Design and Implementation of a Reduced Hardware Description Language for CIRCT

Hochschule München is among the largest German universities of applied sciences, located at the heart of Munich, Germany. The working group "AEMY" focuses on safe, secure and smart systems. Our main working areas include RISC-V processor design, WebAssembly runtime development and open source chip design tools.

For our research project DI-OSVISE we are looking for a motivated student to research the possibility of a Reduced Hardware Description Language for CIRCT.

Circuit IR Compilers and Tools (CIRCT) is a Multi-Level Intermediate Representation (MLIR) Framework based hardware compiler. It is a relatively new tool which offers a new approach to translate hardware descriptions into various formats needed in the hardware design flow. It leverages design principles common in traditional software compilers and reuses the infrastructure of MLIR. This allows for multiple front-ends to coexist. Examples of input languages include SystemVerilog, Python and Chisel. Each of those hardware description/construction languages was designed independently of CIRCT.

In this master's thesis, a completely new hardware description language should be designed and implemented with the internals of CIRCT in mind. The research is not restricted, but for inspiration here are some ideas: - Defining a minimal set of operations - Implementing a parser - Creating simple examples to showcase the functionality - Creating a tutorial for the new language - Adding verification support to the new language, make use of CIRCT's LTL

With this work you will learn the internals of an LLVM/MLIR based compiler. This is a compiler widely used in the industry, for example for RISC-V but also for custom AI accelerators. You will also learn the difference of hardware description language and programming languages.

If this topic is interesting to you and you want to learn more about it, or got inspired and have a suggestion for a similar topic, feel free to reach out! It is also possible

to cover this topic by a bachelor's thesis.

If you are interested, please get in touch:
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Find more on our website:
`https://aemy.cs.hm.edu`