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INTERNSHIP ABSTRACT

Rework of the Coqdoc software

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Summary : The INRIA institute works on the Coq project, a proof assistant. In this project, the subject of this internship is the rework of the Coqdoc software. The goals are to make it more extensible, more maintainable and have a better integration of the software inside the Coq project

Internship done at **INRIA** from : 9/3/2012 to 1/11/2013



1 The company

1.1 General presentation

INRIA stands for the National institute of research in computer science and automatics. It is the main research organism about computer science in France. The institute has for vocation to undertake applied and fundamental research in the domain of information and communication sciences and technologies (ICST).

INRIA is a public institute under the leader of the French ministry of research and the ministry of economy.

The institute has collaborations with many industrial actors, and is also a start-up creator, which commercialize technologies developed at INRIA. It also has many international partners, with multinational companies and foreign universities. It is also active in many international organizations such as ISO, W3C or IETF.

2 The service

2.1 The proof program and systems laboratory

The PPS laboratory brings together researchers coming from computer science and mathematical logic. The laboratory is focused around the idea that logic and mathematical fields can improve computer science, and that reciprocally, computer science can advance research in mathematics.

The main research work led by PPS revolves around the Curry-Howard correspondence between programs and proofs.

2.2 The πr^2 research team

The πr^2 research team is made of scientists of many scientific instances : PPS, INRIA and Paris-Diderot university. Its research topics are the following :

- A fundamental research around the correspondence between proofs and programs
- A theoretical research around the formalism that underlies the Coq proof assistant

- An implementation field with the development of Coq, especially in the view of Coq as dependently-typed programming language

The Coq proof assistant is a software which checks proofs and extracts certified programs from these proofs. It is used for mathematical proofs, certification of critical software, and the fundamental research in computer science.

3 Existing state of affairs

The Coq project is made of several tools revolving around the Coq compiler, which is both a proof assistant and a program compiler. One of the tools is Coqdoc, a documentation software.

Coqdoc allows the programmer to document Coq source files in order to ease the development of a project, the documentation describing its behavior. This documentation is included in the source files, making it easy to update. Coqdoc's role is to translate the source files in order to extract this documentation and generate a more human readable format, such as a PDF or web-pages. Coqdoc provides reference manuals and development documentation to the end-user.

4 Subject of the internship

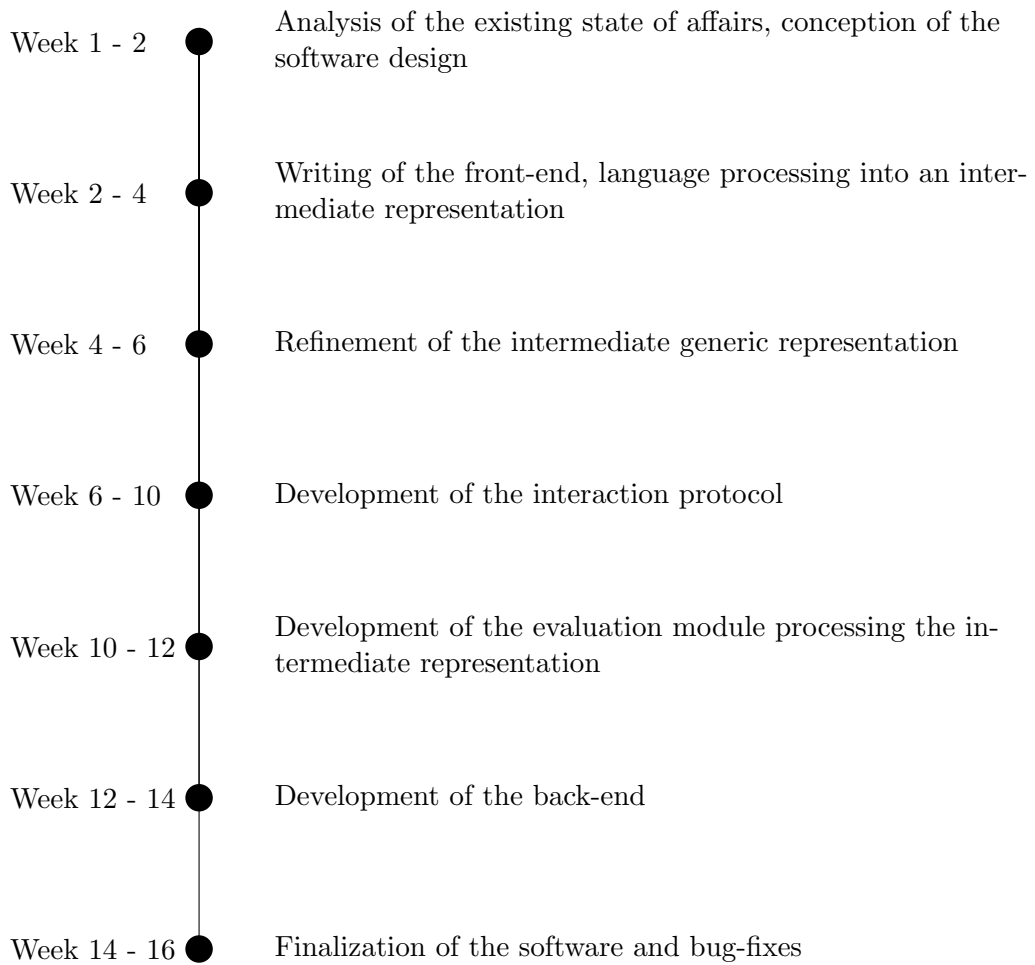
The internship subject was to fully rewrite Coqdoc in order to make a better version of the existing software. Indeed, the previous version has several flaws, motivating a full rewrite :

- Maintainability difficulty : because of its internal design, Coqdoc is hard to maintain. One of the goals for this internship is to design a well written software which is easy to modify and maintaining.
- Extensibility : the current version of Coqdoc is hard to extend for other use cases because of its strict design.
- Redundancy of software elements : Coq's language processing is done in many parts inside the Coq project. A full rewrite would allow to reuse thoses modules, removing the one included in the previous version of Coqdoc

To summarize, the goal of this internship is to make a new documentation tool which is both simple and extensible.

5 Timeline of the internship

The following chart details the different phases of the internship. The software design revolves around a 3 step processing : a front-end reading the Coq's source files and translating into an intermediate representation, an interpretation phase where this representation is translated, and finally a back-end to generate the documentation. The interpretation phase is based around an interaction protocol with the compiler, which was very complex to develop.



6 Internship feedback

This internship was very enjoyable for many reasons. I learned a lot both technically and theoretically, on the aspects of functional programming and software development. The other works done in the laboratory are very interesting, and opened my vision on other research and work topics in the domain of computer science

I met a lot of interesting people who provided me with a lot of insight on my future career and professional orientation after EPITA.

7 Skills acquired

The following list summarizes the skills I acquired or improved during this internship.

- Learn a lot about software design
- Development of complex applications
- Improvements on the Ocaml programming language
- Better understanding of language processing

8 Conclusion

This internship was a success on many aspects, and I enjoyed it. The team was very welcoming and I appreciated a lot the atmosphere in the laboratory. I improved a lot of skills during the time spent at INRIA, and discovered the research subjects of the laboratory in which I worked.