

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 **f**unction **i**nterface

今回は C 呼び出しの話

(C -> Dart の話は省きます)

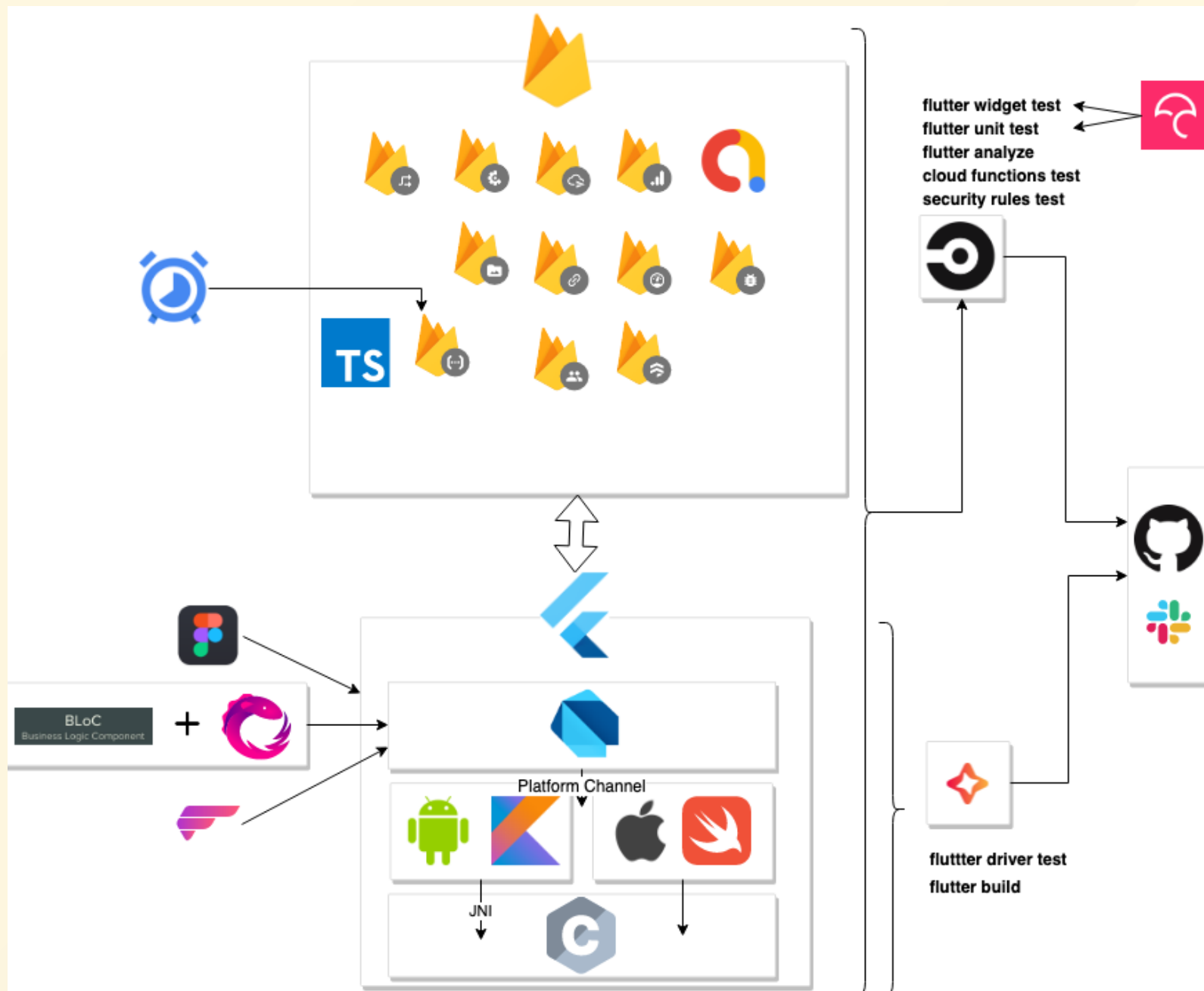
自己紹介

しみず なおき

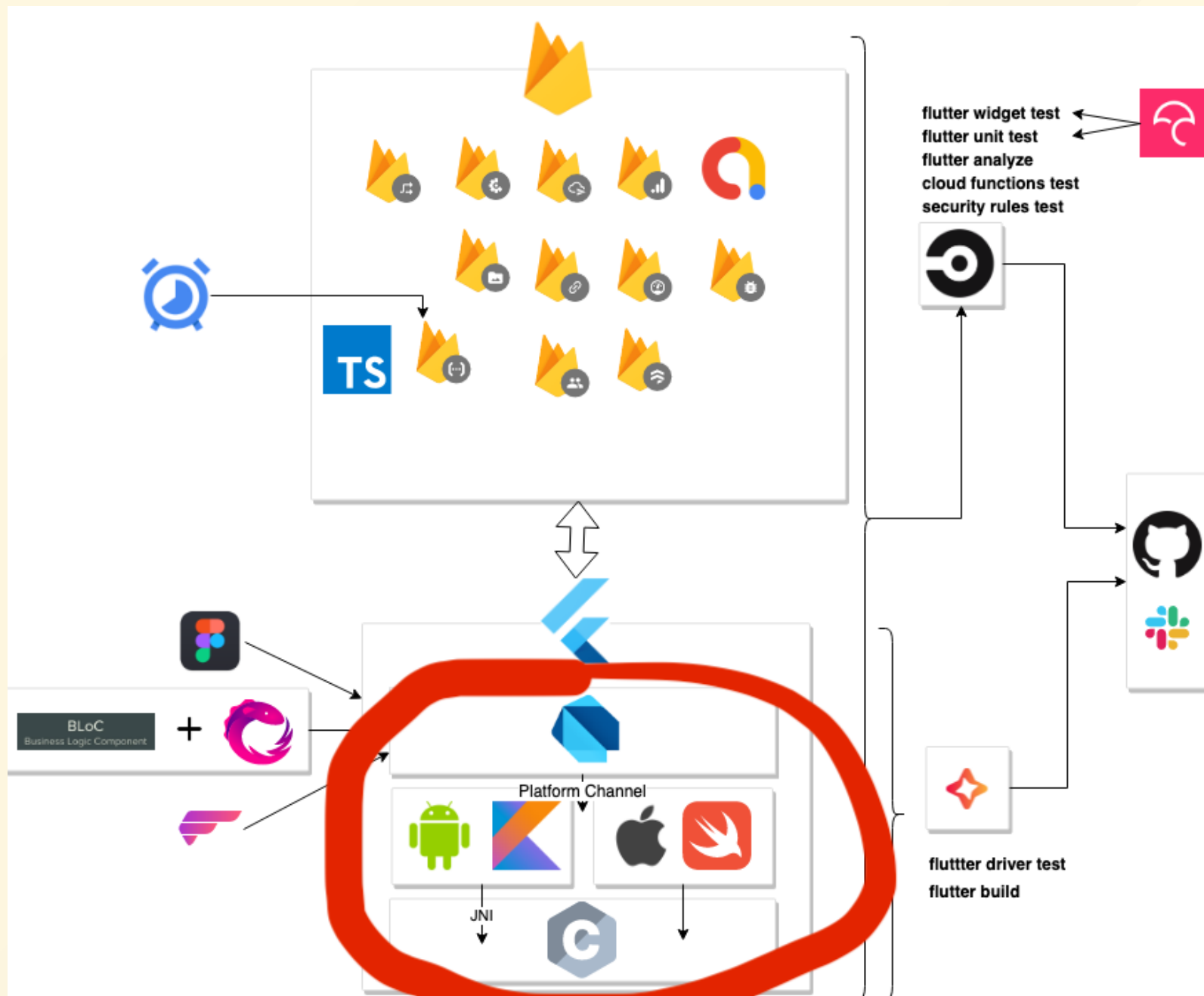




お家で作ってるモノ



オセロには常に C が必要



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 から C を呼ぶ方法 (これまで)

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



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

de

eng

p: 1

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づらい**
- **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...?」

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

Flutter/Dart における Dart->C をどう実現するか？



⇒ 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 🙄
```

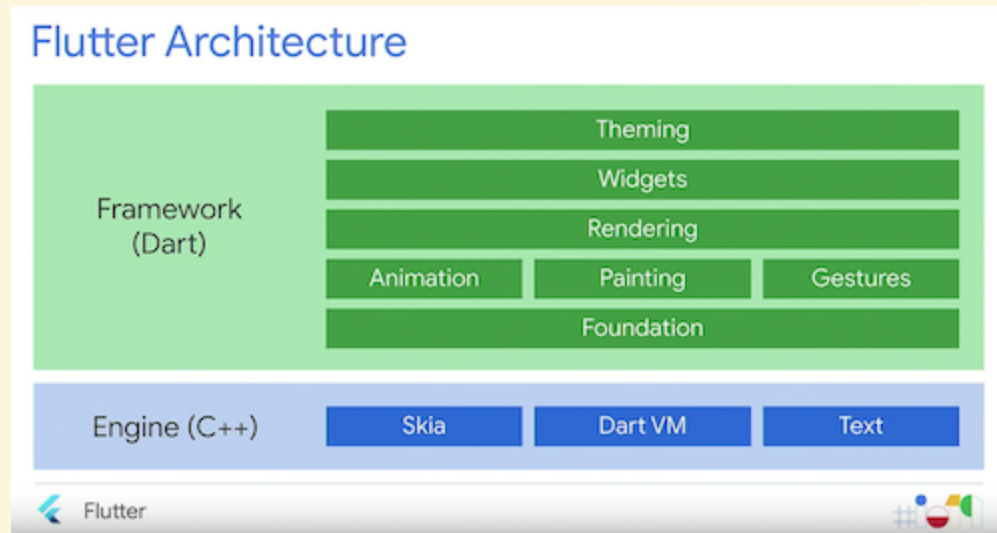
⇒ 引数/返り値が静的に型付けされた上での Marshaling の方が効率良い

⇒ 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？



```
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

ちなみに、先週、 Flutter stable 版に入った

(Android のみで試験的に触れる)

どういう構成になるのか

App Developer	Package Developer			Dart VM Team	Native Library Developer
Flutter App (Imports package)	Package API (Does not expose dart:ffi)	Package Implementation (Code which converts C++ abstractions into Dart abstractions)	Bindings	dart:ffi	Native Library
Dart				C / C++	

👉 Bindings:

```
final helloWorld = libHelloWorld.lookupFunction<ffi.Void Function(), void Function()>
    ("helloWorld");
```

みたいなものを定義するレイヤーのこと

課題

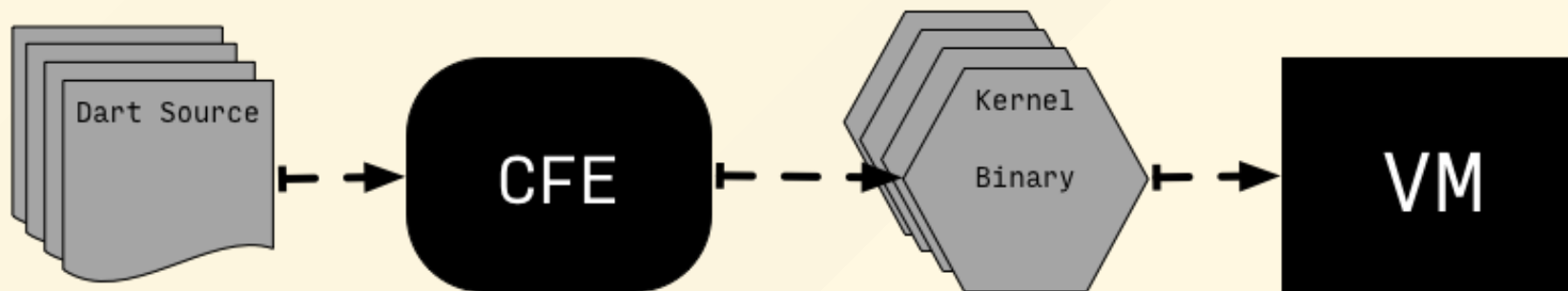
何個かを紹介

1: 例外を拾えない

⇒ C レイヤーを追加実装する

App Developer	Package Developer			Dart VM Team	Package Developer	Native Library Developer
Flutter App (Imports package)	Package API (Does not expose dart:ffi)	Package Implementation (Code which converts C++ abstractions into Dart abstractions)	Bindings	dart:ffi	Glue code (Code which takes care of things such as C++ exceptions)	Native Library
Dart				C / C++		

2: CFE への追加実装



補完や静的解析を行うために、
CFE (Common Front-End) の追加実装がまだまだ必要。

*Dart2 VM からは、生のソースから Dart を直接実行できず、CFE によって生成された Kernel Binary(dill)を与える必要がある

3: Binding 書くの疲れる

```
typedef sqlite3_step_native_t = Int32 Function(Pointer<Statement> statement);

typedef sqlite3_reset_native_t = Int32 Function(Pointer<Statement> statement);

typedef sqlite3_finalize_native_t = Int32 Function(
    Pointer<Statement> statement);

typedef sqlite3_errstr_native_t = Pointer<Utf8> Function(Int32 error);

typedef sqlite3_errmsg_native_t = Pointer<Utf8> Function(
    Pointer<Database> database);

typedef sqlite3_column_count_native_t = Int32 Function(
    Pointer<Statement> statement);

typedef sqlite3_column_name_native_t = Pointer<Utf8> Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_decltype_native_t = Pointer<Utf8> Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_type_native_t = Int32 Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_value_native_t = Pointer<Value> Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_double_native_t = Double Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_int_native_t = Int32 Function(
    Pointer<Statement> statement, Int32 columnIndex);

typedef sqlite3_column_text_native_t = Pointer<Utf8> Function(
    Pointer<Statement> statement, Int32 columnIndex);

(略)
```

⇒ C header からの生成ツール等を検討

4: 型変換の都度実装

[ffi] Helpers for interacting with C data #36711



Open sjindel-google opened this issue on 23 Apr · 2 comments



sjindel-google commented on 23 Apr

Contributor



There are a number of helpful facilities which can be built on top of the FFI foundation and should probably be included in `dart:ffi`, for example:

- `CString` : wrapper for strings allocated in C
- `CArray<T>` : wrapper for arrays allocated in C, compatible with List, Iterable, TypedData, etc. types

Suggestions for others are welcome!



1

⇒ ヘルパーの実装を検討

ぜひ dart:ffi に **FB** を送みましょう 🍑

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 sqlite 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](#)