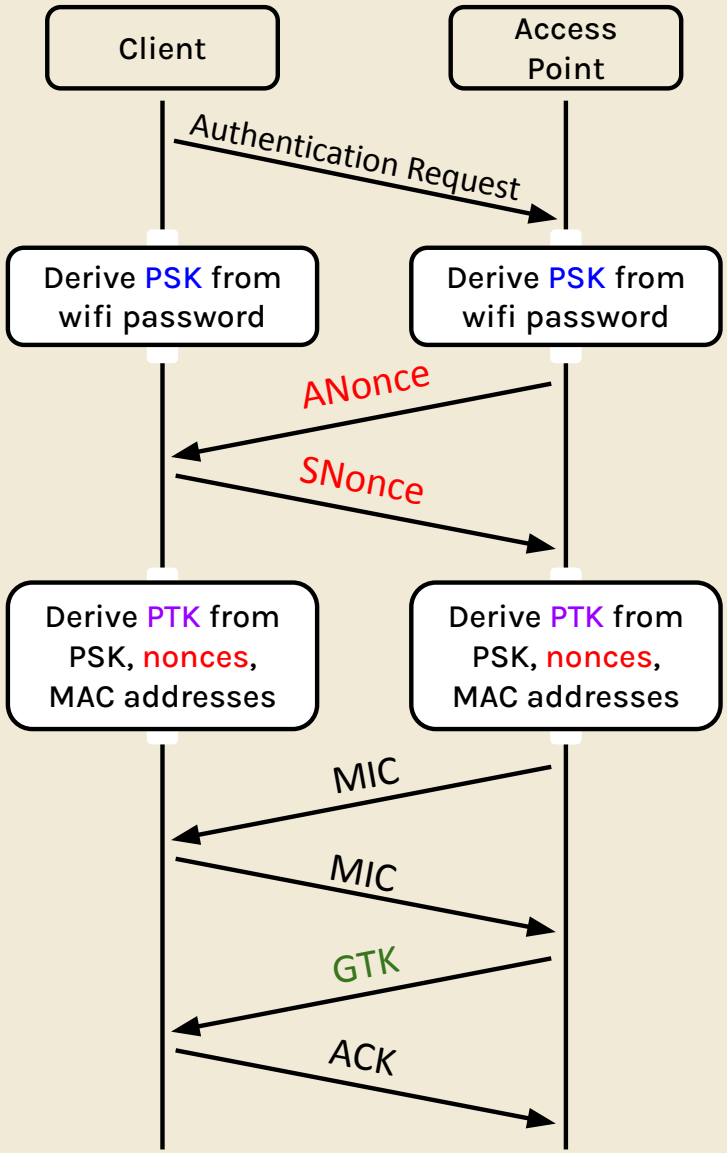

Optimized WPA 4-Way Handshake

1. The client sends an authentication request to the access point
2. Both use the password to derive the *PSK* (pre-shared key)
3. The AP sends *ANonce* to the client
4. The client generates *SNonce*, uses the *PSK*, nonces, and MAC addresses to derive the *PTK* (pairwise transport keys)
5. The client sends *SNonce* and its MIC to the AP
6. The AP uses the *PSK*, nonces, and MAC addresses to derive the *PTK* (pairwise transport keys)
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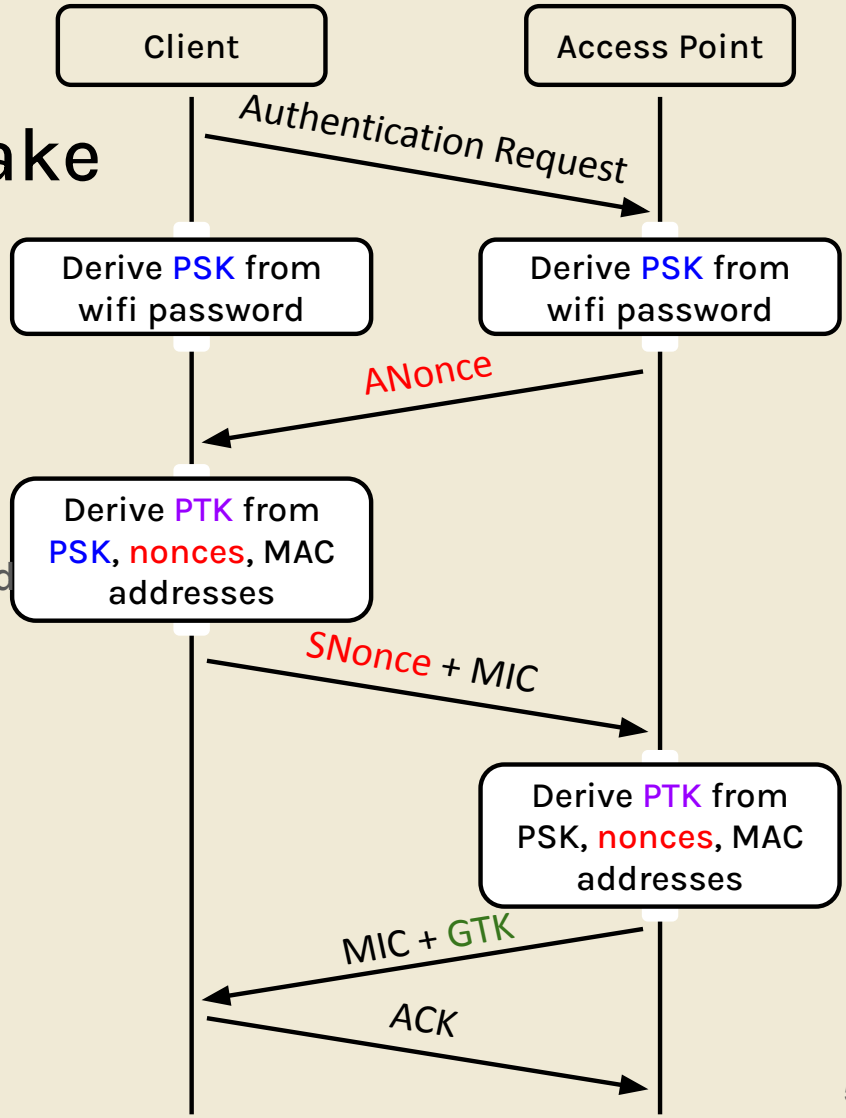

WPA-PSK attacks

- **rogue AP**: pretend to be access point—can be a MITM if attacker knows PSK
- **offline brute-force**: can guess password and check that the derived MIC matches the sent MIC
- **no forward secrecy:** Eve can record ANonce and SNonce and derive PTK if she learns PSK

WPA2-Enterprise

- problem: clients start out with the same PSK to derive PTK
  - solution: each user has their own username + password
- use randomly generated key from authentication server
  1. accept digital certificate
  2. form secure channel to auth server, enter username + password
  3. auth server sends one-time key to client and AP instead of PSK
- continue handshake with above key as PSK

WPA2-Enterprise

- defends against WPA-PSK attacks
- still layer 1, so prone to ARP/DHCP spoofing

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