

2PARMA

PARallel PARadigms and Run-time MANagement techniques for Many-core Architectures

**Cyber-Physical Systems:
Uplifting Europe's innovation capacity
Brussels, 29 October 2013
"Success stories of technology adoption"**

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FP7-248716-2PARMA Project

List of Project Partners



1. Politecnico di Milano (POLIMI) – Italy
(Coordinator)



2. STMicroelectronics (STM) – Italy / France



3. Fraunhofer Institut for Telecommunications / Heinrich-Hertz Institut (HHI) – Germany



4. Interuniversitair Micro-Electronica Centrum (IMEC) – Belgium



5. Institute of Communication and Computer Systems (ICCS) - Greece



6. RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (RWTH) - Germany



7. Synopsys (CoWare) - Belgium

EC contribution:

- 2.741.000 €

Duration:

- 1.01.2010-
31.03.2013

Website:

- www.2parma.eu

Scientific and Technical Objectives

Main Goals

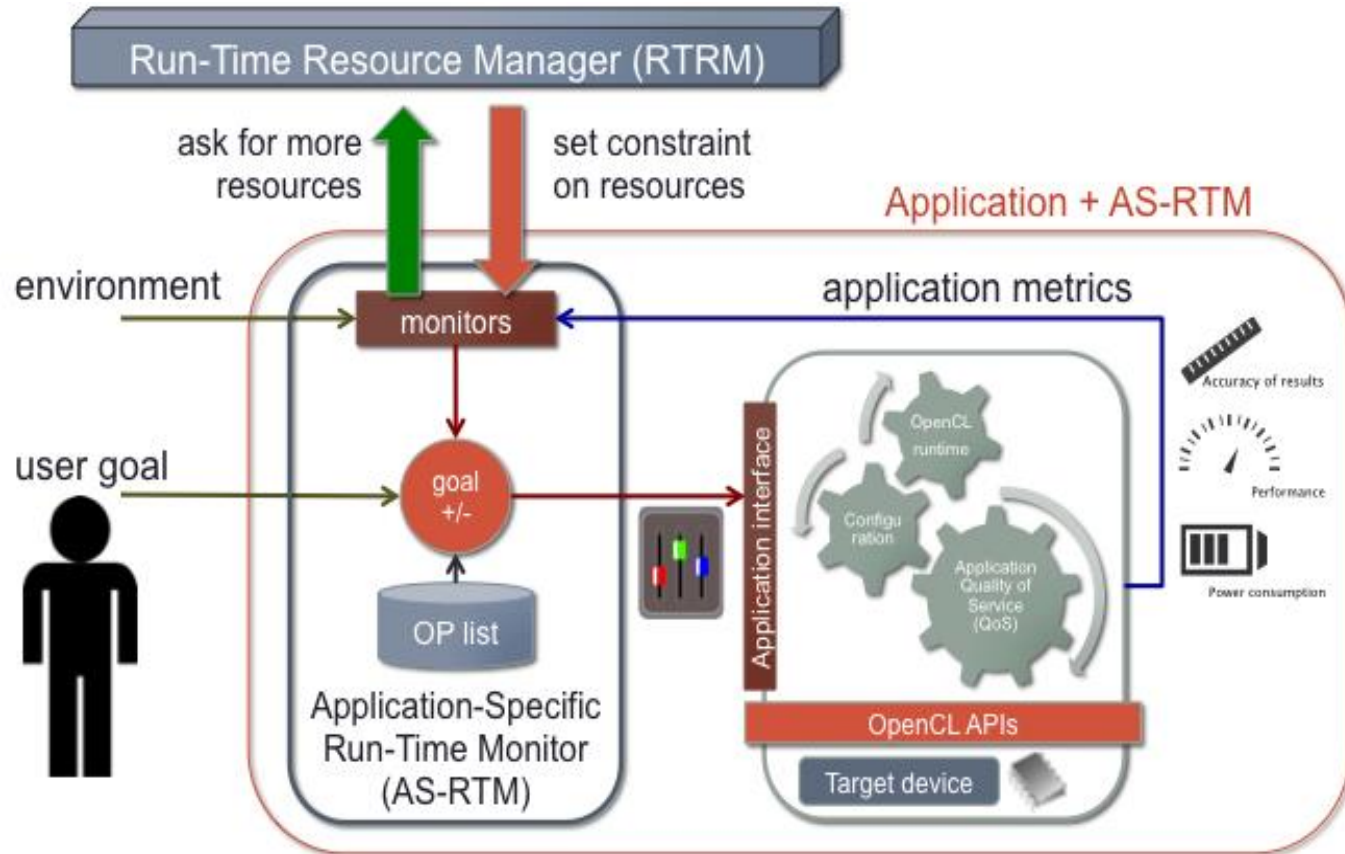
- Programmability of Many-core Computing Fabrics
- Design Space Exploration
- Runtime Adaptivity

Project Outcomes

- Integrated Compiler Toolchain and OS Layer
- Design toolset for HW/SW co-exploration
- Run-time Manager

The 2PARMA project focuses on the definition of suitable parallel programming models, run-time energy/power and resource management as well as design space exploration methodologies for Many-core Computing Fabrics.

Application adaptivity through Run-Time Monitor and Run-Time Resource Manager



User space

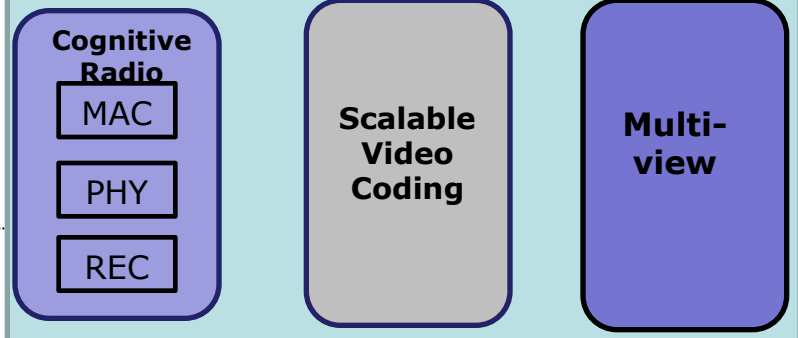
Dynamic Code Generation

Kernel space

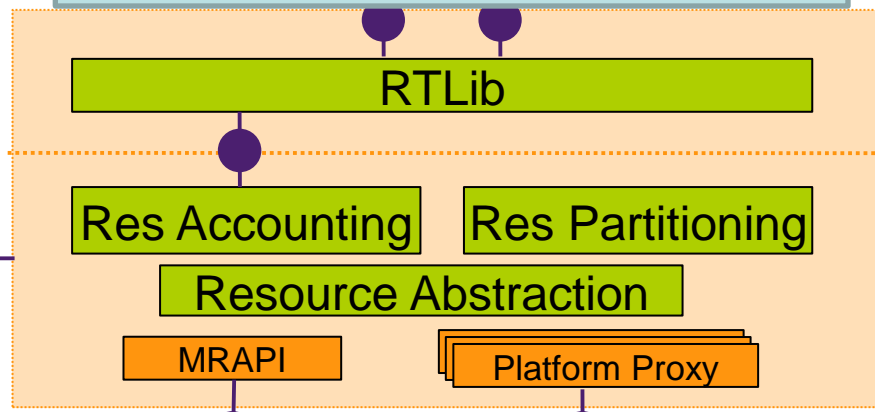
supported platforms

Task Mapping

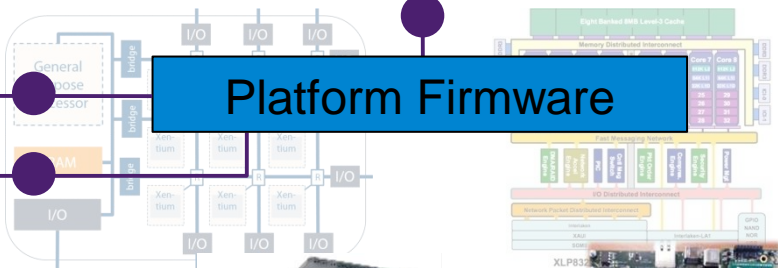
DDM



Application-Specific RTRM



System-Wide RTRM



NUMA Machine (GP computing)

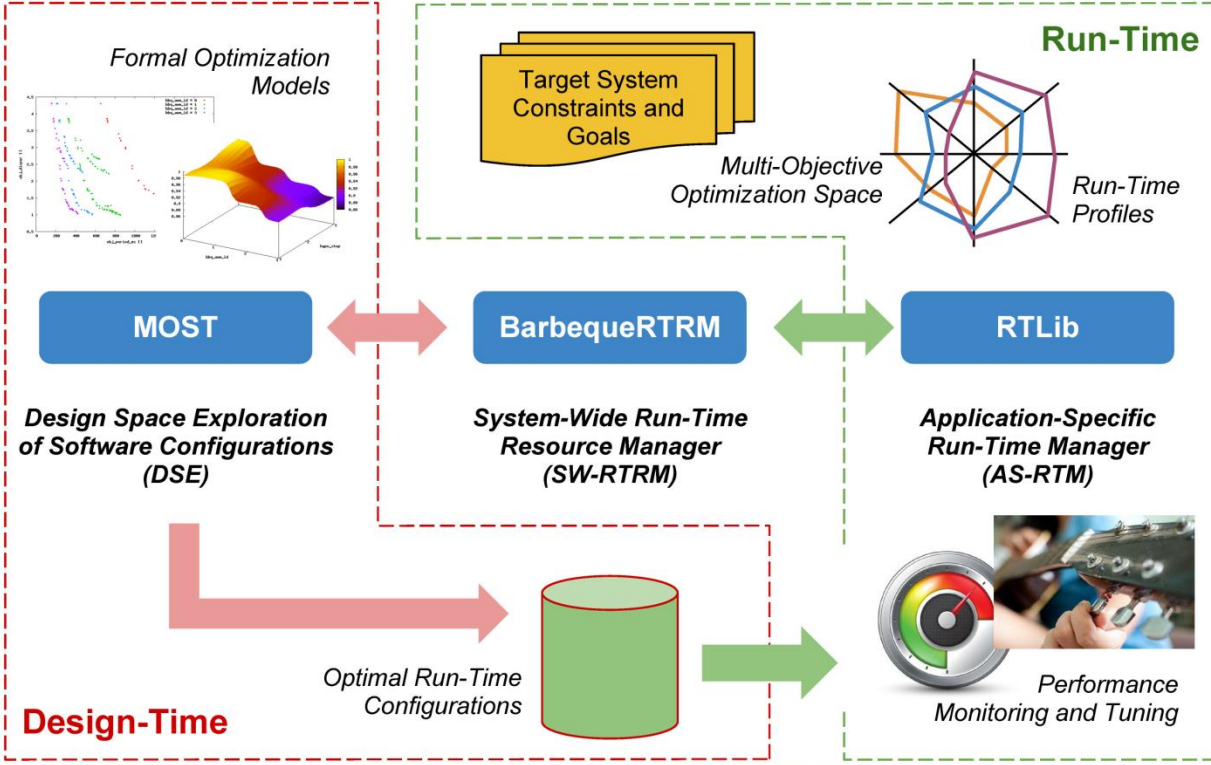


P2012/STHORM (Embedded computing)

Applications

Business Intelligence Guide Assistance Monitoring and Security Access Control

Stream Processing Applications



NUMA Machine (HPC)

STHORM Platform (embedded)

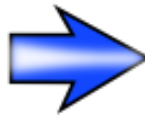
OpenCL

Multi-/Many-Core Platform

Results summary

Exploitable Results (FOSS software)

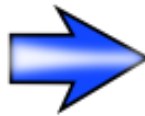
OpenCLang
OpenCRun
 LLVM STM xp70
BarbequeRTRM
dmmlib
 DSE toolchain
 NoCTrace
 Nuclei Toolchains



Exploitation Path

Future Research
 on adaptivity and
 portability of
 parallelism

Computing Fabric
Device Driver
BarbequeRTRM
 LLVM STMxp70



P2012 SDK

LLVM STMxp70



OpenCL 2.0
 production compiler
 R&D roadmap

STHORM/P2012
 platform

ADRES-based
 COBRA platform



Development of
 application library,
 use in products

- Effective management of a platform with up to 64 cores
- Successful porting (availability) of design methodologies and associated toolset also on general purpose commercial architectures
- Efficient RTRM
 - Power saving greater than 10%, up to 5x energy improvement while ensuring QoS and soft-real time in multi-application scenarios
 - Stability and robustness of the RTRM with tunable overhead always below 10%
- Application prototypes and demos
- Already created one startup exploiting DMMLib

The way forward: next steps

- Enlarge participation to opensource projects (also thanks to new approved funded projects)
 - BBQ -> dependable performance and mixed criticalities
 - OpenCRun
 - LLVM
 - DMMLIB -> startup
- IMEC integrates 2PARMA results into product and research program offering to customers
- HHI applies know-how in SVC parallelization to development of HEVC decoder
- Support ST divisions in the utilization of STHORM and 2PARMA technologies
- Sustain STHORM ecosystem