ARGUS

Background

Obtaining physical locations of devices is becoming essential with the massive quantity of internet connected devices. GPS is frequently used for obtaining device location, but it's battery expensive and not accurate indoors. ARGUS allows a network administrator to monitor the locations of devices on a mesh network using a combination of signal strength information in packets.

Goals

- A listing of devices on a network including MAC address, hostname, and manufacturer
- For each device, it's approximate location listed, as well as a visual rendering
- Live cross-platform interface with location mapping and notifications
- Location accuracy within 3 m

Technology

Python: data/location processing
Scapy: packet processing
OpenWRT: device capture
NodeJS: JS runtime / web server
React: user interface

Design

- Network Module: contains devices connected to the network including central server, access points, and target devices
- Central Server: contains processes and submodules necessary for packet capture and location calculations, as well as a web server for administration
- Web Server: contains the web application which displays device locations, configurations, and notification options for the administrator
- Client Module: contains the admin's device which houses the web application frontend used to view devices and configure the network and notifications

Figure 1: High-level view of system design.
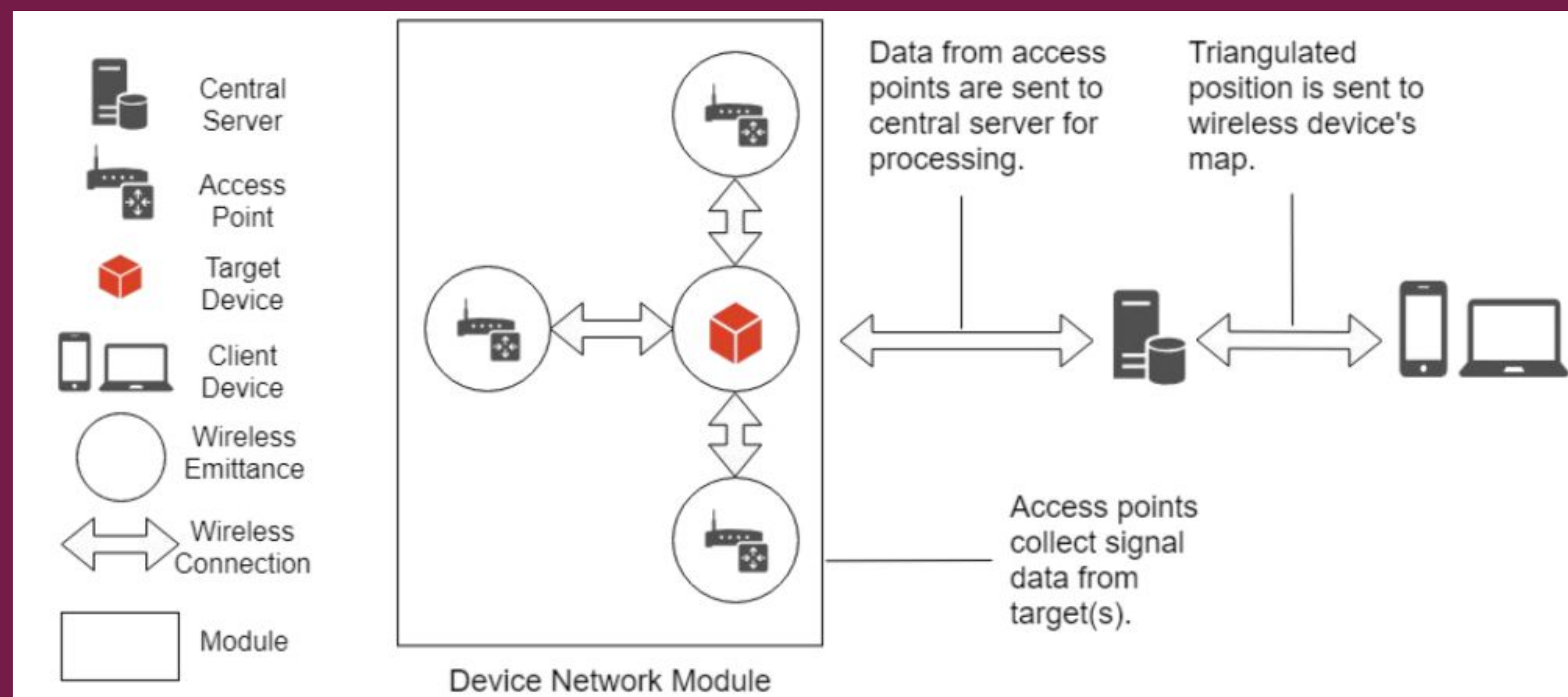
Challenges

a. Parallel workflow between UI design and lower level systems
b. Efficient distance computation
c. Error accounting in trilateration calculation
d. Snapshot decision of packet time interval
e. Heatmap overlay of device mappings

Solutions

a. Obtained test packet capture as early as possible for web developers
b. Used free space path loss algorithm
c. Minimized mean standard error
d. Analyzed data and added configurable time interval for packets
e. Utilized heatmap.js library with mapping plugins

Impact

Efficiency
- Increases efficiency for conference planners to alleviate hot spots of congestion.
- Eases troubleshooting for network administrators.

Security
- Increases monitoring capabilities for IT specialists on IoT networks.

Results

- Captured RSSI information for test devices on established network
- Calculated approximate distances using RSSI information
- Calculated approximate device locations using trilateration
- Deployed user interface with list view and map base
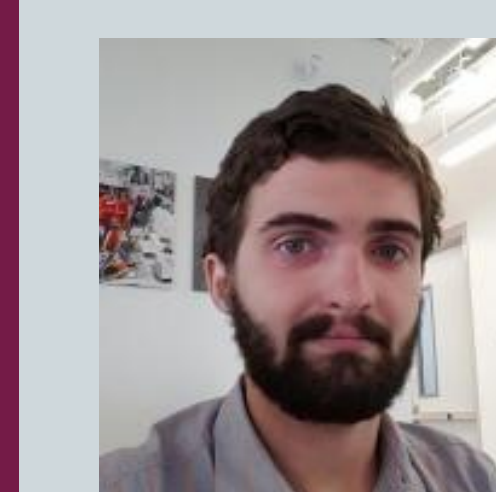- Created heatmap overlay to show device concentrations

Team

Matt Ihlenfield (CS)

Anthony Jantzen (CS)

Pat Millott (CS)

Kyle Trout (CS)

Advised by Dr. Dharma Agrawal