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References and Applicable Documents

[1]   http://summerschool.niif.hu/agenda

[2]   http://www.prace-ri.eu/International-Summer-School-2014-PR

[3]   PRACE-2IP D4.2: Establishment of the PRACE Advanced Training Centres

[4]   PRACE-3IP D4.2: Report on Training Events

[5]   http://www.eudat.eu/

[6]   http://www.cecam.org/

[7]   http://ec.europa.eu/research/mariecurieactions/about-mca/actions/itn/index_en.htm

List of Acronyms and Abbreviations

AISBL	Association International Sans But Lucratif (legal form of the PRACE-RI)
BSC	Barcelona Supercomputing Center (Spain)
CEA	Commissariat à l'énergie atomique et aux énergies alternatives
CECAM	Centre Européen de Calcul Atomique et Moléculaire
CINECA	Consorzio Interuniversitario, the largest Italian computing centre (Italy)
CSC	Finnish IT Centre for Science (Finland)
DEISA	Distributed European Infrastructure for Supercomputing Applications. EU project by leading national HPC centres.
EC	European Community
EPCC	Edinburg Parallel Computing Centre (represented in PRACE by EPSRC, United Kingdom)
ETSF	European Theoretical Spectroscopy Facility
EUDAT	European Data Infrastructure
FZJ	Forschungszentrum Jülich (Germany)
GCS	Gauss Centre for Supercomputing (Germany)
GENCI	Grand Equipement National de Calcul Intensif (France)
HPC	High Performance Computing; Computing at a high performance level at any given time; often used synonym with Supercomputing
ICHEC	Irish Centre for High-End Computing (Ireland)
ITN	(Marie Curie) Initial Training Network
JSC	Jülich Supercomputing Centre (FZJ, Germany)
KTH	Kungliga Tekniska Högskolan (represented in PRACE by SNIC, Sweden)
LinkSCEEM	Linking Scientific Computing in Europe and the Eastern Mediterranean
NCSA	National Center for Supercomputing Applications (USA)
NICS	National Institute for Computational Sciences (USA)
NIIFI	National Information Infrastructure Development Institute (Hungary)
PATC	PRACE Advanced Training Centres
PRACE	Partnership for Advanced Computing in Europe; Project Acronym
PSC	Pittsburgh Supercomputing Center (USA)
RIKEN AICS	RIKEN Advanced Institute for Computational Sciences
RZG	Rechenzentrum Garching (represented in PRACE by GCS, Germany)
U.S.	Unites States of America
WP	Work Package
XSEDE	Extreme Science and Engineering Discovery Environment

Executive Summary

This document describes some of the key output of training collaboration during the course of the PRACE-3IP project. The main focus is a report on the International HPC Summer School 2014, held on 1-6 June in Budapest, Hungary. The event is part of an annual series of summer schools jointly organised by PRACE and the Science and Engineering Discovery Environment (XSEDE) project from the U.S. since 2010. In the past couple of years, the collaboration has expanded to include new partners from Japan (RIKEN Advanced Institute for Computational Science) and from Canada (Compute/Calcul Canada). The 2014 school has attracted unprecedented levels of interest, where 534 applications were received from Canada, Europe, Japan and the U.S. for the 80 available places. The school was extremely successful in promoting knowledge of high performance computing and its applications in various scientific domains; an overwhelming proportion of participants have rated their experience at the school a success. The school has also encouraged friendships and collaborations among an international mix of participants and presenters from a wide range of backgrounds; a unique characteristic of the school that contributes to the learning experience and sets it apart from many other training events. Hence with the high level of interest from students, interest from new partners and steadily excellent reviews by participants, it is imperative that PRACE continues this collaboration in the future.

Another focus of this document is to examine approaches to PRACE training collaboration. While some collaborative efforts in the past were conducted on an *ad hoc* basis (e.g. opportunistic co-location of events), others required more advanced planning and engagement (e.g. the International HPC Summer School series). It is recommended that future PRACE training will facilitate both types of collaborations by engaging with other partner organisations at the budget planning stage as well as providing a defined allocation of resources that can be committed on an *ad hoc* basis towards collaborative training events.

1 Introduction

The PRACE training Work Package (WP4) has always been a collaborative effort among the partners, either in hosting face-to-face training events (e.g. Seasonal Schools) or in developing and contributing material to the PRACE Training Portal. The PRACE projects since PRACE-1IP have also maintained a very successful collaboration with the Extreme Science and Engineering Discovery Environment (XSEDE) project over the past four years in running a series of International HPC Summer Schools, which were formerly known as the E.U.-U.S. Summer Schools; a deprecated title since additional partners joined the collaboration in 2013. Training collaboration with other external organisations has also occurred in the past, but typically on an *ad hoc* basis as required.

This document describes some of the training collaborations of PRACE-3IP WP4. The main focus will be a report on the International HPC Summer School 2014 (Section 0). This is then followed by a report on other examples and an assessment of opportunities of PRACE training collaboration with external organisations and non-PRACE countries (Section 3).

2 International HPC Summer School 2014

In 2010, the Teragrid project in the U.S. and the European DEISA project collaborated to host the first E.U.-U.S. HPC Summer School in Catania, Italy. The event brought together participants and presenters from both regions for an approximate week-long event that combined a mix of presentations and hands-on sessions to address HPC challenges faced by many who are engaged in different areas of computational sciences. After the success of that event, the PRACE projects have continued to support an on-going collaboration with the XSEDE project (successor to the Teragrid project) to host the annual series of HPC summer schools. Table 1 summarises the details of all five schools so far, including the most recent one to be described below.

Traditionally, PRACE and XSEDE each sent around 25-30 participants each to the event. While the school started out as the E.U.-U.S. HPC Summer School, the title of the series of events changed to the International HPC Summer School in 2013 as the event welcomed a new partner organisation, RIKEN Advanced Institute for Computational Science from Japan. At the 2014 International HPC Summer School, Compute/Calcul Canada has also joined as a new partner organisation for that event. Each new partner organisation typically sends around 10 participants to the school.

Date	Location	Number of participants	Collaborative partners
4-7 October 2010	Catania, Italy	60	DEISA (Europe), Teragrid (U.S.)
7-11 August 2011	Lake Tahoe, U.S.	58	PRACE-1IP (Europe), XSEDE (U.S.)
24-28 June 2012	Dublin, Ireland	60	PRACE-2IP (Europe), XSEDE (U.S.)
24-28 June 2013	New York City, U.S.	73	PRACE-2IP (Europe), XSEDE (U.S.), RIKEN AICS (Japan)
1-6 June 2014	Budapest, Hungary	79	PRACE-3IP (Europe), XSEDE (U.S.), RIKEN AICS (Japan), Compute/Calcul Canada (Canada)

Table 1: Details of the annual series of International HPC Summer Schools (formerly the E.U.-U.S. HPC Summer School)

2.1   Overview of the schools

The objectives of the International HPC Summer School series are to:
- Expand the knowledge of the attendees about HPC and its application in multiple fields of science and engineering.
- Foster new collegial friendships and partnerships, nationally and internationally, among presenters and participants.

The format of the summer schools has remained relatively stable over the years, though it has evolved. The programme combines elements of scientific conferences – but where HPC is a dominant theme rather than any specific scientific or engineering discipline – together with elements of HPC training courses where participants engages in learning programming tools and techniques through a mix of presentations and hands-on sessions.

The programme of the school is also designed to actively promote interaction between the participants and the presenters, through the mentoring programme, the electronic poster sessions as well as group activities.

2.2   Organisation of the 2014 school

The organisation of the 2014 International HPC Summer School began about 9 months before the commencement of the school. A combined programme and organising committee (Table 3), consisting of representatives from each partner organisation and region, took part in regular teleconferences that became a weekly occurrence six months before the school. This committee is responsible for all aspects of organising the school, including the design of the programme (talks, hands-on sessions, mentoring, electronic posters), invitation of presenters, dissemination of the event, implementation of application and selection processes, evaluation of the school and logistical coordination.

2.2.1   *Programme Design*

Following a similar format to previous schools, the morning sessions are typically dedicated to talks from leading scientists and technologists. These talks aimed to cover the science, as well as the challenges and solutions, for conducting leading-edge research across multiple fields of study, using HPC and related technologies. They also include talks that focused more on HPC technology and tools intended to increase efficiency and productivity of researchers.

The afternoon sessions are typically dedicated to hands-on sessions where participants take part in tutorials on a variety of HPC topics, such as parallel programming, performance analysis and profiling, usage of Python in HPC and scientific visualisation.

While it is expected that interaction between participants and the presenters/staff occurs naturally at breaks (e.g. coffee breaks, meals), for the past few years this series of schools have put in place a mentoring programme to actively promote such interactions. Every participant at the school is assigned a mentor with whom he/she is encouraged to maintain regular contact throughout the school. In 2014 the mentor/mentee assignment process is based on common interests on research or HPC topics, rather than a random assignment process as was carried out in the past. This was a direct response to feedback comments collected from last year's school. The school's programme also include two sessions for mentoring where participants have an opportunity to speak to particular presenters/staff at the school and/or to raise questions. The lunch-time venue have different seating plans each day to stimulate different interactions; mentors and mentees are seated together on the first day, subsequently tables have different themes for the rest of the week (e.g. scientific/HPC themes, hobbies).

Two electronic poster sessions were held on the first two evenings of the school. The format of these sessions was similar to traditional poster sessions at scientific conferences, but the participants used laptops instead printed posters to present their research. Every participant was requested to prepare a few presentation slides and provide an abstract for their poster; the abstracts are made available to all the participants before the school.

The final programme of the school is available online [1]; the full list of presenters and staff at the school is shown in Table 4.

2.2.2   *Applications and Participants*

Applications for the 2014 school were accepted from 28 January until 9 March. Official announcement of the school was carried out by all the partner organisations on 28 January, including a PRACE press release [2]. Dissemination by e-mail was also carried out; PRACE partners were asked to advertise the event locally, and the prace-training-announce mailing list (with >2,000 addresses from past PRACE training participants) was utilised to attract applications from all over Europe. By the end of the deadline, an unprecedented total number

of 534 applications were received from candidates based in the respective partner regions (i.e. Canada, Europe, Japan, U.S.) for the 80 places available for the school. For PRACE, 160 applications were received for 30 places reserved for Europe.

The effort in selecting the 80 participants was divided locally to the respective partner organisations, i.e. PRACE was responsible to fill its allocated 30 places from the 160 applications received from candidates based in European institutions. The European selection committee consisted of six scientists and HPC experts from Finland (CSC), France (CEA), Italy (CINECA), Germany (RZG), Spain (BSC) and the UK (EPCC). The selection criteria used include:

- Must not have attended before;
- Preference for simulation code developers;
- Skills in parallel programming, experience in MPI (and related topics);
- Strong scientific/technological reasons for participation (as opposed to general interests);
- Broad applicability of Summer School to be able to help advance research goals;
- Experience with computational science and engineering and HPC;
- Strength of the essay responses; and
- Other qualities, publications, awards.

Successful applicants were informed on 9 April and were asked to formally register for the school. A small number had declined to participate but were replaced by others on the waiting list. Unsuccessful applicants were informed on 25 April. Apart from one last minute cancellation, 79 participants attended the event in Budapest; Table 2 shows their geographic distribution according to the country of their affiliation. In summary, the participants are based in 19 different countries (16 of these European), represent 28 nationalities from 5 continents and 25% female.

Country	Number of participants
Austria	1
Bulgaria	1
Canada	10
Czech Republic	1
Finland	1
France	4
Germany	3
Greece	2
Hungary	1
Ireland	1
Italy	3
Japan	10
Lithuania	1
Netherlands	1
Serbia	1
Spain	3
Sweden	1
UK	5
USA	29
Total	**79**

Table 2: Number of participants by country of affiliation at the International HPC Summer School 2014

Figure 1: Group photo of participants and presenters/staff at the International HPC Summer School 2014

2.3   Evaluation

On 6 June, the last day of the school, participants were asked to fill out an online evaluation survey, similar to the one used in the previous year that had been agreed among the organising committee. A total of 72 feedback responses were received, representing a response rate of 91%. The following is a summary of the results in different categories:

- Overall: a general measure of the perceived quality of this event was the response to the statement "Overall I would rate my experience as successful"; to this an overwhelming 97% of respondents were in agreement that the event was a successful experience for them.

- Learning outcome: 86% of respondents indicated that their goals of attending the event were achieved; 94% stated that the skills they've learnt will significantly contribute to their research; 90% are aware of the next step to build on what they have learned.

- Organisation: 96% of respondents found the school to be well organised and the same number were satisfied with the delivery format of the school.

- International audience: 93% of respondents indicated that participation of students from other countries contributed to their learning; 97% have meaningfully engaged with other students at the school.

- Mentoring: 69% respondents have stated to have meaningfully engaged with their assigned mentor during the school. This may be a slight improvement from 59% last year, where there had been some criticism of the random mentor/mentee assignment process. The assignment process based on common research interests this year have helped, but one should keep in mind that such "match-making" procedures are never 100% optimal. The mentoring programme is in place to ensure that every participant

interact with at least one presenter/staff at the school. There are ample opportunities for participants to interact with others who are not their assigned mentors.

- Compute resources: 79% of respondents are interested in learning more about the resources/opportunities available through the partner organisations as a result of their experience; 69% plan on obtaining access to such resources after the school.

2.4   Lessons Learnt and Outlook

The evaluation of the school has been overwhelmingly positive in many aspects. Similar to the year before, one area where improvements can be made in future is the mentoring programme. Even with a more guided, "common interest" approach in assigning mentors to mentees, the process may still need adjustment to better promote participant-presenter interaction.

In conclusion, the 2014 school has been a very successful event and continued an extremely valuable on-going collaboration that has expanded to four partner organisations. The prestigious annual event is now attracting unprecedented interest from some of the top students from all over Europe and the world who face HPC challenges in conducting research. Again, the many opportunities to interact with other international students and presenters from diverse backgrounds were highlighted as a unique feature of the school compared to other scientific conferences and HPC courses.

3 Training collaboration with external organisations

Apart from the International HPC Summer School series, the PRACE projects have been involved in other training collaborations in the past. The Seasonal Schools, for example, have collaborated with various other European projects, such as the DEISA project in running the PRACE Spring School 2011 and the LinkSCEEM project in running the PRACE Winter Schools in 2011 and in 2014. PRACE has also organised a training workshop in Coimbra, Portugal, October 2012 that was co-located with the 17th ETSF Workshop on Electronic Excitations. More recently, the PRACE Advanced Training Centres (PATCs, see [3]) have also been involved in running courses in collaboration with external entities. For example, the 2013-14 PATC curriculum [4] includes two courses, one in Sweden and one in the UK, on data staging and data movement that were held in collaboration with the EUDAT project [5]. Plans are also in place to host a joint PATC course in collaboration with the CECAM association [6] in the 2014-15 curriculum that will be implemented in the PRACE-3IP extension phase.

In order to explore potential training collaboration opportunities, it was proposed at an internal WP4 meeting that some Marie Curie Initial Training Networks [7] may be potential collaborative partners as they are typically involved in training PhD students across different domains. Attempts were made to contact 12 Marie Curie ITNs with subject areas relevant to HPC in order to determine whether they had specific training needs, and if so, whether there were potential collaboration opportunities. Some ITNs were already familiar with the training (e.g. PATC courses) offered by PRACE and have been disseminating such information internally. The indications are that the possibility for training collaboration, at least in terms of jointly-organised or co-located events, requires planning well in advance, i.e. at the proposal-writing stage of the respective partner projects; unless one of the partner has a large degree of flexibility in scheduling and funding events on an *ad hoc* basis.

The International HPC Summer School series is a good example of a collaboration that are planned and budgeted well in advance for its partner organisations. The locations and times of

other training events, such as the PRACE Seasonal Schools and PATC courses, are typically planned more than one year ahead or earlier, i.e. at the start of each project. Hence, in order for PRACE to engage in training collaboration with external partners, it will require:

- Advanced engagement with potential partners when planning training resources and budgets;
- A defined allocation of resources that can be committed on an *ad hoc* basis towards collaborative training events.

There is clear rationale for having a mix of both of the above; the former would cater for large events like the International HPC Summer Schools, while the latter would cater for more *ad hoc* requests from external entities – WP4 do receive these occasionally – to jointly organise training courses.

Finally, training collaboration with non-PRACE countries carries the same planning requirements as for external organisations. However, it should be noted that researchers based in European institutions are eligible to participate in PRACE training events, even if the institution is located in a country that is not a PRACE member state. Regardless, plans are in place to host an external PATC course in Romania, which is not a PRACE member state, in the PATC 2014-15 curriculum that will be implemented in the PRACE-3IP extension phase[1].

4 Conclusion

The International HPC School 2014 was a resounding success and the series of schools have developed a strong brand over the last five years. The event has attracted unprecedented level of interest among students with the highest number of applications ever received in 2014. New partners have joined the collaboration since the initial two-party collaboration between PRACE and XSEDE. Participants have also consistently rated the school extremely highly over the years. Hence it is imperative that PRACE continues this collaboration in the future.

Training collaboration with other organisations should, of course, be continued by PRACE. It is recommended that future PRACE training will facilitate this by engaging with other partner organisations at the budget planning stage as well as providing a defined allocation of resources that can be committed on an *ad hoc* basis towards collaborative training events.

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[1] 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 a 3IP extension period - for short, although no extension for the PRACE project as such is needed; it has a duration of 48 month.

5 Annex

This section contains supplementary info on the International HPC Summer School 2014.

Name	Affiliation, Country
Galen Arnold	NCSA, USA
Tricia Barker	NCSA, USA
Philip Blood	PSC, USA
Scott Callaghan	University of Southern California, USA
Thomas Cheatham	University of Utah, USA
Lizanne Destefano	University of Illinois, USA
Jim Ferguson	NICS, USA
Jonathan Ferland	Compute/Calcul Canada
David Henty	EPCC, UK
Zoltan Kiss	NIIFI, Hungary
Jill Kowalchuk	Compute/Calcul Canada
Scott Lathrop	Shodor Education Foundation Inc./NCSA, USA
Hermann Lederer	RZG, Germany
Dugan O'Neil	Compute/Calcul Canada
Yuri Mazuka	RIKEN AICS, Japan
Lorna Ivette Rivera	University of Illinois, USA
Mitsuhisa Sato	University of Tsukuba, Japan
Barbara Tóth	NIIFI, Hungary
John Urbanic	PSC, USA
Simon Wong	ICHEC, Ireland

Table 3: Programme committee of the International HPC Summer School 2014

Name	Affiliation, Country
Orly Alter	University of Utah, USA
Galen Arnold	NCSA, USA
Phil Blood	PSC, USA
Scott Callaghan	University of Southern California, USA
Thomas Cheatham	University of Utah, USA
Peter Coveney	University College London, UK
Kenton d'Mellow	EPCC, UK
Lizanne DeStefano	University of Illinois, USA
James Ferguson	NICS, USA
Jonathan Ferland	Compute/Calcul Canada
Frank Jenko	Max Planck Institute for Plasmaphysics, Germany
Lars Koesterke	Texas Advanced Computing Center, USA
Scott Lathrop	Shodor Education Foundation Inc./ NCSA, USA
Hermann Lederer	RZG, Germany
Erik Lindahl	KTH, Sweden
Piotr Luszczek	University of Tennessee, Knoxville, USA
Takemasa Miyoshi	RIKEN AICS, Japan
Kenji Ono	RIKEN AICS, Japan
Omar Padron	University of Illinois, USA
Sri Priya Ponnapalli	Bloomberg, USA
Lorna Rivera	University of Illinois, USA
Christian Rössel	JSC, Germany
Mitsuhisa Sato	University of Tsukuba, Japan
Amy Szczepanski	Art of Problem Solving, USA
Barbara Toth	NIIFI, Hungary
John Towns	NCSA, USA
Shinji Tsuneyuki	University of Tokyo, Japan
John Urbanic	PSC, USA
Tyson Whitehead	Compute/Calcul Canada
Simon Wong	ICHEC, Ireland

Table 4: List of presenters and staff at the International HPC Summer School 2014