# SEVENTH FRAMEWORK PROGRAMME
# Research Infrastructures

# INFRA-2012-2.3.1 – Third Implementation Phase of the European High Performance Computing (HPC) service PRACE



# PRACE-3IP

# PRACE Third Implementation Phase Project

**Grant Agreement Number: RI-312763**

# D4.2
# Report on Training Events

## *Final*

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# References and Applicable Documents

[1]     http://www.prace-project.eu

[2]     http://www.training.prace-ri.eu

[3]     D3.2.3: *PRACE Advanced Training Centres*; PRACE-1IP public deliverable, http://www.prace-ri.eu/IMG/pdf/d3.2.3_1ip.pdf

[4]     D3.2.5 *Final Training Report*; PRACE-1IP public deliverable, http://prace-ri.eu/IMG/pdf/d3.2.5_1ip.pdf

[5]     D4.3 *Final Training Report*; PRACE-2IP public deliverable, http://prace-ri.eu/IMG/pdf/d4.3.pdf

[6]     D4.1 *Continuity Plan for the PRACE Advanced Training Centres*; PRACE-3IP public deliverable, http://www.prace-ri.eu/IMG/pdf/d4.1.pdf

[7]     D4.4 *Training Collaboration*; PRACE-3IP public deliverable (in preparation)

[8]     List of PATC courses: http://events.prace-ri.eu/categoryDisplay.py?categId=2

# List of Acronyms and Abbreviations

| | |
|---|---|
| AEC | Ars Electronica Center (Linz, Austria) |
| AISBL | Association International Sans But Lucratif (legal form of the PRACE-RI) |
| AMD | Advanced Micro Devices |
| BLAS | Basic Linear Algebra Subprograms |
| CaSToRC | Computation-based Science and Technology Research Center (Cyprus) |
| CDCC | Christian Doppler Laboratory for Client-Centric Cloud Computing (JKU) |
| CEO | Chief Executive Officer |
| CFD | Computational Fluid Dynamics |
| CINECA | Consorzio Interuniversitario, the largest Italian computing centre (Italy) |
| CPU | Central Processing Unit |
| CSC | Finnish IT Centre for Science (Finland) |
| CUDA | Compute Unified Device Architecture (NVIDIA) |
| EM | Electromechanical Design |
| EU | European Union |
| FEM | Finite Element Method |
| GFFS | Global Federated File System |
| GPU | Graphic Processing Unit |
| GPGPU | General Purpose GPU |
| HPC | High Performance Computing |
| HPCFS | High Performance Cluster File System |
| ICA | Institute for Computer Architecture (JKU) |
| IUCC | Inter-University Computation Center |
| IUCEL | Inter University Center for E-Learning (Israel) |
| IPB | Institut za Fiziku (Serbia) |
| IT | Information Technology |
| JKU | Johannes Kepler University Linz |
| JSC | Jülich Supercomputing Centre (FZJ, Germany) |
| LRZ | Leibniz Supercomputing Centre (Germany) |
| MPI | Message Passing Interface |
| NCSA | National Centre for Supercomputing Applications (Bulgaria) |
| OMB | Operational Management Board |
| OpenCL | Open Computing Language |
| PATC | PRACE Advanced Training Centre |
| PRACE | Partnership for Advanced Computing in Europe; Project Acronym |
| PRACE-1IP | PRACE - First Implementation Phase Project |
| PRACE-2IP | PRACE - Second Implementation Phase Project |
| PRACE-3IP | PRACE - Third Implementation Phase Project |
| RISC | Research Institute for Symbolic Computation |
| SM | Structural mechanics |
| UK | United Kingdom |
| UL | University of Ljubljana |
| ULFME | Faculty of Mechanical Engineering of the University of Ljubljana |
| USA | United States of America |
| VŠB-TUO | VŠB-Technical University of Ostrava (Czech Republic) |
| WP4 | Work Package 4 (Training) |
| XSEDE | Extreme Science and Engineering Discovery Environment (USA) |

# Executive Summary

The Training Work Package (WP4) of the PRACE Third Implementation Phase (PRACE-3IP) project was responsible for the face-to-face training of PRACE. It seamlessly continued the training activities of PRACE-2IP starting from September 2013. Between September 2013 and June 2014 the six PRACE Advanced Training Centres delivered 77 courses with 1448 participants with high level of satisfaction of the participants, expressed through a very positive (8.38) overall rating on average for each course. Similarly, the three PRACE seasonal schools of this period, namely the PRACE Autumn School 2013 in Slovenia, the Winter School 2014 in Israel and the Spring School 2014 in Austria, attracted 152 attendees in total and obtained overall ratings of 7.0, 8.4 and 7.1, respectively. Both forms of face-to-face training are complementary, they contribute to the success of PRACE training activities, and should be continued in the future PRACE HPC training.

In accord with the PRACE-3IP goals most training events address also industrial users, and motivate them by showing the importance and benefits of HPC for the practice.

## 1   Introduction

One of the aims of the PRACE - Third Implementation Phase Project (PRACE-3IP) was to broaden the training activity to engage more user communities, including industry, in the use of HPC. The face-to-face training events were pillars of those activities, for their intensive and imminent impact on geographically and professionally distant communities.

The face-to-face training was served by PRACE-3IP in three flavours. The majority of events were organized by the **PRACE Advanced Training Centres** (PATCs), operating at well-established supercomputing facilities. Continuing the series of **PRACE Seasonal Schools**, three seasonal schools were organized by several emerging partners to reach European users even more widely. The most prominent face-to-face training event was the **International HPC Summer School**, continuing in the tradition of the European-US Summer Schools.

This document is a public report of all face-to-face training events delivered by PRACE-3IP, with the exception of the International HPC Summer School, which is covered in more detail in the deliverable D4.4 *Training Collaboration* [7]. In Section 2 the activities of PATCs are analysed, and in Section 3 all three seasonal schools are summarized with detailed reports from the organizers of the schools available in the Annex.

## 2   PRACE Advanced Training Centres

The mission of the PRACE Advanced Training Centres (PATCs) is to serve as European hubs of advanced, high-quality training for researchers working in the computational sciences. The PATCs provide and coordinate training and education activities needed to achieve the best utilisation of the PRACE research infrastructure by the community. The PATCs promote a common PRACE brand, representing the whole PRACE community rather than only the hosting sites, and implement a jointly developed curriculum, designed and coordinated by PRACE with input from user communities.

The main concepts of the PATCs, including their mission and objectives, were outlined in PRACE-1IP D3.2.3: *PRACE Advanced Training Centres* [3]. PRACE-2IP was responsible for implementation, the establishment of the PATCs and their operation for the duration of the project, as described in PRACE-2IP D4.3: *Final Training Report* [5]. In summary, six PATCs

were established in six partner countries (Finland, France, Germany, Italy, Spain and the UK). They have delivered some initial PATC courses and implemented a pilot PATC curriculum during an approximately 18-month period within the PRACE-2IP project (i.e. March 2012 to September 2013), delivering 90 courses with a total of 2058 participants.

In PRACE-3IP, one significant task was to develop a plan to transform the PATCs into a permanent service of the PRACE AISBL. This was completed with the publication of PRACE-3IP D4.1: *Continuity Plan for the PATCs*, which highlighted the operational and financial models of sustaining the PATCs taking into account lessons learnt thus far [6]. Internal re-allocation of funding has also allowed the operation of the PATCs (i.e. delivery of courses) after the end of the PRACE-2IP project in September 2013 until July 2014 (i.e. a further seven months from what was originally anticipated in the description of work).

Finally, while the PRACE-3IP project had originally set out to establish a PATC with special focus on serving industrial R&D users, the work involved towards this objective was eventually shared between the six established PATCs. The PRACE Board of Directors, advised by an external panel of experts, had highlighted that all PATC courses should be open to both academic and industrial users, rather than setting up a dedicated "industrial PATC" that offers courses exclusively for industry.

## 2.1    Operation of the PATCs

The operation of the PATCs has remained largely unchanged from the PRACE-2IP project (see [5]), with minor evolutionary changes. The work continued to be supervised and steered by the PATC Operational Management Board (OMB), which consists of representatives from each of the PATCs as well as a member of the PRACE-3IP project who is involved in the Training work package (WP4). Some of the key operational functions carried out by the PATC OMB during the PRACE-3IP project include the following:

- **Curriculum planning**
  As part of the work of the PRACE-2IP project, the 2013-14 joint curriculum was developed and subsequently approved by the PRACE Board of Directors (who is in turn advised by an external panel of experts) in early 2013 [5]. PRACE-3IP was tasked with implementation of this curriculum.

  The 2014-15 joint curriculum was also devised and approved in May 2014, using a process similar to formation of the 2013-14 curriculum. Implementation of this curriculum will be carried out within the extension phase of the PRACE-3IP project and potentially in part within the next PRACE project that succeeds PRACE-3IP.

- **Course information, registration and feedback**
  Participants continued to obtain information, register and complete feedback forms for courses through the PRACE events web site powered by the Indico event management tool.

- **Dissemination**
  PATC courses have been advertised through the PRACE Training Portal [2] and periodic e-mails on upcoming courses sent to a growing mailing list that contains over 2000 e-mail addresses. In addition, PRACE directors and coordinators have been given the ability to advertise individual courses to this mailing list.

## 2.2     PATC Courses from September 2013 to June 2014

In September 2013, PRACE-3IP took over the delivery of PATC courses from PRACE-2IP, i.e. delivery of the 2013-14 joint PATC curriculum.

The following provides some key statistics from the PATC courses delivered from September 2013 to June 2014, followed by analysis of the statistics compared to the previous "academic year" curriculum. It should be noted that three courses of the 2013-14 curriculum had to be scheduled in July 2014 for logistical constraints; the statistics from these courses will not be reported or analysed here but in the extension phase of PRACE-3IP WP4.

The original schedule foresaw that WP4 would end in project month M24. To bridge the gap till the start of a planned follow-on project it was decided and included in a Contract Amendment that the work will be extended to M31 within the available resources. The period after M24 will be referred to as the 3IP extension period.

*Key statistics on numbers of participants and courses*

In summary, Table 1 below shows the key output from the six PATCs in the implementation of the 2013-14 curriculum until June 2014 (right-most column). The same statistics from the 2012-13 curriculum are also shown.

| Reporting period | 2012-09 to 2013-08 "2012-13 curriculum" | 2013-09 to 2013-06 "2013-14 curriculum" |
|---|---|---|
| Number of courses | 71 | 78 |
| Total duration (days) | 204 | 222 |
| Number of participants | 1547 | 1448 |
|  |  |  |
| Female (%) | 12.9% | 14.9% |
| Non-academic (%) | 9.9% | 13.3% |
| Non-host country (%) | 20.6% | 23.5% |
| Non-PATC country (%) | 13.8% | 16.4% |

**Table 1. Key statistics from implementation of the 2012-13 and the 2013-14 PATC joint curricula. "Non-host country" indicates the proportion of participants affiliated with institutions from anywhere outside the country hosting the PATC course. "Non-PATC country" indicates the proportion of participants affiliated with institutions from non-PATC hosting countries.**

*Geographical distribution of the participants*

While PATC course participants came from all of Europe during this reporting period, the proportion of European participants from non-PATC hosting countries remained relatively low. Shown in Figure 1 are the geographic distribution of participants affiliated with European institutions for both the 2012-13 curriculum (see also [5]) and the 2013-14 curriculum; for each country, the number of participants are normalised to a number per year for every 1000 students studying mathematical, scientific and engineering disciplines (i.e. representative of the size of the PATCs' target audience, rather than population) in that country.

If one only focuses on Europe, participants from PATC hosting countries still outnumber those from non-PATC hosting countries by a factor of about eight to one, i.e. a similar finding as the 2012-13 curriculum. The apparent increase in the proportion of participants from non-PATC hosting countries, as seen in Table 1, can mostly be attributed to an increase of participants who are affiliated with institutions from outside Europe. The results suggest that

PATC courses are attracting interest from further abroad, although in some cases these may represent visiting students who had been hosted temporarily in European institutions.
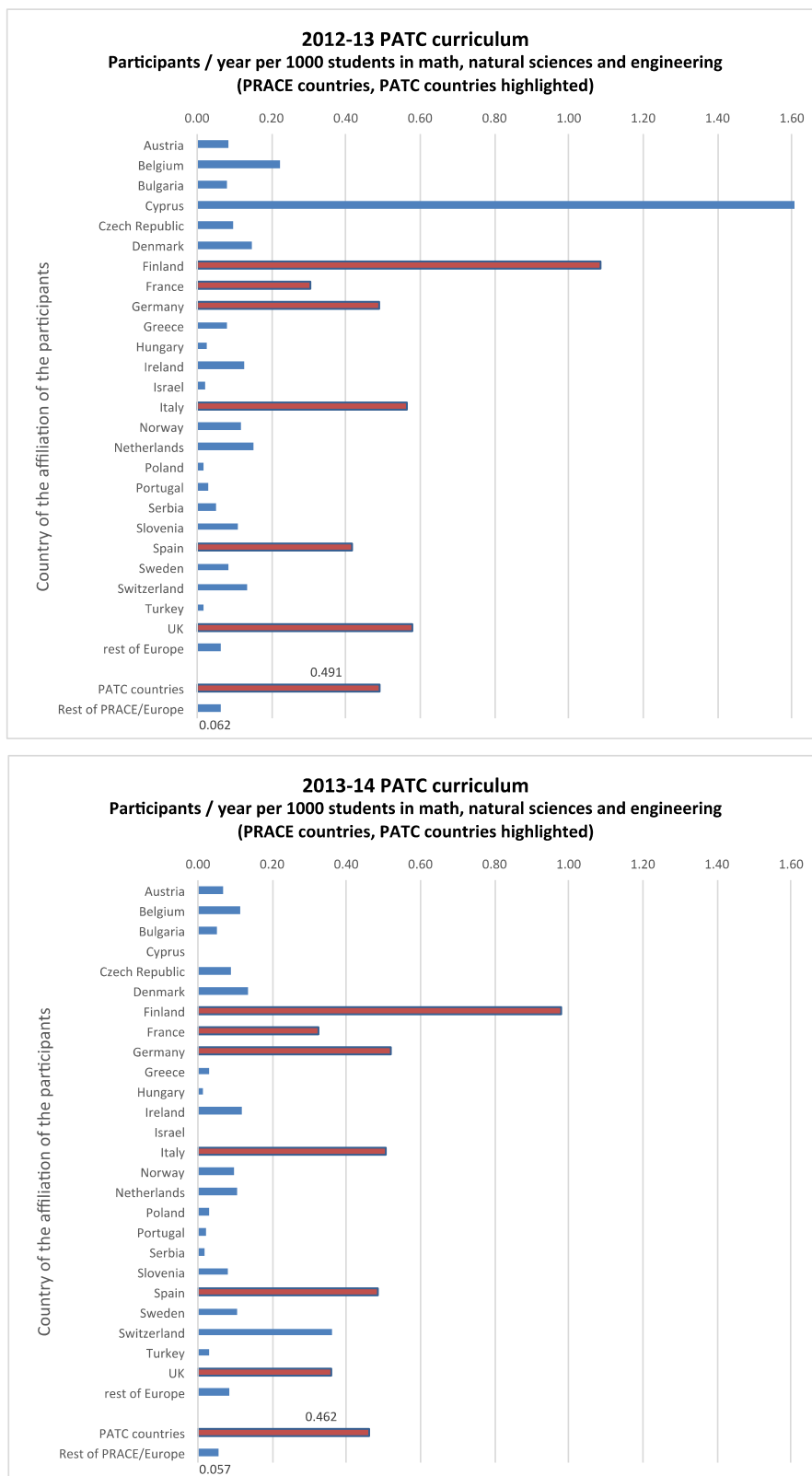


**Figure 1: Participants per year per 1000 students studying mathematics, natural sciences and engineering, individually listed for all PRACE countries. PATC hosting countries are highlighted by red bars. Data is based on all PATC courses from  08/2012 to 07/2013 (top) and 09/2013 to 06/2014 (bottom).**

*Feedback from PATC course participants*

A total of 854 feedback responses have been collected from PATC courses (from 09/2013 to 06/2014). On average, the feedback response rate (i.e. the percentage of respondents or participants who provided feedback at or after the course) per course is approximately 64%. One key question in the feedback form is the overall rating for the course on a scale of 0 (waste of time) to 10 (excellent). The average rating for a PATC course is 8.38, a similar overall rating compared to the year before. Other indicators of participant satisfaction include questions on the logistical aspects of the course, more than 85% of respondents have consistently rated the quality of course information, registration, venue, and organisation as being either good or excellent. There is general agreement that the topics of the courses were relevant to the respondents' research, that the hands-on exercises were useful and that the pace of teaching was right.

*Analyses of the statistics*

The PATCs have continued to be very successful. Every PATC has fulfilled its role to plan and implement the joint curriculum and as a result a large number of people (1448) have been trained through 77 PATC courses that covered a diverse range of topics addressing users with varying levels of HPC experience. The quality of PATC courses has been maintained at a very high standard, as reflected by a high (8.38) overall rating on average for each course. Other course evaluation criteria (e.g. logistics, pace) have also been very positive. Another notable outcome is the increase in numbers of non-academic or industrial participants (from 9.9% to 13.3%) in the 2013-14 curriculum, where the six PATCs had been tasked with focussing some of their course offering to attract industrial R&D users.

Similar to the outcome of the 2012-13 curriculum, an on-going issue has been the access to PATC courses for those who do not work/study in PATC hosting countries, as highlighted by the disproportionately low number of course participants from non-PATC hosting countries. Again trainer and trainee mobility has already been highlighted in the *Continuity Plan for the PATCs* [6] as remedial actions, although they do require significant time and funding to be put in place.

Finally, the on-going series of seasonal schools maintained within the PRACE projects do play an important role in widening the geographic diversity of PRACE training activities since they are typically organised in non-PATC hosting countries. The seasonal schools also impart other benefits for PRACE, the community and the local organising partners. The following section will describe their activities and outcome in the PRACE-3IP project.

# 3  Seasonal Schools

Although during the two-year period of the PRACE-3IP project seven PRACE seasonal schools were organized, only the last three ones fell under the responsibility of PRACE-3IP; the first four were organized by PRACE-2IP (for details see the deliverable D4.3 [5]). The PRACE-3IP seasonal schools seamlessly continued not only the success story of PRACE-2IP schools, but also the preceding series of eight seasonal schools of the PRACE-1IP project [4].

The basic parameters for the PRACE-3IP seasonal schools are summarised in Table 2.

| Event name | Theme/topic | Date | Location | Main organizing site |
|---|---|---|---|---|
| PRACE Autumn School 2013 | Industry Oriented HPC Simulations | 23-27 November 2013 | Ljubljana, Slovenia | ULFME |
| PRACE Winter School 2014 | The Future of HPC: Israeli Innovation and PRACE Introductory Workshop | 10-13 February 2014 | Tel Aviv, Israel | IUCC |
| PRACE Spring School 2014 | Software Engineering for Supercomputers in Research and Industry | 15-17 April 2014 | Hagenberg, Austria | JKU |

**Table 2: List of seasonal schools in PRACE-3IP**

## 3.1    PRACE-3IP Seasonal Schools' Characteristics

In PRACE-3IP three seasonal schools were organized: the PRACE Autumn School 2013 in Slovenia, the Winter School 2014 in Israel and the Spring School 2014 in Austria. Although the programmes of the events naturally corresponded to local needs and competences, all three schools aimed to involve the industrial users and their needs in the programme to support the overall goals of PRACE-3IP. Details of the three schools provided by their organizers can be found in sections 5.1, 5.2 and 5.3 of the Annex. Here we just summarize the contents: the **Autumn School 2013** in Slovenia focused on HPC simulations for the industry, especially in structural mechanics, electromechanical design and computational fluid dynamics, the **Winter School 2014** in Israel, a newcomer to PRACE, wanted to introduce HPC and PRACE with its infrastructure and opportunities to potential academic and industrial users of that region, and the **Spring School 2014** in Austria addressed advanced software engineering techniques for contemporary supercomputers with applications in academia and industry.

An interesting feature of this series of seasonal schools can be seen in the fact that their **organization was shared** among up to three PRACE partners. Although collaboration among two or three groups from different countries may imply some difficulties and overhead, in general we found it very beneficial, especially in the scenario of a PRACE "novice" (first-time organizer) as the host of the school and a more experienced partner in the role of an "advisor" – in fact, all three schools applied this kind of work partitioning. As a by-product, this collaboration is usually reflected in higher attendance from all organizing countries.

The **attendance** at events of about 40 participants is adequate for efficient training (at the Autumn School, having 67 participants, more tracks ran in parallel). The number of registrations was in all cases within reasonable limits, thus all candidates could be accepted. There were 152 participants in total, coming from about 20 countries. The geographic distribution of participants is shown in Table 3. We can observe that participants from the organizing country (and neighbours) clearly prevail at the events – a trend that seems to hold

true at seasonal schools and face-to-face training events in general. Seasonal schools have always a "mobilizing" effect on the hosting partner/country – this is one of their most positive consequences.

| Country | Autumn School 2013 | Winter School 2014 | Spring School 2014 | Total |
|---|---|---|---|---|
| Austria | 1 | | 23 | 24 |
| Belgium | 1 | | | 1 |
| Bulgaria | | | | |
| Cyprus | | 1 | | 1 |
| Czech Republic | 1 | | 5 | 6 |
| Denmark | 1 | | | 1 |
| Finland | | | | |
| France | | | 1 | 1 |
| Germany | 1 | | 4 | 5 |
| Greece | | 4 | | 4 |
| Hungary | | | 4 | 4 |
| Ireland | | | | |
| Israel | | 37 | | 37 |
| Italy | 1 | | | 1 |
| Netherlands | | | | |
| Norway | | | | |
| Poland | | | | |
| Portugal | | | | |
| Serbia | 1 | | | 1 |
| Slovenia | 54 | | 1 | 55 |
| Spain | 1 | | 1 | 2 |
| Sweden | | | | |
| Switzerland | | | | |
| Turkey | 2 | 1 | | 3 |
| UK | | | | |
| rest of Europe | 3 | | 1 | 4 |
| rest of the world | | | 2 | 2 |
| **Total** | **67** | **43** | **42** | **152** |

**Table 3: All seasonal school participants and their geographic distribution**

All seasonal schools asked the participants to provide **feedback** using a standard PRACE training feedback online form (established in PRACE-1IP, see [6]) remotely after the event; the Spring School organizers additionally used a questionnaire of their own on the spot. Table 4 summarizes the basic parameters of the surveys' results, including the average evaluation of the perhaps most important question on overall rating of the event [0 = waste of time, 10 = excellent].

| Event | Number of participants | Number (percentage) of feedback responses | Average overall rating [0 = waste of time, 10 = excellent] |
|---|---|---|---|
| Autumn School 2013 (5 days) | 67 | 23 (35%) | 7.0 |
| Winter School 2014 (4 days) | 43 | 30 (70%) | 8.4 |
| Spring School 2014 (3 days) | 42 | 23 (55%) | 7.1[1] |
| **Total** | **152** | **76 (50%)** | **7.5** |

**Table 4: Key feedback statistics from PRACE-3IP seasonal schools**

Compared with PRACE 2-IP seasonal schools and their evaluation in iv[5], the average overall rating is one point lower. This does not necessarily mean weaker quality of PRACE-

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[1] Interestingly, a special immediate on-site questionnaire of the Spring School 2014, which contained an analogous question, yielded an overall rating equivalent of 9.0.

3IP seasonal schools, their rating is high anyway. However, the surveys asking about the Autumn and Spring Schools were launched quite late after the events, and this must have had obvious impact on the number of participants in the survey and their answers. C.f. also footnote 1.

## 3.2    Seasonal Schools' and PATC Co-existence

After establishment of PATCs in PRACE-2IP, PRACE-3IP was a period of their full operation. This fact raised the question on the seasonal schools' future "right on existence" The topic was thoroughly discussed at a WP4 face-to-face meeting in Helsinki in March 2013. For example, we made a side-by-side comparison of selected features of PATC courses and seasonal schools, such as shown in Table 5.

| Feature | PATC courses | Seasonal Schools |
|---|---|---|
| Stable location | yes | no |
| Repetitive events | yes | no |
| Ability to accommodate ad-hoc needs and experiments | lower | higher |
| Focus on scientific community | lower | higher |
| Number of participants[2] | lower | higher |
| Number of participants from other countries[2] | lower | higher |
| Usefulness for smaller countries | lower | higher |
| Benefit of gaining experience for the organizers | low | high |
| Promotion of trainer mobility | low | high |
| PRACE dissemination effect | high (global) | high |
| Character of a social event as added value | low | high |

**Table 5: Comparison of PATC courses and seasonal schools on selected features**

Discussion ended with a unanimous recommendation that **seasonal schools should be continued** also after PRACE-3IP, because seasonal schools are organized as one-off events with great enthusiasm and boast many unique features that complement the regular high-quality training provided by PATCs. Moreover, ideas have been collected for improved **collaboration between the seasonal schools and PATCs** in a follow-on project.

# 4  Concluding Remarks

Despite of all modern communication and educational means, e.g. webinars, teleconferences, live streaming, e-learning tools, etc., face-to-face training holds its strong position in education. This is also true for PRACE training events. Both PATCs and seasonal schools attracted hundreds of students to travel across great distances with the goal to take part in courses of international scope, in which they can not only learn a lot, but also present their own work, consult it with experts, find new collaborators, try their codes on new machines, and so on. We strongly believe that the excellent reputation of PRACE training events must imply the commitment to further develop and improve this service. During the preparation of PRACE-3IP training events, especially seasonal schools, we discussed/clarified several encountered issues.

All in all, PRACE-3IP organised 80 training events on 232 training days, excluding the International HPC Summer School 2014 as reported in [7]. The training events attracted 1600 participants from all 25 PRACE countries (and several others around the world) and received

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[2] Based on data from [5].

very positive feedback both for their content and quality. In general, we believe that the PRACE-3IP training events can be considered as highly successful and have contributed substantially to the increasing number of users who are competent to take advantage of the PRACE HPC infrastructure.

# 5  Annex

The Annex includes supplementary information to complete the main text above. In particular, individual reports on seasonal schools as delivered by the organizers are presented.

## 5.1    PRACE Autumn School 2013, Ljubljana, Slovenia

Data supplied and report authored by Leon Kos and Mateja Maffi, UL

*Basic information about the event*

**Name:** PRACE Autumn School 2013 – Industry Oriented HPC Simulations

**Dates:** 23-27 November 2013

**Location:** Faculty of Mechanical Engineering of the University of Ljubljana (ULFME), Ljubljana, Slovenia

**Organising sites:** University of Ljubljana (UL), Slovenia; Consorzio Interuniversitario CINECA (CINECA), Italy; National Centre for Supercomputing Applications (NCSA) Bulgaria; Institut za Fiziku (IPB), Serbia

**Web page:**    http://events.prace-ri.eu/event/as13
http://videolectures.net/prace2013_ljubljana/ (videos)

*Organisational details*

**Organizing committee**

| Name | Affiliation |
|---|---|
| Jožef Duhovnik | UL, chair |
| Leon Kos | event deputy |

**Table 6: Organizing committee of the PRACE Autumn School 2013**

**Venue**

The PRACE Autumn School was held at the Faculty of Mechanical Engineering of the University of Ljubljana (ULFME).

Due to the nature of computing classrooms where max 18 and 44 seats are available and the fact that intensive visualizations are required, attendees were not required to bring their own laptops for the hands-on trainings.  In cases where possible two parallel hands-on courses were organized with two lecturers and assistants in two adjacent classrooms with the required bandwidth for remote desktop connection to the supercomputer and local pre-/post-processing and job submission to the HPCFS cluster.

*Programme & content*

**Programme committee**

| Name | Affiliation |
|---|---|
| Alexander Dopf | CADFEM, Austria |
| Antonio C.M. Sousa | University of Aveiro, Portugal |
| Claudio Arlandini | CINECA Milano, Italy |
| Georgi Prangov | NCSA, Bulgaria |
| Paola Alberigo | CINECA, Bologna, Italy |
| Antun Balaz | IPB, Serbia |

| Name | Affiliation |
|------|-------------|
| Leon Kos | UL, Slovenia |

**Table 7: Programme committee of the PRACE Autumn School 2013**


## Final program

The five day programme covered introduction to HPC simulations for industry and PRACE with hands-on training. It targeted HPC applications of structural mechanics (SM), low and high frequency electromechanical design (EM) and computational fluid dynamics (CFD) with some specialized plugins and CFD codes. The programme timetable was tailored to the expected interest of applicants. Depending on the tutorial applications, it was possible to arrange seats in computing rooms and change the timetable to better match the trainers/trainees/class rooms and computing resources available.


**Monday, 23 September 2013**
- 08:30 - 13:00 Registration, Coffee & Poster hanging ( Nearby lecture hall IV/2 )
- 09:00 - 11:30 HPC and parallel programming: Optional training

  Location:        University of Ljubljana, Slovenia ( Computing rooms III/1, N17 and II/5 )
  - o   09:00 HPC architectures and MPI, OpenMP programming hands-on

    Speaker:        Dr. Leon Kos (University of Ljubljana)

- 12:00 - 13:00 Posters ( Hall at the top of the building near the restaurant. )
- 13:00 - 13:20 Opening and Welcome address ( Lecture hall IV/2 )

  Speaker:        Prof. Jožef Duhovnik (University of Ljubljana, PRACE coordinator for Slovenia)

  13:20 - 14:00 HPC – the Perspective of a CFD Practitioner ( Lecture hall IV/2 )

  Speaker:        Prof. Antonio C.M. Sousa (University of Aveiro and New Brunswick)

  14:00 - 15:00 Discover your design quicker as before with HPC ( Lecture hall IV/2 )

  Speaker:        Alexander Dopf (CADFEM)

- 15:00 - 19:00 Structural Mechanics: Best practices for efficient HPC performance with large models

  Location:        Computing room II/5
  - o   15:00 Hands On Training with HPC

    Speaker:        Dr. Bernhard Hössl (CADFEM)
  - o   16:30 Break
  - o   16:45 Hands On Training with HPC (cont.) ( University of Ljubljana, Slovenia ( Computing room II/5 ) )

    Speaker:        Dr. Bernhard Hössl (CADFEM)


**Tuesday, 24 September 2013**
- 09:00 - 17:00 Structural Mechanics: Robust Design Optimization

  Location:        University of Ljubljana, Slovenia ( Computing room II/5 )
  - o   09:00 Robust Design Optimization – from the idea to the optimized product

    Speaker:        Andreas Veiz (CADFEM)
  - o   11:30 Lunch break ( Restaurant at the top of the building )
  - o   13:00 Sensitivity analysis of a notch (cont.)

    Speaker:        Andreas Veiz (CADFEM)


**Wednesday, 25 September 2013**
- 09:00 - 17:00 Multiphysics: Electromechanical and Mechatronic Systems: Hands on with EM

  - o   09:00 EM Simulation Overview (tools and numerical methods) *1h0'* ( Lecture hall IV/2 )

    Speaker:        Jens Otto (CADFEM)
  - o   10:00 Coffee break ( Lecture room IV/2 and computing rooms II/5, III/1, N17 )

- o 10:15 EM Example 1: Position Sensor Design (Hall based) with Maxwell 3D ( Computing room III/1 )
  Speaker:        Jens Otto (CADFEM)
- o 11:30 Lunch break ( Restaurant at the top of the building )
- o 13:00 EM Example 2: WLAN-Antenna Optimization with HFSS *1h30'* ( Computing room III/1 )
  Speaker:        Dr. Christian Römelsberger (CADFEM)
- o 14:30 Break ( Lecture room IV/2 and computing rooms II/5, III/1, N17 )
- o 14:50 EM Example 3: Starter-Generator Design with Maxwell 3D/ Mechanical ( Computing room III/1 )
  Speaker:        Jens Otto (CADFEM)
- o 16:30 EM: Summary and discussion
  Speakers:        Dr. Christian Römelsberger (CADFEM), Jens Otto (CADFEM)
- • 10:15 - 17:00 Computational Fluid Dynamics
  - o 10:15 Sailing Yachts CFD ( Lecture hall IV/2 )
    Speaker:        Dr. Raffaele Ponzini (CINECA)
    11:00 BIO-CFD Case-history
    Speaker:        Dr. Raffaele Ponzini (CINECA)
  - o 12:00 Lunch break ( University of Ljubljana, Slovenia ( Restaurant at the top of the building ) )
  - o 13:30 BIO-CFD Tutorial ( Computing room N17 )
    Speaker:        Dr. Raffaele Ponzini (CINECA)

**Thursday, 26 September 2013**
- • 09:00 - 10:15 Examples of Solving Industrial Cases with Fluent
  Speaker:        Dr. Dimitrios Sofialidis (SimTec)
- • 10:15 - 10:30 Coffee break
- • 10:30 - 15:00 Computational Fluid Dynamics: Express Introductory Training in Fluent
  Location:        Computing room II/5
  - o 10:30 Introduction to CFD
    Speaker:        Dr. Dimitrios Sofialidis (SimTec)
  - o 11:15 Fluent Workshop 1: Fluid Flow & Heat Transfer in a Mixing Tee
    Speaker:        Dr. Dimitrios Sofialidis (SimTec)
  - o 12:30 Lunch break ( University of Ljubljana, Slovenia ( Restaurant on top of the building )
  - o 13:30 Boundary Conditions and Solver Settings (Convergence & Accuracy)
    Speaker:        Dr. Dimitrios Sofialidis (SimTec)
  - o 14:00 Turbulence Modelling, Heat Transfer & Transient Calculations
    Speaker:        Dr. Dimitrios Sofialidis (SimTec)
  - o 14:30 Second Fluent workshop (hands on)
    Speaker:        Dr. Dimitrios Sofialidis (SimTec)
- • 15:00 - 18:00 High-Performance Computing with Fluent (hands-on)
  Speaker:        Dr. Dimitrios Sofialidis (SimTec)

**Friday, 27 September 2013**
- • 09:00 - 17:00 Computational Fluid Dynamics: Custom CFD codes and plugins
  Location:        University of Ljubljana, Slovenia ( Computing rooms III/1, N17 )
  - o 09:00 High Performance Computing of gas turbine flows: current and future trends ( Lecture hall IV/2 )
    Speaker:        Dr. Nicolas Gourdain (CERFACS)
  - o 10:30 Coffee break

- o    10:45 RBF morph theory and applications case-history ( Lecture room VI/2)

     Speaker:            Prof. Marco Evangelos Biancolini ("Tor Vergata" University of Rome)
- o    12:30 Lunch break
- o    13:30 RBF morph hands-on

     Speaker:            Prof. Marco Evangelos Biancolini ("Tor Vergata" University of Rome)
- o    13:30 Multi-block structured code (elsA) and an unstructured code (AVBP) hands-on
     ( Computing room N17 )

     Speakers:          Dr. Nicolas Gourdain (CERFACS), Dr. Michel Gazaix (ONERA)

## List of trainers

Trainers were selected for their skills of giving a broad HPC overview to attendees and at the same time utilize in-house man power. In the area of simulations with specialized knowledge of each package trainers were giving their trainings repeatedly with exchanging attendees in class rooms.

| Name | Affiliation | Subject/expertise |
|------|-------------|-------------------|
| Marco E. Biancolini | "Tor Vergata" University of Rome | RBF morph theory and applications case-history RBF morph hands-on |
| Alexander Dopf | CADFEM | Discover your design quicker as before with HPC |
| Jožef Duhovnik | UL | Opening and Welcome address |
| Michel Gazaix | ONERA | Multi-block structured code (elsA) and an unstructured code (AVBP) hands-on |
| Nicolas Gourdain | CERFACS | High Performance Computing of gas turbine flows: current and future trends… |
| Bernhard Hössl | CADFEM | Hands On Training with HPC |
| Leon Kos | UL | HPC architectures and MPI, OpenMP programming hands-on |
| Jens Otto | CADFEM | Starter-Generator Design with Maxwell 3D/ Mechanical Position Sensor Design (Hall based) with Maxwell 3D … |
| Raffaele Ponzini | CINECA | BIO-CFD |
| Christian Römelsberger | CADFEM | WLAN-Antenna Optimization with HFSS |
| Dimitrios Sofialidis | SimTec | Introduction to CFD Examples of Solving Industrial Cases with Fluent Fluent Workshop … |
| Antonio C.M. Sousa | University of Aveiro and New Brunswick | HPC – the Perspective of a CFD Practitioner |
| Andreas Veiz | CADFEM | Robust Design Optimization – from the idea to the optimized product … |

**Table 8: List of trainers at the PRACE Autumn School 2013**

## Description of the content

Benefits of HPC for industry were presented with process parallelization. Introduction to simulation software gave a broad outlook to the real engineering and scientific problems that are computed at ULFME HPC (HPCFS). Multiphysics simulations were followed in the field of structural mechanics, CFD, electromagnetics and Multiphysics. Examples for processing were prepared and preinstalled into each account to minimize time wasted for preparing simulations that consists from pre/post processing and parallel computation within LSF

batches and interactive submissions to cluster from GUI. Pre and post processing was executed on the prepared workstations.

*Participants & feedback*

**Number of participants by country**

The planned number of participants was 44 due to classrooms capacity limitation. The final number was depending on the interests given to parallel sessions. We received 82 registrations of which 67 (1 cancelled on the first day of the school) actually attended the school in parallel sessions. There were 54 local participants and 13 foreign ones, 63 participants from PRACE members and 3 non-PRACE. There were 32 participants from academia and 35 from the industry. Table 9 shows detailed distribution of the participants by country.

| Country | Number of participants |
|---|---|
| Austria | 1 |
| Belgium | 1 |
| Czech Republic | 1 |
| Denmark | 1 |
| Germany | 1 |
| Italy | 1 |
| Serbia | 1 |
| Slovenia | 54 |
| Spain | 1 |
| Turkey | 2 |
| rest of Europe | 3 |
| **Total** | **67** |

**Table 9: Number of participants by country at the PRACE Autumn School 2013**

**Process for selecting the participants**

Applicants were expected to have some experience with the topic of interest. School attendees were selected based on applications submitted through the registration form, taking into account the order of registrations. Applicants were informed about their acceptance not later than two weeks after the registration. The number of attendees was limited to about 40-50. All attendees were encouraged to bring a poster on their work related to the topics of the school. During the registration we realized that we need to confirm attendance for each day as some of the registrants expressed interest only on specific topics. That is the reason for over 80 registrants and 68 participants at the end.

Remarks: The school was offered free of charge to industrial users, researchers and academics residing in PRACE member states and eligible countries. It was the responsibility of the attendees to arrange and cover travel and accommodation. The school's official language was English. For the local participants we established dedicated local web page that was used for advertisement and list of reserves if the school were overbooked.
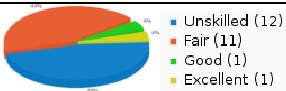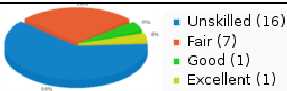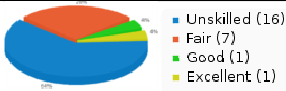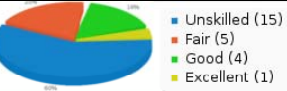
**Statistics and analysis of the feedback survey**

Feedback from attendees was planned as a dialog at the school closing where every participant was asked to fill in the questionnaire. Unfortunately the opening of this dialog was delayed, what resulted in low percentage of responses.
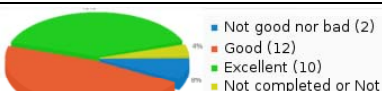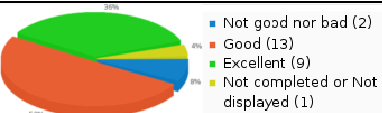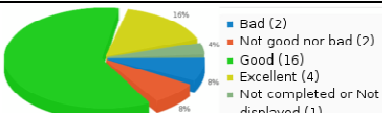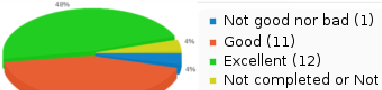
The feedback received was recorded and statistics from the questionnaire were collected for reporting and lessons learned advisories. Content of the questionnaire follows standardized questions by similar PRACE PATC events and were collected and processed by PRACE questionnaire website run by IPB.

The Autumn School targeted industrial users with practical sessions on HPC related tools and not directly HPC programming. This is visible in answers (1) in Figure 2 on level of expertise where we see that participants are mostly unskilled in HPC techniques and running custom codes. In their future activities (4) most of the participants realised the need of such knowledge even if running commercial codes. Having in mind that many participants attended the school to see HPC simulations with tools familiar with, some think that programming is unnecessary and that if simulation tools are available they value programming unnecessary for engineering applications. The overall school organisation and facilities (2) were marked good to excellent and valued on average to 7 in the rank from 0-10 (waste of time-excellent). School material (3) seems to be well presented with special emphasis that hands-on sessions are necessity for school. From the general comments we may see that timeframe in every session is necessary to maintain and that proper introduction to the topic with increasing complexity is required.

**(1)  Please rate your level of expertise in the following (prior to attending the school)**

| | |
|---|---|
| HPC prog. languages (Fortran, C/C++) — Unskilled (12), Fair (11), Good (1), Excellent (1) | Message-passing interface — Unskilled (16), Fair (7), Good (1), Excellent (1) |
| Performance analysis (incl. use of tools) — Unskilled (16), Fair (7), Good (1), Excellent (1) | Code optimisation techniques — Unskilled (15), Fair (5), Good (4), Excellent (1) |
| Parallel program debugging — Unskilled (17), Fair (7), Excellent (1) | Next-generation HPC languages (e.g.PGAS) — Unskilled (17), Fair (7), Excellent (1) |
| Accelerator programming — Unskilled (17), Fair (7), Excellent (1) | Shared-memory prog. (e.g. OpenMP) — Unskilled (16), Fair (7), Good (1), Excellent (1) |

**(2)  Organisation & Facilities; Please rate the following in terms of quality**

| | |
|---|---|
| Information about the school — Good (16), Excellent (8), Not completed or Not displayed (1) | Venue — Not good nor bad (2), Good (12), Excellent (10), Not completed or Not displayed (1) |
| Registration — Not good nor bad (2), Good (13), Excellent (9), Not completed or Not displayed (1) | Catering — Bad (2), Not good nor bad (2), Good (16), Excellent (4), Not completed or Not displayed (1) |
| Overall organisation — Not good nor bad (1), Good (11), Excellent (12), Not completed or Not displayed (1) | |

**(3) About the School**

| | |
|---|---|
| No strong feelings (9)<br>Agree (10)<br>Agree completely (5)<br>Not completed or Not displayed (1)<br>**The topics are relevant to my work/research interests** | No strong feelings (...)<br>Agree (13)<br>Agree completely (...)<br>Not completed or N...<br>displayed (1)<br>**I was inspired to new ways of thinking** |
| No strong feelings (5)<br>Agree (12)<br>Agree completely (7)<br>Not completed or Not displayed (1)<br>**The lectures were clearly presented and comprehensible** | |

| | |
|---|---|
| Disagree (1)<br>No strong feelings (5)<br>Agree (13)<br>Agree completely (5)<br>Not completed or Not displayed (1)<br>**The pace of teaching was about right** | No strong feelings (...)<br>Agree (12)<br>Agree completely (...)<br>Not completed or N...<br>displayed (1)<br>**Teaching aids used (e.g. slides) were well prepared** |
| No strong feelings (1)<br>Agree (12)<br>Agree completely (11)<br>Not completed or Not disp ayed (1)<br>**The hands-on exercises and demonstrations were a valuable contribution to the school** | |

**(4) Future Activities; Please let us know if you see the need for future schools to cover the following areas**

| | |
|---|---|
| No need (1)<br>Some need (3)<br>Important need (11)<br>Urgent need (2)<br>Don't know (4)<br>Not completed or Not displayed (1)<br>**General HPC programming (MPI, OpenMP)** | No need (2)<br>Some need (1)<br>Important need (11)<br>Urgent need (5)<br>Don't know (5)<br>Not completed or Not displayed (1)<br>**Visualisation techniques** |
| No need (2)<br>Some need (9)<br>Important need (7)<br>Urgent need (2)<br>Don't know (4)<br>Not completed or Not displayed (1)<br>**Code optimisation & performance analysis** | |

| | |
|---|---|
| No need (3)<br>Some need (6)<br>Important need (6)<br>Urgent need (4)<br>Don't know (5)<br>Not completed or Not displayed (1)<br>**Porting of existing codes to HPC architectures** | No need (4)<br>Some need (8)<br>Important need (6)<br>Urgent need (2)<br>Don't know (4)<br>Not completed or Not displayed (1)<br>**Specific HPC application(s)** |
| No need (5)<br>Some need (6)<br>Important need (8)<br>Urgent need (1)<br>Don't know (4)<br>Not completed or Not displayed (1)<br>**Parallel program debugging** | |

| | |
|---|---|
| No need (3)<br>Some need (9)<br>Important need (4)<br>Urgent need (5)<br>Don't know (3)<br>Not completed or Not displayed (1)<br>**HPC programming and applications specific to my research community** | No need (5)<br>Some need (6)<br>Important need (5)<br>Urgent need (4)<br>Don't know (4)<br>Not completed or Not displayed (1)<br>**Advanced HPC programming (Hybrid MPI-OpenMP; next-gen HPC languages e.g. PGAS; GPU computing e.g. CUDA)** |

**Figure 2: Survey on the PRACE Autumn School 2014: Four parts (1)-(4) of the collected statistics**

*Conclusions and lessons learnt*

The Autumn School's ambitious goal to present industrial-relevant HPC applications required careful programme planning by the organizing committee. Proper selection of the commercial, proprietary and open source codes turned out to be a major challenge for industrial-oriented seasonal school. Industrial users, targeted by this school, were prepared to attend just the topics of their professional interest. We were aware of the case at the registration and required that each participant confirm attendance for each day and session. As example, we had morning session of CFD and EM tutorials where EM people did not bother to attend CFD and came can just for EM. So, splitting tutorials in the afternoon, where CFD/EM ran in parallel, went just fine. Due to Eurobasket 2013, September 4-22, that was held in Slovenia, we anticipated difficulties to find accommodation in the city centre for the Saturday 21st or Sunday 22nd night unless booking well ahead. To mitigate these problems organizers shifted the school start at Monday 23rd afternoon to allow arrival in the morning. ULFME also reserved 25 double rooms at the hotel BIT Center Ljubljana. Due to the budget

constraints we were forced to limit social activities for the participants to a city walk-around and a poster session at the beginning of the school so that attendees get to know each other by the interest and industrial experience. From the survey analysis we learnt that our initiative for user networking with poster sessions was warmly accepted and there were suggestions for short slide introduction by each participant. Participation certificates that were issued after the school upon request according to attendance list signatures turned out as a good instrument for getting survey responses and assuring presence.

## 5.2 PRACE Winter School 2014, Tel Aviv, Israel

Data supplied and report authored by Hank Nussbacher, IUCC

*Basic information about the event*

**Name:** PRACE 2014 Winter 2011 School – The Future of HPC: Israeli Innovation and PRACE Introductory Workshop

**Dates:** 10-13 February 2014

**Location:** Tel Aviv University Campus, Tel Aviv, Israel

**Organising sites:** Inter-University Computation Center (IUCC), Israel, with the collaboration and financial support of LinkSCEEM

**Web page:** http://events.prace-ri.eu/conferenceDisplay.py?confId=176
(Timetable includes links to videos)

*Organisational details*

**Organizing committee**

| Name | Affiliation |
|------|-------------|
| Hank Nussbacher | IUCC, chair |
| Audrey Gerber | IUCC |
| Eli Shmueli | IUCC/IUCEL |
| Einat Ben-Shushan | IUCC |
| Yossi Baruch | Isragrid |

**Table 10: Organizing committee of the PRACE Winter School 2014**

**Venue**

The opening workshop and training sessions took place on the Tel Aviv University Campus, in close proximity to IUCC offices. The University provided an auditorium suitable for 150 people to attend the half day Innovation Workshop. For the 3.5 day training sessions, classrooms suitable for 60 people were provided. Parking facilities, as well as the all necessary audio-visual facilities were provided including projectors, projector panels, microphones, etc.

The training session program and opening workshop were held on two locations on the campus. The opening dinner was held at the Diaspora Museum (also located on campus) and the half-day tour of the Old City of Jerusalem took us to the historic sites of Jerusalem approximately an hour's drive from Tel Aviv.

Network connectivity was provided by the Tel Aviv University Computation Center. Access to HPC resources via Euclid in Cyprus was arranged prior to the opening of the event and user names and passkeys were delivered to participants.

The selection of the Campus venue proved crucial to the success of the school since the local organizers were supported by IUCC administration and the University computation centre. The location of the campus, at the entrance of the city and adjacent to a commuter train station, also enabled easy access for local trainees and those staying in Tel Aviv hotels.

*Programme & content*

## Programme committee

| Name | Affiliation |
|------|-------------|
| Hank Nussbacher, | IUCC |
| Avi Cohen | Bar Ilan University |
| Ioannis Liabotis | GRnet, Greece |

**Table 11: Organizing committee of the PRACE Winter School 2014**

## Final program

**Monday February 10**

**The Future of HPC Computing: Israeli innovation, Max Webb Family School of Languages Building**

8:00  Registration & Coffee

8:30  Welcome to Israel

Prof. Shlomi Dolev, IUCC

8:45  What is PRACE?

Mr. Hank Nussbacher, IUCC

9:05  Paving the Road to Exascale Computing

    Mr. Gilad Shainer, VP Marketing, Mellanox

9:35  MultiGPU infrastructure for Real Time Applications

    Mr. Eri Rubin, SagivTech

10:05      Developing the HPC Compute Cores of Tomorrow

    Mr. Ofri Wechsler, Intel

*Coffee break*

11:00      Towards an Exascale Operating System

    Mr. Ely Levy, Hebrew University of Jerusalem

11:30      The Future of Heterogeneous Computing

    Mr. Tzachi Cohen, AMD

12:00      Operating System Support for High-Throughput Processors

    Dr. Mark Silberstein, Technion-Israel institute of Technology

*Lunch*


**Monday February 10**

**Training Workshop I, Dan David Building Room 111**

13:30   Programme Overview and Introduction to Accessing PRACE Resources

    Mr. Hank Nussbacher, IUCC

14:00   The LinkSCEEM-2 Project Overview, Mr. Jens Weigand, The Cyprus Institute

14:15   Introduction to Parallel Programming – Message Passing Interface (MPI)

    Dr. Guy Tel Zur, Ben Gurion University of the Negev

*Coffee break*

15:30   Parallel Programming with MPI

    Dr. Guy Tel Zur, Ben Gurion University of the Negev

17:00   Hands On MPI

    Dr. Guy Tel Zur, Ben Gurion University of the Negev

18:15   Dinner & Entertainment, Diaspora Museum, Tel Aviv University


**Tuesday February 11**

**Training Workshop I (cont.), Dan David Building Room 110**

08:30   Advanced MPI I

    Mr. Jussi Enkovaara, CSC

09:30    Hands-on Advanced MPI I
         Mr. Jussi Enkovaara, CSC
*Coffee break*
**Training Workshop II, Dan David Building Room 110**
10:45    Advanced MPI II
         Mr. Jussi Enkovaara, CSC
11:45    Hands-on Advanced MPI II
         Mr. Jussi Enkovaara, CSC
*Lunch*
**Training Workshop III, Dan David Building Room 110**
14:00    Introduction to Parallel Programming with OpenMP
         Mr. Jussi Enkovaara, CSC
15:00    Hands-on OpenMP
         Mr. Jussi Enkovaara, CSC
*Coffee break*
**Training Workshop IV, Dan David Building Room 110**
16:15    Hybrid (MPI + OpenMP) Programming
         Mr. Jussi Enkovaara, CSC
17:00    Hands-on hybrid Programming
         Mr. Jussi Enkovaara, CSC


**Wednesday February 12**
**Training Workshop V, Dan David Building Room 110**
08:30    Usage of Maths and Scientific Libraries (BLAS, LAPACK)
         Mr. Jussi Enkovaara, CSC
09:30    Hands On Installation and Usage of Maths  and Scientific Libraries
         Mr. Jussi Enkovaara, CSC
*Coffee break*
**Training Workshop VI, Dan David Building Room 110**
Training workshop - VI
10:30    Profiling
         Dr. Alan O'Cais, JSC
11:30    Hands on Profiling
         Dr. Alan O'Cais, JSC
*Lunch*
**Guided Tour of Old City of Jerusalem & Dinner**
Return to Tel Aviv 22:00


**Thursday February 13**
**Training Workshop VII, Dan David Building Room 107/8**
08:30    Optimization and Benchmarking
         Dr. Alan O'Cais, JSC
10:00    Hands On Optimization and Benchmarking
         Dr. Alan O'Cais, JSC
*Coffee Break*
**Training Workshop - VIII Dan David Building Room 107/8**
11:45    The PRACE Environment  –Job Submission Scripts - Accounting Tools
         Dr. Alan O'Cais, JSC
*Lunch*
**Training Workshop - IX Dan David Building Room 107/8**
14:00    CUDA Programming

Mr. Oren Tropp, SagivTech

**Training Workshop - X Dan David Building Room 107/8**

16:00    Hands On (CUDA Programming)

Mr. Oren Tropp, SagivTech

17:45    Closing remarks

Mr. Hank Nussbacher, IUCC

## List of trainers

| Name | Affiliation |
|------|-------------|
| Ely Levy | Hebrew University of Jerusalem |
| Tzachi Cohen | AMD |
| Jussi Enkovaara | CSC |
| Alan O'Cais | JSC |
| Eri Rubin | SagivTech |
| Gilad Shainer | Mellanox |
| Mark Silberstein | Technion-Israel Institute of Technology |
| Guy Tel-Zur | Ben Gurion University |
| Oren Tropp | SagivTech |
| Ofri Wechsler | Intel Fellow, Intel Corporation |
| Jens Weigand | Cyprus Institute |

**Table 12: List of trainers at the PRACE Winter School 2014**

## Description of the content

The program committee consisted of experts from the local HPC academic community as well as computational scientists close to the true need of local and regional users. The program was designed to accommodate trainees with varying expertise level and professional backgrounds and to give a very thorough overview and training in fundamental HPC topics and to introduce topics of importance and interest to the computational science community targeted.

These topics covered parallel programming techniques, MPI (lecture and hands-on), OpenMP (lecture and hands-on) as well as sessions on core skills, CUDA programming, HPC system architectures and supercomputer design, visualization techniques and more.

## Computer resources

The school made use of the CaSToRC infrastructure facilities for training purposes. Specifically, the school participants were given accounts to Euclid, a small hybrid cluster combining both traditional nodes with GPU accelerators located on a different building of the same campus. Euclid proved sufficient for the purposes of the school.

*Participants & feedback*

## Number of participants by country

| Country | Number of participants |
|---------|------------------------|
| Israel | 37 |
| Cyprus | 1 |
| Greece | 4 |
| Turkey | 1 |
| **Total** | **43** |

**Table 13: Number of participants by country at the PRACE Winter School 2014**

**Process for selecting the participants**

The school was originally planned to host up to 60 students from Israel, Europe and the Eastern Mediterranean. Initial planning provided for selection criteria only for Eastern Mediterranean participants that applied for funding support available through the LinkSCEEM project.

**Statistics and analysis of the feedback survey**

We were encouraged by the relatively large number of respondents to the feedback survey. The participants, were in general quite eager to share their impressions and offered many useful comments relevant to future planning, indicating willingness to share a stake in future plans.

In terms of the quality and relevance of the program, participants indicated that the program was very relevant and the content well-suited to their needs. Comments did note that the amount of material was perhaps too much for the given timeframe and several indicated that the day was sometimes too full.

In terms of registration, information and organization, all responded with satisfactory to excellent ratings, with no comments or suggestions. The social events were rated similarly.

The overall impression for the school was rated quite positive. A sizeable number of participants indicated a need for more intertwined hands-on exercises, and more variation in the pace of the program.

Responses to questions about the necessity for future schools covering the topics of the school indicated that the school provided training on topics of great interest and usefulness to the community targeted. All this will of course be taken into account on future training activities undertaken by IUCC.

*Conclusions and lessons learnt*

The organization of the PRACE 2014 Winter School was a major undertaking for IUCC. Although some staff had previously been involved in organizing conferences, IUCC had never before undertaken a project of this magnitude and scope. We are fortunate to have been able to rely on PRACE colleagues from other countries where seasonal schools were hosted (most notably Slovenia and Serbia) for advice and practical solutions, and their willingness to help was most appreciated. PRACE support was essential in terms of the provision of the online registration and the evaluation surveys. These tools, provided by PRACE partner IPB, and the support of the staff, proved invaluable.

Our initial estimates assumed higher participation from European countries. But after review of past experience, it was noted that seasonal schools generally attract local and regional applicants. Therefore, our registration data fell well in line with our expectations. Original applications indicated a slight oversubscription, but the overall "no show" of several applicants allowed room for flexibility and we were able to accommodate several last minute applicants.

Securing trainers is a crucial part of the organization process. Particular attention should be paid to noting that the place of employment of such trainers has a significant effect on funding issues, i.e. if they are from PRACE member institutions or not. Confusion in this regard could have been a significant obstacle, but with the support of our LinkSCEEM colleagues for this, as well as funding stipends for costly travel to Israel for applicants from the region, proved to be a key factor in the success of recruiting top flight lecturers and participants from abroad.

The importance of engaging the local research community via events like the opening workshop cannot be stressed enough. In a country where we are working toward raising awareness of the computing power provided by PRACE and the significance of HPC in Israel's remaining a technology innovator, this engagement provides valuable long-term benefits that are unquantifiable. The opening workshop was also covered by technology blogs and participants assisted IUCC in publicizing the event in the local press.

## 5.3    PRACE Spring School 2014, Hagenberg, Austria

Data supplied and report authored by Wolfgang Schreiner, JKU/RISC

*Basic information about the event*

**Name:**  PRACE Spring School 2013 – Software Engineering for Supercomputers in Research and Industry

**Dates:** 15-17 April 2014

**Location:** Research Institute for Symbolic Computation (RISC), Castle of Hagenberg, Hagenberg, Austria

**Organising sites:** Johannes Kepler University Linz (JKU), Austria; VŠB-Technical University of Ostrava and IT4Innovations Centre of Excellence (VŠB-TUO), Czech Republic

**Web page:**    http://events.prace-ri.eu/conferenceDisplay.py?confId=223
http://www.risc.jku.at/projects/prace/SpringSchool2014 (videos, etc.)

*Organisational details*

**Organizing committee**

| Name | Affiliation, Country |
|---|---|
| Wolfgang Schreiner | JKU/RISC, Austria, chair |
| Tanja Gutenbrunner | JKU/RISC, Austria |
| Ilse Brandner-Foissner | JKU/RISC, Austria |
| Michael Krieger | RISC Software GmbH, Austria |
| Cornelia Staub | RISC Software GmbH, Austria |
| Ondřej Jakl | VŠB-TUO, Czech Rep. |
| David Horák | VŠB-TUO, Czech Rep. |

**Table 14: Organizing committee of the PRACE Spring School 2014**

**Venue**

The PRACE Spring School 2014 took place at the Castle of Hagenberg in Austria, home of the Research Institute for Symbolic Computation (RISC) of the Johannes Kepler University Linz. Although the distance between the campus of the Johannes Kepler University Linz and this location is about 25 kilometres, it was selected as location to give the participants the possibility to focus on their training.

The RISC Institute at Castle of Hagenberg is the founding institution of the JKU Softwarepark Hagenberg. This unique educational, research and industry campus is home to about 1500 students and roughly 1000 employees from about 60 companies and 15 research institutes. It provides excellent training infrastructure and possibilities in the heart of the northern part of Upper Austria. The Spring School itself was located partially at the old medieval Castle of Hagenberg and an in 2013 finished new seminar and research building of the RISC Institute, thus bringing together historical as well as modern aspects.

The vicinity of Linz allowed the participants to stay at the capital of Upper Austria and a daily shuttle bus – exclusively for the participants of the spring school – allowed easy commuting between the venue and the hotel. Social events were organised in Linz, which is one of Austria's focal points for the IT-industry and provides through the Ars Electronica Centre a world-wide renown museum for digital arts.

*Programme & content*

## Programme committee

| Name | Affiliation, Country |
|------|---------------------|
| Wolfgang Schreiner | JKU/RISC, Austria |
| Michael Krieger | RISC Software GmbH, Austria |
| Ondřej Jakl | VŠB-TUO & IT4Innovations, Czech Rep. |
| David Horák | VŠB-TUO & IT4Innovations, Czech Rep. |
| Volker Strumpen | JKU/ICA, Austria |
| Karoly Bosa | JKU/CDCC, Austria |

**Table 15: Programme committee of the PRACE Spring School 2014**

## Final program

**Tuesday, April 15**

> **8:30 Hotel Sommerhaus Linz**
> Bus Transfer to Hagenberg
> **9:15-9:30 Hagenberg Castle Seminar Room**
> Welcome
> **9:30-10:30 Hagenberg Castle Seminar Room**
> Keynote: Prof. Andrew GRIMSHAW, University of Virginia
> *The XSEDE Global Federated File System (GFFS/GFFS.eu) - Breaking Down Barriers to Secure Resource Sharing*
> **10:30-10:45 Hagenberg Castle 1st Floor**
> Coffee Break
> **10:45-11:45 Hagenberg Castle Seminar Room**
> Dr. Wolfgang FENZ, Research Department Medical Informatics of the RISC Software Company
> *Simulating Brain Aneurysms with HPC*
> **11:45-13:00 Schlossrestaurant Hagenberg**
> Lunch
> **13:00-14:00 Hagenberg Castle 1st Floor**
> Poster Presentations and Coffee, Spring School Photograph
> **14:00-15:30 Hagenberg Castle Seminar Room**
> Wolfgang PLANER, Catalysts
> *HPC for Processing Satellite Aerosol Observations*
> Prof. Dr. Dieter KRANZLMÜLLER, Leibniz Supercomputing Centre (LRZ)
> *Extreme Scale Computing at the Leibniz Supercomputing Centre (LRZ).*
> **15:30-15:45 Hagenberg Castle 1st Floor**
> Coffee Break
> **15:45-16:45 Hagenberg Castle Seminar Room**
> Panel Discussion: *HPC for Industry: Status and Challenges*
> **17:00 Hagenberg Castle**
> Bus Transfer to Linz

**Wednesday, April 16**

> **8:30 Hotel Sommerhaus Linz**
> Bus Transfer to Hagenberg
> **9:30-10:30 Hagenberg Pond Building Seminar Room**
> Keynote: Dr. Oskar MENCER, Maxeler Technologies
> *OpenSPL - The Open Spatial Programming Language*
> **10:30-10:45 Hagenberg Castle Ground Floor**
> Coffee Break
> **10:45-12:15 Castle Seminar Room (Session A) and Pond Building Seminar Room (Session B)**
> **Session A:** Software Engineering for Parallel & Emerging Computing Architectures

Dipl.-Ing. (FH) Alexander LEUTGEB: *Modern CPU Architectures*
**Session B:** Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK: *Introduction to Elmer Finite Element Software*
**12:15-13:30 Schlossrestaurant Hagenberg**
Lunch
**13:30-15:00 Castle Seminar Room (Session A) and Poind Building Seminar Room (Session B)**
**Session A:** Software Engineering for Parallel & Emerging Computing Architectures
Dipl.-Ing. (FH) Alexander LEUTGEB: *Introduction to Vectorization*
**Session B:** Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK: *Hands-on session using ElmerGUI*
**15:00-15:15 Hagenberg Castle Ground Floor**
Coffee Break
**15:15-16:45 Castle Seminar Room (Session A) and Pond Building Seminar Room (Session B)**
**Session A:** Software Engineering for Parallel & Emerging Computing Architectures
Michael HAVA, M.Sc: *Programming for the Intel Xeon Phi*
**Session B:** Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK.: *OpenLab*
**17:00 Hagenberg Castle**
Bus Transfer to Ars Electronica Center (AEC) in Linz

**Thursday, April 17**
**8:30 Hotel Sommerhaus Linz**
Bus Transfer to Hagenberg
**9:30-10:30 Hagenberg Pond Building Seminar Room**
Keynote: Prof. Oswaldo TRELLES, University of Malaga
*About the Importance of HPC for Life Sciences*
**10:30-10:45 Hagenberg Castle Ground Floor**
Coffee Break
**10:45-12:15 Castle Seminar Room (Session A) and Pond Building Seminar Room (Session B)**
Session A: Software Engineering for Parallel & Emerging Computing Architectures
Thomas PONWEISER: *Profiling Techniques for Parallel Applications*
Session B: Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK: *Advanced Use of Elmer*
**12:15-13:30 Schlossrestaurant Hagenberg**
Lunch
**13:30-14:30 Castle Seminar Room (Session A) and Pond Building Seminar Room (Session B)**
Session A: Software Engineering for Parallel & Emerging Computing Architectures
Bernhard GRUBER: *Introduction to OpenCL Programming in Heterogeneous Architectures*
Session B: Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK.: *Hands-on Session with Advanced Features and Parallel Computation*
**14:30-14:45 Hagenberg Castle Ground Floor**
Coffee Break
**14:45-15:45 Pond Building Seminar Room (Session A) and Castle Seminar Room (Session B)**
Session A: Software Engineering for Parallel & Emerging Computing Architectures
Dipl.Inf. Torsten WELSCH: *Introduction to GPGPU Programming with CUDA*
Session B: Elmer - Finite Element Software for Multiphysical Problems
Dr. Peter RABACK.: *OpenLab*
**16:00-16:15 Hagenberg Castle Seminar Room**
Closing
**16:30 Hagenberg Castle**
Bus Transfer to Hotel Sommerhaus Linz

**List of trainers**

| Name | Affiliation, Country | Subject/expertise |
|---|---|---|
| Wolfgang Fenz | RISC Software GmbH, Austria | FEM/CFD |
| Andrew Grimshaw | University of Virginia, USA | HPC, Distributed Computing |
| Bernhard Gruber | RISC Software GmbH, Austria | CUDA, OpenCL |
| Michael Hava | RISC Software GmbH, Austria | Intel Xeon Phi, OpenMP, MPI |
| Dieter Kranzlmüller | Ludwig-Maximilian-University Munich, Germany | HPC |
| Alexander Leutgeb | RISC Software GmbH, Austria | Intel x86, OpenMP, MPI |
| Oskar Mencer | Maxeler Technologies Inc, UK | Data Flow Engines |
| Wolfang Planer | Catalysts GmbH, Austria | CUDA |
| Thomas Ponweiser | Johannes Kepler University Linz, Austria | Parallel Debugging |
| Peter Rabak | CSC, Finland | Elmer |
| Oswaldo Trelles | University of Malaga, Spain | Bioinformatics |
| Torsten Welsch | RISC Software GmbH, Austria | CUDA, OpenCL |

**Table 16: List of trainers at the PRACE Spring School 2014**

**Designing the programme**

With the PRACE Winter School 2014 scheduled for February and the EU-US PRACE Summer School 2014 scheduled for June, the programme committee decided to have 3-days Spring School in the middle of April, the week before Easter. This ensured that participants had before and after still the possibility to enjoy their Easter vacation and also travel home for the holidays. With the intended main audience of participants being from Austria, the programme committee decided to provide three tracks. One track, being held on the first day, in cooperation between research and industry as a motivation and some detailed insight in different application areas of Supercomputing for researchers and industry. The second track was aimed at software engineers, trying to improve the performance of their software on different hardware architectures and aimed at improving the understanding of hardware limitations in parallelisation and scaling and introduced the participants to a toolset for analysing and optimising their code.

**Description of the content**

The school started with a short introduction covering its programme, organization, venue, hosting institution and PRACE presented by members of the organising committee. After this the first keynote talk was given by Andrew Grimshaw about the Global Filesystem currently being setup at the supercomputing infrastructure of XSEDE. The industry session of the first day was started with a talk about the need for HPC in the medical domain. The participants' poster presentations right after the lunch break also contributed to the general motivation for the tutorials on the second and third day. The afternoon continued with presentations about the application of HPC by Austrian contractors of the European Space Agency for the detection of aerosols and the challenges for scaling applications to more than 100.000 CPUs at the Leibniz Supercomputing Centre in Munich. As summary and conclusion for the first day a panel discussion with the presenters from this day took place with very active contribution from the attendees of the Spring School.

The second day was opened by a keynote talk from Oskar Mencer, CEO of Maxeller Technologies, Inc. about the importance of Data Flow engines for next generations of computing architectures and the concept of Spatial Computing. Following this the two technical tracks on Software Engineering for Parallel and Emerging Computing Architectures and Elmer started with a 2:1-distribution of the attendees between the tracks. This day was ended with a guided tour through the Ars Electronica Centre Linz and the Spring School dinner.

The keynote on the third day by Oswaldo Trelles from the Univeristy of Malage provided the attendees with insights into HPC challenges from non-technical engineering disciplines, namely from the biology and bio-medical domain and was followed by the last day of the two technical tracks.

The contents of two tracks and their tutorials can be characterised as follows:

- **Software Engineering for Parallel and Emerging Computing Architectures**: Tis track was focused on software engineering techniques for HPC environments and software optimisation for different hardware architectures. It was split into several tutorials including practical examples. The tutorials were covering CPU architectures in general, vectorization support on x86 CPUs, programming for Intel Xeon Phi, profiling parallel applications, OpenCL for heterogeneous architectures and programming with CUDA. Attendees had the possibility to try out examples to experience on their own limitations of hardware for parallel applications and improve sample applications based on this knowledge. They learned how software engineers building industrial applications use this knowledge to improve applications for large scale deployments and were introduced to profiling toolsets used by software engineers working in WP7 of the PRACE project to support the scaling of applications in Petascale environments.
- **Elmer – Finite Element Software for Multiphysical Problems**: This track covered the software package Elmer, an open-source multiphysical simulation software mainly developed by CSC – IT Center for Science in Finland. The tutorials started with a basic introduction to Elmer and reached at the end of the second day the optimisation of use cases which participants brought with them. This track covered a wide variety of toolset provided by Elmer and allowed participants to dig deeper into their research topic with guidance and first-hand knowledge provided by one of the developers of Elmer.

**Computer resources**

Thus, the use of computing facilities during the School was as follows:

- Anselm (IT4Innovation/VŠB-TUO): For the Elmer track virtual machines were provided for download and a number of remote virtual machines with Elmer preinstalled were also available at compute resources in the Czech Republic.
- X86 Cluster (RISC/JKU): This machine was employed for the tutorials on modern CPU architectures and the introduction to vectorization. It provided the required capabilities for the attendees to try out and experience the hardware limitations as well as differences in parallel application structures.
- Participants' laptops: For most of the hands-on tutorials and examples for Elmer as well as for the Software Engineering track also the participants' laptops were sufficient. So sufficient compute resources for all attendees were available.

Networking and Internet connection in Hagenberg was realised through a dedicated local wireless infrastructure.

*Participants & feedback*

**Number of participants by country**

| Country | Number of participants |
|---|---|
| Austria | 23 |
| Brazil | 1 |
| China | 1 |
| Czech Republic | 5 |
| France | 1 |
| Germany | 4 |

| Country | Number of participants |
|---------|------------------------|
| Hungary | 4 |
| Romania | 1 |
| Slovenia | 1 |
| Spain | 1 |
| **Total** | **42** |

**Table 17: Number of participants by country at the PRACE Spring School 2014**

### Process for selecting the participants

During the registration, the applicants were asked to provide information about their motivation and background to attend the School. This information was the basis for filtering out applicants which did not fulfil basic requirements. However, the number of registered people was within reasonable limits, so we were able to accept all candidates (except 4 persons not fulfilling elementary criteria).

### Statistics and analysis of the feedback survey

The 42 attendees of the PRACE Spring School 2014 were coming from 10 different countries and three different continents. About half of the attendees were from Austria and only 5 attendees from countries which are not neighbouring countries of Austria. To a certain extent this is a result of the advertisement of the event. At the registration for the event people were asked to also communicate through which communication channel they were informed about this event. 20 of the registrants were made aware of the event exclusively through e-mails which were sent out by the organisers and PRACE partners. 14 registrants discovered the event exclusively at the PRACE website and were through this motivated to register for the Spring School. 4 registrants said that they were informed about the Spring School through the PRACE website and e-mails. Still 5 registrants were informed about the Spring School through people who talked directly with them and not through electronic communication tools. Most of the attendees from Austria were made aware of the Spring School through e-mails sent to Austrian distribution channels.

In order to have a more detailed and specialized feedback on the various parts and aspects of the event and in order to increase the response rate, we did not want to rely on an electronic feedback system to be used by the participants after returning home (the event was immediately followed by Easter holidays) but preferred immediate on-site feedback: therefore at the end of the Spring School a feedback sheet was distributed to the attendees with 26 of these being handed back to the organisers. With 1 being the best grade (very good) and five being the worst grade the following feedback was received: The event was rated overall with an average grade of 1.4; the organisation of the event was rated at an average grade of 1.2; the program structure of the event (including the social event) and both tracks received an average rating of 1.6.

Suggested improvements included to extend the hands-on sessions and practical parts as well as the school for one more day to be able to gain deeper insight into the topics.

*Conclusions and lessons learnt*

The PRACE Spring School 2014 was for the attendees as well as for the presenters and organisers a very successful event. It achieved an excellent rating from all participants and achieved to improve the participation of new communities. Education on using supercomputing infrastructures is of high importance and has to be brought to European countries through different means, to reach audiences in all countries. Apart from the PATCs the seasonal schools play an important role in the context of training and are a perfect tool to bring supercomputing education to all PRACE countries. Previous experience and sharing of

knowledge within PRACE and between the hosting organisations are the foundation of a successful event. Of course there is always space for improvement and the foremost issue for improvement would be the duration of the school to last four days, but the topics were a perfect match for the audience.