OCScraper: Automated Analysis of the Fingerprintability of the iOS API

Gerald Palfinger,
Institute of Applied Information Processing and Communications (IAIK),
Graz University of Technology
A-SIT Secure Information Technology Center Austria

OCScraper - Overview

- Framework to automatically identify fingerprintable information sources
- Systematically probes the iOS API
- Various methods and properties detected

Motivation

- Personalised advertisements require reidentification of users
- App-independent identifiers required
- Unique identifiers have been removed
- Fingerprinting can be used instead

Approach

- Framework traverses through the API
- Collects values from methods and properties
- Framework is executed twice on each smartphone
- Values which differ between devices but are stable on the same device are marked as fingerprintable

Components

- Backend
  - Parser
  - Control Application
- Smartphone Application
- Analysis Component

Methodology

1a. Backend - Parser

- Parse required information from header files
  - Parameters of methods
  - Name, Position, and Type

Methodology

1b. Backend - Control Application

- Controls the data collection
  - Checks if smartphone application is still running
  - Restarts it if necessary
  - Collects results

Methodology

2. Smartphone Application
    - Creates class objects
    - Retrieves properties
    - Invokes methods

Methodology

3. Analysis Component
    - Gathered data of each device cleaned (duplicates, diverging values)
    - Cleaned data is analysed cross-device

OCScraper

Results

API Coverage

- 69 % of relevant methods invoked
- 82 % of discovered properties retrieved

Test Setup

- Two device setups
  - Same-Model
  - Cross-Model

Results

- Same-Model: 368 methods and 274 properties found
- Cross-Model: 133 methods and 107 properties found

Discussion

- iOS offers many information sources which allow fingerprinting
- Evaluation focused on iOS 16.3 $\rightarrow$ no API level differences

Limitations & Future Work

- Limited number of evaluated devices
- $\rightarrow$ only a lower estimate of the quantity of fingerprintable information sources
- $\rightarrow$ limited expressiveness of potential diversity and long-term stability
- Framework based on Objective-C
- Some of the detected methods are considered private

Conclusions

- OCScraper can invoke and query a large number of methods and properties
- Methods and properties provide a plethora of fingerprintable information
- Automatic method detected more sources than previous manual approaches