

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20111

Grantee name: Frédéric Blanqui

Details of the STSM

Title: Translation of HOL4 proofs to Dedukti and Lambdapi

Start and end date: 2023-05-22 to 2023-05-26

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

Grantee enters max 500 word summary here.

I made a presentation of the work of Deducteam on interoperability and explained what is the lambda-Pi calculus modulo rewriting, Dedukti and Lambdapi, and how to encode various logical systems and their proofs in it.

Magnus explained to me how to make proofs in HOL using the Emacs editor, where to find the SML files implementing the kernel of HOL. He also answered various questions I had about SML and HOL.

I started to develop a modified version of the standard kernel of HOL to log the "theorems" that are generated by HOL (proof steps actually), and a program to translate this log into the input format of hol2dk.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

¹This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

(max. 500 words)

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The goal of this short visit was to learn how HOL works and how its code is organized, and evaluate whether the translator from HOL-Light to Dedukti and Lambdapi that I developed, hol2dk, can be applied to HOL proofs as well.

With this visit, I got the basic knowledge necessary to start studying this problem. This problem seems solvable but further work is necessary to be sure. In any case it is not straightforward.

First, hol2dk takes as input data in an unspecified binary format specific to the OCaml programming language in which HOL-Light is written, but HOL is written in SML. Because it would be too difficult and not very robust to try to generate the HOL data in the OCaml format, I started to design a new format, independent of any programming language, to encode HOL proofs, and a translator from this new format to the OCaml format. For efficiency reasons, this new format must be simple to write and read. To avoid size explosion, we will also have to add a sharing mechanism.

Second, HOL developments are organized in theories which are checked in parallel. On the one hand, it is interesting as it will help in having a modular translation. On the other hand, it creates some difficulties since hol2dk is not modular currently. We will therefore have to make hol2dk modular in order to translate HOL proofs to Dedukti or Lambdapi.

Third, the basic deduction rules of HOL and HOL-Light are not exactly the same. HOL-Light uses a smaller set of basic rules. Further analysis is required to see how to encode the deduction rules of HOL in the deduction rules currently accepted by hol2dk. For efficiency reasons, it may be useful to extend this set.