INRIA International program
Associate Team Final Report 2011

Name of the Associate Team: Treaties

URL of the Associate Team website: `http://www.irisa.fr/vertecs/Treaties.html`

A. Scientific report

A1.Did the goals shifted along the completion of the project?

The scientific objectives where the following:

Investigate models of heterogenous software systems with enlarged features such as non-determinism, recursion, time, interruption and compositionality. This goal has been achieved with results for test generation from non-deterministic timed automata, from timed automata combined with data (PhD Thesis of Wilkerson Andrade in Campina Grande), and for data-flow reactive timed systems. Research is still conducted on models with recursion using graph grammars in the thesis of Sebastien Chédor in Rennes. Models with quantitative aspects are also investigated (thesis of Amélie Stainer in Rennes, probabilistic model-checking in Brazil)

Focus on testing from partial models by generating them from abstract test cases and observed behavior This goal, which relies on learning techniques, has not been investigated during the cooperation.

Improve current test case generation techniques by considering semantic rather than structural coverage criteria as well as the conformance relation and model checking coverage criteria. This goal has not been achieved yet. Only some bibliographic work has been done. This demands to open an almost new scientific direction. However, we expect that some work on quantitative models and their use in testing will be helpful.

Investigate conformance based on failure-divergence on process algebraic models This goal has been achieved during the PhD thesis of Sidney Nogueira in Recife. There is also a strong link between a part of these results on refinement and some work done in Rennes on the interest of io-abstraction/refinement for testing from timed models.

Pursue test case generation with the help of diagnosis and controller synthesis. This goal has been partly achieved on the French side, with some work on testability, reusing some results on monitoring.

Investigate automated test case selection strategies based on similarity functions. This goal has been investigated only from the Brasilian side, but the results have been discussed during the visits to Brazil, and in particular concerning the PhD thesis of Emanuela Cartaxo.

A2. State the scientific results of the Associate Team

The main common research has been on testing from timed models. In this domain we had the following results:

- a new model of real-time systems has been proposed as an extension of both symbolic transition systems and timed automata, in order to handle both data and time requirements symbolically in testing. The test case generation process is based on a combination of symbolic execution and constraint solving for the data part and symbolic analysis for timed aspects. This work has been published in AMOST'2011.

- for general non-deterministic timed automata, new test generation algorithms have bee designed, based on symbolic co-reachability analysis, and approximate determinization. The work on approximate determinization has been presented at FOSSACS'2011, anad the work on test generation in TACAS'2011.

Some software have been developped on both sides, but no common worj has been done on tools.

The cooperation has been particularly fruitful for the two PhD students Sidney Nogueira and Wilkerson Andrade who made several visits during the cooperation. We also recently involved Amelie Stainer, a new PhD student in Rennes. She will visit teh Brasilian teams in November, and we expect that she could find interesting topics to pursue.

B. Outcomes of the Associate Team

B1. List the joint papers published by the participants within the realm of the Associate Team

W. L. Andrade, P. Machado, T. Jéron, H. Marchand. Abstracting Time and Data for Conformance Testing of Real-Time Systems. In 7th Workshop on Advances in Model Based Testing A-MOST 2011, Berlin, Germany, March 2011.

B2. List the thesis jointly supervised within the realm of the Associate Team

There was no real co-supervised thesis, but Thierry Jéron was involved in the thesis of Sidney Nogueira (numerous discussions during visits, participation in the evaluation committee of his Thesis Proposal (formal presentation after 2 years thesis)) and precisely followed the thesis of Wilkerson Andrade (discussions during visits).

B3. List the conferences or events organized in continuity of the Associate Team

We only had workshops involving the teams of the participants of the cooperation during the visits in Rennes, Recife and Campina Grande.

C. Assessment of the collaboration

C1. What is your assessment of the collaboration, and its added value for the research conducted within your Inria project-team?

We think that the collaboration was fruitful for the Brazilian teams, in particular for the two PhD students involved in the project during their thesis. We had interesting discussions during

visits from both sides and workshops organized during these visits, but few of them really led to common work, except for the work on test generation from models with time and data. However there has been a mutual stimulation in working in some close research directions. For example, a new PhD student in Recife, Gustavo Carvalho, has been working on the extension of Sidney Nogueira's thesis to handle time in C# for test generation using the PAT tool. The cooperation also led the Brazilian Research Team to work on the formalization of embedded systems testing with new industrial partners.

C2. Do you foresee further developments to this collaboration?

We expect some further common work. We are planning to submit another paper on the joint work on test generation from models with time and data. There is also a new PhD student in Campina Grande working on a continuation of Wilkerson Andrade's thesis on this subject with which we will cooperate on determinization and parallel composition of models with time and data. We expect that she could visit us in 2012.

C3. Additional information and remarks

There are two visits planned for the end of the year, together with meetings during these visits:

- Wilkerson Andrade will visit Rennes in mid-november.

- Amlie Stainer and Nathalie Bertrand will visit Recife in end-november.

These visits will in particular be the occasion to discuss on further collaborations regarding the PhD thesis of Adriana Damasceno in Campina Grande and Gustavo Carvalho in Recife.