This poster illustrates our two-layer Run-Time Power Management (RTPM) developed in PHARAON, aiming at best exploiting the low-power capabilities of embedded heterogeneous multi-core platforms.

First, the poster describes the RTPM methodology. Second, it characterizes the interfaces between the applications and the RTPM, the interfaces between the RTPM and the platform, and the internal interfaces between both layers of the RTPM. Finally, it characterizes the used thread extensions that ensure compatibility (functionality and interfaces) with existing standards such as POSIX and OpenMP.

This RTPM will be applied on the following PHARAON use cases: radio and image processing applications on an ARM-based platform with specialized DSP and without OS and on a multi GPP ARM-platform with a Linux OS.

Our RTPM is a middleware between the applications and the platform. It consists of two main phases. First, a full exploration is done for each application at design time and leads to a multi-dimension set of Pareto-optimal application configurations. Second, critical decisions are taken at run time and are organized into two layers. Layer 1 takes care of coarse-grain decisions, such as optimal selection of application configurations and mapping, which have an impact on the usage of platform resources and require reconfiguration. Layer 2 takes care of fine-grain decisions, such as tuning of application parameters and Dynamic Voltage and Frequency Scaling (DVFS), which are cheaper and can be performed more frequently.
Two-layer Run-Time Power Management for embedded heterogeneous multi-core platforms

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RTPM global approach

RTPM
Run-Time Power Management

Our RTPM is a middleware between the applications and the platform. It consists of two main phases:

- First, a full exploration is done for each application at design time and leads to a multi-dimension set of Pareto-optimal application configurations.
- Second, critical decisions are taken at run time.

RTPM architecture

Run-time decisions are organized into two layers

- Layer 1 takes care of coarse-grain decisions, having an impact on the usage of platform resources, and requiring reconfiguration.
- Layer 2 takes care of fine-grain decisions, being cheaper, and performed more frequently.

Demonstrators

Three demonstrators from two domains, radio and image processing, will be produced.

- Radio demonstrators
  - MAC layer, implemented on multi GPP ARM based platform, with a Linux OS
  - Physical layer (L1) with real-time reconfiguration and multi-stream capabilities, implemented on ARM based platform + specialized DSP, without OS

- Image processing demonstrator
  - Advanced 3D stereoscopic applications with real-time and high definition constraints targeting the automotive domain for humans/obstacle detection, implemented on multi GPP ARM based platform, with a Linux OS

Interfaces for RTPM operations

- User interfaces:
  - HW platform configuration functions
  - SW application configuration functions
  - Optimization setting functions

- Hardware and OS interfaces:
  - DVFS functions
  - CPU load functions
  - Timer functions

- Internal interfaces:
  - Monitoring functions
  - Optimal selection of application configurations
  - Thread mapping and scheduling functions