



PROJECT PROFILE

Open-source compiler solution

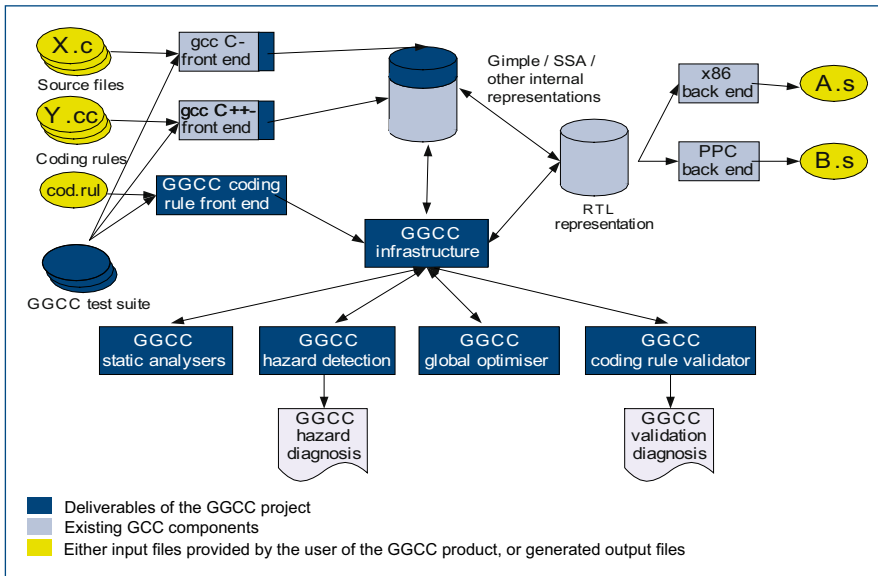
Developer-friendly extension to GNU compiler collection

The GGCC (global GNU compiler collection) project aims to extend the free GNU operating system compiler collection to support new needs of the European software industry by globally processing several compilation units – such as a complete program or library – and using static analysis techniques. In addition to global compilation, it will provide global analysis and optimisation, global hazard detection and global code validation.

The exponential growth of software content in digital systems poses a fundamental challenge to quality assurance (QA), faced by a whole range of industries – from aerospace and automotive to medical systems and consumer electronics. Recent industry reports indicate that from 70 to 90% of total product development costs are spent on integration of components and validation of the complete systems.

At the same time, the open-source community provides more and more of the technology in new products, be they in the embedded world or in general enterprise or consumer software. Open-source software such as the Linux kernel, and the myriad of free development tools – compilers, editors, computer-aided software engineering (CASE), etc. – become common ground reused and improved by a wide population of developers, students and industries.

Most existing work on static analysis and coding rule enforcement falls either in the category of academic prototypes, such as ASTRÉE, Anna or declarative environments, or in that of closed commercial products like Klocwork or PolySpace. There are no examples of initiatives to bring the benefits of these technologies to widely used platforms in an open, accessible and extensible way.



Elements of the GGCC project and product

GGCC (ITEA 05012)

Partners

- AIRBUS France
- AQUILINE
- ANSWARE
- BASE
- BERTIN
- CEA-LIST
- IDI EIKON
- INRIA-Futurs
- Mandriva
- MySQL A.B.
- SICS
- SQS
- Syxxo
- Telefónica I+D
- UPM

Countries involved

- France
- Spain
- Sweden

Project start

September 2006

Project end

December 2008

Contact

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Reinforcing competitiveness

One of the direct aims of the project is to reinforce the competitiveness of computer software providers. By improving the quality of the open source C/C++/Fortran/Java compiler and enhancing it with static analysis, development time will be shortened and test costs reduced, thus reducing time to market.

Software hazards detection exposes potential issues in source code, hence lowering costly testing efforts; coding rules conformance makes corporate knowledge on specific software development processes explicit, and its automatic validation will enhance software quality.

Finally, a global optimisation will open GGCC to new markets, enabling this cutting-edge program optimisation to be integrated into production environments.

Improving open-source access

Advanced global analysis, despite its well-known advantages as an enabling technique to perform static debugging and cross-module optimisation, has not yet been systematically deployed in off-the-shelf compilers for mainstream languages, neither imperative nor object-oriented.

The GNU compiler collection (<http://gcc.gnu.org/>), targeted as the technological platform by this project, is a widely used, open-source general public licence (GPL) compiler for C, C++, Fortran, Ada, and Java. While GCC is a highly portable industry-standard compiler set targeting most of the currently available architectures, it currently falls short in propagating information across compilation units. At this point, a better suite of development tools will improve the quality of software on a large scale, thanks to a widely available, better, de facto open-source standard.

The three dimensions of GGCC – analysis and optimisation, hazard detection, and code validation – require a common framework or platform that GGCC will develop.

Offering developer-friendly solution

GGCC will become the first compiler collection with global static analysis techniques targeting program-wide optimisation, threat detection, and coding rule validation. A framework to support global processing of several compilation units will be developed. It will provide access to the information internally gathered and used by the compiler.

The GGCC tool will be highly configurable, by including some scripting language to drive its various analysers. Software tools – including code generators and preprocessors, and libraries – facilitating the development of complex analysers and optimisers will be developed for the sole use of GGCC.

It will provide:

- An easily extensible **compiler and static analyser platform**, suitable for further experimentation by both industry and research;
- An **improved optimising compiler**, achieved through program-wide analysis – a significant performance boost is expected on certain kind of programs and targets;
- The hazard detection ability, **improving the quality of compilation warnings** by making them program-wide and context-dependent, resulting in a testing effort reduction; and
- **Coding guideline validation** that is likely to detect violation of established best practices.

A significant open source test suite and metrics will support all these new aspects.

Any software produced by GGCC, including code snippets to test the compiler and expose its bugs, will be free, open source, under GPL or lesser GPL (LGPL). Last but not least, Mandriva is set to include GGCC as the system compiler to build its Linux distribution: (more than 4000 software packages).

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