Survey Paper on Google's Flutter SDK

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Abstract— Flutter is Google's new UI toolkit for building attractive, natively compiled applications for mobile, web and desktop from a single codebase. Flutter uses Dart language for both UI Design and coding. Flutter's engine is written in C++. It interfaces with platform specific SDK provided by Android OS and iOS. Flutter will be used to develop cross platform applications for android, ios and web, even for upcoming Google's Fuchsia OS.

Keywords: Flutter, SDK, Dart, Android, iOS, Fuchsia OS, Native

1 Introduction

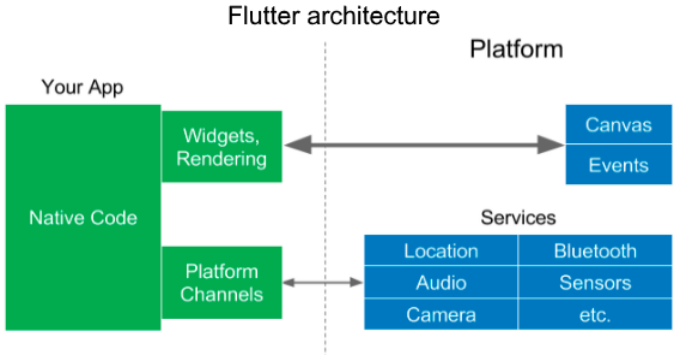
Flutter is a new cross-platform software development kit made by Google. It is being used to create applications for Android, iOS, Fuchsia and other web and desktop based applications. Google announced initial public build of Flutter 1.0 on December 4, 2018 and released first stable version on December 11, 2019. Flutter uses Google's Dart language for both designing and coding.

Flutter can be used in different ways.

1) Android Studio Flutter and Dart Plugin
2) Terminal and any editor
3) Visual Studio Code with Flutter and Dart Plugin

2 Framework Architecture

Flutter architecture mainly consists of Dart platform, Flutter Engine, Foundation Libraries and Design Specific Widgets.



2.1 Dart Platform:

Flutter uses Google's dart language and many of its features. Flutter runs Dart virtual machine which features just-in-time execution engine. This just-in-time engine allows developer to use 'Hot Reload' feature which grants easy way to make changes and run on device without building project again. Later version of Flutter apps versions are compiled with ahead-of-time (AOT) compilation on both Android and iOS which provides as much as high performance.

2.2 Flutter Engine:

Flutter engine is written in C++ , providing low level rendering support using Google's Skia graphics library. Also, it uses platform specific SDKs provided by Android and iOS. It includes core libraries like animations, graphics, file and network I/O, accessibility support, plugin architecture and Dart runtime and compile toolchain.

1) Foundation Libraries:

Foundation libraries are written in dart, which provides basic classes and functions used to build applications in flutter such as APIs to communicate with the engine.

2) Design Specific Widgets:

Framework contains couple of set of widgets which conform to specific design languages. Material Design widgets implement Google's design language whereas, Cupertino is widget implements Apple's Human Interface Guidelines.

3 Features

Following are the main features of the Flutter SDK:

3.1 Fast Development

Hot Reload function helps to quickly and easily experiment, build user interfaces, fix bugs faster than before.

3.2 Expressive and Flexible UI

Flutter provides built in libraries, designing widgets,

rich motion APIs, smooth natural scrolling and platform awareness. Layered architecture allows full customization, which results in incredibly fast rendering and flexible designs

3.3 Native Performance

Flutter's widgets incorporates all critical platform differences such as scrolling, navigation, icons and fonts and Flutter code is compiled to native ARM machine code using Dart's native compilers. Thus, Flutter offers full native performance on both Android and iOS.

3.4 Mildest Learning Curve

Learning Dart is quite easy. Often it is observed that people with very limited programming knowledge can code or build an application or websites. According to Google Flutter team, there is no need to have mobile development experience to start with Flutter.

3.5 Documentation

Google is known for their detailed and well-structured documentation, which is something React Native struggles with. Also Google provides video tutorials and go-through practical exercises on Codelabs.

3.6 Growing Community

As Fluttter is growing very fast, developers community on internet is also growing fast. Developers' interest has been noticed on StackOverflow day by day. Despite still being in Beta Development, Flutter is available and widely adapted by enterprises, medium & small scale IT companies.

3.7 Dart

It is modern object oriented language and is responsible for some of the crucial things about Flutter.
No need for XML Files: In Native Android development, work is seprated into layout and code which uses XML and Java/Kotlin respectively. Dart keeps layout and code in one place.

3.8 Better performance without a Javascript bridge

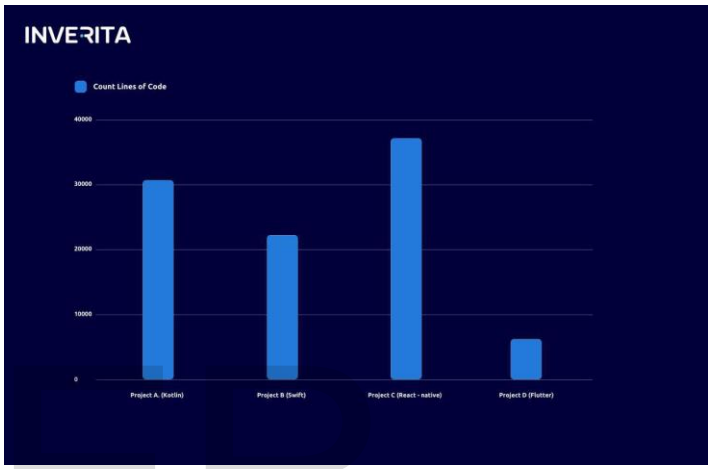
Dart compiles into native code directly, without the Javascript bridge.

3.9 Portability

Since flutter is not just a framework but a whole SDK, it can run virtually on any device having display. There are some third party ports which have been created to build Flutter apps for Fuchsia, iOS, MacOS, Windows, Linux as well as Web.
They include embedding APIs, mouse and keyboard input functions and different plugins.

3.10 Internationalization and Accessibility

Google provides built-in opportunities to make applications accessible to wider range of users.
When application is to be used in different languages and countries, developer need to create a localized content and this process is called as Internationalization.



4 DISADVANTAGES

4.1 Lack of third party libraries

Third party libraries and packages plays major role in automating software development. These libraries are mostly open source, easily available.
For older and famous technologies, it is easy to find desired packages and libraries.
On the other side, Flutter is new technology in the industry, so official resource of free packages gets better every day and other tools are growing fast.

4.2 Dart

Though Dart is object oriented, but it often loses, in comparison with other technologies especially Javascript, C#, and Java.

4.3 Large file size

Developers do major changes to app code for decreasing overall size and load of their applications. To decrease, developers tend to avoid animations, compress images and use minimum possible number of libraries and packages.
Flutter has made developers go crazy when a simple hello world program went for around 7 to 8MB in size. After optimizing and droping this size to 4MB, it

remained bigger than native java (539KB) and kotlin (550KB).
On the other side, other hybrid app development technologies like Xamarin and React Native takes almost 16MB and 8MB respectively.

4.4 Issues with iOS

Since Flutter is developed by Google, develoeprs are worried about its integration with iOS support.
Flutter Release Preview 2 included a pixel perfect iOS look, the flutter team demonstrated the possibilities of Cupertino widgets by recreating iPhone settings on Flutter.

5 Comparative study between Native Android Studio and Flutter SDK

Comparison Type	Native	Flutter SDK
Development	Android Studio, Eclipse	Android Studio Plugin, Visual Studio Code Plugin and Command Line Tool
Languages used	XML & Java / Kotlin	Google Dart
Development Type	Native	Hybrid / Crossed Platform
Application	Android	Android, iOS, MacOS, Windows, Linux, Fuchsia & Web Apps
Application Size	Around 500 – 600 KB for basic hellow world	7 to 10MB for basic hello world
Virtual Machine	Dalvik Virtual Machine	Dart Virtual Machine
Build Feature	Instant Run	Hot Reload

6 Conclusion

Flutter framework do provides an excellent framework to build applications in truly platform independent way. Flutter will be used to develop high performace web apps, desktop apps as well as natively performance giving Android, Fuchsia and iOS applications. Flutter will engage number of developers in cross platform development field and hopefully perform better than existing technologies like Cordova, Xamarin and React Native.

7 References

[1] https://flutter.dev/
[2] https://flutter.dev/docs
[3] https://dart.dev/
[4] https://dart.dev/platforms
[5] https://dart.dev/guides
[6] https://en.wikipedia.org/wiki/Flutter_(software)
[7] https://en.wikipedia.org/wiki/Dart_(programming_language)
[8] https://www.tutorialspoint.com/flutter/index.htm