Flutter/Dart における FFI

今日話すこと

dart:ffi の実装が始まった背景と課題

FFI ?

Foreign function interface

今回は C 呼び出しの話

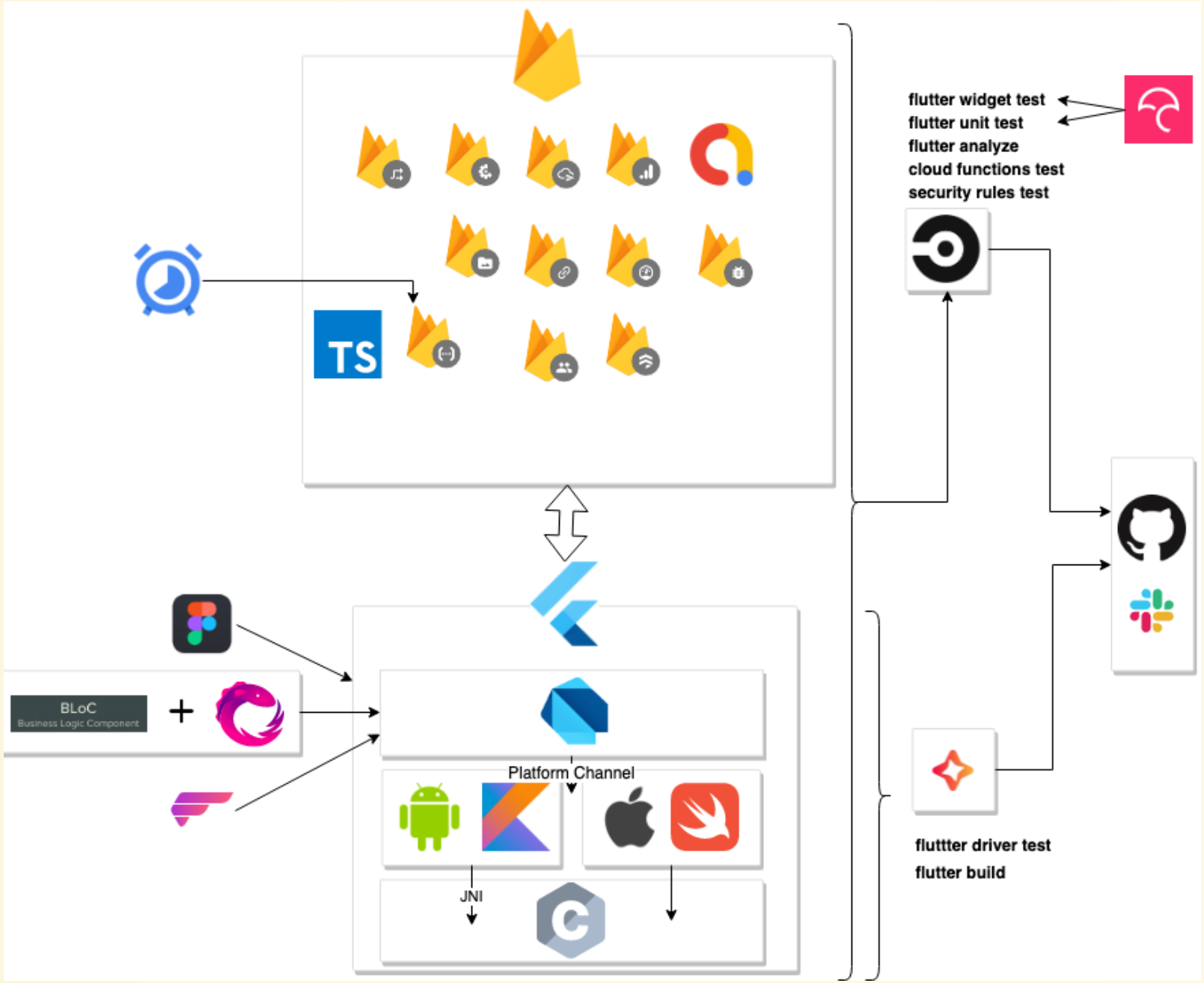
(C -> Dart の話は省きます)

自己紹介

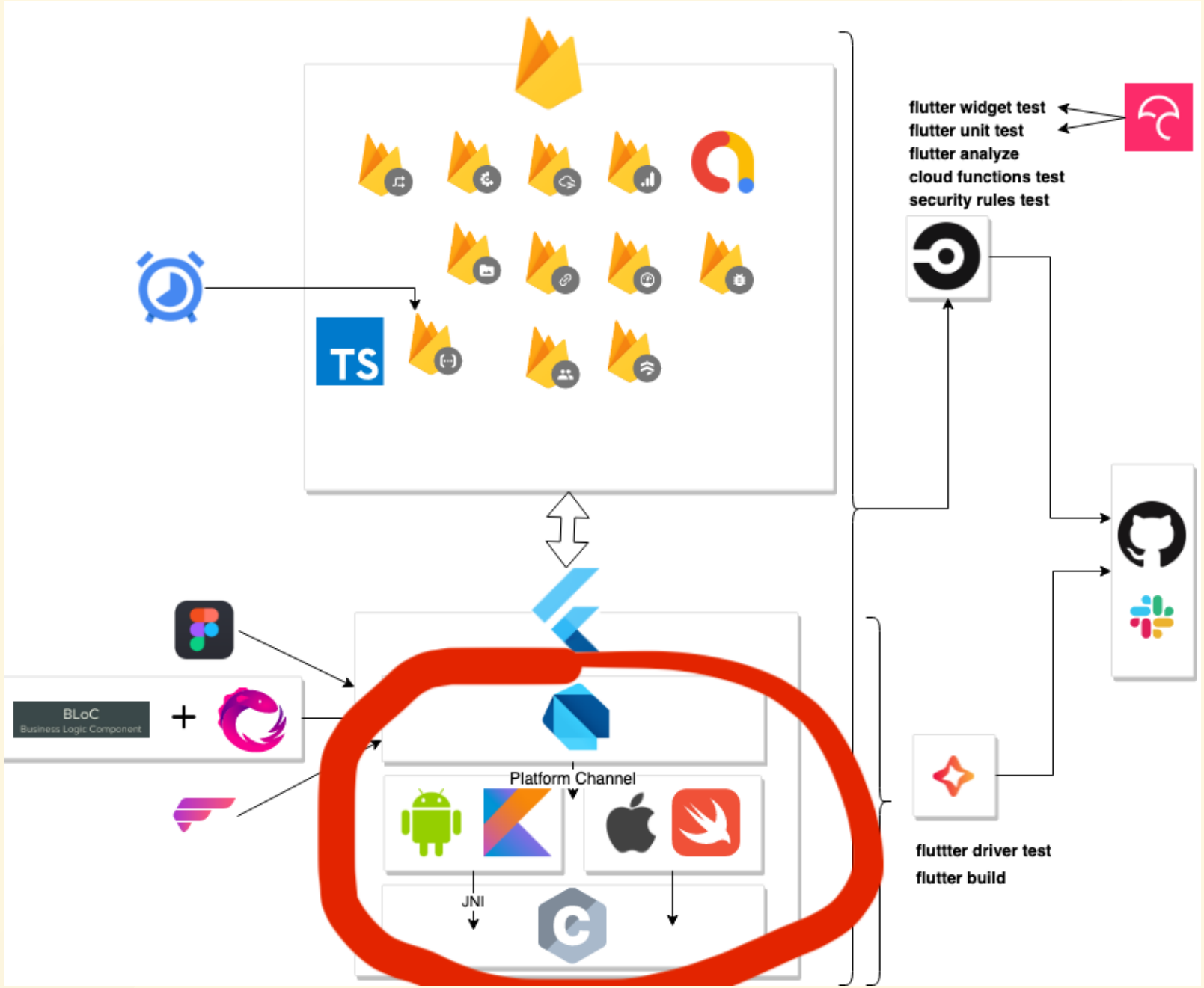
しみず なおき

自己紹介

お家で作ってるモノ


TS
BLoC
Business Logic Component
Platform Channel
JNI
flutter widget test
flutter unit test
flutter analyze
cloud functions test
security rules test
fluttter driver test
flutter build

オセロには常にCが必要


flutter widget test
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各言語の C 呼び出し

代表的なもの

言語	実装方法
Java	JNI や JNA, SWIG を使う
Go	cgo を使う
Python	ctypes や cffi を使う
Rust	extern キーワードで容易に呼べる
Ruby	Ruby-FFI を使う
Javascript	WebAssembly を使う
Swift	そのままいけるし、カスタムも可能

Dart は？

Dart から C を呼ぶ方法
(これまで)

Native Extension

Dart 側

```
library sample_hello;
import 'dart-ext:sample_hello';
void hello() native "Hello";
```

参考: dart-lang sample_extension

C++ 側 (一部省略)

```
DART_EXPORT Dart_Handle sample_hello_Init(Dart_Handle parent_library) {
  if (Dart_IsError(parent_library)) return parent_library;
  Dart_Handle result_code = Dart_SetNativeResolver(parent_library, ResolveName, NULL);
  if (Dart_IsError(result_code)) return result_code;
  return Dart_Null();
}

void hello(Dart_NativeArguments arguments) {
  Dart_EnterScope();
  printf("Hello\n");
  Dart_ExitScope();
}

Dart_NativeFunction ResolveName(Dart_Handle name, int argc, bool* auto_setup_scope) {
  if (!Dart_IsString(name) || auto_setup_scope == NULL) return NULL;
  Dart_EnterScope();
  const char *cname;
  Dart_StringToCString(name, &cname);
  Dart_NativeFunction result = NULL;
  if (strcmp(cname, "hello") == 0) result = hello;
  Dart_ExitScope();
  return result;
}
```

👉 深いレベルで拡張可能

👉 都度 `ResolveName` する

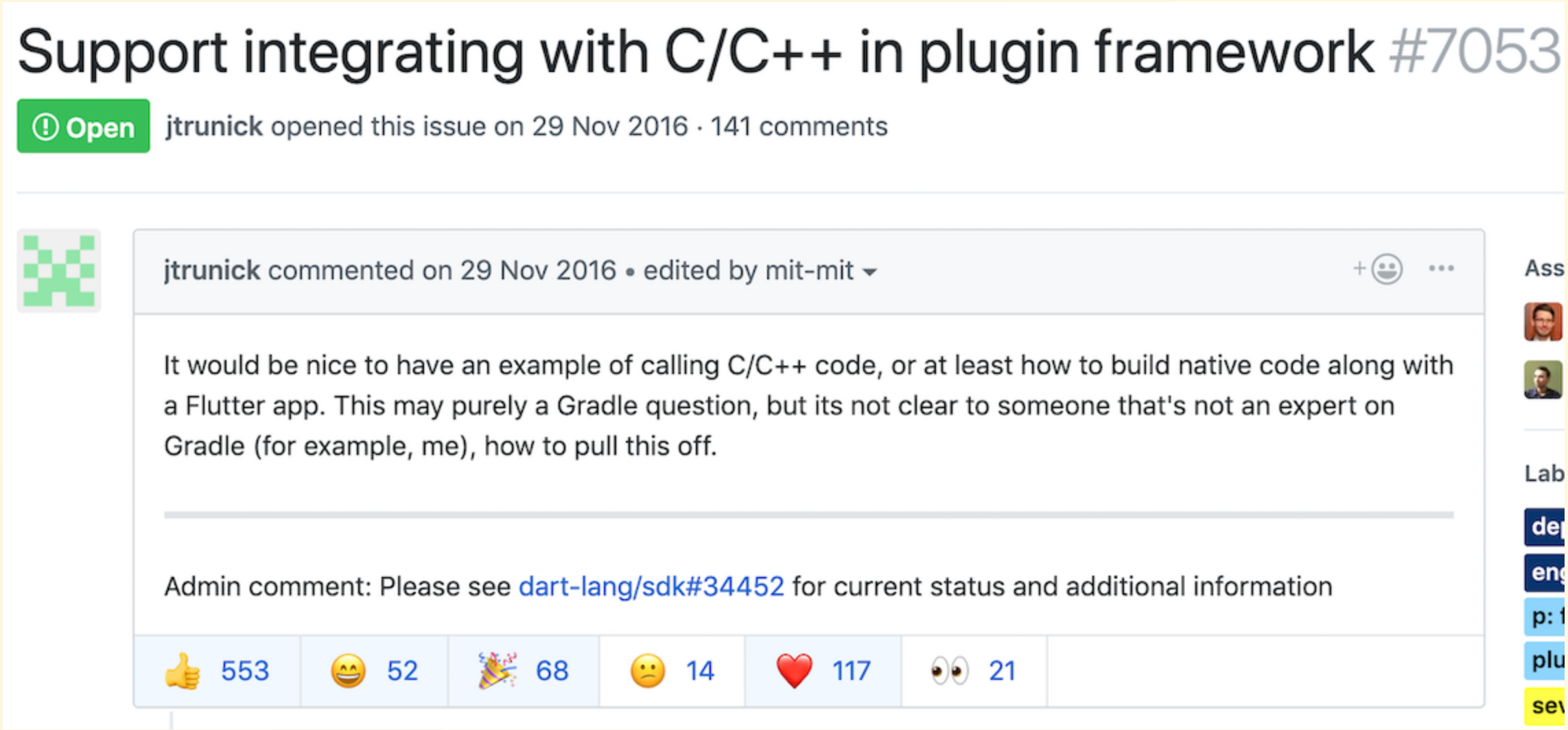
わかりやすく例をもう一個

```
void isEven(Dart_NativeArguments arguments) {
  Dart_EnterScope();
  Dart_Handle arg1 = Dart_GetNativeArgument(arguments, 0);
  int64_t input;
  if (Dart_IsError(Dart_IntegerToInt64(arg1, &input)))
  {
    Dart_ThrowException(Dart_NewStringFromCString("Error だよ"));
  }
  Dart_SetReturnValue(arguments, Dart_NewBoolean(input % 2 == 0));
  Dart_ExitScope();
}
```

👉 引数と返り値の型情報が静的に定義されていない

さて、Flutterでは？

現状、Swift/Objective-C, Kotlin/Java を経由する必要がある



Support integrating with C/C++ in plugin framework #7053

Open jtrunick opened this issue on 29 Nov 2016 · 141 comments

jtrunick commented on 29 Nov 2016 • edited by mit-mit

It would be nice to have an example of calling C/C++ code, or at least how to build native code along with a Flutter app. This may purely a Gradle question, but its not clear to someone that's not an expert on Gradle (for example, me), how to pull this off.

Admin comment: Please see dart-lang/sdk#34452 for current status and additional information

553 52 68 14 117 21

Ass

Lab

dep

eng

p: f

plu

sev

たくさんの 👍 の思いは？

① 既存ソフトをより統合しやすくしてほしい

○ 大量のグルーコードがつらい

○ 低オーバーヘッドがいい

SQLite

Realm

OpenCV

crypto, ssh ... libraries

などが具体例として挙げられている

② 大量のデータを効率よく出し入れしたい

なお、Dart 2.4 から TransferableTypedData が使用できるようになったので、ある程度はそれで間に合いそう

こういう要望にどう応えるか？

「Native Exstention でいいんじゃないの…?」

flutter / flutter

Unwatch releases 2,351 Sta

Code | Issues 5,000+ | Pull requests 112 | Projects 34 | Wiki | Security | Insights

Support for Dart Extensions #2396

Closed **eseidelGoogle** opened this issue on 4 Mar 2016 · 9 comments

eseidelGoogle commented on 4 Mar 2016 Contributor

https://www.dartlang.org/articles/native-extensions-for-standalone-dart-vm/

We've had at least one request for this. I suspect it's implemented entirely in the `dart` CLI.

My understanding is it's just a bit of code to map dart-ext: urls to making a dlopen call and passing the symbols off to the VM. **@johnmccutchan**

I'm mostly seeking to document how we'd do this in this bug. It's not clear if this is generically useful.

👍 14

⇒ Dart VM FFI Vision に理由が述べられていた

【理由１】

名前ベースの API

```
// dart-lang/sdk/runtime/include/dart_api.h より引用
DART_EXPORT DART_WARN_UNUSED_RESULT Dart_Handle
Dart_SetField(Dart_Handle container, Dart_Handle name, Dart_Handle value);
```

👉 名前解決がキャッシュされない

👉 AOT コンパイラに厳しい

(最悪の場合を想定したり、手動でアノテーションを付けてまわったりしないといけない)

【理由２】

Reflective Marshaling は効率良くない

```
void isEmailAddress(Dart_NativeArguments arguments)
```

`void` `arguments` 👀

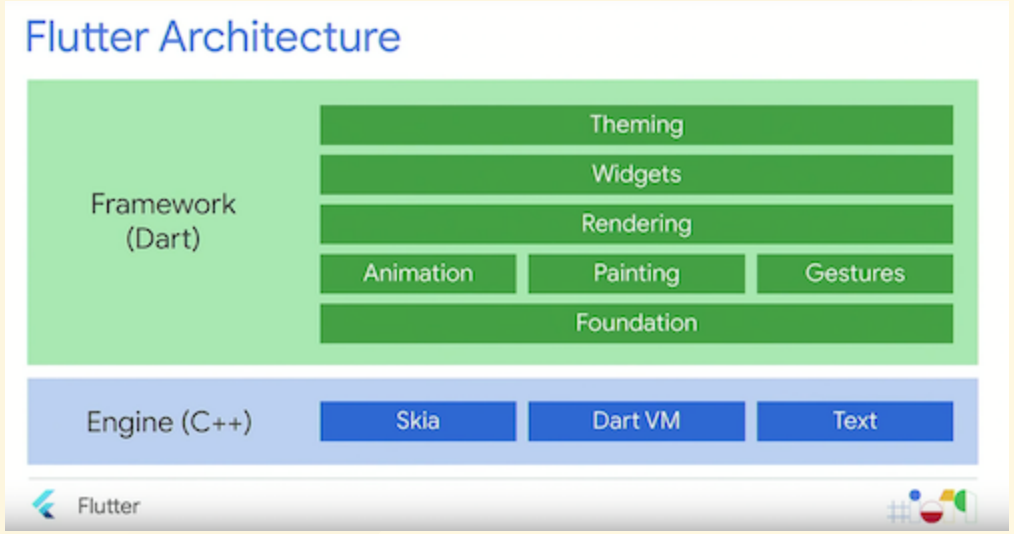
⇒ 引数/返り値が静的に型付けされた上での Marshaling の方が効率良い

⇒ その点は FFI が優れている

そこで、dart : ffi 👍

https://github.com/dart-lang/sdk/tree/master/sdk/lib/ffi

Google I/O'19 でも言及あり



> **We are working on a new foreign function interface. This should help you reuse existing C and C++ code, which is important for some critical stuff**

ちなみに

> we expect that moving Flutter Engine from C API to FFI should significantly reduce overheads associated with crossing the boundary between Dart and native code

どう使えるのか？

👍

```dart
import "dart:ffi" as ffi;
import 'dart:io' show Platform;

void main() {
  final libHelloWorld = ffi.DynamicLibrary.open("./libHelloWorld.dylib");
  final helloWorld = libHelloWorld.lookupFunction
        <ffi.Void Function(), void Function()>("helloWorld");

  helloWorld();
}
```

https://github.com/sensuikan1973/Dart_FFI_Hello_World

そして、先週、、、

Flutter stable 版に preview が!

(Android のみの試験的なもの)

どういう構成になるのか

<table>
<tr><td>App Developer</td><td colspan="3">Package Developer</td><td>Dart VM Team</td><td>Package Developer</td><td>Native Library Developer</td></tr>
<tr><td>Flutter App

(Imports package)</td><td>Package API

(Does not expose dart:ffi)</td><td>Package Implementation

(Code which converts C++ abstractions into Dart abstractions)</td><td>Bindings</td><td>dart:ffi</td><td>Glue code

(Code which takes care of things such as C++ exceptions)</td><td>Native Library</td></tr>
<tr><td colspan="4">Dart</td><td colspan="3">C / C++</td></tr>
</table>

(dart-lang/sdk/samples/ffi/sqlite/docs/sqlite-tutorial.md より引用)

課題

ぜひ dart:ffi に FB を送りましょう 👍

(課題 は多いです。Dart VM FFI の進行状況は ココ)

ありがとうございました

リンク一覧

- **Dart VM FFI Vision**
  - **Introduction to Dart VM**
  - Design and implement Dart VM FFI
  - Flutter Support integrating with C/C++ in plugin framework
  - Native extensions for the standalone Dart VM
  - Support for Dart Extensions
- C & C++ interop using FFI
  - **sdk/lib/ffi/**
  - Dart Native platform
  - dart:ffi sqllite sample
- The Engine architecture
  - Writing custom platform-specific code
  - Custom Flutter Engine Embedders
- Language features for FFI
- sensuikan1973/flutter-ffi-slide
- sensuikan1973/Dart_FFI_Hello_World