Identifying and Responding to Wireless Attacks

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A brief history of wireless security and attacks

- Wired Equivalent Privacy (WEP) was the original security mechanism for 802.11 networks.
- Scott Fluhrer, Itsik Mantin, and Adi Shamir discovered that WEP was flawed in their paper “Weaknesses in the Key Scheduling Algorithm of RC4”

A brief history of wireless security and attacks

- Attacks based on Fluhrer, Mantin, and Shamir's paper have come to be known as "FMS Attacks"
- Shortly after the FMS paper was released tools to automate WEP cracking were developed
  - WEPCrack
  - AirSnort

A brief history of wireless security and attacks

- In response to the weaknesses in WEP new security mechanisms were developed.
  - Cisco developed the Lightweight Extensible Authentication Protocol (LEAP)
  - WiFi Protected Access (WPA) was developed to replace WEP
    - WPA-PSK (Pre-Shared Key)
    - WPA-RADIUS

A brief history of wireless security and attacks

- In March, 2003, Joshua Wright disclosed that LEAP was vulnerable to a dictionary attack
- A short time later Wright released ASLEAP, a tool to automate attacks against LEAP.
- Cisco released EAP-FAST as a replacement for LEAP about a year after Wright's initial disclosure to them.

A brief history of wireless security and attacks

- In November 2003 Robert Moskowitz of ISCA Labs detailed potential problems with WPA when deployed using a Pre-Shared Key in his paper “Weakness in Passphrase Choice in WPA Interface”

A brief history of wireless security and attacks

- In November 2004 Joshua Wright released CoWPAtty.
- CoWPAtty automated the dictionary attack process against WPA-PSK networks.

A brief history of wireless security and attacks

- Despite excessive cries to the contrary, WEP was still relatively safe to use in some environments.
- Cracking a WEP key was so time consuming that it was often not feasible.
- Regular rotation of WEP keys could render FMS attacks ineffective on most networks.

A brief history of wireless security and attacks

- After the release of the FMS paper, h1kari of Dachboden Labs released a paper detailing ways to more effectively crack WEP.
- In 2004 new tools based on a Chopping attack were released

A brief history of wireless security and attacks

- Chopping attacks take a WEP packet and “chop” off the last byte.
- This breaks the CRC/ICV.
- If the last byte was 0, xor last the last 4 bytes with a certain value to make a valid CRC.
- Retransmit the packet.

A brief history of wireless security and attacks

- This attack methodology significantly reduced the amount of time required to crack WEP keys.
- Made a largely theoretical attack (FMS) realistic
- Tools
  - Aircrack
  - weplab

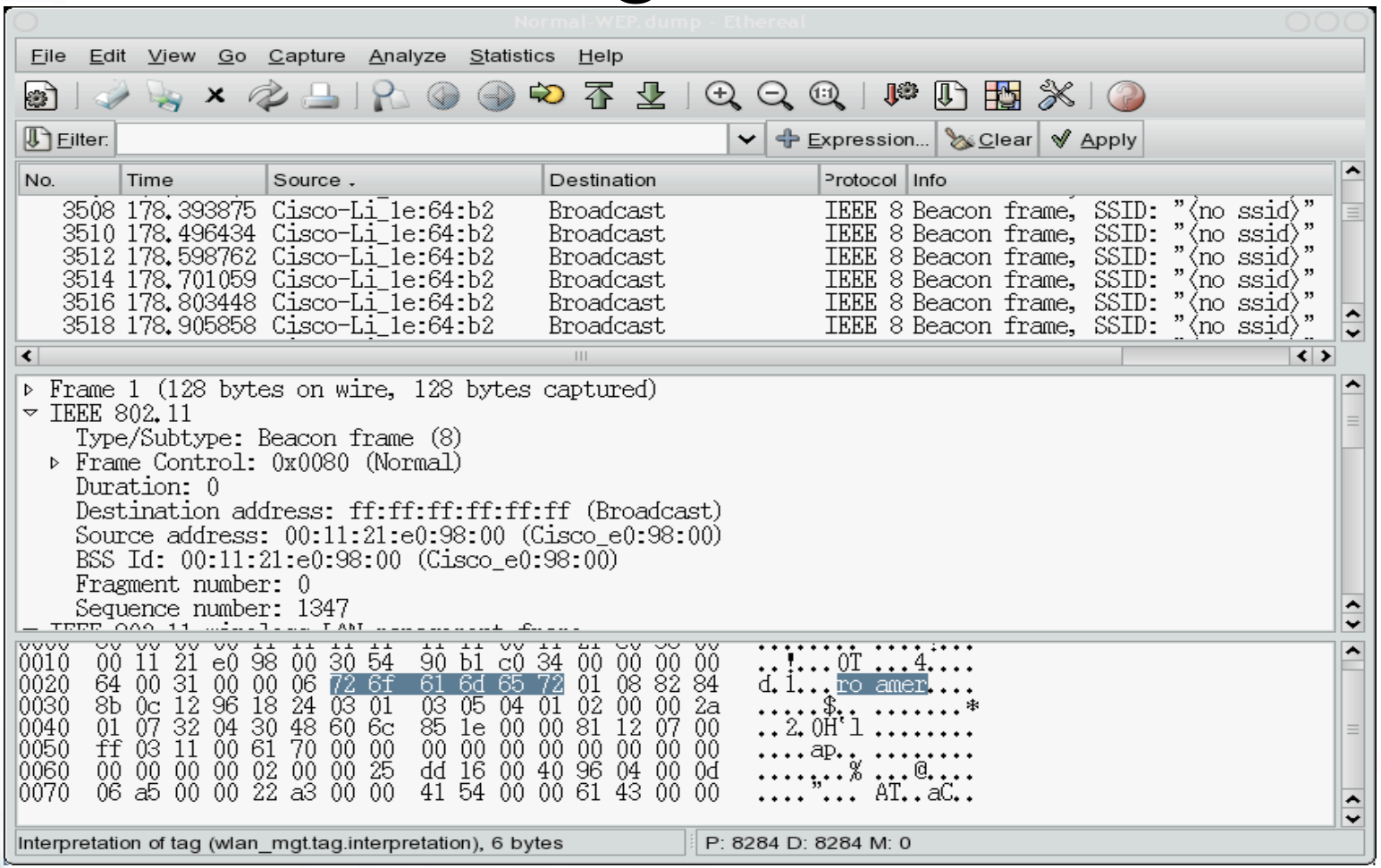
A brief history of wireless security and attacks

- Where are we now?
  - Can wireless networks be deployed in a corporate environment securely?
  - Is wireless intrusion detection viable?
  - Can attacks against wireless networks be observed and reacted to in real time?

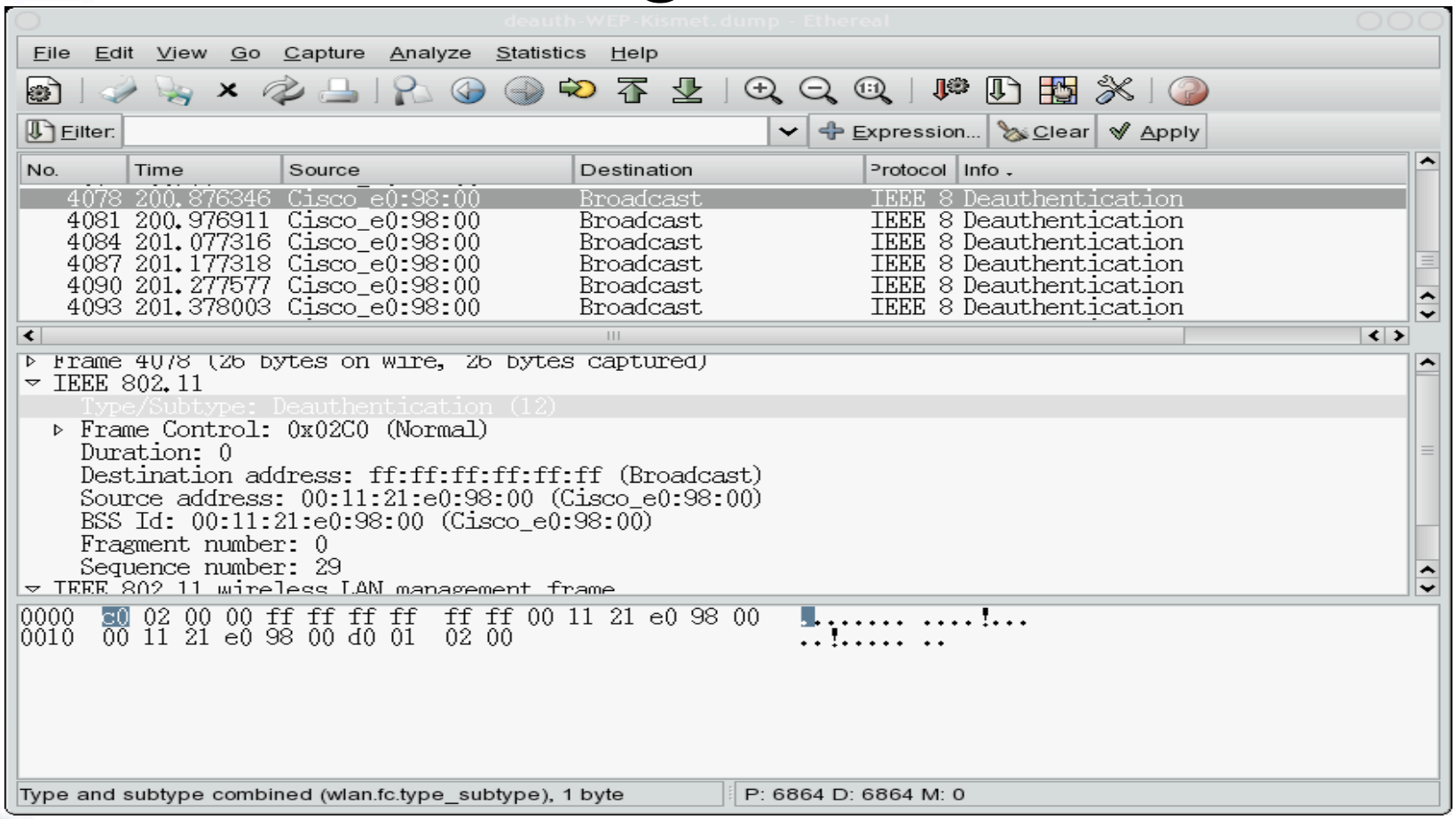
Attacks Against WEP

- Even with chopping attacks, a large number of packets still need to be captured by an attacker
- The easiest way to do this is by reinjecting packets back into the network to generate unique initialization vectors.

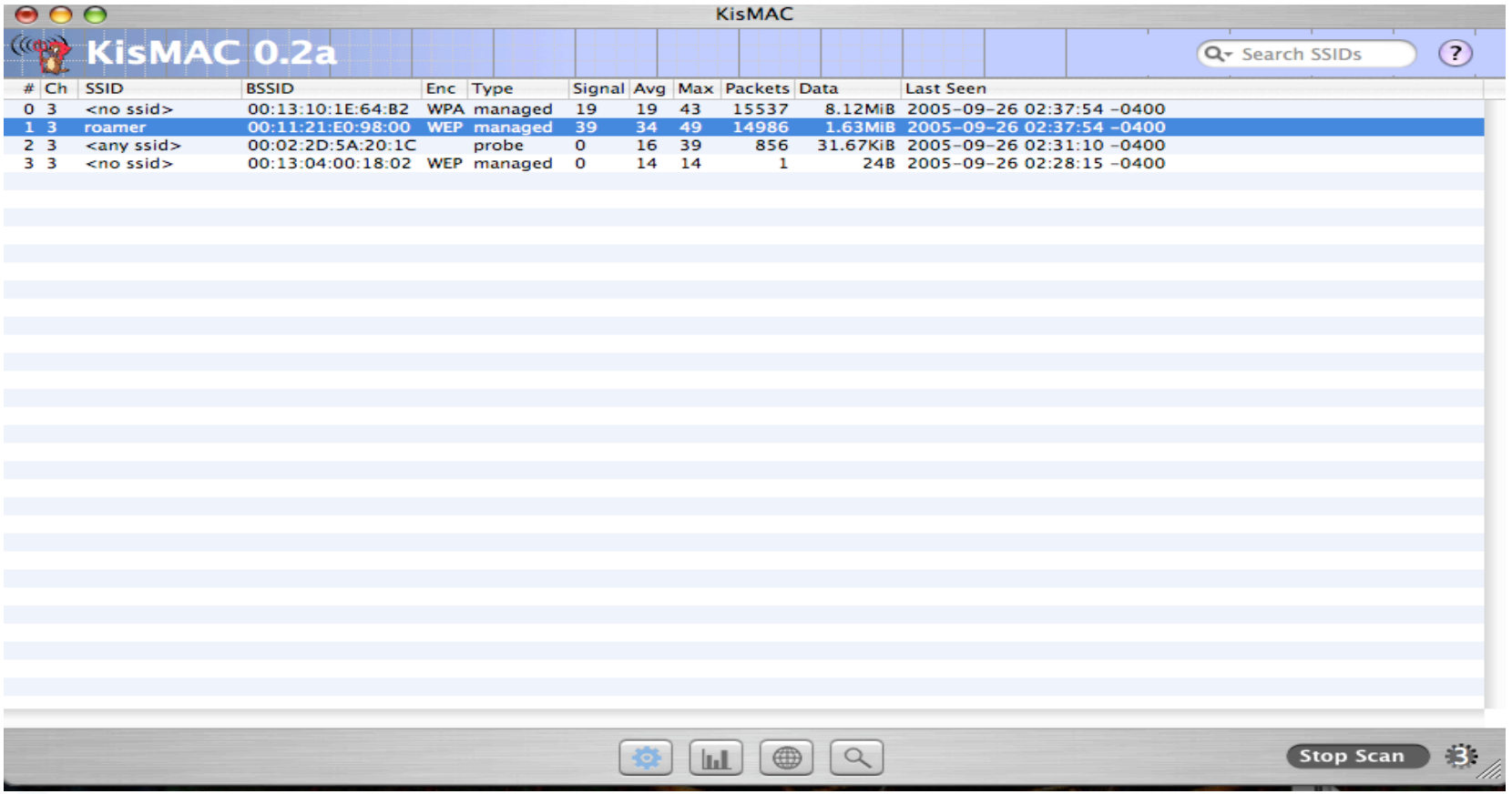
Attacks Against WEP



Attacks Against WEP

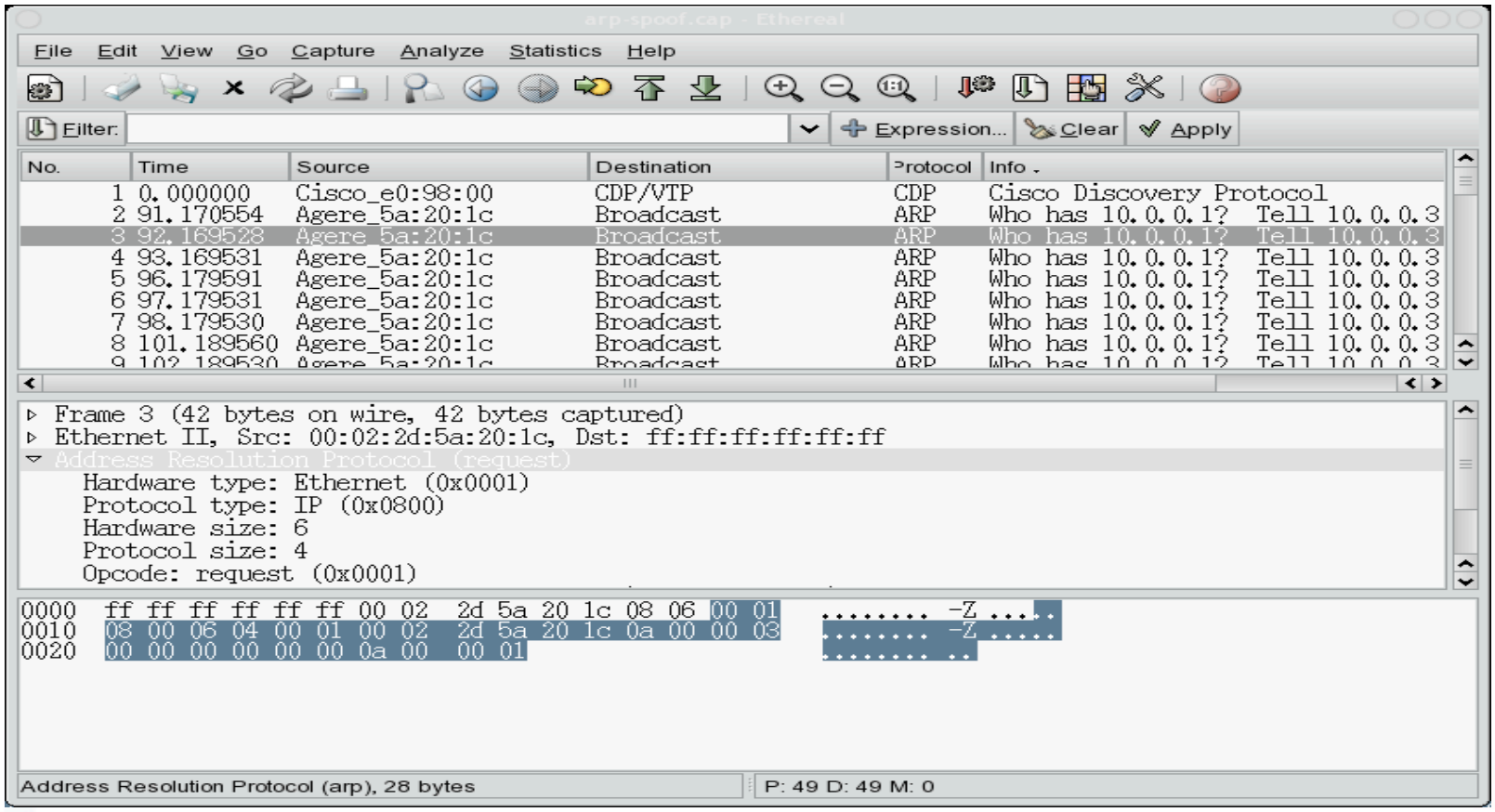


Attacks Against WEP



#	Ch	SSID	BSSID	Enc	Type	Signal	Avg	Max	Packets	Data	Last Seen
0	3	<no ssid>	00:13:10:1E:64:B2	WPA	managed	19	19	43	15537	8.12MiB	2005-09-26 02:37:54 -0400
1	3	roamer	00:11:21:E0:98:00	WEP	managed	39	34	49	14986	1.63MiB	2005-09-26 02:37:54 -0400
2	3	<any ssid>	00:02:2D:5A:20:1C		probe	0	16	39	856	31.67KiB	2005-09-26 02:31:10 -0400
3	3	<no ssid>	00:13:04:00:18:02	WEP	managed	0	14	14	1	24B	2005-09-26 02:28:15 -0400

Attacks Against WEP



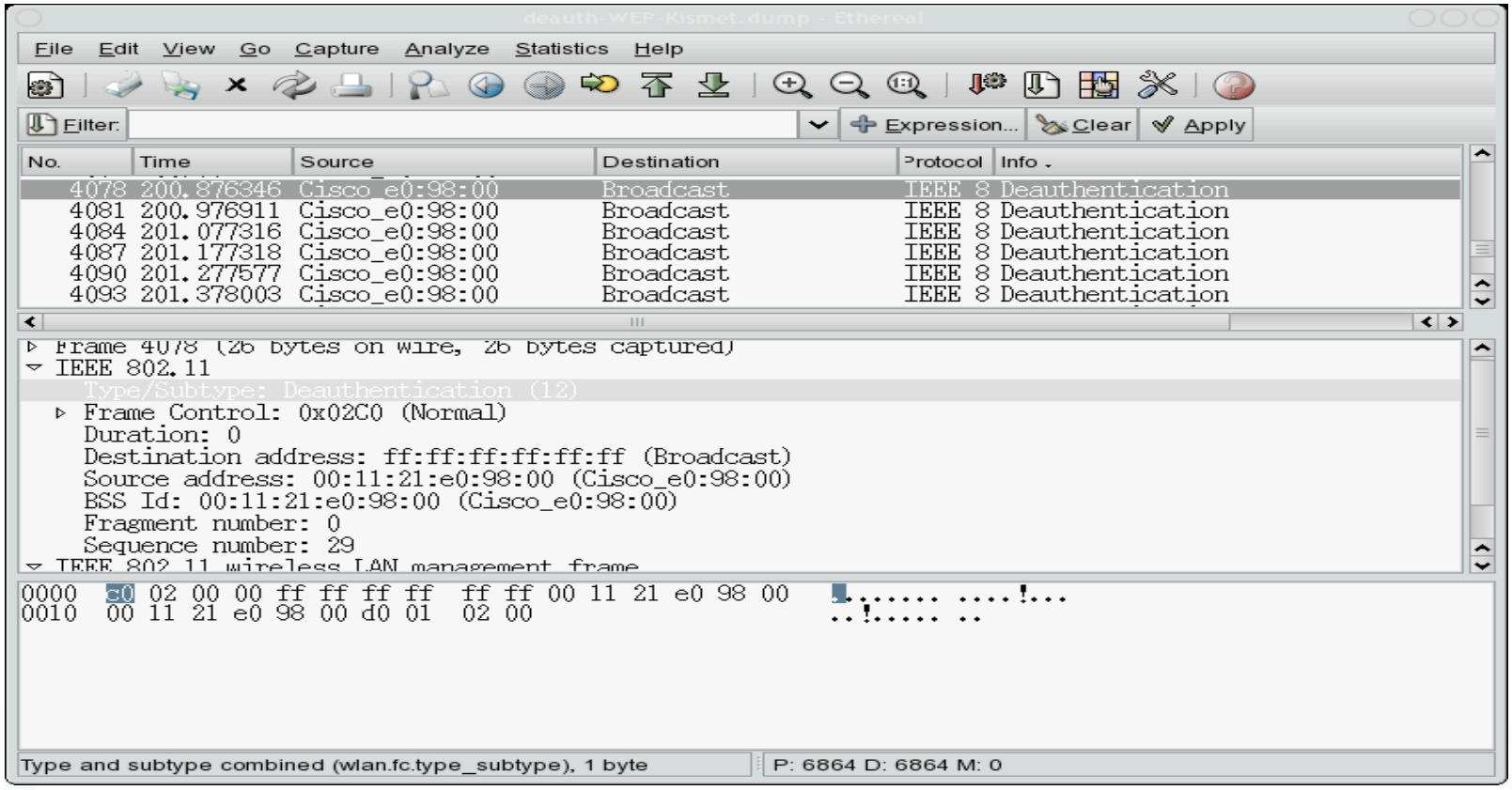
Responding to Attacks Against WEP

- An attack against WEP is in progress
  - Deauthentication block
  - ARP Injection block
    - ARP Injection is easy to identify
    - Understand the approximate number of ‘normal’ ARP packets seen on your network
  - Rotate WEP keys
  - LAST RESORT: Shut down the WLAN

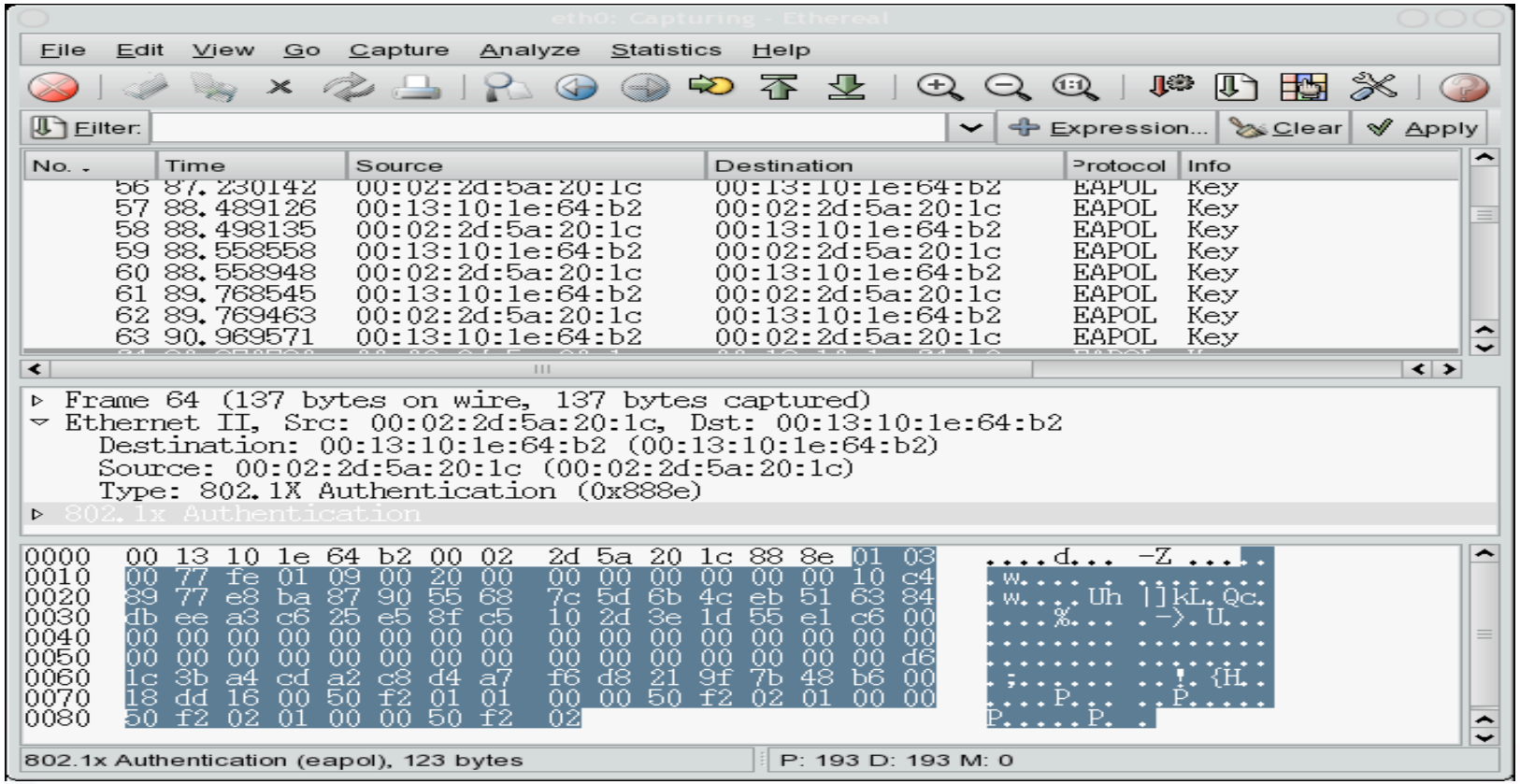
Attacks Against WPA

- WPA Pre Shared Keys with passphrases shorter than 21 characters are vulnerable to dictionary attacks
- This is an offline attack and not as easy to identify in real time as attacks against WEP

Attacks Against WPA



Attacks Against WPA



Responding to Attacks Against WPA

- Unlike WEP attacks by the time you can take action, it is likely too late
- If your WPA passphrase is more than 21 characters, no action is necessary
- If it is shorter than 21 characters, immediately change to a passphrase longer than 21 characters
- Use WPA with RADIUS or some other form of secondary authentication. Preferably two factor authentication

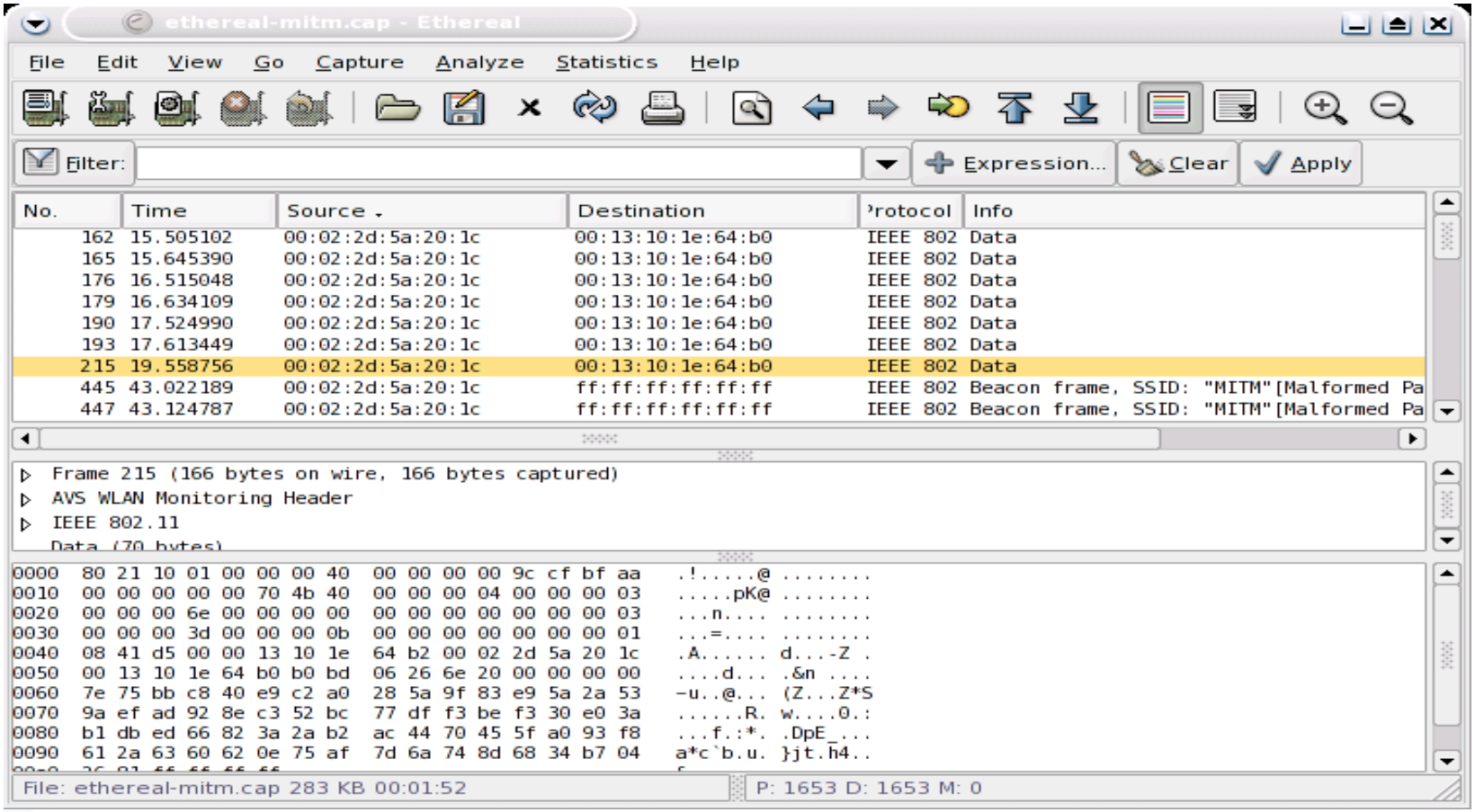
Man in the Middle Attacks

- Attempt to have clients authenticate to an access point that is not a legitimate AP.
- Capture cleartext traffic to glean usernames, passwords, and other sensitive information

Man in the Middle Attacks

- Client based MITM attack
  - Use a client card configured in HOSTAP mode to act as an access point
  - Use a client card configured in HOSTAP mode to spoof a legitimate access point
- Access Point based MITM attack
  - Use an access point with custom firmware to spoof a legitimate access point

Man in the Middle Attacks



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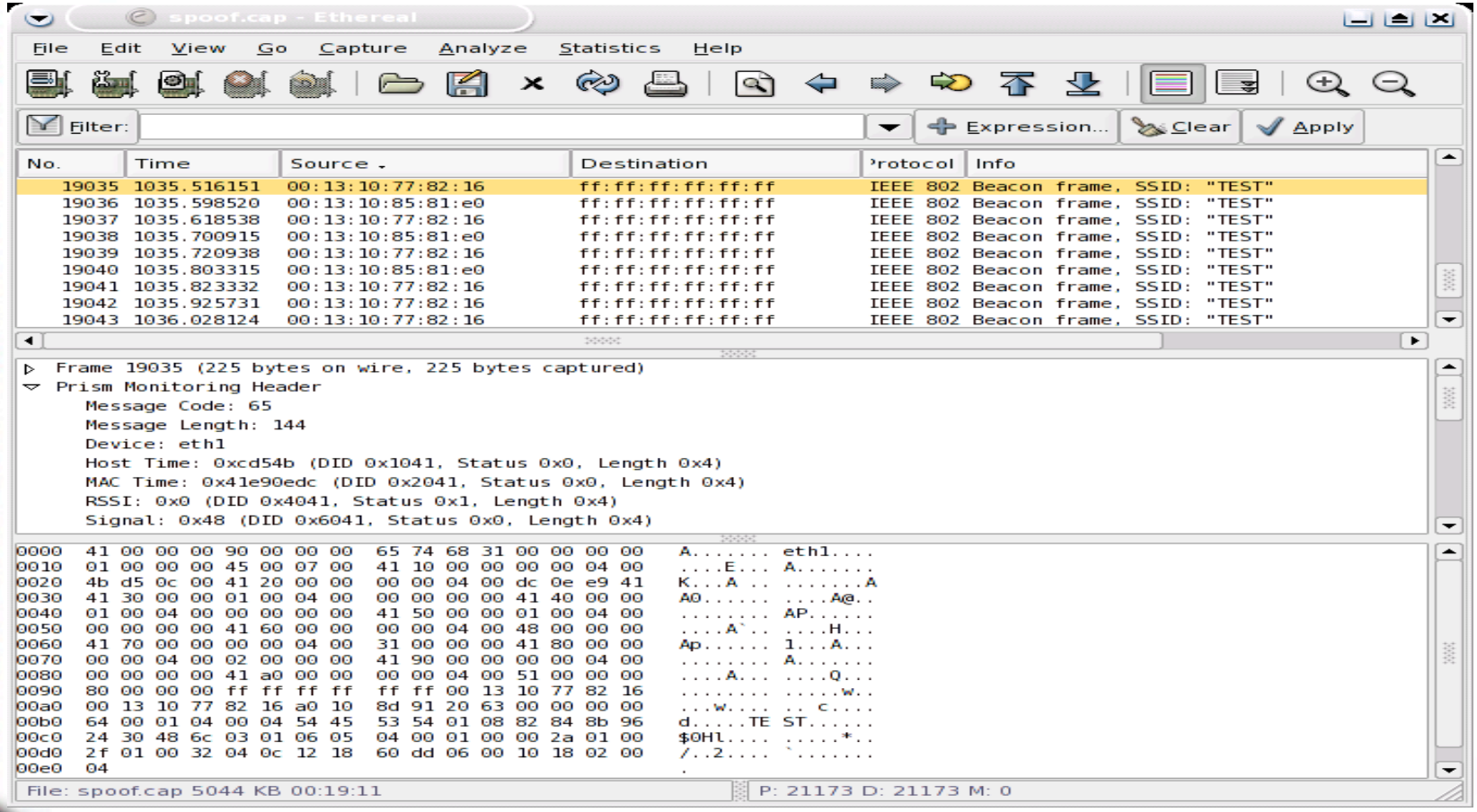

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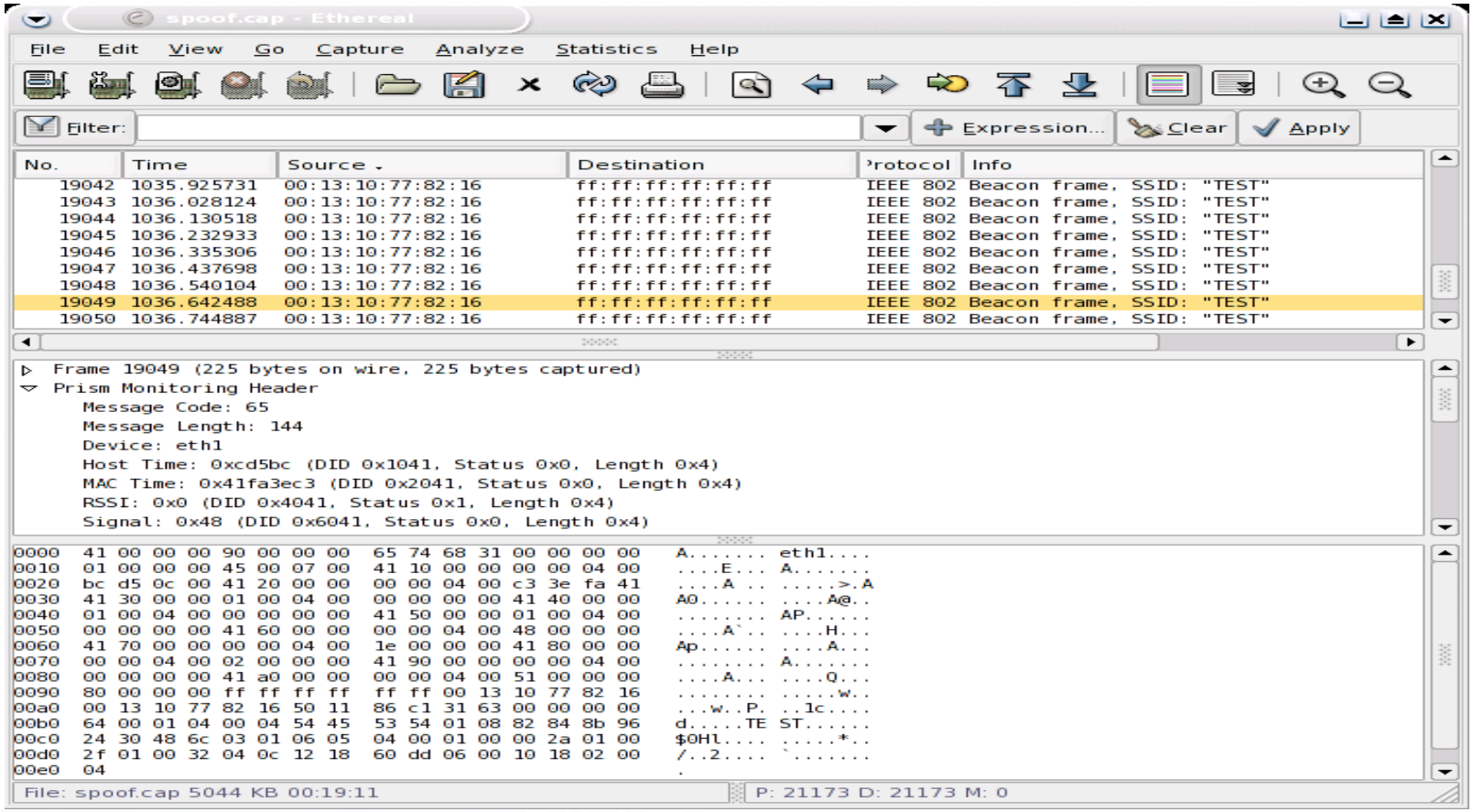

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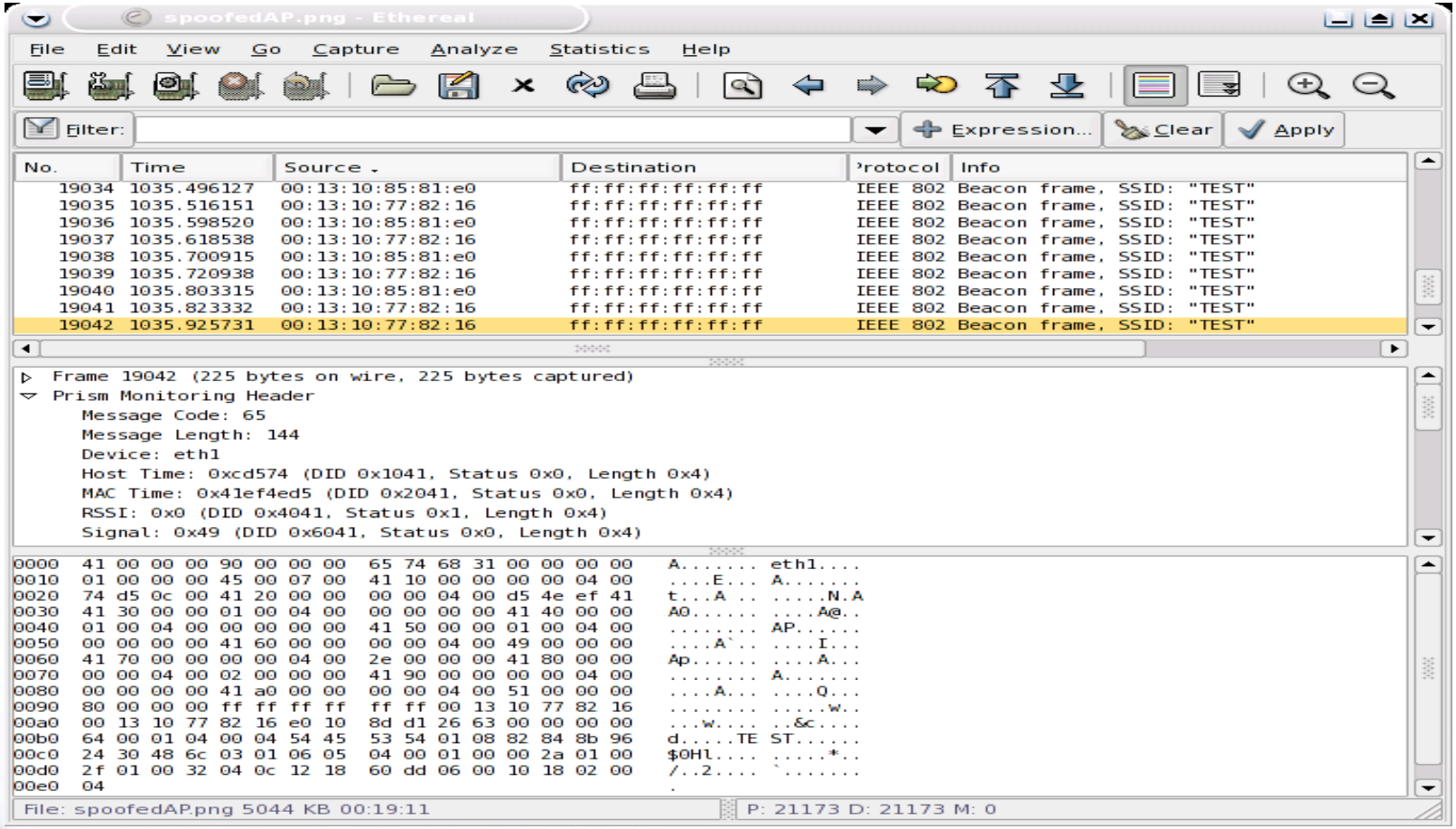
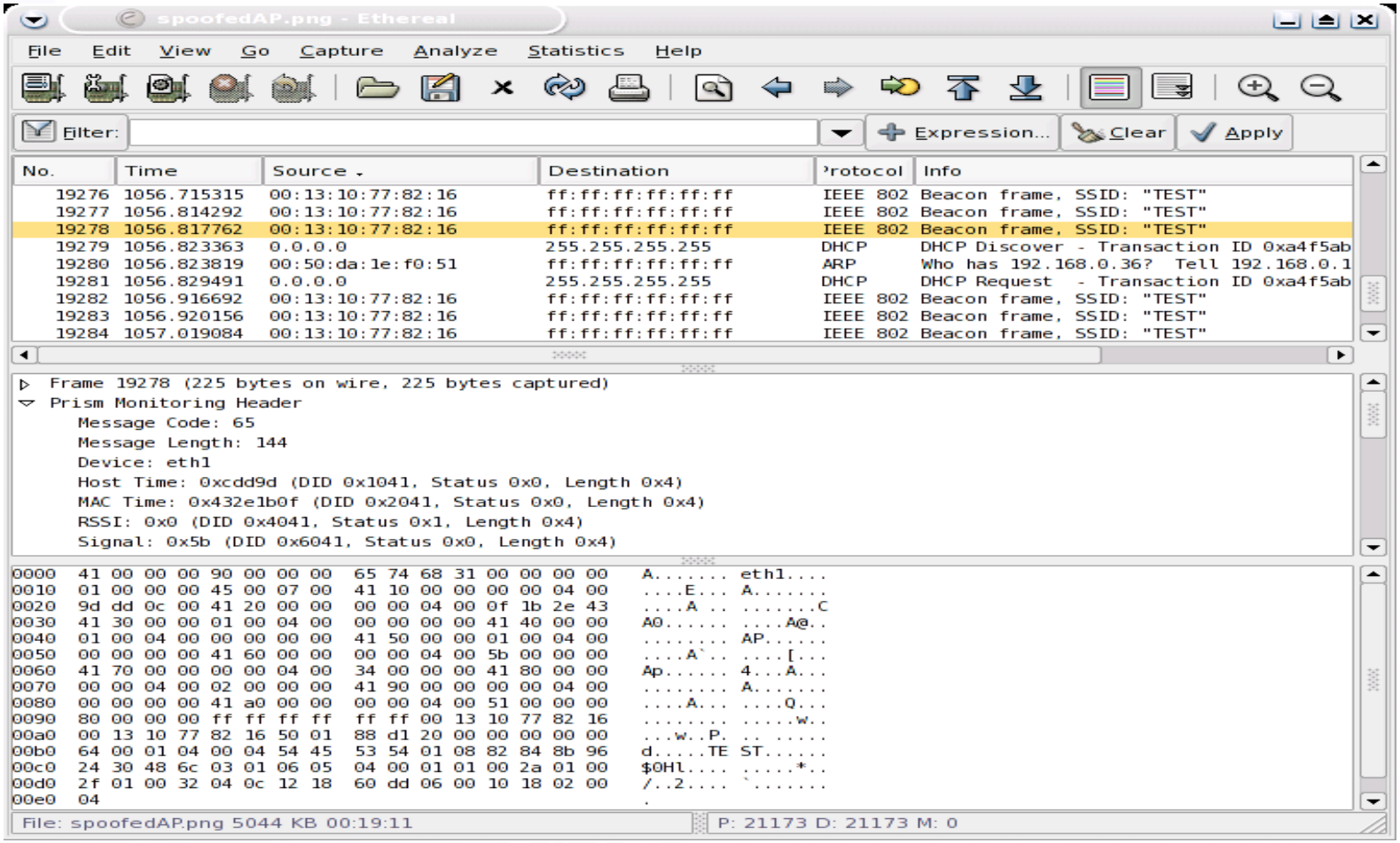


Man in the Middle Attacks



Responding to Man in the Middle Attacks

- Real time response to Man in the Middle Attacks is difficult.
- Preventative measures should be in place prior to a Man in the Middle attack commencing.

Responding to Man in the Middle Attacks

- Always require authentication to the network over an encrypted channel
- Use two factor authentication
- Treat the WLAN as a DMZ host with no network privileges without authentication
- Utilize wireless network equipment that actively responds to these type of events

Conclusion

- Wireless attacks have evolved significantly over the years
- As attacks have evolved, so have the tools available to administrators to respond to attacks
- No tool is a substitute for well trained, vigilant Administrators

Questions?

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