

CS3210 – Parallel Computing

Course Admin

Lecture 0

Overview

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Teaching Staff – **Lecturer**

- Dr. Cristina Carbunaru

- Contact Information:

Phone number: 65168850

Email: **ccris@comp.nus.edu.sg**

- Comments / suggestions welcome

- Email in advance to book a consultation slot

Teaching Staff

■ Teaching Assistants:

- ❑ Keven Loo Yuquan – teaching T1 & T4
 - Email: keven@comp.nus.edu.sg
- ❑ Lee Yong Jie, Richard – teaching T2
 - Email: e0191783@u.nus.edu
- ❑ Wang Yiwei
 - Email: e0409763@u.nus.edu

Course Objectives

- Provide an introduction to the field of parallel computing with **hands-on** parallel programming experience on **real parallel machines**
- Four major parts:
 1. Parallel architectures
 2. Parallel computation models
 3. Parallel algorithm design and programming
 4. Performance of parallel programs

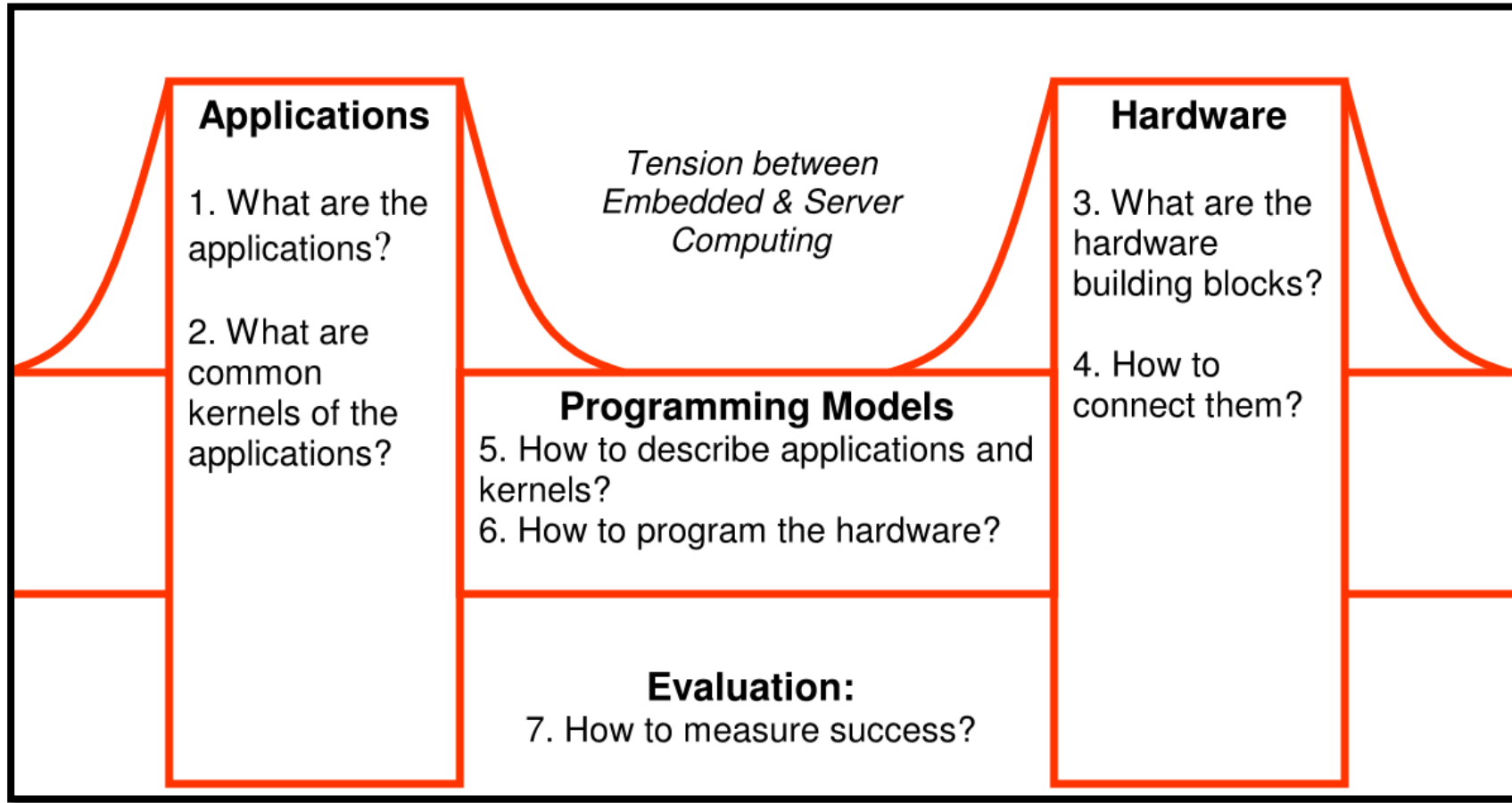
Not-so-formal Objectives

- Designing and writing scalable parallel programs
 - Parallel thinking and writing code in popular parallel programming languages
 - Emphasis on performance
- Parallel computer hardware implementation: how parallel computers work
 - Characteristics of the machine really matter
- Efficiency of running parallel programs on parallel hardware
 - Efficient \neq fast: running faster on a parallel computer, it does not mean it is using the hardware efficiently

Topics in Lectures

- Background on parallelism (from OS)
 - L2: Processes and threads
- Architecture
 - L3: Processor and memory organizations
 - L7: Cache coherence and memory consistency models
 - L10: Interconnection networks
- Parallel computation models
 - L4: Shared-memory architectures
 - L6: Data parallel architectures
 - L8, L9: Distributed-memory models
- Performance and scalability of parallel programs
 - L5: Performance of parallel systems
 - L11: Performance instrumentation
- New trends
 - L12: Energy efficient computing

Overview

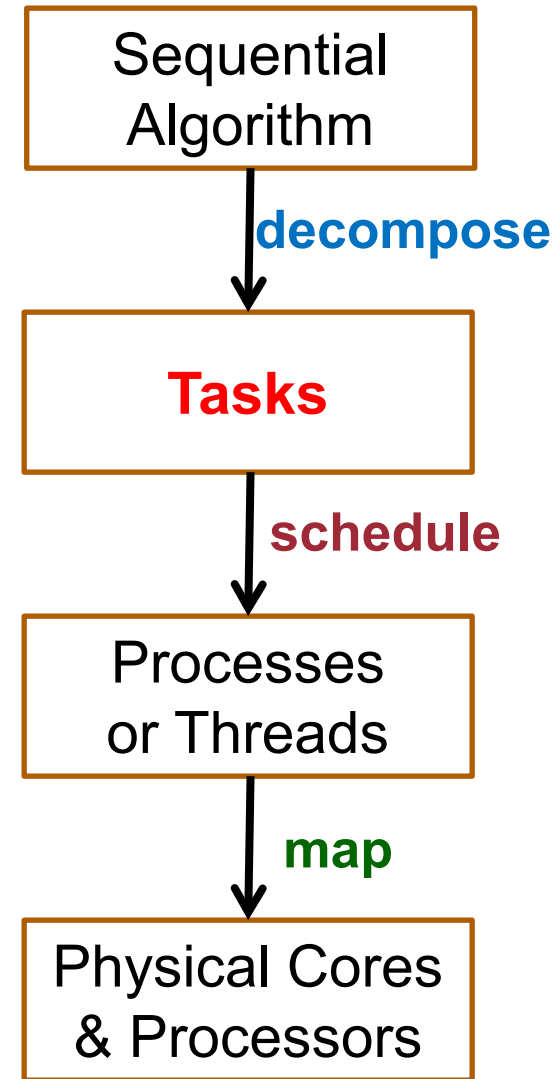


Picture taken from "The Landscape of Parallel Computing Research: A View from Berkeley" (2008)

Program Parallelization: Steps

- 3 main steps:

1. **Decomposition** of the computations
2. **Scheduling** (assignment of **tasks** to processes (or threads))
3. **Mapping** of processes (or threads) to physical processors (or cores)



High-level Structure of the Module

- **L1-L7: Shared-memory models**

- Architecture, memory consistency, programming
- OpenMP and CUDA

- **L8-L11: Distributed memory models**

- Architecture, interconnects, programming
- MPI

- with an emphasis on **Parallel performance**

Survey on LumiNUS

- Take 5 mins to complete the survey:
 - Expectations and background

Synchronous Online Teaching

- Lessons take place at the scheduled time on Zoom
 - ❑ Use “Raise hand”, Yes/No buttons, etc
 - ❑ Timetable with Zoom links will be published on LumiNUS
- All lessons are **recorded**
 - ❑ Recordings published on Luminus Multimedia
 - ❑ Access only your tutorial/lab recordings (not all recordings)
- No attendance taking, but we have quizzes and lab sheets
 - ❑ **Tutorial quizzes are graded**

Course Structure – Tutorial & Lab

- Tutorials and Labs in different weeks:
 - Starting with Lab 1 in Week 3, Tutorial 1 in Week 4,, etc
 - Register on EduRec for a tutorial slot
 - Each session is 2 hours long
 - 2nd hour is open session (and **optional**)
 - Parallel & Distributed Computing Lab, Com 1, #B1-02
 - Classes are conducted online

Course Structure - Assessment

- Continuous Assessment (60%)
 - Lab (10%)
 - 3 lab sheets
 - 4 quizzes
 - Programming Assignments (40%)
 - Midterm Test (15%)
 - Tentatively in Week 8 (Mon, 5 Oct, 2pm)
 - Open book, online
- Exam (35%) – Mon, 30 Nov, 9am
 - Open book, online

Supplimentary Reference Book

- Parallel Programming for Multicore and Cluster Systems
 - ❑ by Thomas Rauber and Gudula Rünger
 - ❑ 1st Edition, Springer-Verlag, 2010
 - ❑ Ebook - NUS Digital Library - <http://linc.nus.edu.sg/record=b2974382>
- 2nd Edition (2013) available online

