

Practical Parallel Programming 0



Course Organization

Jan Lemeire
2022–2023

Overview of Courses

- ◆ My former course 'Parallel Systems' (6SP) has been split into 2 smaller courses (each 3SP).

Parallel Systems



Practical Parallel Programming

- Introductory course, for newbies in parallel computing
- The basics
- First semester

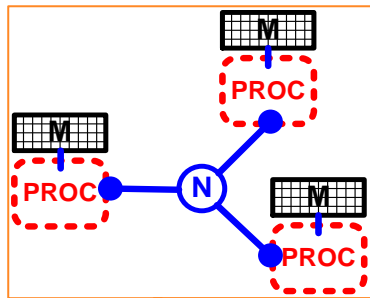


GPU computing

- Advanced course, completely focused on GPUs.
- Extensive programming experience is required
- Second semester

Parallel Systems

Distributed memory

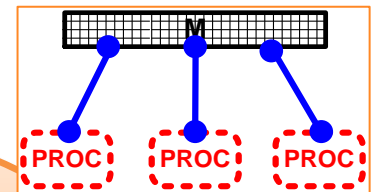


**Message-
passing
MPI**

*coarse-grain
parallelism*

Shared memory

*coarse-grain
parallelism*



**Explicit
multi-
threading**

OpenMP

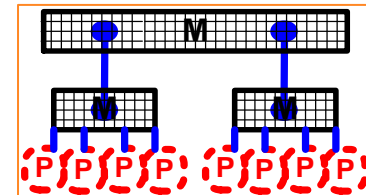
**OpenCL/
CUDA**

GPU

**Vector
instructions**

CPU

*fine-grain
parallelism*



Goals of course PPP

- ◆ Understand architecture of modern parallel systems
 - ✦ All important ones except for GPUs (see overview scheme)
- ◆ Employ software technologies for parallel programming.
- ◆ Understand their performance.

Evaluation of Practical Parallel Programming:

20% Mini-project on optimization
40% Oral exam on theoretical part
40% Project: parallelize an algorithm with the learned technologies

Organization

<http://parallel.vub.ac.be/education/ppp>

- ◆ Theory sessions: 5 chapters
 - ✦ Starts in week 4
 - ✦ Interleaved with the exercises
 - ✦ sessions were recorded and are available on website
- ◆ Practica: exercises to train you
 - ✦ Starts in week 5
 - ✦ Install Visual Studio (Community edition is for free)
 - ✦ explanation is recorded and made available
- ◆ Mini-project with 1-2 students
 - ✦ Starts by the end of October
- ◆ Project with 1-2 students
 - ✦ Starts in November

References

<http://parallel.vub.ac.be/education/ppp>

PPCP

- ◆ "Parallel Programming: Concepts and Practice" by Schmidt et al. (2019)

PPP

- ◆ "[Principles of Parallel Programming](#)" by Calvin Lin and Larry Snyder (2009)
 - ✦ Chapters 1-6, 7 (partly)

KUMAR

- ◆ "[Introduction to Parallel Computing](#)" by Grama, Gupta, Karypsis & Kumar (2003)
 - ✦ Chapters 1-7, 8.2, 9, 11

PPCP

Parallel Programming

Concepts and Practice



Bertil Schmidt | Jorge González-Domínguez
Christian Hundt | Moritz Schlarb

MK
MOSKOWSKI & KAPPA

PPP

PRINCIPLES OF PARALLEL PROGRAMMING



CALVIN LIN
LAWRENCE SNYDER

KUMAR

Introduction to

Parallel Computing

Second Edition

Second
Edition

Introduction to Parallel Computing

GRAMA
GUPTA
KARYPIS
KUMAR

ANANTH GRAMA • ANSHUL GUPTA
GEORGE KARYPIS • VIKIN KUMAR

ADDISON-WESLEY

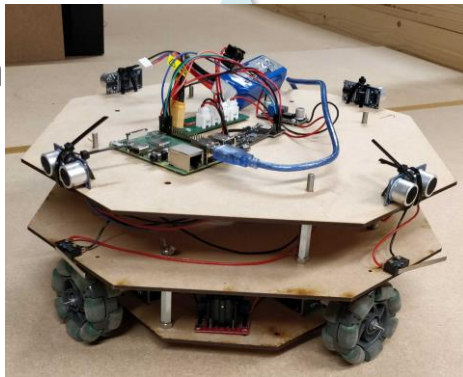
Jan Lemeire (jan.lemeire@vub.be K3.53)

- ◆ Burgerlijk ingenieur - elektronica, 1994, VUB
 - + bijkomende masters in de computerwetenschappen (1995)
- ◆ Werkte 4 jaar in de privé, voor 2 IT-consultancy companies
- ◆ 2000-2007: doctoreerde aan de VUB als assistant
 - ✦ Gaf oefeningen informatica
- ◆ Sinds 2008: professor aan VUB
 - ✦ Vak 'parallel systems' in de masters
 - ✦ Sinds 2011: titularis 'Informatica' eerste bachelors burgerlijk ir
- ◆ Sinds oktober 2013: geeft ook les aan *industriële ingenieurs*
 - ✦ Computerarchitectuur, elektronica, informatica
- ◆ Onderzoeksdomeinen:
 - ✦ **self-learning robots**, GPU computing (minder)
- ◆ <http://parallel.vub.ac.be> & <http://rapptor.vub.ac.be>

Research Jan

SELF-LEARNING ROBOTS

Gen



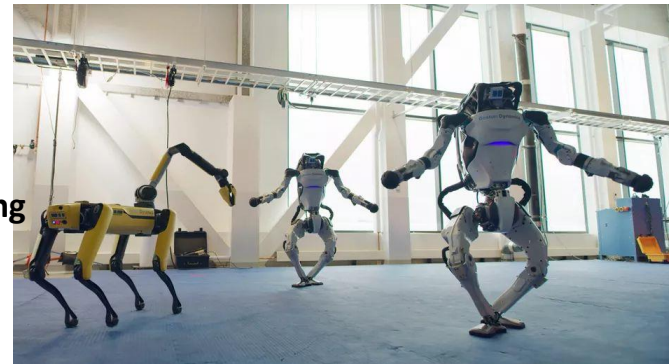
Learning /
adaptability

Self-learning

Unsupervised
learning

One-shot learning

Supervised learning



Complexity