Wireless and Cyber Security Lesson Plan

Purpose: help students understand how attackers can breach wireless Internet using a router and WEP encryption.

Standards

CPP.L3A-09 Explain the principles of security by examining encryption, cryptography, and authentication techniques.

Objectives

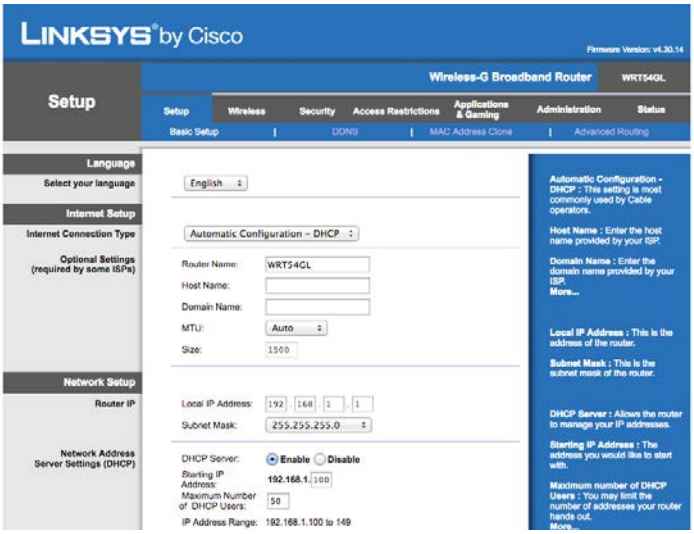
Students will understand a brute force attack to try to find a valid username and password combination.
Students will be able to explain the importance of good practices in personal information security, using passwords, encryption, and secure transactions.
Students will explore principles of system design in security.
Students will be able to describe ethical issues that relate to computers and networks.

From https://www.techopedia.com/definition/18091/brute-force-attack

Attack 1-Wireless Router and Cain & Abel Software using AirPcap hardware

Materials: Wireless Attacks PowerPoint, wireless router (optional), AirPcap (optional), Cain & Abel software (optional)

Vocabulary: wireless router, AirPcap, Cain & Abel, WEP encryption, brute force



The images for each of the steps is available in the PowerPoint slide deck listed in the materials.

1.In the online router setup, begin by naming the SSID (service set identifier), which will name the router.

2. Notice the router's capabilities related to the standard's protocol.

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Also important is to choose the router's channel from 1-11. Although there are 14 channels, the upper ones could possibly interfere with 2.5GHz frequencies. One, six, and eleven are the typical choices as they are spaced 22 MHz apart with a 1 MHz guard band between.

3.Routers typically offer several security modes. We are going to be using WEP for the password exploitation attack in the upcoming demo. WPA2 is currently the preferred security mode with the least vulnerability for attack. Remember earlier we said the difference between a 64 bit and a 128 bit encryption is 750,000 possibilities; this small difference exponentially increases the possibilities, thereby reducing the threat.

4.For the attack described in this presentation, we are going to unblock anonymous Internet requests to enable the packet capture. This will reinforce how important it is to make sure firewall rules are enabled as this attack would not work very well if at all if this box was checked.

5. 2.4 is the predominant frequency for wi-fi transmission due to the resilience of the signal as compared to 5GHz.

However, 5GHz offers less congestion as it is not used as much and can transmit data faster than 2.4GHz.

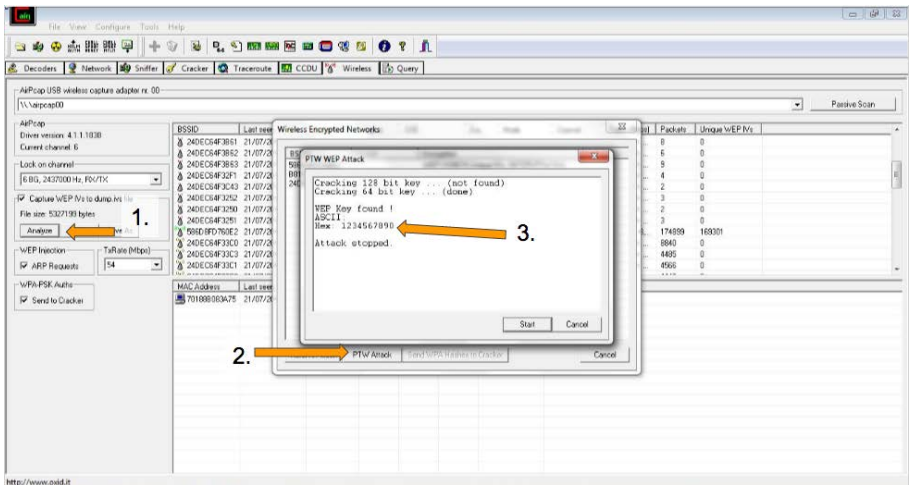
More about wi-fi can be found https://en.wikipedia.org/wiki/IEEE_802.11

6.This frequency allocation chart by the FCC will give a nice pictorial representation of how the frequencies are utilized by which sources and systems. Particularly important are the bands at 2.4 GHz and 5.0 GHz

7. Active and Passive Scanning

Passive: Beacon Frames sent from Access Point (AP)
Association Request (not encrypted) or Authentication Request (encrypted) sent from computer to router
Association/Authentication Response sent from router to computer

Active: Probe Frames sent from Access Point (AP)
Association Request (not encrypted) or Authentication Request (encrypted) sent from computer to router
Association/Authentication Response sent from router to computer



To actually perform the attack, install the Cain & Abel software and attach the AirPcap hardware to the computer.

1. Open the program Cain and Abel
2. Click on the tab “Wireless”
3. In the AirPcap USB wireless capture adapter field, select “\\\airpcap00”
4. Start active scanning for available SSID signals, then click “stop”
5. Select the target SSID, in this case the linksys, and notice the encryption is set to WEP and the channel is “6”
6. Set the lock on channel to the corresponding channel
7. Check WEP Injection to enable “ARP Request” (address resolution protocol)
8. For maximum speed, set the TxRate to “54” Mbps
9. Begin passive scan; hint, to increase the speed of the scan, right click on the list of the mac addresses and select “deauth”
10. After the suggested number of packets have been acquired, click “Analyze” and select the “PTW Attack” to enable the WEP attack. If you are successful, it will show the key; if not successful, continue with the scan to increase the number of packets before trying again.

Attack 2-ARDrone2

Materials and Resources
FreeFlight Mobile app (available for iOS and Android)

https://github.com/felixge/node-ar-drone

In this scenario the owner is controlling the drone with a mobile device, which is used to move the drone to hover next to the attacker. The attacker decides to ground the drone with telnet, which is a remote log in. Finally the attacker runs a previously created program to control the drone.

1. Using a mobile device, connect to the drone's wireless signal. Using the Free Flight app, the owner maneuvers the drone to hover near the attacker.

2. The attacker (who is annoyed by the hovering drone) makes a connection to the wireless network. Then opens the terminal and connect to the drone first testing the connection and then through telnet and drone IP address.

- ping w.x.y.z
- telnet w.x.y.z
- poweroff

or

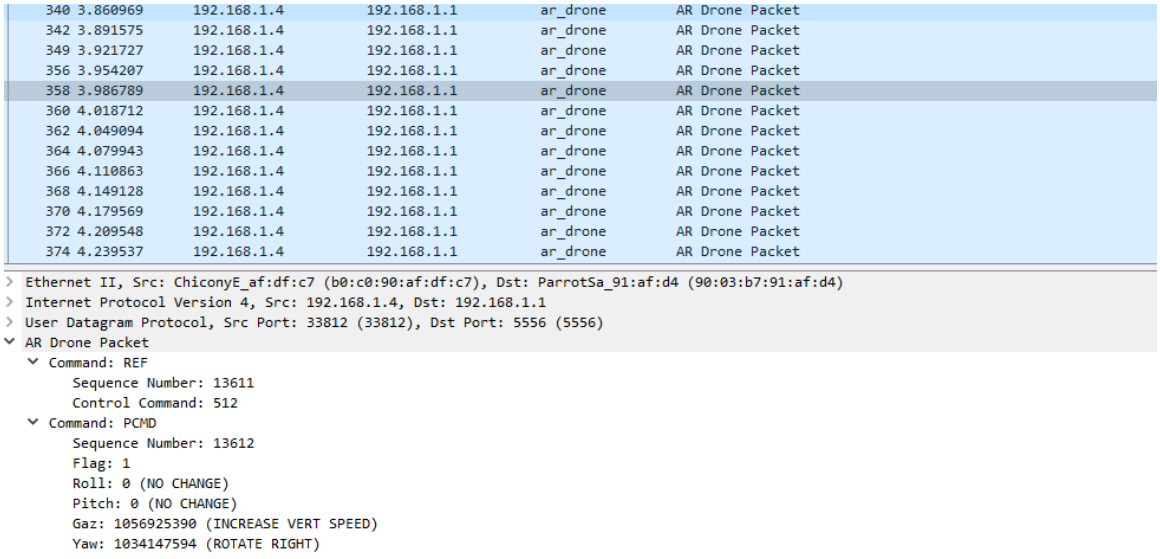
- reboot

3. The attacker can change the name of the drone and the IP address to hide declare that he's the owner. If the attacker didn't want to take control of the drone, he could just take data from the device like the image, video, or flight data or programs set on it. Another attack would be that he could inject some kind of program into the drone as well.

Then the attacker grabs the drone and begins flying it with his own device trading roles as the new owner.

4. The new attacker takes control of the drone by setting a program.
This program injects arbitrary packets to the drone in order to take the control of it. In this case the attacker is able to send its own command to the drone. We are using Node js and java script to write the program for the drone.

- vi drone.js



What's an Algorithm?
David York
Youtube https://www.youtube.com/watch?v=6hfOvs8pY1k
What's an algorithm?
A. A science, B. A set of instructions for solving a specific problem, C. A sequence of steps that will repeat some number of times, D. English-like syntax that resembles a programming language

If there are three people in the room, how many times does line 3 of the algorithm execute?
A. 0, B. 1, C. 23 D. 6

If there are six people in the room, how many times does line 3 of the algorithm execute?
A. 0, B. 1, C. 23 D. 6

Einstein's Riddle by Dan Van der
Youtube
https://www.youtube.com/watch?v=1rDVz_Fb6HQ

YoutubePasscode Riddle by Ganesh Pai
https://www.youtube.com/watch?v=7Vd1dTBVbFg

Can you solve the temple riddle? by Dennis E. Shasha
https://www.youtube.com/watch?v=nSbvlktToSY

Prisoner Hat Riddle by Alex Gendler Youtube
https://www.youtube.com/watch?v=N5vJSNXPEwA