UBAC: UI-Based Fine-Grained Access Control on Android

Ziyue Yang[i]	Yuanchun Li[ii]	Yao Guo	Xiangqun Chen
Peking University	Peking University	Peking University	Peking University
Beijing, China	Beijing, China	Beijing, China	Beijing, China
yzydzyx@pku.edu.cn	liyuanchun@pku.edu.cn	yaoguo@pku.edu.cn	cherry@pku.edu.cn

In the current access control mechanisms on Android, users can choose whether to grant a permission to an app. However, in many case, it is difficult for a user to understand how and why an app requests for a particular permission. Furthermore, it is difficult to provide fine-grained access control in the current system because there is no way to differentiate whether a permission is used for different purposes within an app.

To address these two problems, we propose UBAC, a UI-based fine-grained access control model, which enables fine-grained access control on the granularity of UI components. UBAC first maps UI elements to access control targets and permissions, helping mobile users to understand why and how permissions are used within an app. Based on the mapping, we are able to enforce fine-grained access control based on UI components.

We evaluated our implementation on three aspects: accuracy, coverage and performance. It could achieve both relatively high accuracy and coverage in nine apps in the test, with little overhead on app execution time.

---

[i] Ziyue Yang is a master student at Peking University, and he will be the presenter of this poster.

[ii] Yuanchun Li is a Ph.D. student at Peking University.

UBAC: UI-Based Fine-Grained Access Control on Android

Ziyue Yang, Yuanchun Li, Yao Guo, Xiangqun Chen

Peking University, Beijing, China

INTRODUCTION

- **Problem: Grant/Deny Permissions in Android**
  - Coarse-grained (app level)
  - Difficult for a user to understand
  - Difficult to provide fine-grained access control
- **Solution: UI-Based Fine-Grained Access Control Model (UBAC)**
  - Enables fine-grained access control on UI components
  - Maps UI elements to access control targets and permissions
  - Helps mobile users to understand permissions used
- **Implementation: Proof-of-Concept Prototype on Android**

SYSTEM DESIGN

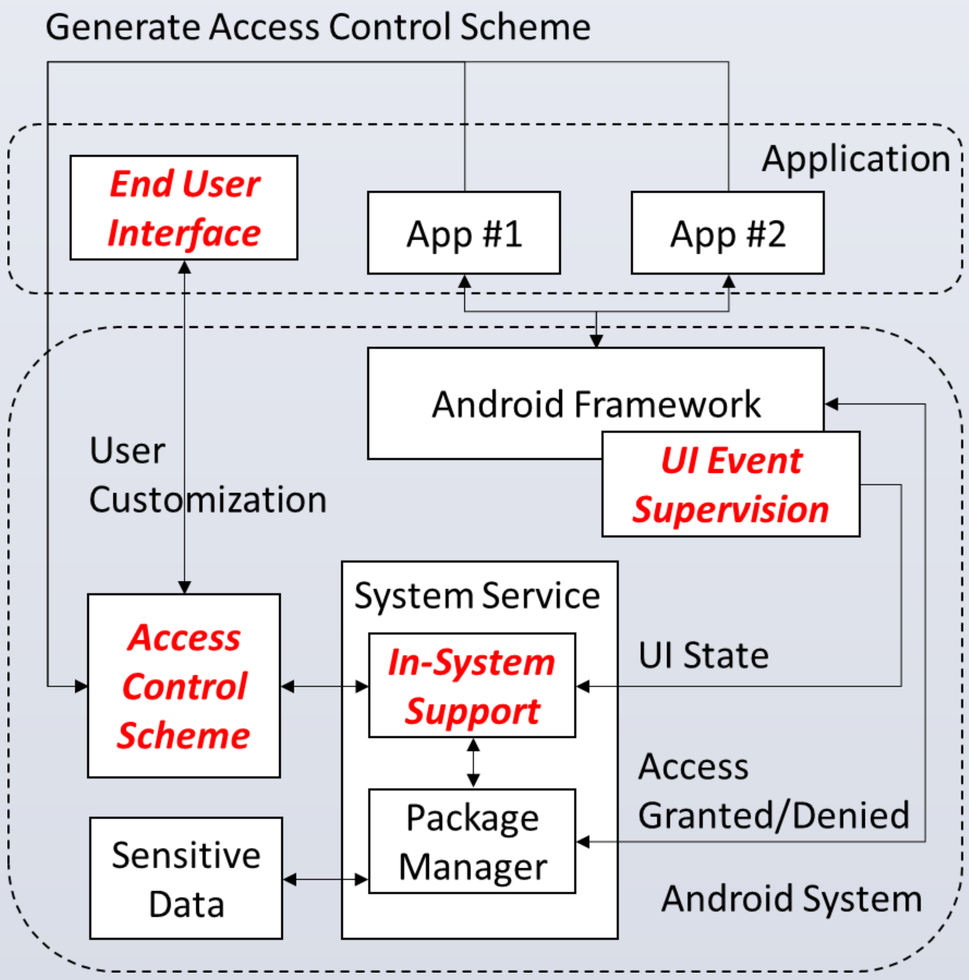

Figure 1 UBAC Architecture. The red part is our implementation.

IMPLEMENTATION

- **Access Control Scheme**
  - Prerequisite: an app's UI Transition Graph (UTG)
    - Nodes: UI states, containing multiple interactable UI elements
    - Edges: UI events causing UI transitions
  - Definition
    - <UI State, UI element, permission, true/false>
    - Grants or denies certain permission on certain UI elements of certain UI states
- **End-User Interface**
  - An app to let users customize access control policies
  - "OK button in Photo UI can access camera"

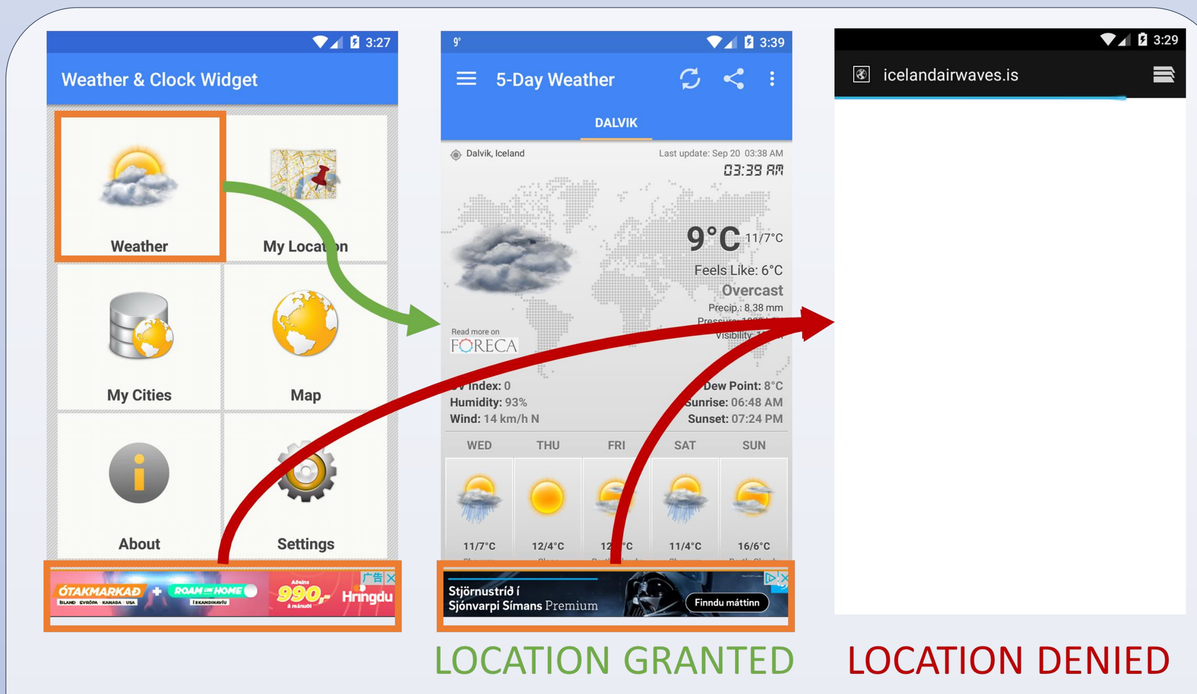

Figure 2 Access Control Scheme Example: We allow weather UI to access location, while keeping it from AD UI.

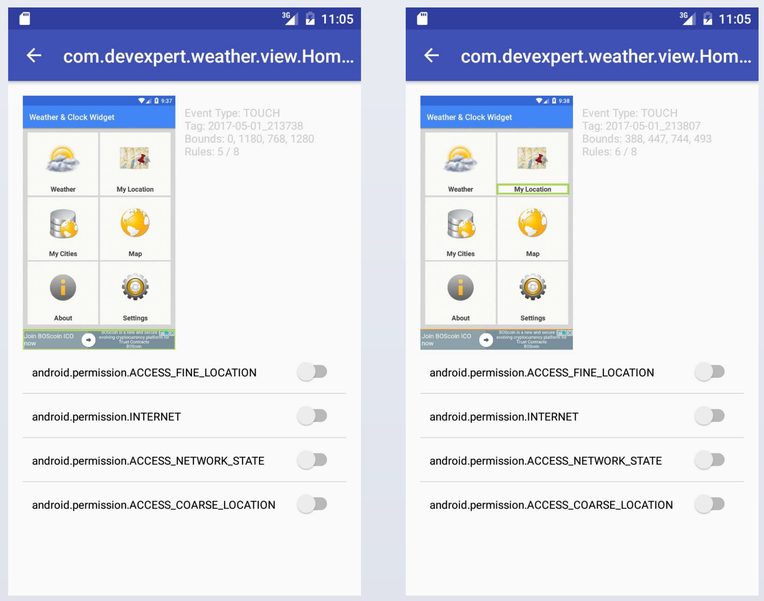

Figure 3 UBAC App Example: Users can choose whether to enable a permission detected for certain UI

- **UI Event Supervision**
  - Modifies Android framework
  - Generates UI event notification on each UI transition
  - Streams the events to system core
- **In-System Support**
  - Judges whether to grant the permission according to UI context
  - Checks on each permission request

EVALUATION

- **Accuracy:** Whether a permission is correctly mapped to a UI element. **About 87%**
- **Coverage**: Whether a UI element is contained in automated generated access control scheme. **About 70%**
- **Performance**: **Little** overhead in app execution time

CONTACT

Ziyue Yang: yzydzyx@pku.edu.cn

Yuanchun Li: liyuanchun@pku.edu.cn

Yao Guo: yaoguo@pku.edu.cn

Xiangqun Chen: cherry@pku.edu.cn