

Factsheet



CompCert C Compiler

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CompCert is an optimizing C compiler which is formally verified, using machine-assisted mathematical proofs, to guarantee the absence of compiler bugs.

Its intended use is compiling safety-critical and mission-critical software written in C and meeting high levels of assurance. The code it produces is proved to behave exactly as specified by the semantics of the source C program.

The formal proof covers all transformations from the abstract syntax tree to the generated assembly code.

Key benefits

- The correctness proof of CompCert guarantees that all safety properties verified on the source code (e.g. by static analyzers or model checking) automatically hold for the generated code as well.
- On typical embedded processors, code generated by CompCert offers performance comparable to code generated by *GCC* at optimization level 1.

Optimizations

CompCert implements the following optimizations, all formally verified:

- Register allocation using graph coloring and iterated register coalescing.
- Instruction selection with strength reduction, to take advantage of combined instructions provided by the target architectures.
- Constant propagation, for integer and floating-point types.
- Common subexpression elimination.
- Dead and redundant code elimination.
- Function inlining.
- Tail call elimination.
- If-conversion.

Supported C dialect

CompCert supports nearly all of the ISO C 2011, ISO C 1999, and ANSI C language standards including:

- The `_Alignof` operator and the `_Alignas` attribute from ISO C 2011.
- Anonymous structures and unions from ISO C 2011.
- Static assertions via the `_Static_assert` keyword from ISO C 2011.
- Unicode string literals and character constants.
- Pragmas and attributes to control alignment and section placement of global variables.

Supported targets

- PowerPC 32-bit
- PowerPC VLE 32-bit (Signal Processing Extension *SPE* and Variable Length Encoding *VLE*)
- PowerPC 32-/64-bit hybrid (32-bit pointers, 64-bit integer computations)
- ARMv6 ISA with VFPv2 coprocessor (big or little endian)
- ARMv7 ISA with VFPv3-D16 coprocessor (big or little endian)
- AArch64 (ARMv8 ISA, 64-bit, little endian)
- ia32 (x86 32-bit, SSE2 extension required)
- AMD64 (x86 64-bit)
- RISC-V (Base instruction sets *RV32I* and *RV64I*; extensions *M*, *F*, and *D*)
- TriCore AURIX

Supported target systems are *Linux* with the GNU toolchain for all architectures with Linux support. For ARM 32-bit *EABI* is supported with the GNU toolchain. Additionally, for PowerPC 32-bit *EABI* is supported with Diab and GNU toolchains, for PowerPC VLE 32-bit *EABI* is supported with the NXP-GCC toolchain. For RISC-V *ELF psABI* with *ILP32D* or *LP64D* calling convention is supported. For TriCore *EABI* is supported with AURIX GCC as toolchain.



Supported tool chains

To preprocess and produce object and executable files, an external C preprocessor, assembler and linker have to be provided. CompCert is currently tested for compatibility with:

- GNU Compiler Collection version 3 or newer, version 4 or 5 is recommended
- Wind River Diab Compiler version 5 for 32-bit PowerPC target architectures

Availability

- The source code and documentation of CompCert, including all proofs, can be downloaded from compcert.inria.fr or github.com/AbsInt/CompCert. For research purposes, usage of CompCert is free of charge.
- AbsInt offers commercial licenses, provides industrial-strength support and maintenance, and contributes to the advancement of the tool.

More information

- Visit our website: www.absint.com
- Speak with a product specialist:
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About AbsInt

AbsInt provides advanced development tools for embedded systems, and tools for analysis, optimization and verification of safety-critical software. Our customers are located in more than 40 countries worldwide. We have distribution agreements with major software distributors in Asia, North America, Middle East, and throughout Europe.

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