

Course Outline

Lecturers

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Purpose of Module

Software is no longer sequential. Many programs are now concurrent, parallel, distributed or mobile. This module explores technologies that enable, the design issues that concern, and the hierarchy of architectures that deliver, distributed and parallel systems.

The parallel strand starts by reviewing basic concepts including brief overviews of the need for parallelism, parallel architectures and programming approaches. The main focus is then on parallel programming models, namely

- MPI with C,
- Glasgow parallel Haskell,
- OpenMP on multicores,
- GPU processing.

Following a review of C and an introduction to essential MPI concepts and constructs, parallel design patterns and their realisations as algorithmic skeletons are explored.

The distributed strand also starts by reviewing basic concepts, including concurrency, threads and sockets. Existing technologies covered include fault tolerance, remote evaluation (RPC/RMI), and distributed object-based systems including object request brokers like CORBA. Several emerging technologies are covered, and compared to existing technologies. These include high-level coordination languages, mobility, Clouds and Grids.

Tutorials & Labs

During the course there will be tutorial/problem classes. *The lab sessions will take place in 2.50 in the normal lecture slot.*

Structure of Module

The following schedule is a plan that may evolve over the coming months!

Week 1

Introducing Parallelism (HWL/PWT)
C Revision I
C Revision II

Week 2

C Tutorial
Communication Libraries (MPI) I
Communication Libraries II

Week 3

MPI Tutorial I
Higher-order Parallelism (Skeletons) I
Haskell I

Week 4

MPI Tutorial II
Haskell II
Glasgow parallel Haskell (GpH) I

Week 5

Haskell Lab
GpH II
GpH III

Week 6 Programming Week**Week 7**

GpH Lab
OpenMP I
OpenMP Lab

Week 8

Higher-order Parallelism (Skeletons)
Higher-order Parallelism (Skeletons) II
Warehouse Computing Frameworks I
Coursework Deliverable due

Week 9

Warehouse Computing Frameworks II
Hadoop Lab
Vector Processing

Week 10

Introducing Distribution & Sockets
Remote Evaluation (RPC/RMI)
Concurrent & Distributed Haskell

Week 11

Cloud & Grid Computing (GridGpH)
Distributed Object-based systems (CORBA)
Mobile & Global Computation (mHaskell)

Week 12

Revision

Coursework

Students will undertake a piece of coursework comparing existing and emerging parallel software engineering technologies using both the department's Beowulf cluster, and multicore resources. The coursework will be handed out in week 6 and deliverables are due at the end of weeks 7 and 10.

Course Materials

Vision and Web Support

There are Vision and web pages providing supporting materials, e.g. copies of lecture notes, and tutorial sheets and solutions:

www.macs.hw.ac.uk/~trinder/ParDistr/
<http://www.macs.hw.ac.uk/~hwloidl/Courses/F21DP2>

Reading List

No single book or web resource covers the course, but recommended reading is associated with many lectures.