CAREER: Securing Mobile Devices by Hardening their System Software

Ardalan Amiri Sani
University of California, Irvine

Award #1846230

Problem Statement

- Mobile devices, such as smartphones, tablets, and wearables, are hot targets for security attacks these days [1, 2].
  - "80% growth in iOS and Android vulnerabilities from 2016 to 2017" [2].
- According to Google, an increasing number of these attacks are now targeting the operating system (OS) kernel (i.e., 44% of attacks in 2016 vs. 9% and 4% of them in 2015 and 2014, respectively) [3].
- OS kernel is vulnerable due to size and complexity.

[1] Skycure. Mobile Threat Intelligence Report – Q4 2016. 2016.
[2] Symantec. Mobile Threat Intelligence Report – 2017: The Year In Review. 2018.
[3] What's New in Android Security (Google I/O '17) - Video.
https://www.youtube.com/watch?v=C9_ytg6MUP0.

Proposed Solution

- A multi-approach solution to harden the OS and the user against this ever-increasing number of attacks.

- **Research thrust 1: security monitor for mobile devices**
  - Protect the user, apps, and services by providing critical security and privacy guarantees, e.g., secure use of camera, despite a compromised OS.
  - Preliminary work: Viola [MobiSys'16], Ditio [Sensys'17], SchrodinText [MobiSys'17]

- **Research thrust 2: dynamic analysis of mobile OS**
  - Reduce the possibility of the OS getting compromised by developing novel and mobile-specific tools to facilitate finding (and then fixing) the vulnerabilities in the mobile OS.
  - Preliminary work: Charm [USENIX Security'18]

- **Research thrust 3: Protecting the mobile OS interfaces**
  - Make it hard for an attacker to exploit the vulnerabilities remaining in the OS with a vetting layer that limits the inputs passed to the OS kernel system calls and the rest of OS API, such as Android API.
  - Preliminary work: Milkomeda [CCS'18]
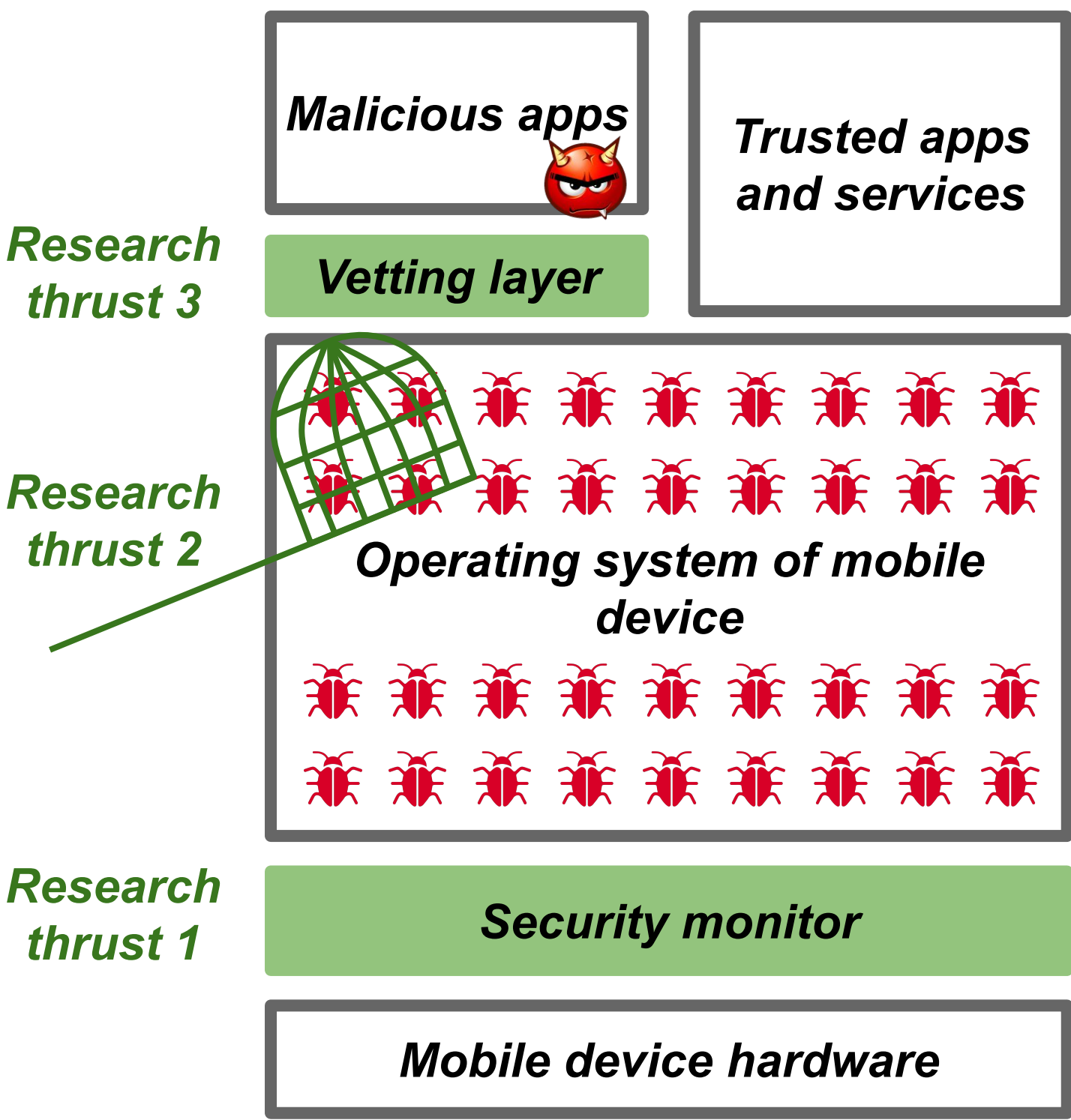
Broader Impacts

- Impacts on global societies and economies by securing mobile devices
- Dissemination of research results
- Mentoring graduate students
- Related education activities (Course and Curriculum Development, reading groups, etc.)
- Outreach to undergraduate, women, minority, and K-12 students

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