

Probabilistic analysis takes critical real-time safety certification and verification to new level, says EU project

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Using probabilistic techniques to support timing analysis and safety certification and verification in critical real-time embedded systems is the future, according to the partners behind a revolutionary research project.

The objective of the PROARTIS (*Probabilistically Analyzable Real-Time Systems*) research is to demonstrate how a probabilistic approach to timing analysis will significantly improve system checking and verification of new high performance hardware features and more complex critical real-time embedded (CRTE) software systems. This new approach marks a radical break away from traditional attempts to predict with cycle accuracy the state of hardware and software through analysis.

Using probabilistic analysis is expected to promote dramatic performance improvements in, for example, the avionics industry. The modern aircraft requires millions of lines of code just for on-board control functions such as guidance, navigation and control algorithms. Even in the most modest projections, a fourfold increase in performance will be required for on-board processors in next-generation aircraft. Existing software platforms may struggle to cope with these new demands.

PROARTIS will show that new advanced hardware/software features enabling truly randomized timing behaviour can be used in CRTE systems.

Demonstrating why pathological timing cases in complex software used in avionics and elsewhere only arise with negligible probability will ultimately permit more widespread and effective use of probabilistic analysis techniques in system verification and certification.

The three key objectives driving PROARTIS over a 36-month period are:

- Increased performance, reliability and reduced overheads (weight, power consumption and size of systems) by enabling CRTE systems to take full advantage of advanced hardware like deep memory hierarchies and multi-core processors
- Increased productivity by enabling software engineers to develop more complex real-time software systems through timing-aware systems that reveal crucial timing details while dramatically simplifying analysis
- Reduced time-to-market by enabling trustworthy worst-case execution time (WCET) and other analyses for large-scale real-time systems that will dramatically reduce testing time

Backed by significant EU investment, PROARTIS is a joint initiative by several European organisations. The partners all have a recognised track record in timing analysis work or in helping to promote advances in software development.

The five partners responsible for the management and delivery of PROARTIS are:

- Barcelona Supercomputing Center - Centro Nacional de Supercomputación (Spain) investigates embedded processor architecture
- Rapita Systems Ltd. (U.K.) is the company behind the RapiTime software tool-set that analyses the timing behaviour of real-time embedded systems and WCET
- Università di Padova (Italy) is currently conducting a series of investigations on the impact of the cache jitter on the timing predictability of on-board applications. The work was commissioned by the European Space Agency
- Institut National de Recherche en Informatique et Automatique (France) is currently working on probabilistic approaches for real-time systems
- Airbus Operations SAS (France) is a pioneer in the use of safe embedded computer systems

The project also collaborates with the University of Massachusetts Amherst (USA) and the University of York (UK). The project includes strong participation from industry with an Industrial Advisory Board composed of key experts from University as well as Automotive, Space and Microprocessor industries and experts in Real-Time Operating Systems, Compilers and Software tools for CRTE systems.

PROARTIS is scheduled to take three years to complete and has a budget of €2,425,654. The EC contribution to this FP7-ICT-2009-4 small or medium-scale focused research project (STREP) is €1,800,000. The Contract Number is INFSO-ICT-249100.

For further information, visit the project website at www.proartis-project.eu or contact:

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