Project Ideas

- Semester long projects of medium scope
- TAs presenting project ideas today
- Students can submit their own ideas
  - Send to **cs161projectidea@gmail.com**
  - To be approved by staff
  - **Short** presentation of approved ideas **this** Wed.

Project Groups

- Each group is 6 people, *no exceptions*
  - Can be with lab partner, but doesn't need to be
- Form your own groups
- Use the discussion forum!

Project Group Submission

- Groups choose top 2 project preferences
  - We'll try hard to give top preference
  - Multiple groups on same project
- Provide times the group can meet
  - Needs to be many, many times!
- Web submission

Project Signup Schedule

- 1/23 Monday – TA project presentation
- 1/24 Tuesday – Students submit project ideas
- 1/25 Wednesday – Approved ideas presented by students
- 2/1 Wednesday – Group signups due

Web Security

Joel

Content Security Policy for Web Applications

- Content Security Policies (CSP) can be applied to sites to stop XSS
- …but requires modifying the application
- Modify a large application (e.g. MediaWiki) to use an effective CSP
- Show that the application still works with the policy applied

Privilege Granularity in Chrome Extensions

- Extensions add functionality to web browsers
- Chrome limits privileges to only those requested
  - **Coarse grained**
- How well does the granularity match actual functionality?
- Evaluate this over several hundred extensions
- Find common patterns in extensions
  - Propose alternative privileges?

More Web Security

Dev

Measuring Incoherencies on the Web Platform

- **Goal**: Write an addon and a crawler to measure the prevalence of same-origin-policy inconsistencies. For example, cross-origin overlap, document.domain usage.
- **Motivation**: Can't improve what you don't know. The current situation is a mess.
- **Evaluation**: Number of checks implemented and scale of data collected.
- **Prereqs**: HTML, JavaScript, the Web

Privilege Separation of HTML5 applications

- Goal: Implement privilege separated versions of popular HTML5 applications
- Motivation: TCB Reduction, auditability, SECURITY!
- Evaluation: TCB reduction achieved, functionality reduced, security analysis
- Prereqs: HTML, JavaScript

Implementation of DSI in Firefox

- Goal: Implement a nonce based approach to XSS mitigation
- Motivation: XSS is difficult to protect against purely on the server side. Enlist help from the browser.
- Evaluation: HTMLPurifier test cases passed
- Prereqs: C/C++ knowledge, HTML, JavaScript

Measuring JavaScript Dynamicity

- Goal: Write an addon and a crawler to measure the prevalence of crazy js on the web
- Motivation: JS consists of a number of crazy features that make analysis difficult. A measurement will tell us what we can ignore and what we can't.
- Evaluation: Number of checks implemented and scale of data collected.
- Prereqs: HTML, JavaScript

Android Security

Steve

Similarity Among Android Applications by GUI Feature Extraction

- **Goals**: Develop a system to compute similarity between GUIs in Android apps
  - Examine both static elements (XML) and dynamic elements (DEX)
- **Motivation**: Piracy, malware detection
  - Similar looking applications with underlying differences in code is a good metric for detecting trojaned applications
  - Copied or stolen interface detection
- **Description:** Feature extraction and comparisons Android GUIs
  - Students will be expected to evaluate their tool against no less than 1000 applications and demonstrate and evaluate their approach
- **Prereq**: Android, Java, C++, machine learning a plus!

Measuring Intent Security Problems in Android

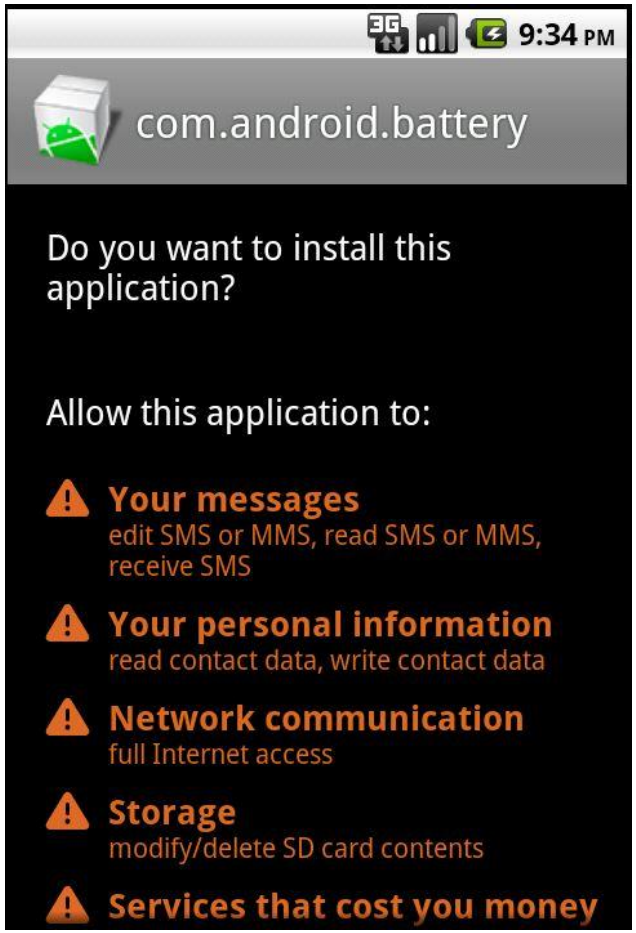
- **Goals**: Develop a tool to detect problems with Android intents and measure their prevalence among a large set of applications. Suggest proposals to fix most common bugs.
- **Motivation**: Intents can leak information or be used to abuse privilege
  - Pressing need to quantify the prevalence of these errors
  - Can shed insight into developing a better Intent system to make Android more secure.
- **Description:** Understand common flaws with the Intent system in android, classify and quantify their prevalence on a large dataset.
- **Prereq**: Android (very experienced!), Java

Android and Testing via Crowd Sourcing

Kevin

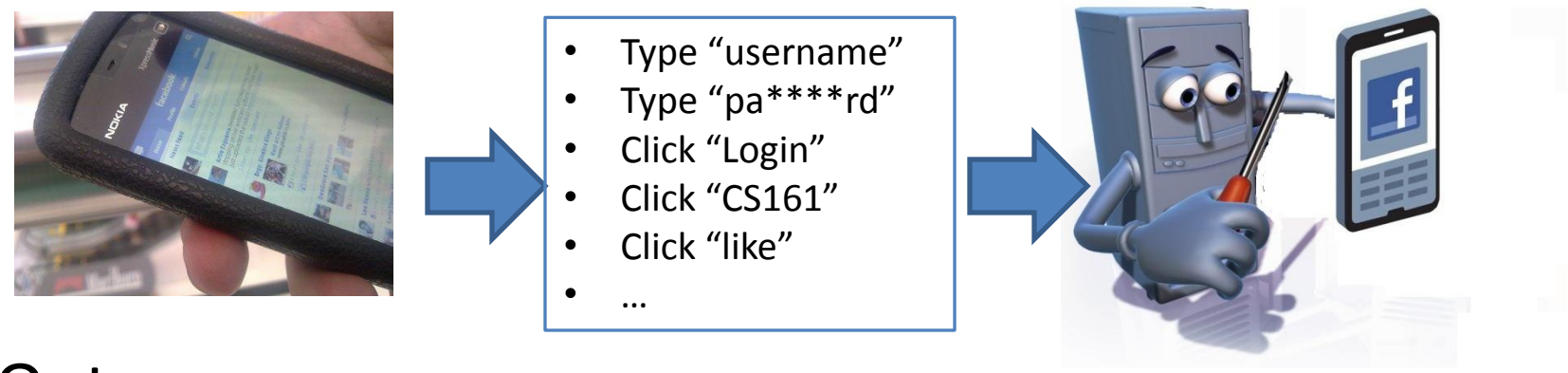
Fine-grained permission control engine on Android

- The current coarse-grained permission system:
  - Application-level
  - Install-time decision
  - All-or-nothing decision
- Goal: Fine-grained rule-based permission system
  - (App, Package/Callstack, Permission)
- Outcome:
  - Policy engine
  - Sample rules



Testing via Crowd Sourcing

- HCI-based programs should be tested by a human
  - Event-driven, user-interaction directed
- A first step towards that: describing interactions



- Outcome:
  - Interaction recorder and replayer

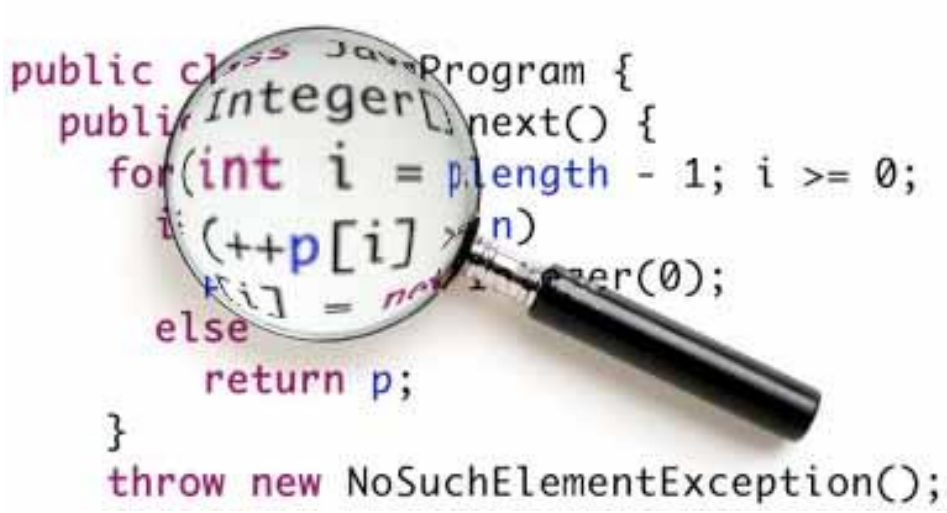
An Evaluation of Automated Bug-finding Approaches

Cho

Automated Software Analysis

- Tidal Wave in constraint solving and symbolic execution techniques
- Analysis of software security will be **increasingly automated** and based on **logic**

- Different SE approaches
  - "Dynamic" symbolic execution
  - Static checking
  - Model checking



How do they compare?

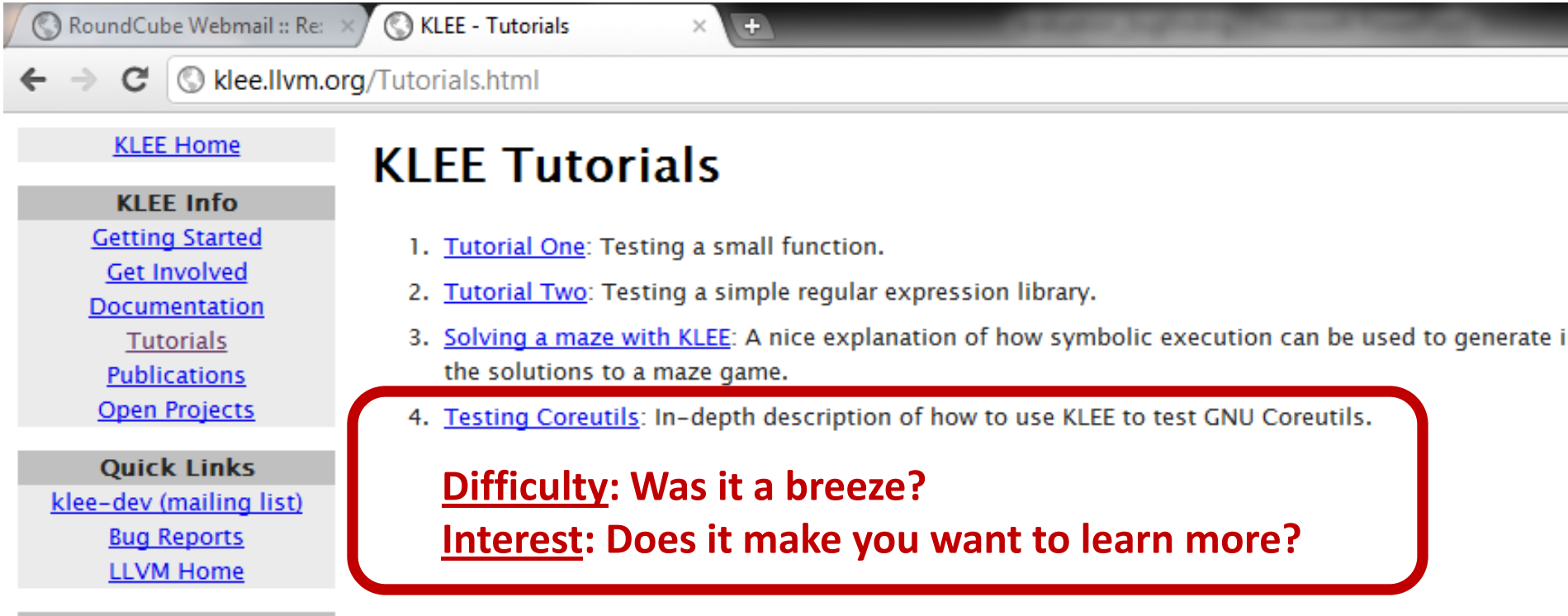
Source: A. Platzer

What do I need to do?

- Evaluate and compare the best-of-breed tools of the 3 approaches
  - On a common set of real-world applications
  - Focus on security bugs
  - Soundness & Completeness
- [Practical] Determine the kind of programs each approach is well-suited for
- [Research] Gain insights into how they work / apply symbolic execution differently

ACID Test

- Evaluate your own suitability for this project (and your team-mates)
- Google: "**KLEE symbolic execution**"



Privacy

Emil

Enhance Privacy of Open Source Apps

- **Goal:** Combine popular open source applications with UC Berkeley's platform for private data.
- **Example Apps:** Online document editors, photo galleries, video conferencing, chat rooms, webmail.
- **Why:** Offer rich applications to users with strong privacy guarantees.

Privacy Extension for Browsers

- **Goal:** Prevent a website from sending user data to another website.
- **Example:** Your online tax software should not share your financial data with crooks.
- **How:** Develop a browser extension that intercepts HTTP requests.

Google+ Data Analysis

- **Goal:** Analyze Google+ data on a global scale.
- ** We have daily snapshots of the Google+ social graph and profile data. **
- Explore and model how social patterns evolve.
- Determine importance and weights of traits in social networks.
- Why do people accept friend requests?

Graduate School Application System

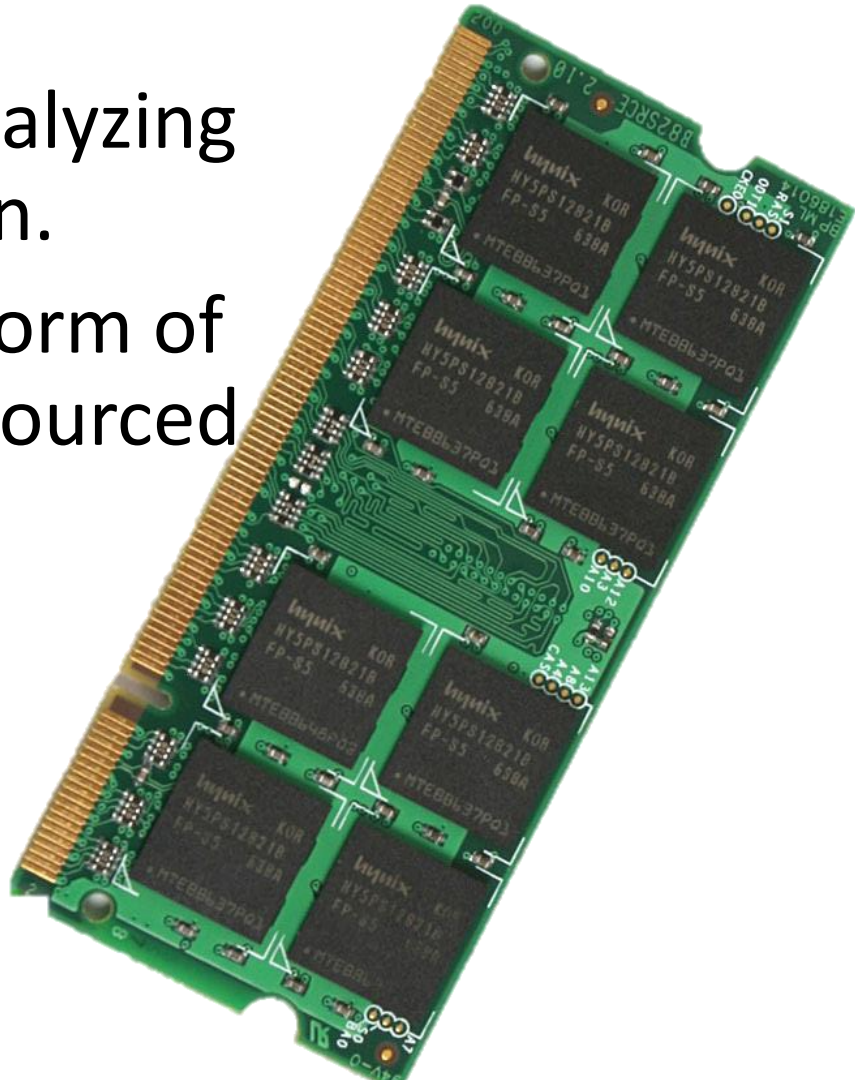
- **Goal:** Create a single website for submitting applications to multiple graduate schools.
- **Why:** Offer enhanced privacy for students, and letter recommendation writers.

Virtual Machine Forking

- **Goal:** Efficiently isolate web sessions from each other on a server to improve security.
- **Why:** Prevent privacy breaches across users.
- **How:** Fork virtual machine metadata and memory mapping for each user session.

Memory Access Privacy

- **Goal:** Determine what an application is doing by analyzing its memory access pattern.
- **Why:** Demonstrate new form of attack on privacy for outsourced computation.
- **How:** Record and analyze memory traces of applications.



Alternative Authentication

Daniele

Active Authentication based on mouse and keyboard usage

- Goal: write Javascript collection code and Python analysis code to distinguish mouse/keyboard usage patterns
- Motivation: Active authentication aims at strengthening the classic password authentication by observing user behavior
- Evaluation: Robustness and portability of Javascript code. Quality of the analysis (number and uniqueness of extracted features)
- Prereqs: HTML, JavaScript, Python