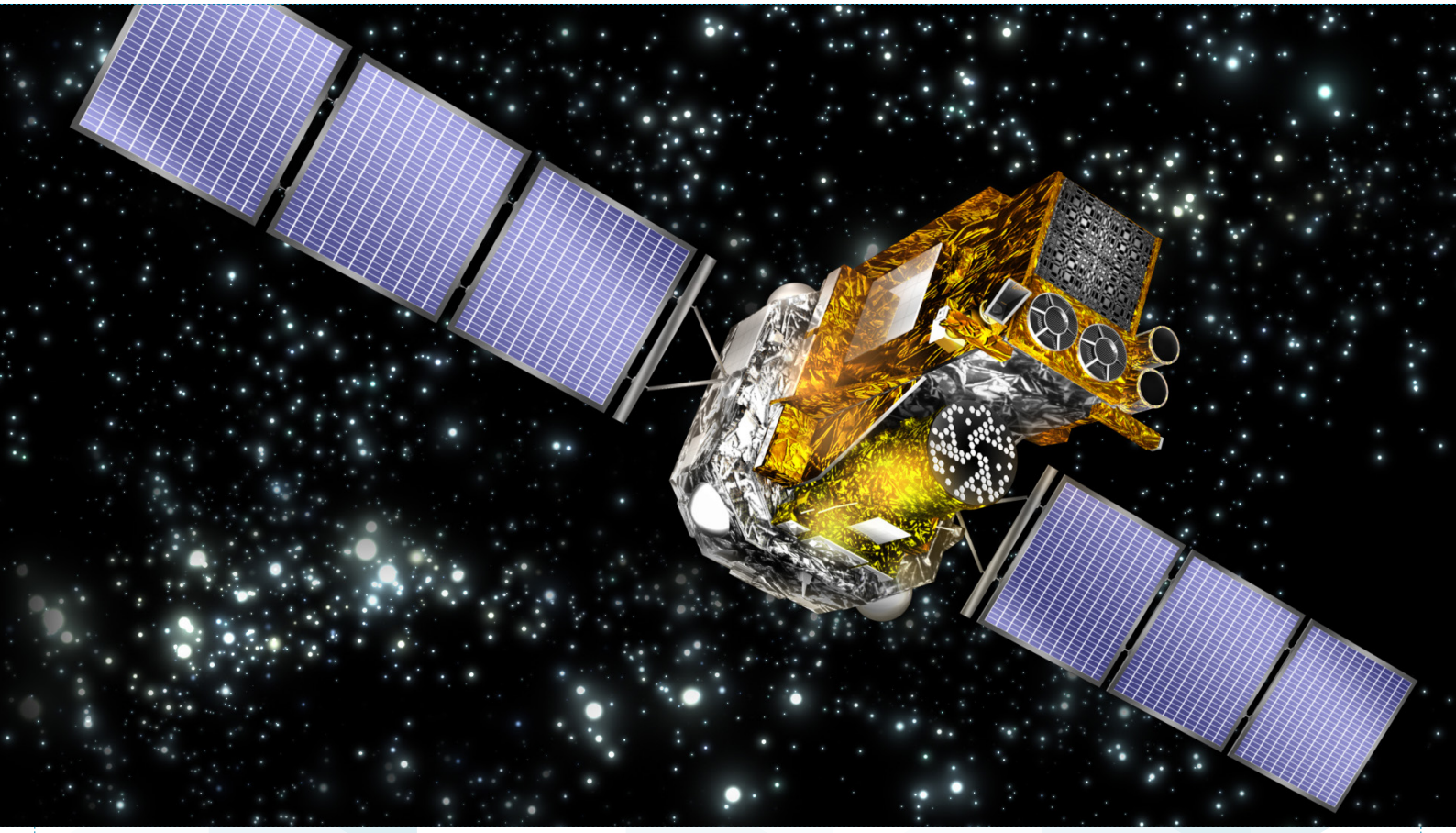
ARTEMIS Call 2011 Project
295440

PaPP

Developing Future-Proof Parallel Software



EXECUTIVE *summary*

PaPP aims to deliver solutions facilitating the development of software for the future parallel and heterogeneous embedded systems. Any software will need to cope with varying degree of parallelism and heterogeneity. To this end, PaPP considers the whole system stack from architecture to application in order to deliver future-proof software.

CONTRIBUTION *to SRA*

Faster time to market. Achieved by integrating standard sub-systems into overall architecture, using open source standard software and interfaces, innovating programming models and re-usable parallel SW components across application domains.

Reduction in system design cost. We will contribute significantly to the automation of embedded SW porting across different platforms that are not yet mainstream.

Achieve cross-domain reusability. PaPP addresses the development of innovative, unified embedded architectures and platforms, which will be employed across multiple domains. A special care will be devoted to contribute to the *Open Source community*.

Manage a complexity increase with less effort. The project will deliver tools, system software and development guidelines to significantly reduce the development effort for the increasingly complex heterogeneous systems currently emerging.

MARKET INNOVATION *& impact*

Ensuring **portable and predictable performance** will significantly reduce cost of design and development for application providers that today have to deal with numerous hardware and OS platforms, each requiring acquisition and maintaining of in-depth knowledge: a model not easily sustainable for many companies. SW developers will also gain in flexibility, by not being bound to a particular hardware platform, thus increasing the business flexibility, interoperability and, the competitiveness in an open market.

For the **Space application domain**, the results will be demonstrated on the commonly used satellite platforms, to verify a number of features already on going through European Space Agency. In the **multimedia domain**, the results on performance portability will

contribute to the reuse of important media processing IP on wider set of heterogeneous media processing chips, like future generations of GPUs or FPGAs.

RELEVANCE & CONTRIBUTIONS *to Call 2009 Objectives*

The project, PaPP, **aims at making performance predictable for parallel applications on heterogeneous parallel platforms.** This goal is achieved by early specification and analysis of performance of systems, its adaptation to different hardware platforms, including an adaptive runtime system. The outcome of PaPP will contribute to that European industry can deliver software with predictable and performance portability and reduced resource usage when moved from current platforms to future parallel platforms, including:

- Manycore platforms (50+ cores)
- Heterogeneous platforms, such as:
  - CPU/GPU-combinations, and
  - Custom built FPGA-platforms

The project addresses the sub-programme **ASP5 on Computing environments for embedded systems**. A crucial goal of the project is to deliver guidelines supporting architects and software designers in the development of applications targeting **complex multicore systems**. This method and its associated tools will be **applicable to multiple application domains**. To demonstrate the wide applicability of the results of the project, we have selected applications issued from three different application domains, some of which have soft or firm real-time constraints. The programming model and cross-domain software stack will therefore offer the possibility to **handle real-time data processing** and clearly target a wide set of embedded devices. We intend to contribute to the ARTEMIS Tool Platform initiative, possibly by joining one of the existing proposals such as iFEST, Genesys or RECOMP. However, there is also a need for platform thinking which is neither tool platform nor H/W platform which is in the system software (Operating system, run-time system). Here PaPP would be able to contribute the most and we would like to get involved the right working groups to establish this as an execution platform defined by PaPP.

R&D INNOVATION *and technical excellence*

One important aspect of our approach is **a task-centric approach for parallel execution**. Task-centric run-time systems for homogeneous multicores have been shown to have attractive predictive properties which we believe can carry over to heterogeneous platforms as well. As opposed to data parallelism or explicit threading, application execution in this approach is structured as a graph of dynamically created tasks. Temporarily coexisting tasks can be executed in parallel by a number of native threads usually called workers. In this model, application developers can focus on application functionality determined by the task graph structure and individual task behaviour, while **the run-time system can optimize execution on a particular platform**. Furthermore, task graphs of application sub-components can be naturally composed for parallel execution, which might not be possible with e.g. threads due to resource exhaustion. One purpose of the project is to contribute to the task-centric approach and in particular to run-time systems and operating systems enabling dynamic software adaptation for **optimization of performance and resource utilization**, and **supporting heterogeneous multicore** hardware and different inter-core communication schemes. Separation between platform-independent applications and platform-optimized run-time systems will **reduce development efforts and time to market, improve product quality, and ultimately improve competitiveness of the European industry**. System software supporting the task-centric programming model is key to enable the performance portability that is the focus of this project.

PROJECT *partners*

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ARTEMIS

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PaPP

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WEBSITE
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START
September 1, 2012

DURATION
36 months

TOTAL INVESTMENT
€9.5 M

PARTICIPATING ORGANISATIONS
15

NUMBER OF COUNTRIES
7