ERCIM "Alain Bensoussan" Fellowship Scientific Report

Fellow:	Lacramioara Astefanoaei
Visited Location :	University of Wroclaw
Duration of Visit:	9 months
Scientific coordinator:	Witold Charatonik, Gregor Gössler

I - Scientific activity
(1 page at maximum)

At the University of Wroclaw, in the Group of Programming Languages, I have continued the research I have started at INRIA, in the first part of the fellowship. There, Gregor Gössler introduced me to the analysis of logical causality, and more precisely, to its application for component-based systems. Roughly, components are seen as *black boxes* which are shipped with specifications given as finite state machines. The observable behaviour of the components is given as *traces*, that is, sequences as actions. The global behaviour of a set of components is given as the *composition* of local traces with respect to an interaction model describing possible synchronisations between components. Each component is shipped with its own *specification* and there is also given a global specification of the whole system. In this context, roughly speaking, causality analysis relates and builds upon local violations (i.e., violations of local behaviours with respect to the corresponding local specifications) and global violations (i.e., violations of the whole global behaviour with respect to the global specification).

In this second part of the fellowship, together with Witold Charatonik and Gregor Gössler, we have worked on another application of causality analysis. This time, we proposed to analyse causality of coordination artifacts instead of components. The coordination artifacts in cause are Reo connectors. Reo is a coordination language which was designed by Farhad Arbab, one of the (sub)group leaders in the team SEN3, at CWI, where I did my PhD. The purpose of Reo is to facilitate the construction of complex coordination mechanisms from a set of basic channels with fixed semantics. Since connectors may become arbitrarily large, their behaviour is less obvious for a less trained eye and this justifies the need to provide automatic approaches to reveal possible sources of failures like it is, for instance, the lack of data flow in a connector. This is what motivates us to study the application of logical causality. The way we approached this subject is as follows. Intuitively, the same picture of black boxes is extrapolated to connectors: we have no information about the inner design of a connector, however, what we have access to is the interface and the specification of the connector. With this understanding, given that the definitions of causality are generic enough, the difficulty shifts from the application to Reo connectors itself to working out from head to tail through a complex case study to illustrate the practical relevance of our approach.

All the material is incorporated in a paper:
- "*Causality Analysis for Reo Connectors*", Lacramioara Astefanoaei, Witold Charatonik, Gregor Gössler,
which we hope to finalise so that it can be submitted.

II- Publication(s) during your fellowship

III -Attended Seminars, Workshops, and Conferences

- Seminars of the Group of Programming Languages organised by Leszek Pacholski
- Working visit : *Gregor Gössler at INRIA Grenoble, on 04.09.2012*
- Given talks :
  - *at the University of Wroclaw, on 12.01.2012: "An executable Theory of Multi-Agent Systems Refinement"*
  - *at EPFL, Lausanne, hosted by Viktor Kuncak, on 06.08.2012: "Causality Analysis for Reo Connectors"*