WiFi Identification & Authentication

[redacted]

Terms and Concepts

- AP - “Access Point”
  - A device capable of accepting client WiFi connections
- SSID - “Service Set Identifier”
  - Human-readable network name (“Brown-Guest”)
- BSSID - “Basic Service Set Identifier”
  - Identifies the AP (usually the device’s MAC address)
- Can be multiple APs serving a single SSID
- Thus, can be multiple BSSIDs per SSID

SSID Issues

- SSIDs are all that identify a network
    - Can’t tell two networks with same SSID apart
- “On iPhone, beware of that AT&T WiFi hot spot”
    - “Rogue AP” problem

SSID Issues

- SSIDs are all that identify a network
  - Can't tell two networks with same SSID apart
- "On iPhone, beware of that AT&T WiFi hot spot"
  - "Rogue AP" problem
- Client devices actively broadcast trying to connect to known SSIDs
  - Sniff these broadcasts, pretend to be the SSID

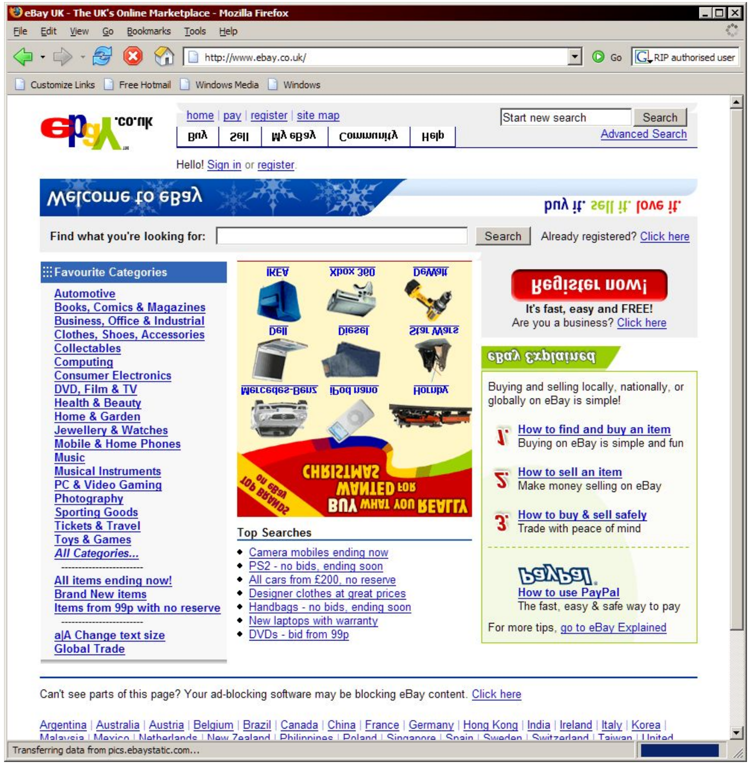
SSID Issues

- What can you do with a rogue AP?

SSID Issues

- What can you do with a rogue AP?
- Sniffing, but you could do that anyway
- Active MitM
  - Fake captive portal (phish credentials)
    - "Phishing in Public WiFi Connections Plagu China's Major Cities"
  - Upside-Down-Ternet

SSID Issues - Upside-Down-Ternet



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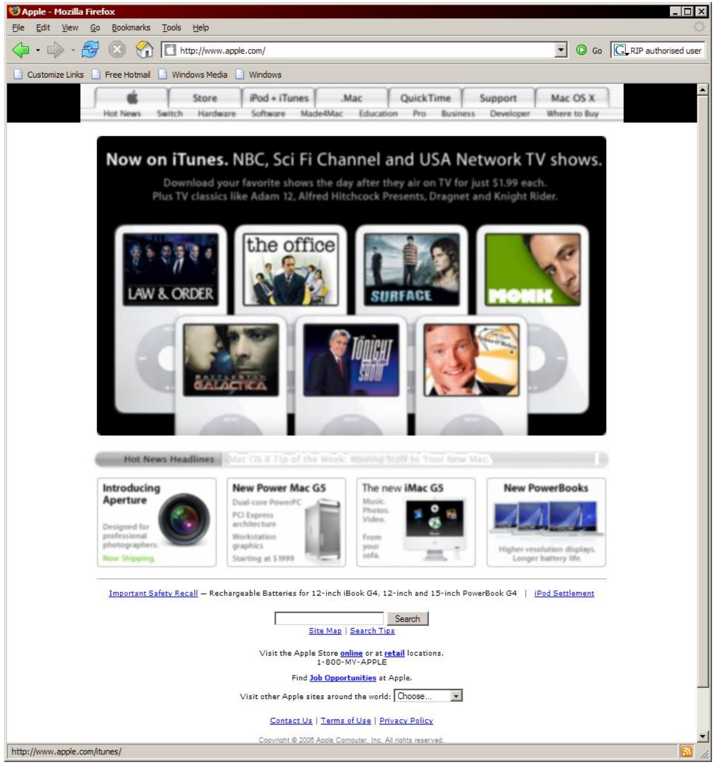
SSID Issues - Upside-Down-Ternet



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SSID Issues - Privacy

- Clients broadcast looking for known SSIDs
- What could we learn?

SSID Issues - Privacy

- Clients broadcast looking for known SSIDs
- What could we learn?
  - Lots, but let's look at location
- Skyhook
  - "No GPS? No problem!"
- Google Street View
  - Joffe v. Google (Google violated the Wiretap Act)
- WiGLE (Wireless Geographic Logging Engine)

Ivy + WEP

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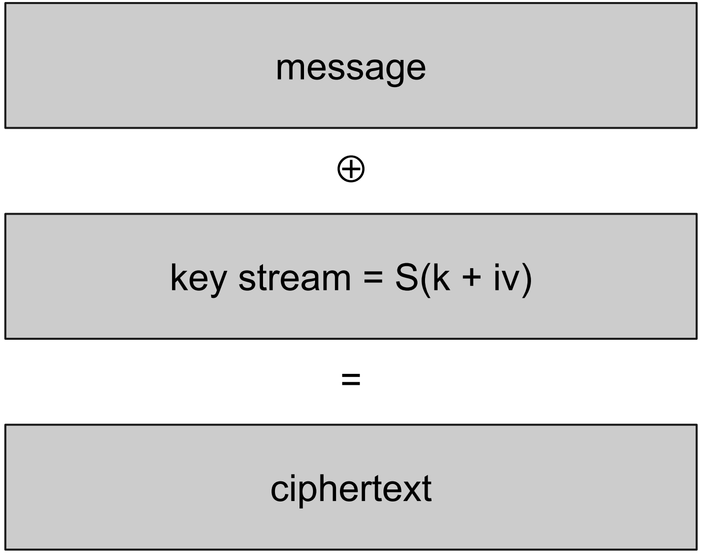
Ivy Problem Recap



message

⊕

key stream = S(k + iv)

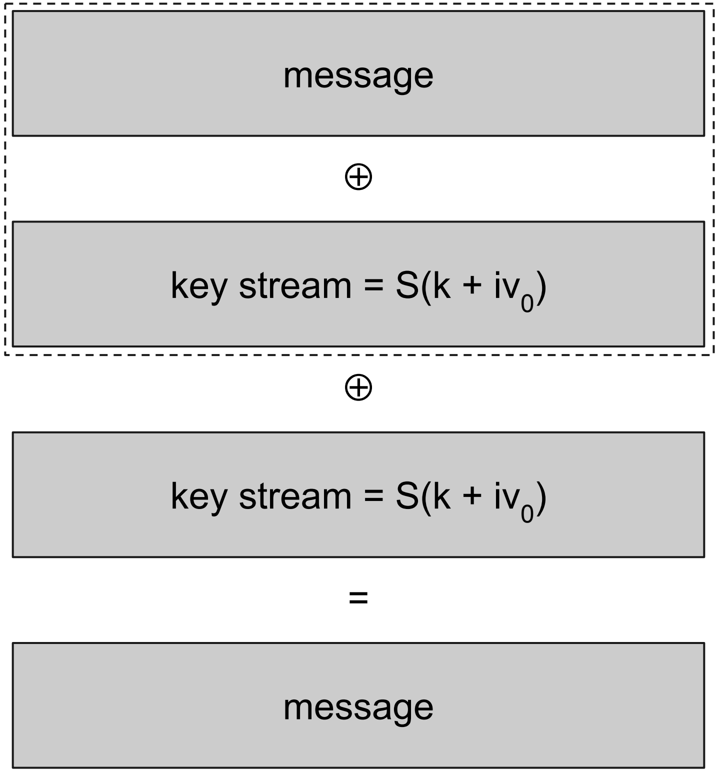
=

ciphertext

Ivy Problem Recap

- Randomly-generated IVs
- Problem: Same IV means same key stream
- Get key streams to cancel

Ivy Problem Recap



message

⊕

key stream = S(k + iv_0)

⊕

key stream = S(k + iv_0)

=

message

WEP

- Very similar to Ivy
- 24-bit IVs
- RC4 PRNG
- RC4 seed = shared secret key + iv

WEP - RC4 Weakness

- Fluhrer, Mantin, and Shamir, 2001
- RC4 has “weak [seeds]” (usually called keys)
- Given ciphertexts, can recover full RC4 seed

- WEP has RC4 seed as *key* + *iv* (*iv* is public)
- Last 24 bits of seed (IV) is enough to know whether the seed will be a weak seed

WEP Attack

- Step 1. Sniff many packets
- Step 2. Filter for IVs that indicate weak seeds
- Step 3. Recover full RC4 seed
    - High-order bits are the shared secret WEP key
- Step 4. Profit

WEP Attack

- Problem: need *many* IVs to find enough weak seeds. For a 104-bit key:
  - 40K IVs = ~50% probability of success
  - 85K IVs = ~95% probability of success
- Might take a while...

WEP Attack

- Solution: injection
- Idea: force network to send more packets

WEP Attack

- Step 1. Capture packets
- Step 2. Wait for an ARP request
  - Always 28 bytes long (WEP preserves plaintext length)
  - Once you have a candidate ARP request, send it to the AP. Does it send an ARP reply?
- Step 3. Replay the ARP request over and over
- Step 4. AP will respond to each with an ARP