MHPC: first achievements and future perspectives

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HPC-TS conference 24-26 February 2016
Agenda

• Introduction: Why a master in HPC?
• The MHPC program
• The MHPC achievements
• Conclusion: The MHPC perspective
Why a master in HPC?

From http://www.information-age.com

How high-performance computing can break through the skills barrier

The lack of people with in-depth HPC skills continues to hold back the sector

Posted by Ben Rossi on 4 August 2014

The European Commission and Member States should also collaborate to address the shortage of qualified HPC job applicants, especially by ensuring that HPC competency is required in university scientific and engineering curricula, and that students are aware from an early age of attractive, rewarding HPC careers.
Building an MHPC program..
The beginning is the most important part of the work*

A proposal for a joint SISSA ICTP “International Master in High Performance Computing (HPC) for Science and Technology”

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Trieste, March 1st 2013

*PLATO
SISSA and ICTP: a perfect place for the next HPC professional to thrive

A broad range of scientific and technological challenges that HPC can address
The MHPC program

• A unique opportunity to combine cutting edge science and frontier in HPC techniques

• Key factors:
  - 15 months full time program
  - Strict selection
  - Interactive/hand-on sessions
  - Fee required
  - Opportunities to get fellowship/sponsorship
The target audience

- People interested in becoming professional in HPC techniques
- People with affinity to IT and Science that want to be involved in HPC projects in academia and industry
- People with strong interest in advanced programming for scientific computing and software optimization
MHPC timetable
- Scientific Programming Environment
- Introduction to Computer Architectures for HPC
- Parallel Programming
- Numerical Analysis
- Object-Oriented Programming
- Parallel Data Management and Data Exchange
- High Performance Computing Technology
- Advanced Computer Architectures and Optimizations
- Best Practices in Scientific Computing
Part II courses

- Data Structures and Sorting & Searching
- Fast Fourier Transforms in Parallel and Multiple Dimensions
- Spatial locality algorithms
- Domain Decomposition Methods
- Speeding up calculations using pre-stored information: neighbour list, cell and linked list
- Parallel Linear Algebra
- The Finite Element Method Using deal.II
- Monte Carlo methods
- Approximation and interpolation of simple and complex functions
- Reduced basis methods
- Machine learning algorithms
MHPC first year timeline..

June 2014:
- Application closed: 160 applications

July 2014:
- Selection performed: 15 student selected

September 2014:
- Lesson started: 14 students attending

May 2015:
- 12 students started working on thesis

December 2015 18th:
- 10 first graduated
Part III research project

• 2014-2015 projects examples
  – Application-level energy profiling and energy-aware scheduling (Moreno Baricevic)
  – High Performance Programming Paradigms Applied to Computational Fluid Dynamics Simulations (Mauro Bardelloni)
  – Performance-driven refactoring of Potts and Grid cells neural network codes. (Leonardo Romor)
  – High Order and High Regularity HPC Finite Element Approximations for IsoGeometric Analysis (Marco Tezzele)
Two months later...

- 1 hired from a company (even before the end of the master) with permanent position
- 4 people with fellowship/ mid-term contract
- 2 moving on with their PhD Studies
- 2 looking for PhD/master position to continue in scientific research
- 1 back to his permanent position in HPC
MHPC second year timeline..

June 2015: application closed: 170 applications

July 2015: selection performed
15 student selected

September 2015: lessons started
12 students attending

February 2015: 11 students survived intense first part
How much intense ?
MHPC 2015/16
sponsors and fellowships

• 2 full fellowship by ICTP for developing countries: Pakistan and Costa Rica
• 2 SISSA PhD students
• Sponsors for local students
  – 3 OGS fellowship through HPC-TRES program
  – 4 covers the fee
    • eXact – lab / Fincantieri / Generali / CNR (NFFA project)
Resources for MHPC

- SISSA Ulysses HPC system
  - The toy for our students

- Financial resources
  - Ongoing contribution by FVG region
Human Resources for MHPC

• Faculty
  – Mainly local HPC experts and scientists
  – Important contributions for research institutions (CNR/CINECA) and HPC industries (NVIDIA/INTEL/ DDN)

• 2 Assistant Program Coordinators
  – Giuseppe Piero Brandino/Nicola Cavallini

• Secretarial Supports
  – Claudia/Mila (ILAS) Sabrina (ICTP)
So far so good..

- MHPC is growing at the right pace and represents an high education international opportunity
- Interest is rising among industrial partner and academic institutions
- Partnership with ULM University master in science in the framework of Erasmus+ international agreement
Next steps

• Call for Applications will open on March 1\textsuperscript{st}
  – Deadline for ICTP fellowships: 30 April
  – Deadline for standard application: 7\textsuperscript{th} July

• Start looking for Academic and Industrial sponsorship/fellowship

• Start advertising/promoting the master to receive high level applications
The future ahead of us

• Build a path to provide “laurea magistrale”
  – in collaboration with University of ROMA3
• Consolidate/enhance the strict cooperation with industry
• Make this educational offer part of the FVG portfolio in the HPC activities
THANKS FOR YOUR ATTENTION!

www.mhpc.it