About Rust in Android apps

Android applications are mainly written in Java, but it often calls C functions through JNI in order to gain high performance.

In my research, I make an Android application which uses Rust functions from Java because Rust functions make applications safer.

Safety of Rust

Calling C programs is unsafe. This is because C compiler does not check data type. C can access incorrect memory address. These are connected to unsafe.

In order to enhance safety, I replace C functions with Rust functions.

Why is Rust safe?

The ownership model confirms safety of Rust.

Ownership: limiting access to resources

Borrowing: borrowing ownerships to data and getting temporary accessibilities to certain resources

Lifetimes: giving an expiration of borrowed ownerships

Methods

Algorithm of the app

I make a simple calculator application which calls a Rust function from Java through C.

Java

C

Rust

This application follows 3 steps below.

1. Choose x

2. Choose y

3. Show result

C calls a Rust function in step 3. The flowchart below shows how the Rust function works.

[Rust] Calculate x+y

[C] Pass x, y to Rust function

[Rust] Return x+y to C

[C] Return x+y to Java

Android Studio

I use Android Studio to build the calculator application. Android Studio is an official IDE to build Android applications.

JNI(Java Native Interface)

JNI(Java Native Interface) is a framework to call other language (C or C++) from Java.

Java

C

JNINativeMethod

Cross compile is a way to compile source codes for other devices, not for one on which the compiler is running, and programs compiled by a usual compiler cannot be used in other devices.

In this research, I have to cross compile the Rust codes because Rust functions are used in Android smartphone, not in my laptop.

Future Research

- Measuring the latency caused by calling Rust function
- Figuring out when we should use Rust instead of C
- Figuring out what kind of errors Rust can prevent

Acknowledgements

This research project was conducted as a part of the Nakatani Foundation’s 2018 Nakatani RIES Fellowship for Japanese Students. Special thanks to the members of the Zhong Group for their research mentorship and support. I would also like to than Prof. Junichiro Kono, Sarah Phillips, Kenji Ogawa, Aki Shimada, Natsumi Komatsu and other members of Rice University for making this program possible.

References