

# Flutter and iOS Application Comparison

An Empirical Metric Analysis of Performance and User Experience

## Bachelor Thesis

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# Chapter 1

## Introduction

Mobile platforms are dominated by two players - Apple and Google with their respective operating systems iOS and Android. Cumulatively, they form a duopoly in the smartphone operating systems market with a combined usage shares of 15.2% for iOS and 84.8% for Android in 2020 according to IDC (2021).

To develop a mobile application for both target platforms, the corresponding development environments and technologies are utilized for each platform. This leads to a doubling of cost, development time and the need for knowledge of two different application development paradigms. This has resulted in the creation of cross platform frameworks such as Xamarin (Corp. 2021), React Native (Facebook 2021) and Ionic (Ionic 2021).

The premise of these frameworks is a tech stack operating on a single code base leading to increased development speed while also having the ability to deploy for both operating systems.

However, platform-specific development, these cross-platform frameworks lack in terms of performance and usability when compared to native technologies as shown by Mercado et al. (2016) and Ebone et al. (2018).

Flutter claims to solve both of these issues. It is an open-source cross-platform UI toolkit developed by Google for building "[...] *natively compiled applications for mobile, web and desktop from a single code base*" (Inc. 2020). The main value proposition of Flutter is native performance by compiling to platform specific code while also providing the ability to develop expressive and flexible UI designs.

If these claims hold true, there could be shift in terms of usage of Flutter by app developers. Unfortunately, since Flutter was first released in March 2018 (Google 2021), there are no peer

reviewed articles comparing the performance or usability to native apps.<sup>1</sup>

## 1.1 Motivation

As a digital agency specialized on native iOS and Android development, apploft GmbH is highly interested in Flutter. The implications of using this framework could be wide ranging. The services portfolio of apploft could be extended to clients with lower budgets while not being tied to a specific operating system.

Furthermore, infrastructure setup, package development and app updates would only need to be done for one codebase.

## 1.2 Thesis Goal

Based on the above stated problem and the potential business implications, the goal of this thesis is to evaluate whether Flutter's claims on performance, and usability hold up in practice.

## 1.3 Methods

To properly compare Flutter and native, an application will be developed which has typical mobile app features including the interaction with a remote API, user authentication and authorization and different means of navigation between screens.

Based on these characteristics, *Kickdown* - an online car auction app was chosen. The app is already developed for iOS by apploft. To verify laid out claims of the Flutter framework an exact clone is built to compare performance and usability characteristics.

### 1.3.1 Performance comparison

To evaluate performance the typical measures of CPU, GPU and memory usage are chosen in this paper. On the one hand these metrics are the underlying causes of more ephemeral metrics such as page load speed apart from software implementation complexity. On the other hand, these metrics can be easily measured using software tools.

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1. An extensive search for relevant articles has been conducted using Google Scholar, Sci-hub and IEEE Xplore.

### 1.3.2 Usability comparison

Expert interviews with employees of apploft are conducted to compare the user experience of the developed Flutter app with the iOS application.

## 1.4 Scope & Limitations

The feature set of the implemented app is representative for most, but not every type of app. Therefore the results cannot be generalized to every type of app. The usability study doesn't have a statistical significance due to its qualitative nature.

The feature variance of mobile applications is rather high. Features beyond those mentioned in 1.3 include on-device machine learning, augmented reality and more. These types of features will be intentionally excluded from the app, due to the high implementation effort which would exceed the scope of this thesis.

*If a usability study is conducted,  $N$  may be too small to have a statistical significance.*

## 1.5 Plan of Attack

The following is a list of subgoals of this thesis including accompanying deadlines.

### 1.5.1 Section Writing

- ~~write draft of *Introduction* section and discuss - 05.02.21~~
- write draft of *Flutter* section and discuss - 19.02.21
- write draft of *Study Design* section and discuss - 05.03.21
- write draft of *Application Design* section and discuss - 19.03.21
- write draft of *Performance Comparison* section and discuss - 02.04.21
- write draft of *UX Comparison* section and discuss - 02.04.21
- write draft of *Summary* section and discuss - 02.04.21
- write draft of *Abstract* section and discuss - 02.04.21

### 1.5.2 Performance Measurement

- prepare tooling and conceptualize measurement process - 26.02.
- execute a first iteration of measurement process - 05.03.
- execute a final iteration of measurement process - 26.03.

### 1.5.3 UX Measurement

- prepare interview process - 26.02.
- conduct min 3 interviews - 31.03.
- evaluate interviews - 01.04.

### 1.5.4 Submission

- topic submission - 15.02.
- send out thesis for proof reading - 05.04.21
- submit to examination office + register for colloquium - 09.04.

\*It is unclear how fast the author will be able to implement the features of the app. The minimum requirement is to complete building out the *offerings* screen. This is the most complex screen of the app and constitutes the main feature. It is sufficient for performance comparison as well as a usability study. However, if time permits, more of the app will be developed and comparatively evaluated.

### 1.5.5 Following Chapter Summary

- *TODO: Describe structure of thesis and summarize each chapter. This should be somehow interwoven into introduction.*

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