Wireless Internet – Projects proposal

Here are some proposals for the course projects, divided in practical projects (max 4 points) and video reports (max 2 points).

Both types of projects can be implemented in groups of maximum 2 people.

Project deadline: within the call of fall exam session (aug-sept 2023)

Practical projects

These types of projects require to write some codes (python or any other language), make some experiments and write a small report.

1. Wi-Fi encrypted traffic classification: implement a machine-learning classifier able to distinguish what kind of activity a user is performing with his/her smartphone/laptop by sniffing traffic in monitor mode. The system should perform the following operations:
a. Sniff traffic in monitor mode from a known MAC address
b. extract statistical features from the traffic every W seconds. The following traffic features can be extracted: number of packets up/down, average and variance of the packet size, average and variance of the inter-arrival packet times etc.
c. use a pre-trained machine-learning classifier of your choice to recognize the user activity among at least the following: idle, web browsing, YouTube streaming.
d. Report the accuracy of the approach through a confusion matrix
Reference: https://ieeexplore.ieee.org/abstract/document/8543584

2. Characterizing MAC randomization: modern smartphones randomize their MAC address during probe request emission. You are requested to produce a dataset characterizing the MAC randomization of your own device, following what done in the following paper: "A dataset of labelled device Wi-Fi probe requests for MAC address de-randomization" by L. Pintor and L. Aztori, Computer Networks, Vol. 205, March 2022.
The project should output a set of .pcap files, containing probe requests emitted from your smartphones in different conditions (screen on/off, Wi-Fi on/off, Power saving on/off) to characterize the randomization behaviour of your smartphone. A final report is required to describe your findings.

3. Fingerprint localization: implement an indoor localization system based on fingerprint for the place where you live. Collect a dataset of RSS fingerprints sniffing beacons from nearby access points. Perform localization with at least 2 different machine learning techniques (e.g., k-NN and Random-Forest) and compare the obtained results.

Video Reports

These types of projects require you to gather and read material about a specific topic (using google scholar, ieee xplore, etc.), prepare a max. 15 min presentation on it, record a video and send it to me for evaluation.

All topics related to the course and not already explained in the lectures are welcome, with particular emphasis on:

- New Wi-Fi amendments: 802.11ax, 802.11be, WPA3
- Initiatives not touched in the course (e.g., EasyMesh)
- New types of attacks over WLAN
- Techniques for mitigating greedy behaviours in WiFi networks