UNIVERSITÄT LEIPZIG

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# Tracking Load-time Configuration Options

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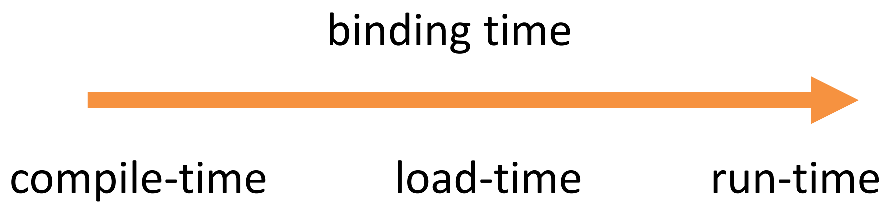
## SPL or one App to rule them all?

## Challenge

- Apps must handle variability regarding hardware and software
  - Tablet?
  - Bluetooth?
  - NFC?
  - Old Android
  - Current Android?
- There must be features everywhere!?

## Current Solution

- Use of (load-time) configuration options



- Use of normal Java variables and control structures
  - No preprocessor

## Example

```
public static ActionBarWrapper getActionBar(Activity activity) {
 if (PreferenceConstants.PRE_HONEYCOMB)
  return new DummyActionBar();
 else
  return new RealActionBar(activity);
}
```

**Configuration option**

**Alternative implementations depending on version option**

```
public class PreferenceConstants {
 public static final int SDK_INT = Integer.parseInt(Build.VERSION.SDK);
 public static final boolean PRE_ECLAIR = SDK_INT < 5;
 public static final boolean PRE_FROYO = SDK_INT < 8;
 public static final boolean PRE_HONEYCOMB = SDK_INT < 11;
```

## How to identify configuration options?

- There is no easy way to differentiate between a **normal variable** and a **variable with a configuration value**
- Common APIs to access configuration options (Build.VERSION.SDK) are known (from the documentation)
- We track the accessed information from the API through the program

## Approach

- Extended static taint analysis
- Basic steps:
  1. Look for access of known configuration API
  2. taint value
  3. track tainted value along control and data flow
  4. check where tainted value is used to include/exclude code

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## Results

- Constraint for each statement
  - Example: Feature A and not Feature B
- Whole functions and classes could be annotated this way

## Comparison

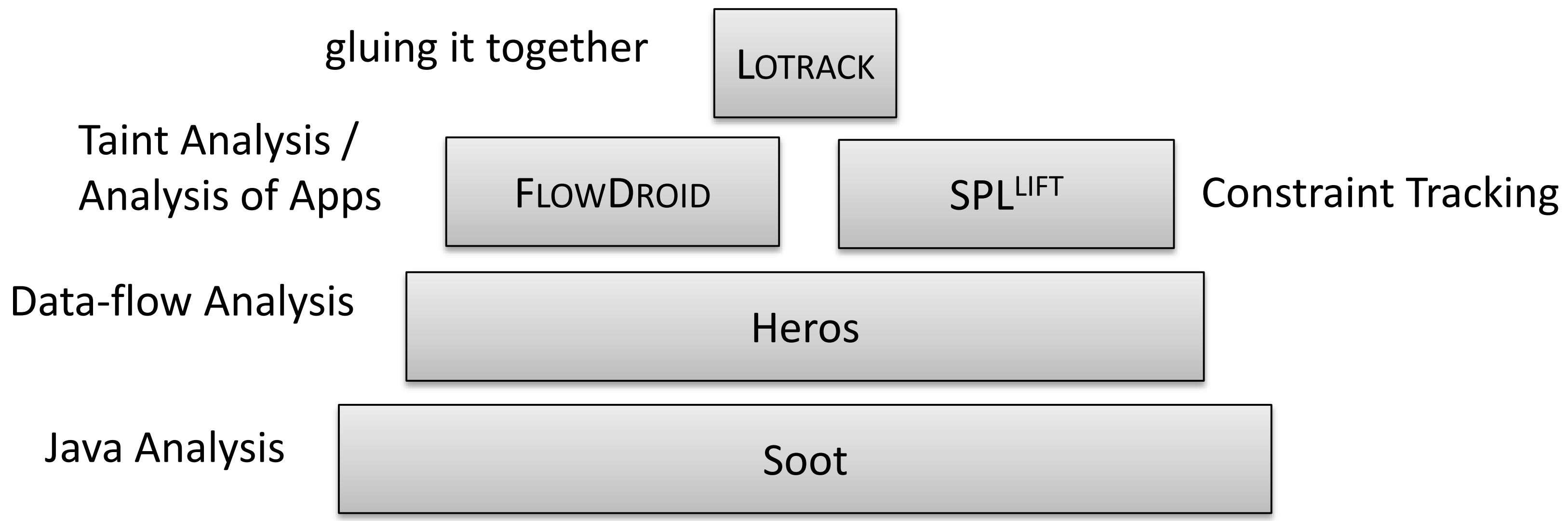
- Slicing
  - Slicing would include all statements affected by a config value

    → We only look for optional statements
  - Slicing does not know *how* a config value affects a statement

    → We know Bluetooth must be enabled and version is >= 1.3

## Implementation

- New tool **LOTRACK**[1]
- Standing on the shoulders of giants:



1 https://github.com/MaxLillack/Lotrack

## Android Case Study: What did we learn?

- Configuration options are used by the majority of apps
  - Framework version (SDK) is a popular option
  - Interactions happen but are rare and limited to first order interactions
- Feature localization? Depends …
  - Some apps have whole classes used only by certain configurations

    →Could easily be refactored to feature modules
  - Other uses only affect a single line of code within the app

    →Important info for testing / maintenance

## Work Ahead

- LOTRACK currently only supports Boolean variables
  - Falls back to a “in some unknown way related to” for other types
  - We need at least handling of enumerable integer values (like possible versions)
- Limited to standard options
  - We only looked at options from the Android framework
  - What about user-defined options?
- Comparison to other approaches (such as program slicing)