Universität des Saarlandes
MI Fakultät für Mathematik und Informatik
Department of Computer Science

Bachelorthesis

Capabilities as a Solution against Tracking

submitted by

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on January 01, 1970

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Yes, you can

Abstract

Trusted Web Activities and Custom Tabs enable Android developers to seamlessly integrate web content into native applications, offering a powerful tool for features such as Single Sign-On and in-app monetization. However, as shown by HyTrack, this integration also introduces severe privacy risks by blurring the boundary between web and app contexts, allowing persistent cross-app tracking through the browser's shared cookie storage.

In this work, we propose a novel framework based on capability-based access control to mitigate these risks. By issuing fine-grained security tokens, our framework limits the access of third-party libraries to browser state, without compromising core functionalities such as SSO or web-based UI components.

We evaluate our solution against the threat model and methodology introduced in Hy-Track. Preliminary results indicate that our framework is easy to integrate, preserves application behavior, and successfully blocks unauthorized cookie access across applications. In our tests, it prevented [X]% of third-party cookies from being shared, while maintaining [Y]% compatibility with existing third-party SDKs.

how to best test this?

maybe add some other number stuff: Cookies set, sent, types, permissions ...

Acknowledgements

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Chapter 1

Introduction

In recent years, Android applications have increasingly leveraged web content within their interfaces to enhance user experience and streamline features such as authentication and monetization. To enable this, developers often use Custom Tabs (CTs) and Trusted Web Activities (TWAs), technologies that provide seamless, browser-backed web integration while maintaining native-like performance and features. This approach allows web-based functionality like Single Sign-On (SSO), for example login via Facebook or embedded advertising, without forcing users to switch between app and browser.

However, these benefits come at a cost. CTs and TWAs share the browser's cookie storage across all apps, enabling continuity of web sessions—but also opening serious privacy vulnerabilities. Recent research by Wessels et al. introduced HyTrack, a novel tracking technique that exploits this shared browser state to persistently track users across different applications and the web, even surviving device changes, cookie clearing, or browser switching [1]. HyTrack works by embedding a third-party library into multiple unrelated apps. Each app, unaware of the library's true purpose, opens a CT or TWA to the same tracking domain. This domain sets a unique identifier in a cookie, stored in the browser's shared cookie jar. When another app using the same library loads content from the same domain, the cookie is sent, enabling the tracker to correlate activity across apps—and even into regular browser use. Due to Android's backup mechanisms, the tracking ID can be restored even after a factory reset, rendering it more persistent than traditional evercookies

This thesis explores whether Capabilities, a fine-grained access control model, can be used to limit or prevent these privacy issues without breaking legitimate use cases of CTs and TWAs. Specifically, we aim to design and evaluate a framework that allows developers to retain the benefits of third-party libraries—such as SSO or monetization—without exposing users to invisible, cross-app tracking. The framework should be simple to

Cite here or directly after name?

integrate, practical in real-world deployments, and minimize interference with established app workflows.

Chapter 2

Related Work

Write the related work (hytrack)

Citation to Hytrack[1]

Chapter 3

Methodology

Write the methodology.

Chapter 4

Evaluation

Write the evaluation.

Chapter 5

Schedule

Write the schedule.

Chapter 6

Success Criteria

Write the success criteria.

Bibliography

[1] M. Wessels, S. Koch, J. Drescher, L. Bettels, D. Klein, and M. Johns, "Hytrack: Resurrectable and persistent tracking across android apps and the web," in *34th USENIX Security Symposium (USENIX Security 25)*. Seattle, WA: USENIX Association, Aug. 2025.

Additional Something

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