

24th Aug 2017

Report for 'Sista: a Metacircular Architecture for Runtime Optimisation  
Persistence' by Clément Béra

Modern programming languages are often best implemented as Virtual Machines (VMs) with JIT compilers. While simple VMs are easy to write, they also lead to poor performance; good quality JIT compilers are extremely hard to write.

This thesis introduced a new point in the VM design space. It shows how one can reuse an existing (simple) JIT compiler by implementing an optimiser 'in front of it' to improve performance. This works due to a simple, but powerful observation: the input bytecode to an existing JIT compiler can be optimised based on dynamic information that the JIT compiler itself does not make use of. The resulting *Scorch* system provides a useful performance improvement but doesn't significantly increase the maintenance burden. As a useful bonus, the thesis is also able to 'snapshot' (machine independent) bytecode between VM instances which reduces warm-up costs (something which is a real problem for many users). The overall *Sista* architecture described in the thesis fits well into the existing Pharo architecture.

The thesis itself is 137 pages long and contains 10 chapters. It is structured into three major parts. First, there is an extensive and thorough overview of existing JIT compiler approaches. Second, the *Scorch* is introduced and explained as being part of the *Sista* architecture. Third, bytecode snapshotting to reduce warm-up costs is explained. A performance evaluation backs up the claims made in the thesis.

Overall, the thesis is well written and easy to understand. It is clear that the thesis's contri-

butions are significant for Pharo and the Pharo community, and will (and probably already are) making a positive contribution to the experience of real programmers. I also expect the work in the thesis to be cited by those outside of the Pharo community, showing that it has wider applicability.

I note that Clément has published 4 conference papers and 5 workshop papers, which is a high number for a PhD student. This is more than I would expect for a PhD student, showing that he is a productive researcher with a promising career ahead of him.

In conclusion, Clément's thesis is clear evidence that he deserves to receive a PhD. I comment this thesis to you.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'L. Tratt', with a stylized flourish at the end.

Dr Laurence Tratt