Identifying and Responding to Wireless Attacks

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Contents

- A brief history of wireless security and attacks
- Attacks against WEP
- Attacks against WPA
- Attacks against VPN
- Man in the Middle Attacks
- Identifying and responding to these 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"

- 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

- 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

- 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.

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"

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

- 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.

- 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

- 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.

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

- 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?

- 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.

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## 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

- 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

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<ul> <li>▶ Frame 64 (137 bytes on wire, 137 bytes captured)</li> <li>&gt; Ethernet II, Src: 00:02:2d:5a:20:1c, Dst: 00:13:10:1e:64:b2 Destination: 00:13:10:1e:64:b2 (00:13:10:1e:64:b2) Source: 00:02:2d:5a:20:1c (00:02:2d:5a:20:1c) Type: 802.1X Authentication (0x888e)</li> <li>&gt; 802.1X Authentication</li> <li>0000 00 13 10 1e 64 b2 00 02 2d 5a 20 1c 88 8e 01 03 Outlo 00 77 fe 01 09 00 20 00 00 00 00 00 00 10 c4 WUh ]]kL.Qc.</li> <li>0000 00 13 10 1e 64 b2 00 02 2d 5a 7c 5d 6b 4c eb 51 63 84 WUh ]]kL.Qc.</li> <li>0020 89 77 e8 ba 87 90 55 68 7c 5d 6b 4c eb 51 63 84 WUh ]]kL.Qc.</li> <li>0030 db ee a3 c6 25 e5 8f c5 10 2d 3e 1d 55 e1 c6 00 Outlo 00 00 00 00 00 00 00 00 00 00 00 00 00</li></ul>	•	63	90, 9695	71	00:13:		~ ^ ^	b2	00:	:02:	2d:5a	1:20:	lc	Ŀ	APOL	Key			
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## 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

- 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

- 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

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19043	3 1036.028124	00:13:10:7	7:82:16		ff:ff	:ff:ff	:ff:ff		IEEE	802	Beacon	frame,	SSID:	"TEST"		
	4 1036.130518	00:13:10:7			ff:ff	:ff:ff	:ff:ff							"TEST"		
	5 1036.232933	00:13:10:7					:ff:ff							"TEST"		
	5 1036.335306	00:13:10:7					:ff:ff							"TEST"		
	7 1036.437698	00:13:10:7					:ff:ff							"TEST"		
	3 1036.540104	00:13:10:7					:ff:ff							"TEST"		
	9 1036.642488	00:13:10:7					:ff:ff							"TEST"		
	0 1036.744887	00:13:10:7	7:82:16		TT:TT	: TT : TT	:ff:ff		TEEE	802	Beacon	Trame,	5510:	"TEST"		
• I					200000											
> Frame	19049 (225 by	tes on wire	. 225 byt	es car	tured	)	******									
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MA( RSS	st Time: 0xcd5b C Time: 0x41fa3	3ec3 (DID 0) x4041, Statu	x2041, Sta us 0x1, Le	atus O ength	x0, Le 0x4)	ength (										
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Black Hat Japan 2005

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19	035 1035.516151	00:13:10	9:77:82:16	f	f:ff:f	f:ff:ff:	f	IEEE	802 B	Beacon	frame,	SSID:	"TEST"		
19	036 1035.598520	00:13:10	0:85:81:e0	f	f:ff:f	f:ff:ff:	f	IEEE	802 B	Beacon	frame,	SSID:	"TEST"		
19	037 1035.618538	00:13:10	0:77:82:16	f	f:ff:f	f:ff:ff:	f	IEEE	802 E	Beacon	frame,	SSID:	"TEST"		
	038 1035.700915	00:13:10	0:85:81:e0	f	f:ff:f	f:ff:ff:	f						"TEST"		
	039 1035.720938		9:77:82:16			f:ff:ff:							"TEST"		
	040 1035.803315		0:85:81:e0			f:ff:ff:							"TEST"		
	041 1035.823332		0:77:82:16			f:ff:ff:							"TEST"		
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Black Hat Japan 2005

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## 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

