A propos du centre ou de la direction fonctionnelle

The Inria Lille - Nord Europe Research Centre was founded in 2008 and employs a staff of 360, including 300 scientists working in sixteen research teams. Recognised for its outstanding contribution to the socio-economic development of the Hauts-de-France region, the Inria Lille - Nord Europe Research Centre undertakes research in the field of computer science in collaboration with a range of academic, institutional and industrial partners.

The strategy of the Centre is to develop an internationally renowned centre of excellence with a significant impact on the City of Lille and its surrounding area. It works to achieve this by pursuing a range of ambitious research projects in such fields of computer science as the intelligence of data, the design of distributed and adaptive systems, the development of software and computer-aided design tools, and the study of system approaches to support developers in their workflow and domain, but also be dynamically activated even if the virtual machine does not support them. Therefore, virtual machines should also be extendable with new, user-defined primitives and support for debugging.

Results will be submitted to international conferences and journals and an effort will be put to produce systems that can be used by (normal) developers so that user experiences provide real data. The work will happen in collaboration between Inria Lille (RMOD team) and Vrije Universitat Brussels (SOFT lab).

Contexte et atouts du poste

Debuggers are applications that developers use to debug other applications. Lots of tools provide users with a large variety of debugging capabilities. However, several aspects of the debugging activity are poorly covered by scientific and technical state-of-the-art. For example, it is still very hard to debug concurrent or parallel systems.

It is also not very clear how to implement advanced debugging tools such as back-in-time debuggers, or what support should a run-time infrastructure (e.g., a virtual machine) provide for advanced debugging.

Finally, often tools are inflexible and cannot be adapted to specific domains, projects or even down to a single specific problem. New generation tools should not only support the developers customising tools to their own workflow and domain, but also be dynamically activated even if the virtual machine does not support them. Therefore, virtual machines should also be extendable with new, user-defined primitives and support for debugging.

Results will be submitted to international conferences and journals and an effort will be put to produce systems that can be used by (normal) developers so that user experiences provide real data.

Mission confiée

Objectives

The goal of this Ph.D. is to learn how to build new advanced debuggers to explore and experiment one or more of the following topics:

Back-in-time and scriptable debuggers

- How to build back-in-time debuggers?
- What abstractions do we need to take advantage of back-in-time debuggers? (scripting, DSLs...)
- How can users extend, customise and enhance their debugger? (following PhD of A. Chis on Moldable Tools and the work of T. Dupriez on scriptable debuggers)

Extendable virtual machines for advanced debugging support

- What primitives do we need from the virtual machine to support advanced debugging tools? (back-in-time debuggers, object-centric debuggers, etc.)
- How can users create new debugging primitives and enable them on-demand when a particular bug happens and requires investigation without restarting the program?

Advanced debuggers for concurrency

- How can we track specific objects in a concurrent execution and how this capability helps in debugging concurrent programs? (following the PhD of S. Costiou on unanticipated object-centric debugging)
- What are and how to express object-centric debugging queries on the flow of objects, shared by concurrent processes?
Can we leverage Dynamic Software Update techniques to safely instrument running concurrent programs with advanced debugging instrumentation? (following the PhD of P. Tesone on DSU for live and production environments)

Support for debugging tools

Can we use type inferencers to ease the design of debugging tools and limit their impact on performance and memory on dynamic languages runtimes? (following work on RoelTyper and PhD of L. Spoon on type inference)

References:

2. Pablo Tesone, Guillermo Polito, Noury Bouraquad, Stéphane Ducasse, Luc Favresse. Dynamic Software Update from Development to Production. The Journal of Object Technology, Chair of Software Engineering, 2018
11. S. A. Spoon and D. Shivers, Demand-Driven Type Inference with Subgoal pruning: Trading Precision for Scalability, Proceedings of ECOOP’04, 2004

Principales activités

The plan is to:

- Join the team work around debugging, that includes 3 researchers, 1 phd student and a collaboration with the Soft team at VUB Brussels
- Survey the key developer activities
- Define new models and enhance current
- Realize and experiment prototypes, possibly using Pharo
- Design and run validation with real end-users
- Publish results in top venues

Compétences

Technical skills and level required

- OOP, TDD
- Reflective programming
- Program transformation

Language

- English

Relational skills

- Good team work skills

Other valued appreciated

- Knowledge of the Pharo language is a plus
- A strong interest about debugging and/or dynamic languages is also appreciated

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

1st and 2nd year : 1 982€ Gross monthly salary (before taxes)
3rd year : 2085€ gross monthly salary (before taxes)