



*Announcement: Research Assistant (HiWi) in Cooperation with Fraunhofer AISEC, Garching*

## Secure Integration of C/C++ with Rust / Swift / etc.

C and C++ belong to the most prevalent programming languages. For over 30 years they have been used to develop software on different levels of abstraction, e.g. operating systems, compilers, communication protocols and cryptography libraries. However, most of the high-severity bugs that were found in the last years can be traced back to memory corruption vulnerabilities, caused by the error-prone manual memory management of C/C++.

Within the last decade multiple modern, memory-safe programming languages were released. Especially Rust, Swift and Go stick out, as all of them are memory-safe but also compile to native binary code and thus approach the efficiency of C/C++. Unfortunately, complete replacement of C/C++ seems unrealistic, because rewriting all libraries in a modern language is infeasible.

At Fraunhofer AISEC we are researching new approaches to combine modern programming languages with C/C++ in a safe manner, such that developers for modern language code can make use of legacy C-libraries without sacrificing security.

### Task Description

For this student job, you will investigate compilers of different modern languages and examine their memory management. The LLVM compiler infrastructure will play a central role for your work as it builds the basis for compilers of multiple programming languages. Amongst other tasks, you will write LLVM Passes to foster exchange of memory management metadata. You will learn about several main aspects of the LLVM framework:

- How the particular compilers build an LLVM language frontend to translate language-specific syntax to LLVM's Intermediate Representation (IR).
- How security mechanisms are analyzing and instrumenting code on LLVM IR level.
- How code can be added through LLVM to perform security checks at runtime.

### Requirements

- Initial experience with Rust or Swift or a strong interest in learning one of them
- High interest in compilers (especially the LLVM framework) and software hardening techniques
- Self-driven work ethic and fun experimenting with new techniques

### Contact

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