TapTrap: Animation-Driven Tapjacking on Android

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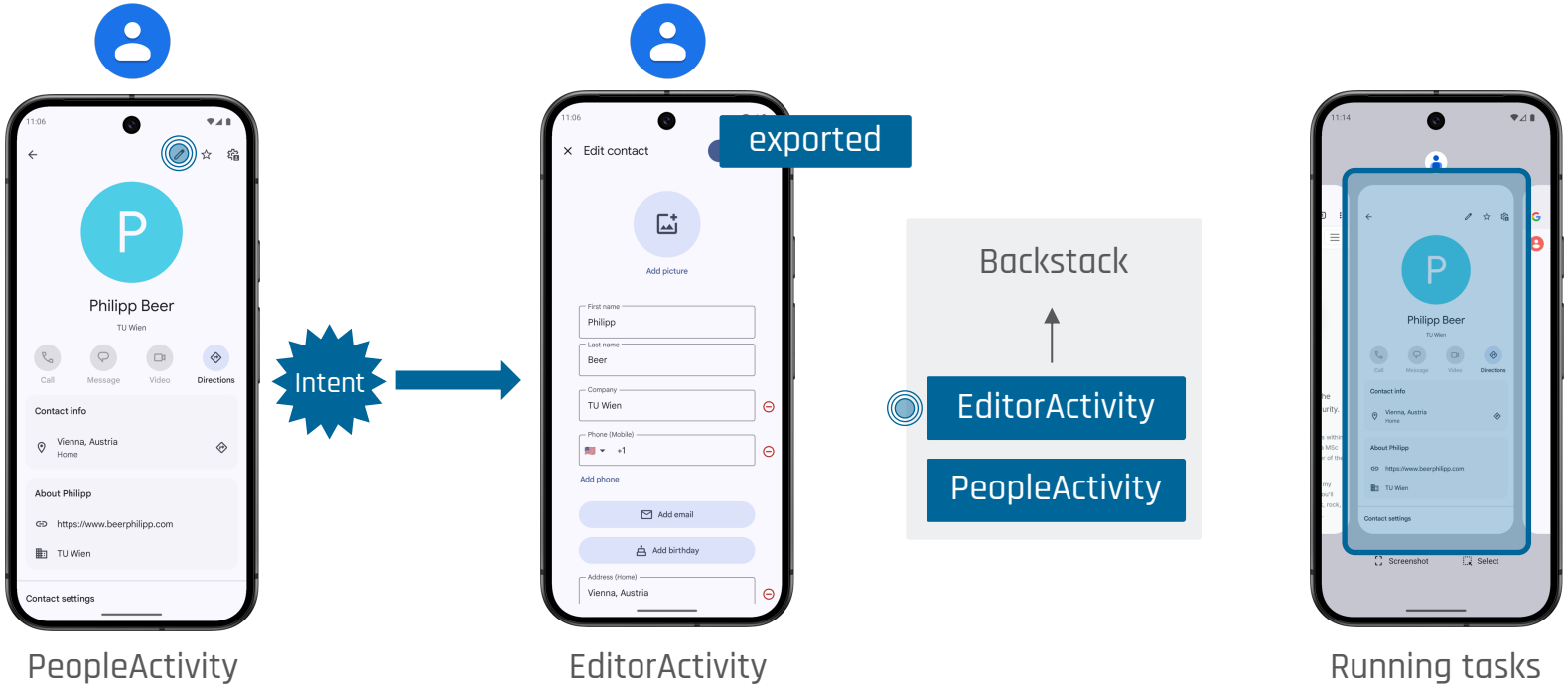
https://taptrap.click

34th USENIX Security Symposium 2025

Background

Background | Activity Fundamentals



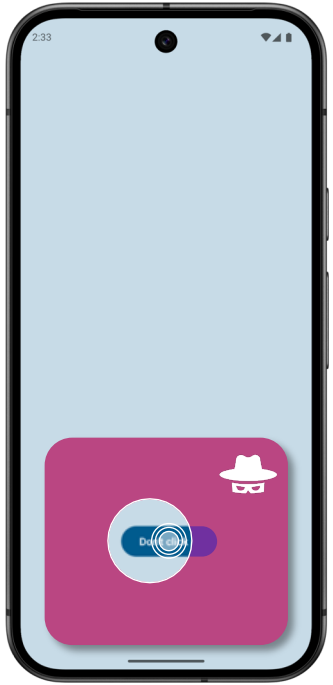
PeopleActivity EditorActivity Running tasks

Background | Previous Tapjacking Approaches

SAW* permission

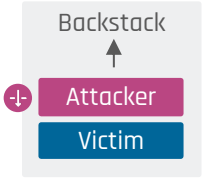
SAW notification

Mitigations assume the malicious app is **on top**



Detect overlays

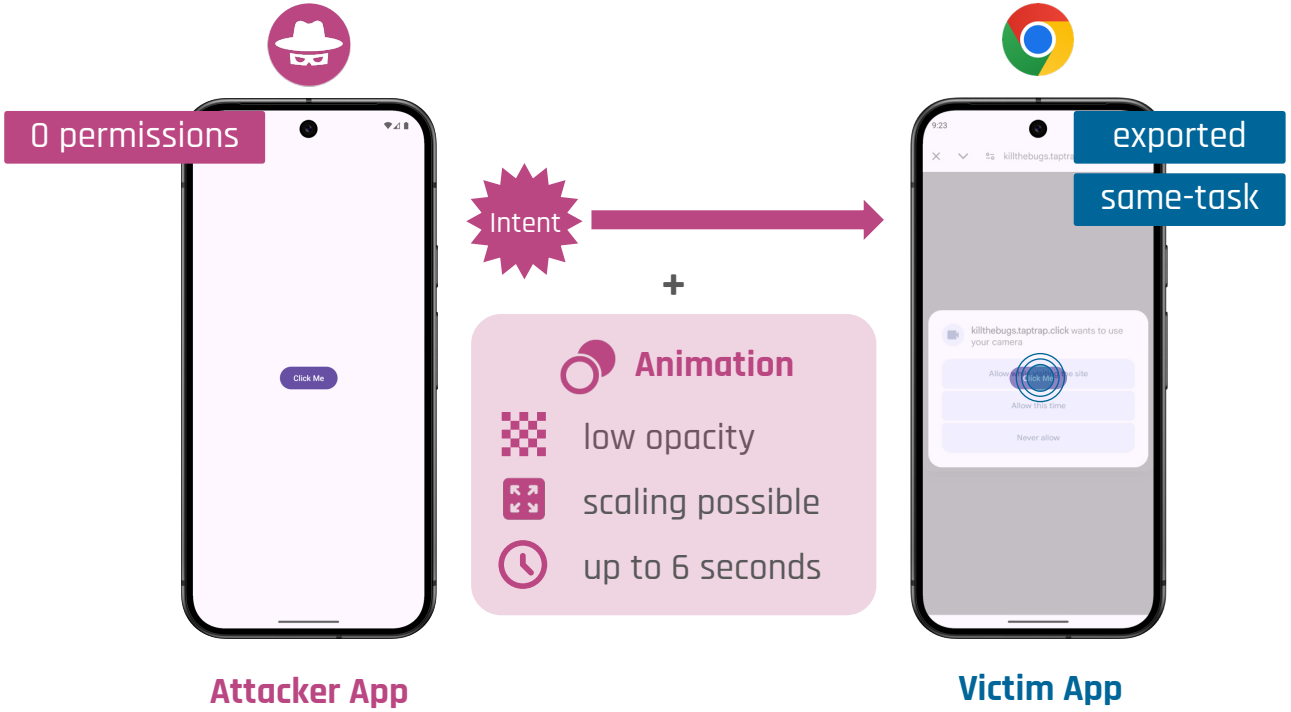
Block pass-through



*SAW = System Alert Window

TapTrap

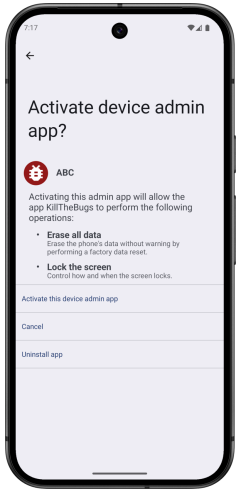
TapTrap | Threat Model & Mechanism



TapTrap | Implications (1/2)

Attack System Apps and Dialogs

Bypass runtime permissions
camera, microphone, location,
...



Device erasure
by requesting device admin permissions

and more

TapTrap | Implications (2/2)

Attack Browsers

Permission Bypass

Load **attacker-controlled website** in a Custom Tab that requests sensitive permission

Web Clickjacking

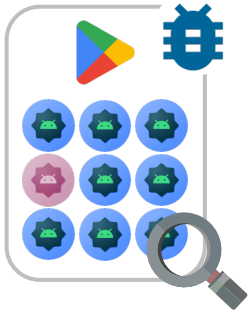
Open **victim website** in a Custom Tab and lure users into clicking sensitive button, e.g., “pay now”

Browser Vulnerability

- Chrome
- Samsung Internet
- ~~Opera~~
- ~~UC Browser~~
- Firefox (*)
- Edge
- Yandex
- Naver Whale
- Coc Coc
- Brave (*)

(*) requires 2 clicks to persist permissions

Attack 3rd Party Apps



App Vulnerability

App Vulnerability

Analysis of ~100K apps from the Google Play Store

An activity is vulnerable to TapTrap if it

is externally launchable

is same-task launchable

does not overwrite entry animations

does not wait for animation end before handling user input

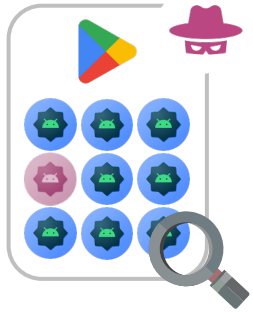
Manifest analysis

Bytecode analysis

76 **% of apps are vulnerable**

7 **% of activities are vulnerable**

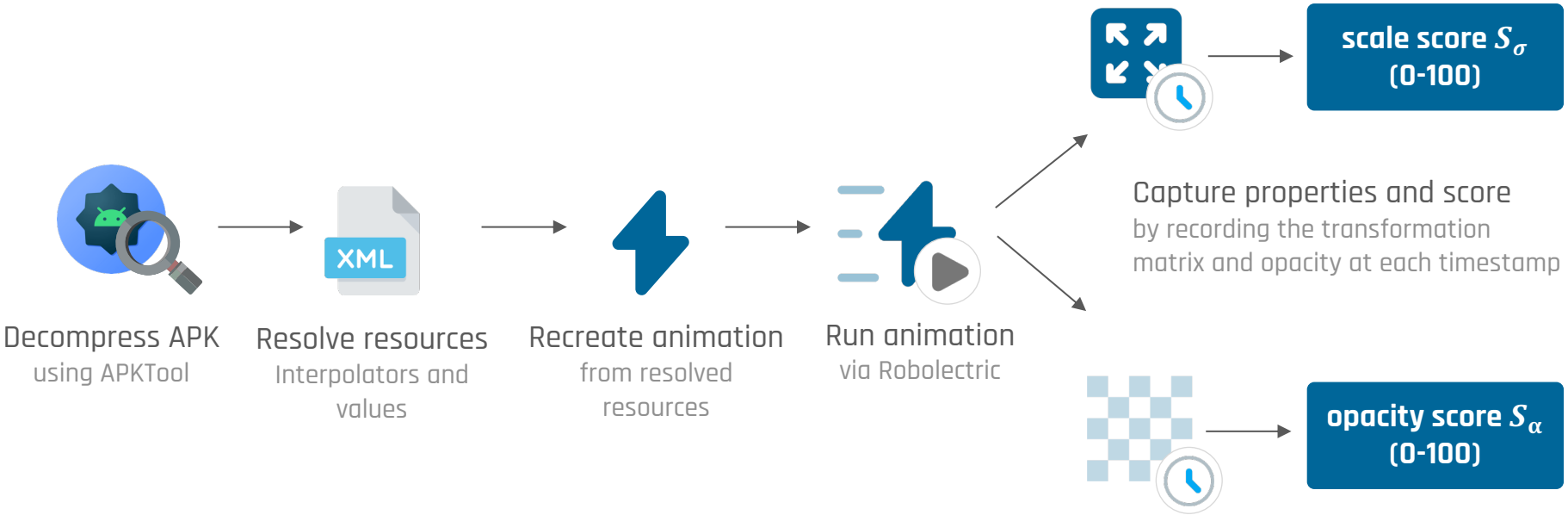
An app is vulnerable if it contains a vulnerable activity



In The Wild

Exploitation In The Wild | Methodology

Analysis of ~100K apps from the Google Play Store



Decompress APK
using APKTool

Resolve resources
Interpolators and values

Recreate animation
from resolved resources

Run animation
via Robolectric

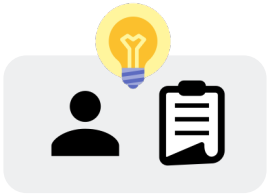
Exploitation In The Wild | Results

Finding #1: Animations can exceed the predefined limit

Our pipeline identified that animations can last longer than 3 seconds (up to 6 seconds)

Finding #2: TapTrap is not exploited in the wild

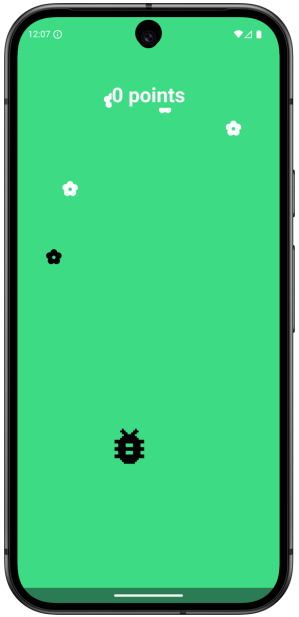
While 28 apps had $S_\sigma \geq 50 \vee S_\alpha \geq 50$, manual analysis of these showed no evidence of exploitation



User Awareness

User Awareness

User study with 2 rounds to evaluate user awareness



User Study App “KillTheBugs”

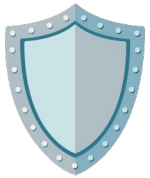
Level 1
Request location permission via Chrome Custom Tab

Level 2
Request camera permission via Chrome Custom Tab

Level 3
Trick user into granting the device administrator permission

20 **participants**
recruited from entry-level bachelor courses and via word of mouth

all **failed to detect at least one TapTrap variant**
even after being informed that the app is malicious



Mitigations

Mitigations

Android

ignore touches under a certain opacity threshold or over a scale threshold

Android 16 still vulnerable*

GrapheneOS fixed

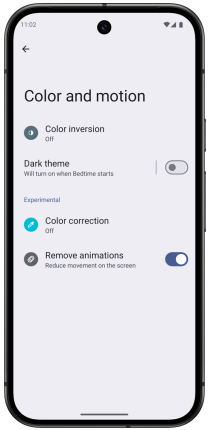
Apps

override entry animation

wait for animation to finish before handling user input

fixed

Users



disable animations

* as of July 23, 2025

In the paper

Proposing TapTrap

Animation-based tapjacking attack

Classification of Previous Tapjacking Attacks/Mitigations

First to exploit activity transition animations

Exploitation in the Wild

Analysis of ~100K apps finding no evidence of exploitation

App Vulnerability

Analysis of ~100K apps finding 76% are vulnerable to TapTrap

User Awareness

User study with 20 participants finding that all failed to notice at least one TapTrap variant

demonstration video, artifacts, and more info

https://taptrap.click

This work was supported by the Vienna Science and Technology Fund (WWTF) and the City of Vienna, the Austrian Science Fund (FWF), and SBA Research.

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