Contents

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ICT Solutions for Brilliant Minds

*CSC is a Finnish centre of expertise in ICT that provides ICT expert services at an internationally high level of quality for research, education, culture, public administration and enterprises, to help them thrive and benefit society at large.*
Non-profit state enterprise with special tasks

Turnover in year 2015

35.7 M€

Headquarters in Espoo, datacenter in Kajaani, Finland

Owned by state (70%) and all Finnish education higher institutions (30%)

Circa 280 employees in year 2016
CSC’s Services

Scientific Computing and Software
Funet Network Services
Identity and Access Management
Training services
Research Information Management
Education Management and Student Administration Services
Datacenter and Capacity Services
Consultation and Tailored Solutions
CSC datacenter in Kajaani

- 3,000 m² (option to 4,000 m² additional datacenter space)
- Redundant green power scalability up to hundreds of MW, based on customer need. Existing power capacity: 10 MW (redundant)
- Local and competent partner network guarantees rapid scalability and secure operations
- State-of-the-art datacenter technology (modularity of the datacenter, easy expansion, free air cooling all year round) delivering world-class eco-efficiency and zero carbon footprint. Annual pPUE 1.03 (2015)
- Also traditional water cooling datacenter facilities are available for certain supercomputer type of services
- High-end availability on both power supply, cooling and core network connectivity
CSC – IT Center for Science Ltd., Finland

- Non-profit company
- State-owned
- Staff 280+
- Turnover 35+ M€
- www.csc.fi

Funet Services (NREN)
Computing Services
Data Services for Science and Culture
Information Management Services
Datacenter and Capacity Services
Training Services, Consultation

Supercomputing environment:
- Cray XC40, 1.7 PF
- HP, IB cluster, 0.6 PF
  - as IaaS cloud, too
- Bull, Xeon Phi & Tesla, 0.24 PF
- DDN storage, 4 PB, 90 GB/s

Offices, greater Helsinki
Datacenter, Kajaani (64 deg N)
Training activities

• Offer a versatile, top-quality training portfolio

• Support university education by providing e.g. training material, facilities, computing resources and accounts for their own courses

• Maintain top-notch training facilities

• Facilitate and host training events in collaboration with doctoral programs

• Participate in pan-European training networks
Motivation

• Training activities are intended
  o to familiarize users with the infrastructure offered by CSC and its effective use
  o to make users aware of the news, trends and future scenarios within IT technology for science
  o to promote horizontal networking between users
  o to provide an important customer interface

• The ultimate purpose is to support the work and competitiveness of Finnish science, research, and product development
Courses and events, 2012–2016

Total of 2,783 participants during 2016.

Count

2012: 108 courses, 25.7 course days, 25.7 participants per course (av.)
2013: 90 courses, 25.7 course days, 25.7 participants per course (av.)
2014: 92 courses, 33.2 course days, 33.2 participants per course (av.)
2015: 90 courses, 30.9 course days, 30.9 participants per course (av.)
2016: 101 courses, 27.6 course days, 27.6 participants per course (av.)
Course examples / Autumn 2016

• Programming the D-Wave 2X Quantum Computer (12.-13.10)
• Ansys CFD with Fluent (17.-18.10)
• Introduction to Parallel Programming (19.-21.10)
• High-performance geocomputing 2016 workshop (25.10)
• Linux 2 - Intermediate Linux (7.-8.11)
• Scientific visualization with ParaView and VTK (9.-10.11)
• Data Intensive Analysis with R (17.-18.11)
• ...
Course examples / Spring 2017

• Python in high-performance computing (Jan)
• Linux 1 - Introduction to Linux (Jan)
• Using CSC Environment Efficiently (Feb)
• Advanced Parallel Programming (Feb)
• GPU Programming with CUDA (Feb)
• Advanced Fortran programming (Mar)
• Advanced Threading and Optimisation (Apr)
• CSC Spring School in Computational Chemistry (Mar)
• cPouta Cloud course (May)
• CSC Summer School in HPC (Jun)
• ...
More information at

csc.fi/training
csc.fi/training-services
PRACE is an international not-for-profit association under Belgian law, with its seat in Brussels.

PRACE has 25 members and 2 observers.

PRACE is governed by the PRACE Council in which each member has a seat. The daily management of the association is delegated to the Board of Directors.

PRACE is funded by its members as well as through a series of implementation projects supported by the European Commission. Computing resources are made available by a group of members (Hosting Members)
Mission: enabling world-class science through large scale simulations

Offering: HPC resources on leading edge capability systems

Resource award: through a single and fair pan-European peer review process for open research
The road went so far

- 2004-2006
  - HPCEUR
  - HET
  - Scientific case

- 2007
  - HPC in ESFRI roadmap
  - HPC vision involving 15 countries
  - PRACE initiative started

- April 2010
  - PRACE preparatory phase project
  - EC funding from the FP7

- 2010-2015
  - PRACE AISBL created
  - HQ office in Brussels
  - 1st call for project access launched
  - PRACE IP projects (1-4)
  - PCP for energy efficiency launched
  - Regular calls (2 per year)
  - Industry and SME support
  - Expanding training (PATC)
  - End of PRACE initial period

- 2016
  - PRACE members agreement on new funding model
  - New HM: Switzerland
  - Call 14 for more than 2000 M core/h

- 2017
  - PRACE 2 starts issuing Call 15
  - PRACE-5IP kick-off

- 2008-2010
  - PRACE vision involving 15 countries
  - PRACE vision involving 15 countries
PRACE achievements so far

- 530 M€ of funding for the 2010-2015 period (PRACE initial phase)
- 50 Pflop/s of aggregated peak performance on 7 world-class systems
- 465 scientific projects enabled
- 12.2 thousand million core hours awarded since 2010 by peer review
- Open R&D access for industrial users (> 50 companies supported)
- > 7000 people trained in 6 PRACE Advanced Training centers (PATC) and other events
PRACE Hosting Members offering of core hours on 7 world-class machines

MareNostrum: IBM
BSC, Barcelona, Spain

JUQUEEN: IBM
BlueGene/Q
GAUSS/FZJ
Jülich, Germany

SuperMUC: IBM
GAUSS/LRZ
Garching, Germany

CURIE: Bull Bullx
GENCI/CEA
Bruyères-le-Châtel, France

Hazel Hen: Cray
GAUSS/HLRS,
Stuttgart, Germany

Piz Daint: Cray XC 30
CSCS
Lugano, Switzerland

MARCONI: Lenovo
CINECA
Bologna, Italy
PRACE Training figures

6 PRACE Advanced Training Centres (PATC):

• Barcelona Supercomputing Center (Spain)
• CINECA – Consorzio Interuniversitario (Italy)
• CSC – IT Center for Science Ltd (Finland)
• EPCC at the University of Edinburgh (UK)
• Gauss Centre for Supercomputing (Germany)
• Maison de la Simulation (France)

PATC events:
from March 2012 until July 2016
(PATCs started in 2012)

321 events
7087 participants
915 PATC training days

ALL PRACE training events
(including PATC courses, seasonal schools, workshops, International HPC Summer School, etc), since 2008/09:

8664 participants
353 training events
1040 training days
## PATC courses implementation

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of courses</strong></td>
<td>19</td>
<td>71</td>
<td>81</td>
<td>77</td>
<td>73</td>
<td>79 (28)</td>
</tr>
<tr>
<td><strong>Total duration (days)</strong></td>
<td>56</td>
<td>204</td>
<td>233</td>
<td>219</td>
<td>203</td>
<td>215 (82)</td>
</tr>
<tr>
<td><strong>Number of participants</strong></td>
<td>511</td>
<td>1,547</td>
<td>1,682</td>
<td>1,786</td>
<td>1,561</td>
<td>596</td>
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<tr>
<td><strong>Number of participant-days</strong></td>
<td>1,715</td>
<td>4,702</td>
<td>5,187</td>
<td>5,384</td>
<td>4,583</td>
<td>1,656</td>
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<tr>
<td><strong>Female (%)</strong></td>
<td>-</td>
<td>12.9%</td>
<td>14.4%</td>
<td>16.3%</td>
<td>17.4%</td>
<td></td>
</tr>
<tr>
<td><strong>Non-academic (%)</strong></td>
<td>-</td>
<td>9.9%</td>
<td>12.3%</td>
<td>15.6%</td>
<td>20.8%</td>
<td></td>
</tr>
<tr>
<td><strong>Non-host country (%)</strong></td>
<td>-</td>
<td>20.6%</td>
<td>25.4%</td>
<td>29.5%</td>
<td>16.1%</td>
<td></td>
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<tr>
<td><strong>Non-PATC country (%)</strong></td>
<td>-</td>
<td>13.8%</td>
<td>17.7%</td>
<td>19.9%</td>
<td>8.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Feedback response rate (%)</strong></td>
<td>-</td>
<td>63%</td>
<td>64%</td>
<td>53%</td>
<td>52%</td>
<td>54%</td>
</tr>
<tr>
<td><strong>Average overall rating (0-10)</strong></td>
<td>-</td>
<td>8.5</td>
<td>8.4</td>
<td>8.4</td>
<td>8.4</td>
<td>8.5</td>
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</tbody>
</table>
## PATC Example: EPCC courses in 2015/16

<table>
<thead>
<tr>
<th>Date</th>
<th>Course</th>
<th>Days</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-01-15</td>
<td>Data Management: IO, Transfer and Storage</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>16-04-15</td>
<td>Software Carpentry</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>20-05-15</td>
<td>Single Sided PGAS Communications</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>25-05-15</td>
<td>HandsOn Introduction to HPC for WiHPC</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>25-06-15</td>
<td>Performance Analysis Workshop</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>29-06-15</td>
<td>Introduction to Molecular Dynamics</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>02-07-15</td>
<td>Advanced OpenMP</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>13-07-15</td>
<td>Hands-on Introduction to HPC</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>15-07-15</td>
<td>Message-Passing Programming with MPI</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>28-10-15</td>
<td>Advanced MPI</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>29-10-15</td>
<td>Data Carpentry</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>24-11-15</td>
<td>Practical Software Development</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>10-12-15</td>
<td>Efficient Parallel IO</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>14-12-15</td>
<td>Software Carpentry</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>15-12-15</td>
<td>Shared Memory programming with OpenMP</td>
<td>2</td>
<td>12</td>
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<tr>
<td></td>
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<tr>
<td>16-12-15</td>
<td>Intro OpenMP+MPI</td>
<td>1</td>
<td>26</td>
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<tr>
<td>19-01-16</td>
<td>Materials Modelling Packages</td>
<td>4</td>
<td>31</td>
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<tr>
<td>14-03-16</td>
<td>Data Storage and Management</td>
<td>2</td>
<td>7</td>
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<tr>
<td>24-03-16</td>
<td>Software Carpentry</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>19-05-16</td>
<td>Scientific Python</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>06-07-16</td>
<td>Performance Analysis Workshop</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>11-07-16</td>
<td>Hands-on Introduction to HPC</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>13-07-16</td>
<td>Message-passing Programming withMPI</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>02-08-16</td>
<td>Advanced OpenMP</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>06-09-16</td>
<td>Intro to Scientific Programming using Python</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>28-09-16</td>
<td>Practical Software Development, RAL</td>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>29-09-16</td>
<td>Advanced MPI</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>11-10-16</td>
<td>GPU Programming with CUDA</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>28-11-16</td>
<td>Single Node Performance Optimisation</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>12-12-16</td>
<td>Writing Scalable Applications with MPI</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>
PATC 2016-17 Programme

• 79 courses, 215 training-days
  – Wide coverage of topics, code development and applications.
  – 16 new courses, for instance in: new systems, CFD, material science, engineering, bioinformatics, Big Data & HPC, accelerators, new paradigms for scalability & fault tolerance
PRACE Training Centres (PTCs) = Non-Advanced Training

- New initiative in PRACE-5IP project.
- Establish 4 PTCs.
- Open to all PRACE-5IP partners (apart from those in PATC-hosting countries).
Massive Open Online Courses
MANAGING BIG DATA WITH R AND HADOOP

MANAGING BIG DATA WITH R AND HADOOP
PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE (PRACE)

Learn how to manage and analyse big data using the R programming language and Hadoop programming framework.

📅 20 Mar  📅 5 weeks  ⏰ 4 hours pw  🗓️ Certificate
SUPERCOMPUTING

PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE (PRACE)

Discover how supercomputers work and the real-life scientific breakthroughs made possible by today's computer simulations.

📅 6 Mar  🕒 5 weeks  ⏰ 3 hours pw  🌐 Certificate  

More
Summer of HPC

http://summerofhpc.prace-ri.eu
Projects

• 20+ projects with HPC and visualization relevance (outreach).
• Proposed by mentors that work with students during the summer.
• Ideally one-to-one (student-mentor) match.
• 10+ sites hosts at least two students.
Projects 2017

- 1701 Hybrid Monte Carlo Method for Matrix Computation on P100 GPUs, BSC, Barcelona, Spain
- 1702 Monte Carlo and Deep Learning Methods for Enhancing Crowd Simulation, BSC, Barcelona, Spain
- 1703 Apache Spark: Are Big Data tools applicable in HPC?, CC SAS, Bratislava, Slovakia
- 1704 Calculation of nanotubes by utilizing the helical symmetry properties, CC SAS, Bratislava, Slovakia
- 1705 Web visualization of Energy load of an HPC system, CINECA, Casalecchio di Reno, Italy
- 1706 Web visualization of the Mediterranean Sea, CINECA, Casalecchio di Reno, Italy
- 1707 Development and validation of real-time earthquake hazard models, EPCC, Edinburgh, UK
- 1708 Interactive weather forecasting on supercomputers as a tool for education, EPCC, Edinburgh, UK
- 1709 Online visualisation of current and historic supercomputer usage, EPCC, Edinburgh, UK
- 1710 Visualizing European Climate Change, AUTH/GRNET, Athens, Greece
- 1711 European climate model simulations, AUTH/GRNET, Athens, Greece
- 1712 El-Nino: It’s periodicity and impact on world weather, ICHEC, Dublin, Ireland
- 1713 Radiosity in Computer Graphics, ICHEC, Dublin, Ireland
- 1714 Visualization of real motion of human body based on motion capture technology, IT4I, Ostrava, CZ
- 1715 Performance visualization for bioinformatics pipelines, IT4Innovations, Ostrava, Czech Republic
- 1716 Cude colors on phine grid, JSC, Jülich, Germany
- 1717 Hip, hip, hooray! Get your 2-for-1 GPU deal now., JSC, Jülich, Germany
- 1718 Accelerating climate kernels, UCPH, Copenhagen, Denmark
- 1719 Tracing in 4D data, UCPH, Copenhagen, Denmark
- 1720 Parallel algorithm for non-negative matrix tri-factorization, UL, Ljubljana, Slovenia
- 1721 CAD data extraction for CFD simulation, UL, Ljubljana, Slovenia
BSC Spain

- Hybrid Monte Carlo Method for Matrix Computation on P100 GPUs
- Monte Carlo and Deep Learning Methods for Enhancing Crowd Simulation
CC SAS Slovakia

- Apache Spark: Are Big Data tools applicable in HPC?
- Calculation of nanotubes by utilizing the helical symmetry properties
Training week at JSC
Awards

• The Best HPC Ambassador award
  – Presented to the participant who best embodies the outreach spirit of the programme.
• The Best Visualisation Award
  – Presented to the participant who completes the best visualisation during the Summer of HPC Programme.
• The awards consist of a diploma, a trophy and a budget of €1,500,- per winner to go to a PRACE Training Event or similar.
• Awards Ceremony was organised by CINECA
International Summer Schools

• International Summer School 2016
  – Slovenia, University of Ljubljana, Faculty of Mechanical Engineering
  – 80 students attended

• 2017 International Summer School
  – June 25 - 30 2017, in Boulder, Colorado, United States
Seasonal schools & On-demand events

• Six seasonal schools in 2016-2017
  – Typical duration ~4 days
  – 40-60 participants

• Examples:
  – Spring 2016, Ireland
    • HPC Applications in Material Science
    • In collaboration with “An e-infrastructure for software, training and consultancy in simulation and modelling” CoE (E-CAM)
  – Spring 2017, Sweden
    • HPC in the Life Sciences
    • In collaboration with ”Centre of Excellence for Biomolecular Research” (BioExcel)
Further information:

- http://www.training.prace-ri.eu/nc/training_courses/index.html
Thank you!