

A Heterogeneous Runtime Environment for Scientific Desktop Computing

COMPUTER SYSTEMS / Tomo-GPU Project



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Research: heterogeneous multi-core platforms, parallel programming

Objectives

Mainstream computers have been evolving to an heterogeneous architecture encompassing classical CPUs, GPUs and other hardware accelerators. Visual programming environments (such as SCIRun PSE toolkit) have been successfully used to build programs by experts of a particular area of science and engineering. Most of the environments used in this context are based on the workflow paradigm: a program is a set of processing modules organized as a pipeline.

The main objective of this project is to build a runtime environment (H-RTE) that supports efficiently the execution of programs define by a visual program environment, to be executed in a desktop PC with one or more accelerators.

Methodology

Incorporating runtime environment H-RTE in SCIRun in order to do an integrated resource management, scheduling modules to execution in a processing unit in a way to keep all hardware resources occupied while taking into account the reduction of the data transfer overheads.

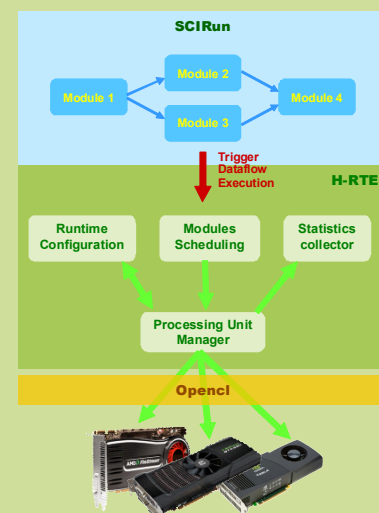
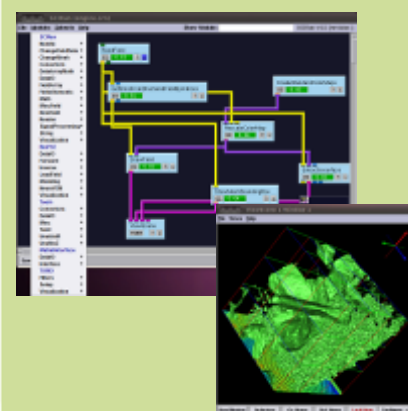
Functionalities of runtime environment H-RTE:

- Select the hardware that executes a module.
- Distribute the work load.
- Optimize the data flow between communicating modules

Expected Results

The system is built around a toolkit PSEs – SCIRun. The PSE allows a non-specialist in computer science to define a sequence of processing steps in a visual manner, interconnecting modules chosen from a repository.

Tomo-GPU supports 3D image processing algorithms and visualization functionalities, tailored to be executed efficiently in desktop PCs equipped with accelerators, mainly GPUs. Runtime will schedule the execution of the several modules using all the resources available achieving a load balance between processing units as well as reducing the move of data between the hierarchical memory architecture.



Intel® Xeon®
E5506 @ 2.13GHz



Quadro FX 3800
Tesla C2050 (Fermi)

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