# Evaluation of Constraint-Based Register Allocation and Instruction Scheduling for the ARM Architecture

## Background

Scientists at SICS and KTH have developed a constraint model for code generation in a compiler back-end. The model captures register allocation as well as instruction scheduling, combining aspects such as multiple register banks (subsuming spilling to memory), coalescing and packing.

The feasibility of the model has been demonstrated in a proof-of-concept implementation that generates code of quality on par with LLVM. Two recent paper can be found [here](#) and [here](#). So far, the approach has been tried on MIPS, a typical RISC architecture, and Hexagon V4, a very large instruction word (VLIW) DSP for mobile devices. Due to the increased interest in and visibility of ARM, we would like to evaluate the approach for that architecture as well.

The UNISON project is funded in part by LM Ericsson AB and by the Swedish Research Council. Two PhD students are working full-time in the project.

## Objective

The work consists of:

- Familiarization with the code generation project and its constraint model
- Familiarization with the ARM architecture
- Producing a machine-readable architecture description in the required format
- Connecting `llvm` with the UNISON tool-chain for ARM
- Plan an experimental comparison of UNISON vs. `llvm`, optionally vs. other compilers
- Carry out the experimental comparison
- A written report covering the above

## Competence

We are looking for a bright MSc student with the following requirements:

- Completed computer architecture and compiler courses
- Completed constraint programming course is a plus but not strictly required
- Familiar with the Linux environment and tools like `make`, `bash`, `git`
- Well-disciplined and methodical
- Fluent in spoken and written English

## Applications

Applications should include a brief personal letter, your CV with your education, professional experience and specific skills and recent grades. In your application, make sure to give examples of previous programming or other projects that you consider relevant for the position. Candidates are encouraged to send in their application as soon as possible via e-mail. Suitable applicants will be interviewed as applications are received.

## About SICS

The Swedish Institute of Computer Science (SICS) is a non-profit research organization focusing on applied computer science. SICS employs approx. 130 researchers, including 70 PhDs.

## Work Environment, Supervision, Examination

We offer you a challenging task, a good working environment and a supervision that makes sure that both the project and your academic thesis will be successful.

The work will be supervised by Mats Carlsson (SICS, Uppsala). IAR Systems, Uppsala will advise on the experimental evaluation. If you are a student at UU, the work will be reviewed (ämnesgranskat) by Christian Schulte (KTH, Kista) and examined by Olle Eriksson (UU). If you are a KTH student, the work will be examined by Christian Schulte (KTH, Kista).

## Contact

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