CompCert

## Formally Verified Optimizing C Compiler

CompCert is an **optimizing** C compiler which is **formally verified**, using machine-assisted mathematical proofs, to **guarantee the absence of compiler bugs**. The code it produces is proved to behave exactly as specified by the semantics of the source C program. This level of confidence in the correctness of the compilation process is **unprecedented** and contributes to meeting the **highest software assurance levels**.
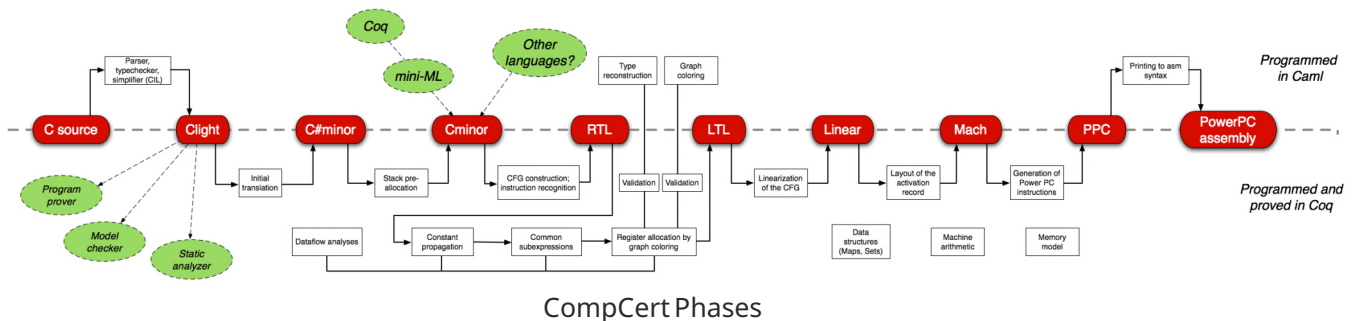
CompCert Phases

"The striking thing about our CompCert results is that the middle-end bugs we found in all other compilers are absent. As of early 2011, the under-development version of CompCert is the only compiler we have tested for which Csmith cannot find wrong-code errors. This is not for lack of trying: we have devoted about six CPU-years to the task. The apparent unbreakability of CompCert supports a strong argument that developing compiler optimizations within a proof framework, where safety checks are explicit and machine-checked, has tangible benefits for compiler users."

Study by Regehr, Yang et al. on a development version of CompCert in 2011

In 2021, the **CompCert** development team received the prestigious ACM Software System Award.

Your Benefits:

· Using the **CompCert** C compiler is a natural complement to applying formal verification techniques (static analysis, program proof, model checking) at the source-code level. The correctness proof of **CompCert** guarantees that all safety properties verified on the source code automatically hold for the generated code as well.
· On typical embedded processors, the code generated by **CompCert** usually runs twice as fast as the code generated by GCC without optimizations, and only 20% slower than GCC at optimization level 3.

Availability:

· **CompCert** has been developed at INRIA by architect and lead developer Xavier Leroy with numerous renowned researchers contributing ideas, code, or feedback.
· Source code and documentation of **CompCert**, including the compiler proofs, can be downloaded from the website http://compcert.inria.fr. For research purposes, the usage of CompCert is free of charge.
· In 2014, INRIA and AbsInt entered a license agreement to provide commercial licenses to end users. AbsInt offers commercial licenses, provides industrial-strength support and maintenance, and contributes to the advancement of the tool.

Supported Targets:

• PowerPC (32-bit and 32/64-bit hybrid)
• ARM (ARM & THUMB 32-bit)
• AArch64 (ARM 64-bit)
• IA32 (x86 32-bit)
• AMD64 (x86 64-bit)
• RISC-V (32- and 64-bit)