Partnership for Advanced Computing in Europe

Track B: Particle Methods - Introduction

PRACE Spring School 2012

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Agenda

- **Introdution to Track A** – 10 min.
- **PART1: Particle methods** – 2h
  - Computational problem and implementation ~ 20 min.
  - First look at the code and execution on Notos ~ 30 min.
  - Parallel Random Number Generation (SPRNG) ~ 30 min.
  - Visualization with VisNow ~ 30 min.
- **Coffee break**
- **PART 2: Load-balancing and migration** – 1.5h
  - Zoltan set-up ~ 15 min.
  - Load-balancing in Zoltan ~ 15 min.
  - Hands-on exercises ~20 min.
  - Migration in Zoltan ~ 15 min.
  - Hands-on exercises ~ 25 min.
- **Lunch break**

Agenda continued

- **PART 3: Exchange of particles** – 1.5 h
  - Computing interactions between particles ~ 45 min
  - Hands-on Zoltan neighbourhood assignment ~ 45 min
- **Coffee break**
- **PART 4: Hybrid parallelization and scalability testing** – 1h
  - Hybrid parallelization and execution on the Blue Gene/P architecture ~ 30 min
  - Scalability testing ~ 30 min

Motivation

- I am developing a scalable software that simulates human cell collonies dynamics
- During my work I have found a lot of great tools that:
  - Speeded up the execution of my code (MPI, OpenMP),
  - Speeded up the development process (SPRNG, Zoltan library),
  - Enabled good scalability (Performance Analysis Tools).

- **Efficient parallel implementation of a particle system code is not hard with the use of available libraries**

- **Simple example presented within this training can become a basis for efficient simulation code**

How it is organized?

- Description of problems and tools - presentations
- Hands-on sessions:
    - Description of the exercises given in a presentation
    - Individual work on Notos system
    - For each of the exercise: 3 fastest students will receive a small gift
    - The solution of each exercise will be delivered in a paper copy 10 min before deadline

How it is organized?

Hands-on exercises:

- Start from existing sources
- Learn and implement most important library calls
- End up with parallel particle simulation code
- Implement hybrid MPI + OpenMP parallelization
- Test scalability of the code

List of exercises

- **Exercise 1**: Random number generation   **PART 1**
- **Exercise 2**: Load-balancing
- **Exercise 3**: Data migration   **PART 2**
- **Exercise 4**: Exchange of particles   **PART 3**
- **Exercise 5**: Hybrid parallelization (MPI+OpenMP)
- **Exercise 6**: Scalability testing   **PART 4**