The airborne nature of wireless transmission offers a potential target for attackers to compromise IEEE 802.11 Wireless Local Area Network (WLAN). In this dissertation, we explore the current WLAN security threats and their corresponding defense solutions. In our study, we divide WLAN vulnerabilities into two aspects, client, and administrator. The client-side vulnerability investigation is based on examining the Evil Twin Attack (ETA) while our administrator side research targets Wi-Fi Protected Access II (WPA2).

Three novel techniques have been presented to detect ETA. The detection methods are based on (1) creating a secure connection to a remote server to detect the change of gateway’s public IP address by switching from one Access Point (AP) to another. (2) Monitoring multiple Wi-Fi channels in a random order looking for specific data packets sent by the remote server. (3) Merging the previous solutions into one universal ETA detection method using Virtual Wireless Clients (VWCs). On the other hand, we present a new vulnerability that allows an attacker to force the victim's smartphone to consume data through the cellular network by starting the data download on the victim's cell phone without the victim's permission.

A new scheme has been developed to speed up the active dictionary attack intensity on WPA2 based on two novel ideas. First, the scheme connects multiple VWCs to the AP at the same time—each VWC has its own spoofed MAC address. Second, each of the VWCs could try many passphrases using a single wireless session. Furthermore, we present a new technique to avoid bandwidth limitation imposed by Wi-Fi hotspots. The proposed method creates multiple VWCs to access the WLAN. The combination of the individual bandwidth of each VWC results in an increase of the total bandwidth gained by the attacker. All proposal techniques have been implemented and evaluated in real-life scenarios.

Major: Computer Engineering

Educational Career:
Bachelor's of Computer Engineering, BS, 2004, University of Mosul
Master's of Computer Engineering, MS, 2007, University of Mosul

Committee in Charge:
Cliff Zou, Chair, Computer Science
Mostafa, Bassiouni, Computer Science
Mainak, Chatterjee, Computer Science
Damla, Turgut, Computer Science
Morgan, Wang, Statistics

Approved for distribution by Cliff Zou, Committee Chair, on October 17, 2017.

The public is welcome to attend.