EXA2PRO-EoCoE joint workshop

Report of Contributions

https://indico.math.cnrs.fr/e/eocoe-exa2pro-2021

Contribution ID: **1** Type: **not specified**

EXA2PRO framework overview & success stories

Monday, February 22, 2021 9:30 AM (30 minutes)

Overview of the EXA2PRO project and EXA2PRO framework

Presenter: PAPADOPOULOS, Lazaros (ICCS/NTUA)

Track Classification: EXA2PRO

Contribution ID: **2** Type: **not specified**

EXA2PRO High-level programming interface: SkePU and ComPU

Monday, February 22, 2021 10:00 AM (45 minutes)

We shortly present the main concepts of the EXA2PRO high-level programming model: SkePU skeletons (i.e., generic C++ program constructs with multiple backends supporting heterogeneous systems and clusters), multi-variant software components with explicit metadata annotation, smart data-containers for array-based data types, and the XPDL platform modeling framework.

https://skepu.github.io/tutorials/eocoe-exa2pro-2021/

Presenter: KESSLER, Christoph (Linköping University)

Track Classification: EXA2PRO

Contribution ID: **3** Type: **not specified**

EXA2PRO Runtime system: StarPU

Monday, February 22, 2021 11:15 AM (45 minutes)

We present the concepts of the EXA2PRO low-level programming model: StarPU task-based programming (https://starpu.gitlabpages.inria.fr/), which provides optimized execution on clusters of heterogeneous platforms. We will start with the basic principles of task-based programming. We will then bring an overview of the set of features and optimizations which are thus made possible at little extra cost from the programmer, from optimized scheduling to efficient distributed execution.

Presenter: THIBAULT, Samuel (University of Bordeaux)

Track Classification: EXA2PRO

Contribution ID: **4** Type: **not specified**

EoCoE framework overview & success stories

Monday, February 22, 2021 2:00 PM (30 minutes)

Overview of the EoCoE project

Presenter: AUDIT, Edouard (CEA)

Track Classification: EoCoE

Contribution ID: **5** Type: **not specified**

EoCoE - The Parallel Data Interface

Monday, February 22, 2021 2:30 PM (45 minutes)

Links:
- project website - https://pdi.julien-bigot.fr/master/

Presenter: BIGOT, Julien (MdlS/CEA)

Track Classification: EoCoE

Contribution ID: **6** Type: **not specified**

EoCoE - FTI - State-of-the-art multi-level checkpointing library

Monday, February 22, 2021 3:45 PM (45 minutes)

Large scale infrastructures for distributed and parallel computing offer thousands of computing nodes to their users to satisfy their computing needs. As the need for massively parallel computing increases in industry and development, cloud infrastructures and computing centers are being forced to increase in size and to transition to new computing technologies. While the advantage for the users is clear, such evolution imposes significant challenges, such as energy consumption and fault tolerance. Fault tolerance is even more critical in infrastructures built on commodity hardware. Recent works have shown that large scale machines built with commodity hardware experience more failures than previously thought.

Leonardo Bautista Gomez, senior Researcher at the Barcelona Supercomputing Center, will focus on how to guarantee high reliability to high-performance applications running in large infrastructures. In particular, they will cover all the technical content necessary to implement scalable multi-level checkpointing for tightly coupled applications. This will include an overview of the internals of the FTI library, and explain how multilevel checkpointing is implemented today, together with examples that the audience can test and analyze on their own laptops, so that they learn how to use FTI in practice, and ultimately transfer that knowledge to their production systems.

Presenter: BAUTISTA-GOMEZ, Leonardo (Barcelona Super-Computing Center)

Track Classification: EoCoE

Contribution ID: **7** Type: **not specified**

SkePU Skeleton Programming Hands-on Session

Tuesday, February 23, 2021 9:00 AM (3h 30m)

This session is limited to 20 participants.

Tutorial website: https://skepu.github.io/tutorials/eocoe-exa2pro-2021/

Presenters: ERNSTSSON, August (Linköping University); Dr KESSLER, Christoph (Linköping University); AHLQVIST, Johan (Linköping University)

Track Classification: EXA2PRO

Contribution ID: **9** Type: **not specified**

SkePU Skeleton Programming Hands-on Session (next part)

This hands-on session is limited to 20 participants.

3.Individual work session
(90min, A. Ernstsson, J. Ahlqvist, C. Kessler)

For this session we expect that participants install or have installed SkePU on some Linux system accessible to them (GPU or cluster architecture is not required). For fast installation we provide a binary x86-64 Linux distribution of SkePU (for ubuntu 18.04 and possibly other Linux variants) as well as a docker image; it is also possible to install SkePU from source, see https://skepu.github.io. We encourage participants to bring their own problems or C++ application codes for porting to SkePU. As alternative, we will provide further example problems for participants to experiment with programming in SkePU at their own pace. We will set up a shared queueing mechanism for providing individual assistance on a first-come first-served basis.

Tutorial website: https://skepu.github.io/tutorials/eocoe-exa2pro-2021/

Presenters: ERNSTSSON, August (Linköping University); Dr KESSLER, Christoph (Linköping University); AHLQVIST, Johan (Linköping University)

Track Classification: EXA2PRO

Contribution ID: **10** Type: **not specified**

Performance Engineering and code generation techniques

Tuesday, February 23, 2021 2:00 PM (3h 30m)

This hands-on session is limited to 20 participants.

Presenters: HOLZER, Markus (FAU); KUCKUK, Sebastian (FAU); GRUBER, Thomas (FAU)

Track Classification: EoCoE

Contribution ID: **11** Type: **not specified**

Performance Enginnering and code generation techniques (next part)

Practical Session: Coupling Performance Engineering and code generation with pystencils/lbmpy (75 min, Markus Holzer)

Presenter: HOLZER, Markus (FAU)

Track Classification: EoCoE

Contribution ID: **14** Type: **not specified**

StarPU task-based programming hands-on session

Wednesday, February 24, 2021 9:00 AM (3h 30m)

This hands-on session is limited to 20 participants.

https://starpu.gitlabpages.inria.fr/tutorials/2021-02-EoCoE/

Presenters: FURMENTO, N.; AUMAGE, Olivier; THIBAULT, Samuel (University of Bordeaux)

Track Classification: EXA2PRO

Contribution ID: **15** Type: **not specified**

Solving large linear systems with parallel solvers designed on top of runtime systems

Wednesday, February 24, 2021 2:00 PM (1h 30m)

The HiePACS Inria team co-develops linear algebra libraries to solve very large numerical systems on supercomputers. To get good performances whatever the computing machine, these libraries are designed as task-based algorithms and make use of runtime systems such as OpenMP (task), Parsec or StarPU. One main advantage is that with a single algorithm we can deploy executions on different architectures (homogeneous, heterogeneous with GPUS, with few/many cores, different kind of architectures and networks) achieving relatively high performance without requiring a lot of parameter tuning. Three of these libraries will be highlighted within a thirty minutes presentation to which will succeed a one hour demonstration on our PlaFRIM supercomputer: Chameleon (parallel dense linear algebra), PaStiX (parallel sparse direct solver) and Maphys (parallel hybrid solver). We will show how to install each library, how to use it through examples, discuss how to get good performances by tuning some parameters and finally visualize execution traces. The demonstration will put the emphasis on the reproducibility of experiments and performance; we will do so thanks to the GNU Guix distribution.

Presenter: PRUVOST, Florent (INRIA)

Track Classification: EoCoE

Contribution ID: **16** Type: **not specified**

Extreme-scale computation with PSBLAS and AMG4PSBLA

Wednesday, February 24, 2021 4:00 PM (1h 30m)

Track Classification: EoCoE