DIVIDEND - DISTRIBUTED HETEROGENEOUS VERTICALLY INTEGRATED ENERGY EFFICIENT DATA CENTRES

Goal of the project

DIVIDEND aims to optimize heterogeneous data centers, combining CPUs, GPUs, and task-specific accelerators, as a unified entity to the application developer and let the runtime optimize the utilization of the system resources during task execution. DIVIDEND embraces heterogeneity to dramatically lower the energy per task through extensive hardware specialization while maintaining the ease of programmability of a homogeneous architecture.

Short description of the project

DIVIDEND provides cross layer energy monitoring and management in data centers that use heteregenous CPU, GPU and FPGA based processing. We aim to provide energy optimization using a vertical based integration from different abstraction layers: hardware, operating system, compiler and application.

Project implemented by

- University of Edinburgh – Coordinator
- University of Lancaster
- Queens University of Belfast
- Ecole Polytechnique Federale de Lausanne
- Universitatea Politehnica Timisoara
- INRIA Paris,
- Advanced Micro Devices, Paris

Implementation period

May 2015 – May 2017

Main activities:

The main activities performed in UPT are related to the development and integration of energy monitoring of dedicated FPGA accelerators into the Distributed Heterogeneous System Architecture (DHSA) concept. The UPT research represents the first approach to use the FPGA accelerators in hybrid architecture with full access to the system shared memory, as well as complete queuing support for DHSA. We aim at providing efficient acceleration for irregular parallel application using the proposed approach.

Results

The DIVIDEND project has provided a complete integration of FPGA based application accelerators into the DHSA systems, by offering the required hardware, as well as driver and operation system level support. Furthermore, energy accounting for dedicated FPGA hardware accelerators for distributed applications is offered. Therefore, an energy aware FPGA acceleration in distributed HSA based heterogeneous CPU-GPU-FPGA systems has been developed.

Applicability and transferability of the results

The DIVIDEND project developed the first approach that provides an energy cost for an application that has been executed in the distributed data center, composed of a heterogeneous computation platform consisting of CPUs, GPUs, or FPGAs. Therefore, for each user which runs applications on a data-center, a cost for the execution of each task can be offered. Therefore, the DIVIDEND project offers an energy aware application execution framework on distributed data-centers.

Financed through/by

CHIST-ERA NR 5/2015

Research Centre

Research Centre in Computing and Information Technology – CCCTI

Research team

Dr. Alexandru Amaricai – Principal Investigator
Prof. Marius Marcu
Dr. Sebastian Fuicu
Dr. Cosmin Cernazan
Dr. Sergiu Nimara
Gyorgy Kolumban Antal

Contact information

Alexandru Amaricai, PhD
Department of Computer and Information Technology
Address: Vasile Parvan Blvd., Nr. 2, 300223, Timisoara
Phone: (+40) 256 403272
E-mail: alexandru.amaricai@cs.upt.ro