CADP: A Toolbox for the Construction and Analysis of Distributed Processes

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Description

Asynchronous concurrency is becoming increasingly present in a large spectrum of systems, spanning from the level of systems- and networks-on-chip, over multi-processor architectures, up to the level of grid and cloud computing. Due to the intrinsic complexity of asynchronous concurrency, the correct design of such systems is notoriously difficult, requiring the support of formal methods and verification tools.

CADP (*Construction and Analysis of Distributed Processes*) [2] is a toolbox for the design, functional verification, and performance evaluation of asynchronous concurrent systems. Currently, CADP consists of about fifty interconnected tools and software libraries[1]. The toolbox is distributed free of charge to academia and public research institutes[2], and is already used by more than 440 research institutions and companies worldwide in many application domains. Given the increasing number of systems featuring asynchronous concurrency, CADP could be used still more widely in research, industry, and education (in particular for teaching the concepts of concurrency theory).

Tutorial Objectives

This tutorial presents the architecture and main functionalities of CADP, with a twofold objective. On the one hand, the tutorial illustrates the application of CADP to the modeling, functional verification, and performance evaluation. On the other hand, the tutorial presents various input languages accepted as input by CADP, together with software libraries that enable users to develop their own analysis tools.

The well-known, but fundamental problem of mutual exclusion [4] will serve as support to illustrate the principal functionalities of CADP: formal modeling of protocols, compositional state space generation, graph visualization, interactive step-by-step simulation, formulation and verification of temporal logic properties, as well as performance evaluation by compositional insertion of latency constraints and transformation into interactive Markov chains [3, 1].

Covered Topics

- Theoretical foundations: labeled transition systems (LTS), bisimulations, Boolean equation systems, etc.

[1]See `http://cadp.inria.fr`.

[2]Since July 2011, a CADP license is granted to any user who can provide an academic e-mail address and Web page, without the need to sign a paper contract.

- The LNT language for the formal modeling of asynchronous concurrent systems.
- State space exploration tools for step-by-step simulation, state space generation, graph visualization, etc.
- The MCL language for the expression of temporal logic properties extended with data.
- Verification tools for model checking, equivalence checking, etc.
- Models and tools for performance evaluation: interactive Markov chains, numerical analysis, steady-state simulation, etc.

Presenter

Radu Mateescu holds a PhD and an HDR (*Habilitation à Diriger les Recherches*) from Grenoble INP (National Polytechnic Institute). He is currently a senior researcher at Inria and leader of the joint Inria/LIG Convecs team (`http://convecs.inria.fr`), which is a follow-up of the Vasy team. In the past, he gave courses on formal methods at ENSIMAG (Grenoble), ESIREM (Dijon), ESIA (Annecy), and the VTSA summer school of the Max Planck Institute (Saarbrücken, Germany).

Duration: half a day (about 3 hours).

Keywords: asynchronous concurrency, Boolean equation system, bisimulation, compositional verification, distributed systems, exhaustive state-space exploration, formal modeling languages, formal specification, interleaving semantics, Markov chains, modal μ-calculus, on-the-fly verification, performance evaluation, process algebra, temporal logic.

References

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