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PRACE Winter School

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	Contributors:	Dimitra Kotsokali, GRNET
	Reviewed by:	Martin Polak (GUP) Florian Berberich (FZJ)
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Keywords:	PRACE, HPC, Research Infrastructure, Training, Education, Hybrid, PGAS, UPC, Chapel, Optimization, PRACE prototypes, Winter School
Abstract:	The PRACE Winter School was hosted by GRNET with the cooperation of AUTH in Athens from February 10th to 13th 2009. There were 79 registrations for the event and 48 students were selected from 18 different countries. The participants received advanced training on current and future parallel programming models and optimization techniques. The latest PRACE developments were integrated into the program and two PRACE prototypes were used (POWER6 at SARA and CELL at BSC) for the hands-on sessions. In the anonymous feedback returned by 38 students, the School organization and training content received excellent grades.

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References and Applicable Documents

[1] The PRACE project**,** http://www.prace-project.eu
[2] GRNET**,** http://www.grnet.gr/
[3] AUTH**,** http://www.auth.gr/home/
[4] PRACE Winter School**,** http://pracewinterschool.grnet.gr
[5] CORDIS**,** http://cordis.europa.eu/fetch?CALLER=EN_NEWS_EVENT&ACTION=D&SESSION=&RCN=30273
[6] TERENA**,** http://www.terena.org/news/community/index.php?_dgpear_news_v408pageID=3
[7] HPCwire Calendar**,** http://www.hpcwire.com
[8] PRACE D3.3.1 "Survey of HPC Training and Educational Needs"
[9] PRACE Winter School Program, http://pracewinterschool.grnet.gr/program/index.php?ctn=1&language=en&kind=p
[10] Chapel exercises, http://chapel.cs.washington.edu/PRACE/exercises
[11] The AlphaGalileo service**,** http://www.alphagalileo.org

[12] BELIEF II - Bringing Europe's eLectronic Infrastructures to Expanding Frontiers, http://www.beliefproject.org

List of Acronyms and Abbreviations

AUTH	Aristotle University of Thessaloniki
BSC	Barcelona Supercomputing Center
CEA	French Atomic Energy Commission
CRAY	Supercomputing Company
CSC	IT Center for Science Ltd. (Finland)
CSCS	Swiss National Supercomputing Center
DoW	Description of Work for PRACE
EPCC	Edinburgh Parallel Computing Centre
FZJ	Forschungszentrum Jülich
GRNET	Greek Research and Technology Network
IBM	Supercomputing Company
HPC	High Performance Computing; Computing at a high performance level at any given time; often used synonym with Supercomputing
KTH	Royal Institute of Technology in Stockholm
LOC	Local Organizing Committee of the PRACE Winter School
LRZ	Leibniz Supercomputing Center
MPI	Message Passing Interface (Parallel Programming Model)
OpenMP	Open Multi-Processing (Shared Memory Parallel Programming Model)
OTE	Greek Telecommunications Organization
PC	Program Committee of the PRACE Winter School
PDC	Center for Parallel Computers at KTH
PGAS	Partitioned Global Address Space (Parallel Programming Model)
PRACE	Partnership for Advanced Computing in Europe; Project Acronym
PWS	PRACE Winter School
P2S2	PRACE Petascale Summer School
SARA	ICT Service Center in the Netherlands
SEE GRID	South Eastern Europe Grid
SC08	Super Computing 2008 Conference for High Performance Computing, Networking Storage and Anal
UPC	Universitat Politecnica de Catalunya
UPC	Unified Parallel C (PGAS Parallel Programming Model)
WP3	PRACE Work Package 3; Dissemination, Outreach and Training

WP4   PRACE Work Package 4; Distributed system management

WP5   PRACE Work Package 5; Deployment of prototype systems

WP6   PRACE Work Package 6; Software enabling for Petaflop/s systems

WP7   PRACE Work Package 7; Petaflop/s Systems for 2009/2010

WP8   PRACE Work Package 8; Future Petaflop/s computer technologies beyond 2010

Executive Summary

On February 10th to 13th, the PRACE project organized a Petascale computing Winter School in Athens, Greece. This four-day training event was hosted by the Greek Research & Technology Network (GRNET), with the cooperation of the Aristotle University of Thessaloniki (AUTH), and it took place at the training center of the Greek Telecommunications Organization, the OTE Academy. The PRACE Winter School was organized as part of the PRACE project activities [1for the dissemination of knowledge across the HPC Community in Europe, and it comes in a natural sequence of the successful PRACE Summer School, which was organized in Sweden from August 26th to 29th, 2008.

The program of the Winter School was designed to provide participants with a deep and thorough insight into the current and the future trends of parallel programming models and paradigms for Petascale computing. As it was clearly demonstrated by the "Survey on Training and Educational Needs for Petascale Computing", which has been published in June 2008, the HPC users in Europe would welcome advanced training on these topics. The objectives of the Winter School were to provide world-class training on current programming trends, which include MPI, OpenMP, Hybrid MPI/OpenMP and the PGAS programming model of UPC. Training on next-generation HPC programming models was addressed with a thorough introduction to the Chapel programming language.

Throughout the Winter School, participants had the opportunity to gain experience with the lecture material through hands-on sessions on two PRACE prototype machines: the POWER6 system at the SARA Computing and Networking Services in Amsterdam, Netherlands, and IBM CELL system at the Barcelona Supercomputing Center (BSC), Spain.

48 registered participants from 18 European countries were selected from among 79 total applications to the event.

Ten leading experts on both current and future HPC programming trends were invited from Europe and the USA to lecture the Winter School students. The trainers were chosen for their world-class expertise in a given topic (many are leading authorities in their field), as well as their ability to communicate their knowledge to students in an effective manner.

The increased participation of females (6 as students and 2 as trainers) was one of the significant successes of the event. The PRACE Winter School received an average rating of 3.60 by the participants.

1. Introduction

The present deliverable reports on the activities that were carried out in the framework of the PRACE Winter School, both with regard to the organizational aspects and the program structure. It also provides detailed feedback on the outcomes of the training, as well as recommendations for future training events.

The PRACE DoW stipulates that PRACE is to organize a Summer School in 2008 and a Winter School in 2009. The total budget for these events has been 30.000 Euro. It was agreed within WP3 that the Summer School and the Winter School should share this budget equally.

The Winter School [4] was hosted by GRNET [2], with the cooperation of AUTH [3. GRNET has a long experience in organizing and hosting successfully international conferences and workshops, such as the TERENA Networking Conference in 2004, the 3rd EGEE Conference in 2005, and the GGF (Global Grid Forum) Conference in 2006. Moreover, GRNET organizes annual training workshops for its local communities, and a plethora of dissemination events.

2. Preparation

In order to ensure the high quality of the PRACE Winter School in an efficient and organized manner, an initial planning was required, which would define the tasks of the PRACE partners who would contribute to the preparatory phase. Three separate committees were created with the responsibility to carry out distinct and complementary tasks:

- The Program Committee assumed responsibility for the preparation of the technical program and had the overall supervision of the event

- The Admission Committee undertook the task of evaluating all the registrations in order to choose the most qualified participants

- The Local Organizing Committee assumed responsibility for handling the financial aspects and the logistics of the event

The target groups of the Winter School were the HPC user communities, computational researchers, scientists and application experts across PRACE member countries.

2.1 Program Committee

One of the most important tasks of the initial planning phase was to form a Program Committee (PC), which would be populated by individuals, who are distinguished for their expertise in HPC, including training and education. It was agreed that members of the Summer School Program Committee should form the basis of the Winter School Program Committee, due to their recent experience in organising a highly successful PRACE training event. Some additional competences would be added, whose experience and knowledge would greatly assist in conducting a well-structured, constructive program that would benefit the Winter School students.

Part of the Program Committee's preparation activities was the establishment of cooperation among individuals who participate in different PRACE Work Packages, with the aim to receive constructive feedback about the latest PRACE developments

regarding technologies and architectures. In this respect, the Program Committee included one representative from WP6, and WP7, and two WP8 representatives. The cooperation of the WP8 participants was highly important, since they are engaged in the preparation of future Petascaling Systems that could be potentially used and presented during the Winter School.

One of the key factors in conducting the Winter School Program was the PRACE document "Survey on Training and Education Needs on Petascale Computing" [8]. For this reason we invited the lead author of the report to participate in the Program Committee. The survey's main contribution lies in making clear the main HPC topics which the users from all across Europe consider being of great significance and on which a further and more elaborate training would be welcome. In fact one of its authors was a member of the Winter School Program Committee.

Table 1 describes the members of the Program Committee.

Name	Institute	Country	Role
Nikos Tsakiris	AUTH	Greece	Chair
Dimitra Kotsokali	GRNET	Greece	Financial & Organizational Issues
Ioannis Liabotis	GRNET	Greece	Financial & Organizational Issues
Tim Stitt	CSCS	Switzerland	Training Survey
Fotis Karayannis	GRNET	Greece	Organizational Issues
Christos Kanellopoulos	AUTH	Greece	Organizational Issues
David Henty	EPCC	UK	WP6
Jean-Philippe Nomine	CEA	France	WP7
Iris Christadler	LRZ	Germany	WP8
Guillaume Collin de Verdière	CENCI CEA	France	WP8
Marina Bouianov	CSC	Finland	Financial Issues
Wolfgang Frings	FZJ	Germany	WP6
Lennart Johnsson	KTH	Sweden	WP3
Ari Turunen	CSC	Finland	WP3

Table 1: Members of the PRACE Winter School Program Committee

A total of 11 teleconferences were held by the Program Committee between October 2008 and February 2009. After each TC an electronic document was sent to all the members of the PC with the minutes and the action points that were discussed.

Furthermore, the Program Committee members met face to face during the SC'08 in Austin, Texas, USA, and during the WP6 meeting in Amsterdam.

It was the mutual decision of the PC, since the first phone meeting, to formulate the technical program based on the following:

- The necessity to extend the solid training foundations which were set during the Summer School

- The training recommendations, which were identified by the Training and Education Survey

- The integration of the latest PRACE developments, such as the prototype systems, which have been installed in HPC centers across Europe

The Program Committee decided upon the duration of the event based on the outcomes of the Training Survey, strongly indicated that participants preferred a 3 day training course. Consequently, it was decided that the PRACE Winter School would comprise 3 days, with an optional 4th day for interested students.

Additionally, it was decided that during each day there would be a distinction between lectures and hands-on sessions. The Program Committee considered the sequence of theoretical and practical training to be highly educational for the PRACE Winter School.

The hands-on sessions would be using one or more of the PRACE prototypes. The members of the Program Committee from WP7 and WP8 made continuous briefings on the status of the systems that were already installed in HPC centers or that would be prior to the start of the Winter School. In total, there were 6 prototypes that would be available for the Winter School. To determine the best choice of prototype architectures for the hands-on sessions, the PC contacted the respective machine administrators requesting answers to the following:

- The availability and the suitability of the system during the period of the Winter School

- The Advanced Programming Environments and if there was any support for PGAS and Next Generation HPC Languages

- The possibility to send an on-site trainer for support and if there was any educational material that could be delivered to the students

- The number of accounts that could be created for the Winter School

From the feedback received, it was confirmed that two of the prototypes would not be available during the Winter School. In addition to the BlueGene/P at Jülich, Germany and a CRAY XT system at CSC, Finland had already been used for the Summer School needs, so it was decided that the IBM POWER6 system at SARA, Netherlands and the IBM CELL system at BSC, Spain to be used for the hands-on sessions. Based on the answers from the systems administrators, it was initially decided to accommodate 40 participants in the Winter School. However, it was noted that this number should not be a limiting factor and that it could be increased if the anticipated number of registrations would be far exceeded.

The members of the Program Committee spent much time discussing the orientation and structure of the Winter School program. They cooperated in an excellent way to identify the key points of the Program. Although the process was initially time-

consuming, it finally proved to be highly constructive and lead to a consensus concerning the final version of the program.

The main themes of the PRACE Winter School were finalized as the Parallel Programming models and the Optimization Techniques for Petascale Computing. During the Summer School, there was a thorough presentation of the current parallel programming techniques, such as MPI and OpenMP. The PC decided to formulate the program in such a manner, as to offer to the students an insight into the combination of these techniques, namely Hybrid programming, as well as the increasingly important PGAS languages. In addition, it was decided, based on recommendations from the Training Survey and the availability of the compilers, that students be given exposure to next-Generation HPC languages, with a focus on Chapel. The bonus day was dedicated to the presentation of the novel IBM CELL system.

Since the parallel programming models were the main topic of the School, the PC set the following prerequisites for accepting the applicants:

- Good knowledge of the C programming language.

- Good knowledge of the parallel programming models of MPI and OpenMP

The trainers who were invited to deliver the lectures and prepare the hands-on sessions were chosen based on their scientific skills and their ability to communicate their knowledge to their audience. There were 10 trainers selected and each one of them is an expert in his field, possessing a deep knowledge on the topics which were discussed. Some of the trainers are currently the lead developers of the future programming trends (such as Brad Chamberlain from CRAY, who presented Chapel) and it was deeply appreciated by the participants that they had the chance to get an insight from people who significantly influence the progress in this field.

The final agenda was set on the 9th teleconference on January 8th, 2009. Online registration was open since the first press announcement was released on December 15th, 2008. The deadline for registration was on January 15th, 2009. Until that time the Program Committee had received 53 registrations. The registration period was extended until the 21st of January and by that time there were 79 applications for attending the Winter School.

2.1.1 Advertisement of the event

One of the most important tasks of the Program Committee was to disseminate the event to its target groups, i.e. the researchers & students. The objective was to stimulate the interest of future HPC users and receive as many applications for participation as possible, and to gain general publicity regarding the PRACE project through the Winter School. Even before the opening of the registration on December 15th, 2008, there was a well-coordinated attempt by the Program Committee to promote the event. To this respect, electronic announcements were sent to the PRACE partners who promoted the event to the relevant local lists, as well as to the top ten HPC users of each country. Additionally, a press release was sent, and the Winter School was announced on websites, which are widely accessed by members of the European HPC Community. More specifically, the Winter School was disseminated to the following groups:

- A mail announcement was sent to the Top 10 HPC Users at each European HPC site.

- A press release about the Winter School was disseminated through the AlphaGalileo [11] **The AlphaGalileo service, http://www.alphagalileo.org**service, which reaches some 7,000 media experts.

- Two press releases about the event were posted on the PRACE website on 31.10.2008 (preliminary information about the Winter School) and on 15.12.2008 (the final press release).

- The final press release was sent directly to a wide list of journalists within the HPC field (e.g. such publications as HPCwire, ISGTW.org)

- A mail announcement was sent to all the participants of the PRACE project through the project lists (prace-all@fz-juelich.de). The members of the project promoted the event via this announcement to their local communities

- The Program Committee members sent an announcement to their local communities

- A mail was sent to the PRACE WP3 list (prace-pro-wp3@fz-juelich.de) and the Winter School opening announcement was circulated to the HPC users of the local community of each WP3 member

- The contact points of the HPC centers across Europe that contributed to the Training Survey received a mail announcement

- The announcement mail was sent to the SEE-GRID-SCI list (see-grid-all@see-grid.eu)

- E-mails were also sent to the GRNET local communities through relevant mailing lists (grids@grnet.gr, grnet-tech@grnet.gr, user-info@grnet.gr)

- The event was advertised through the Belief-II portal [12] **BELIEF II - Bringing Europe's eLectronic Infrastructures to Expanding Frontiers, http://www.beliefproject.org**

Since it was decided that there would be an extension of the registration period, further e-mails were sent to all the recipients mentioned above.

The PRACE Winter School was also announced in the following websites:

- The CORDIS website [5]

- The TERENA website [6]

- The HPCwire Calendar [7]

- The PRACE website [1] **The PRACE project, http://www.prace-project.eu**

Advertising the PRACE Winter School in the most efficient and effective manner was one of the high priority tasks of the Program Committee. Formulating a very good program was not enough by itself; the success of the event also required its dissemination to as many people as possible. The final number of registrations (79 applicants), proves that the Program Committee conducted a constructive program and successfully disseminated the event to its target groups.

2.2 Admission Committee

The main task of the Admission Committee was to evaluate the registrations and decide which people met the admission criteria, which included experience with C, MPI and OpenMP. Since the registrations greatly exceeded the limit of 40 participants that the Program Committee had initially agreed to accept, the Admission Committee had to carry out the difficult task of choosing the most qualified applicants. The final admission was done based exclusively on the prerequisites which were set by the Program Committee. Additionally, it was decided to increase the number of the PRACE Winter School students to a maximum of 50. Table 2 lists the members of the PRACE Winter School Admission Committee.

Name	Institute	Country
Nikos Tsakiris	AUTH	Greece
Dimitra Kotsokali	GRNET	Greece
Ioannis Liabotis	GRNET	Greece
Tim Stitt	CSCS	Switzerland

Table 2: Members of the PRACE Winter School Admission Committee

All the applicants had completed a form stating their current occupation, their knowledge on programming languages and parallel programming models. Additionally, they were asked to submit a short version of their CV. The structure of the registration form provided the necessary information to the Admission Committee in order to select the final participants of the Winter School.

The evaluation process had begun since the opening of registration, by screening each applicant and by conducting a list of the participants, which would be finally accepted. The admission letters were sent to 50 accepted registrations, asking the applicants to confirm their participation. Their enrolment was completed with the deposit of the registration fee at a bank account that had been created exclusively for the Winter School.

By January 23rd the Admission Committee received 46 confirmations and decided to contact the applicants of the backup list. Two of them confirmed their participation and the final number of the PRACE Winter School students was 48. Each applicant who confirmed his/her participation received a gratification letter, with details concerning the accommodation. On January 23rd the Admission Committee informed via e-mail all the registrants who were not accepted, about the status of their application. After the completion of the Winter School on February 13th, the participants received a gratification letter, with information about some extra material which was added on the website such as photos and the final versions of the presentations.

The PRACE website statistics show, that the Winter School material on the PRACE website was accessed 502 times during February.

The highly increased interest for participation to the Winter School in relation to the Summer School indicates the eagerness of the HPC Community to continue receiving high quality training. More specifically, the PRACE Summer School was attended by 31 students out of 34 registrations, and the PRACE Winter School was attended by 48 students out of 79 registrations. The above proves that the PRACE project initiatives for the dissemination of knowledge have been very successful, and that the PRACE Schools are high-quality training events, which attract researchers and students.

The final 48 Winter School participants originate from 18 different countries, all of which are PRACE members, except Croatia. There was an issue with the vendor of the POWER6 and the CELL system, which in both cases is IBM. The Admission Committee received a list of the countries, whose citizens cannot have access to these systems and Serbia was among them, despite the fact that since December 2008 it is part of the PRACE Initiative. There were 2 registrants from Serbia, both of which qualified to participate to the Winter School. The Admission Committee contacted IBM once more, explicitly pointing this issue and finally the two students attended the event.

Since the vast majority of the people who registered had indeed the required qualifications, the evaluation was done with extreme care and thorough investigation, keeping in mind the limited number of available places.

2.3 Local Organizing Committee

The Local Organizing Committee had undertaken the task of organizing the event on-site. Its main responsibilities were the following:

- To seek for the most suitable venue and arrange for the accommodation of all participants by negotiating with the hotel the relevant rate. To arrange the transportation of the students and lecturers from the hotel to the venue, as well as to the venues of the social events

- To create and maintain the web site of the PRACE Winter School, containing an overview of the event, the registration page, the detailed program, useful links, information on the logistic of the event and other details such as information on how to commute while in Athens. Additionally, all the presentations were available online during the event. Finally, the website provided a direct link to the PRACE project website and the Winter School presentations were also downloaded to the PRACE project website

- To hire the 20 pc workstations that would be used during the hands-on sessions and to provide high quality on site service during the Winter School by arranging for a registration and information desk

- To organize the social events, namely a dinner at a restaurant in the historical part of Athens, and a night out at a brewery to strengthen bonds between the members of the Winter School Community. Moreover, to arrange the coffee breaks and lunches, which were served everyday

- To prepare the promotional, the training and other useful material for students and lecturers, namely badges, bags, handouts, usb sticks, etc.

- To assist the participants concerning organisational issues, such as the deposit of the money and the preparation of the invoices and to check the list of

payments in cooperation with the National Bank of Greece, with regard to the registration fee

- To arrange for the travel details of the trainers

Table 3 contains the members of the Local Organizing Committee:

Name	Institute	Country
Dimitra Kotsokali	GRNET	Greece
Ioannis Liabotis	GRNET	Greece
Nikos Tsakiris	AUTH	Greece
Tim Stitt	CSCS	Switzerland
Christos Kanellopoulos	AUTH	Greece

Table 3: Members of the PRACE Winter School Local Organizing Committee

The actual members of the Local Organizing Committee were also supported by Efi Mouzika and Memi Triantafyllidou.

3. Outcome of the Preparation

3.1 Registration

The registration for the PRACE Winter School was done online [4]. A form had to be completed, where the applicants had to fill in their personal information, their current occupation and their affiliation. Moreover they were asked to describe briefly their knowledge on programming languages (C, FORTRAN, etc.) and on parallel programming models (MPI, OpenMP, etc.). In order to provide more details concerning their skills, they had to submit a more detailed CV. The website also provided extra fields to be completed from the people that had special preferences regarding meals and dinners (e.g. vegetarians), and people that needed special assistance (e.g. accessibility issues).

The registration chronicle is described in Table 4: Registration timetable

Activity	Date	Number of registrations
1st Press Release – announcement	December 15, 2008	-
Registration Opening	December 15, 2008	-

Activity	Date	Number of registrations
2nd announcement	December 30, 2008	5
3rd announcement	January 9, 2009	20
1st Registration Deadline	January 15, 2009	53
2nd Registration Deadline	January 21, 2009	79

Table 4: Registration timetable

The number of the attendants had been reached since the first deadline, but the Program Committee had already decided to extend the registration period and some of its members had already informed their local communities. The extension was finally beneficial for the PRACE Winter School, since most of the people who registered in the extra period were also highly qualified. At Table 5: Number of registrations per country, the number of registrations per country is presented.

Country	Number of Registrations
Austria	1
Croatia	1
Cyprus	1
France	7
FYRoM	1
Germany	6
Ghana	1
Greece	30
India	1
Ireland	1
Italy	1
Netherlands	1
Nigeria	1
Norway	2
Poland	3
Portugal	2
Serbia	2
Spain	9

Country	Number of Registrations
Sweden	4
Switzerland	2
Turkey	1
United Kingdom	1
Total	**79**

Table 5: Number of registrations per country

In order to finalize their enrollment, the participants had to deposit the registration fee. The bank details were sent to them by the admission notification mail. The fees can be seen at Table 6: PRACE Winter School registration fees and they were similar to the ones of the PRACE Summer School.

Date	PRACE members	Non-PRACE members
10 – 12 February	100 €	140 €
13 February (bonus day)	Free	Free

Table 6: PRACE Winter School registration fees

3.2 Participants

There were 48 participants in the PRACE Winter School. They originate from 18 different European countries. Table 7 : Number of students per country presents the students by country.

Country	Number of Students
Austria	1
Croatia	1
Cyprus	1
France	3
Germany	3
Greece	14
Ireland	1
Italy	1
Netherlands	1
Norway	2
Poland	3
Portugal	1

Country	Number of Students
Serbia	2
Spain	8
Sweden	2
Switzerland	2
Turkey	1
United Kingdom	1
Total	**48**

Table 7 : Number of students per country

The PRACE Winter School was attended by representatives from 13 out of the 14 PRACE partners, since there were no registrations from Finland. It is positive that all the additional PRACE Partners (Cyprus, Ireland, Serbia and Turkey) were represented by at least one participant. The only non-PRACE participant was a researcher from Croatia. Out of the 48 participants, 6 were females (12.5%).
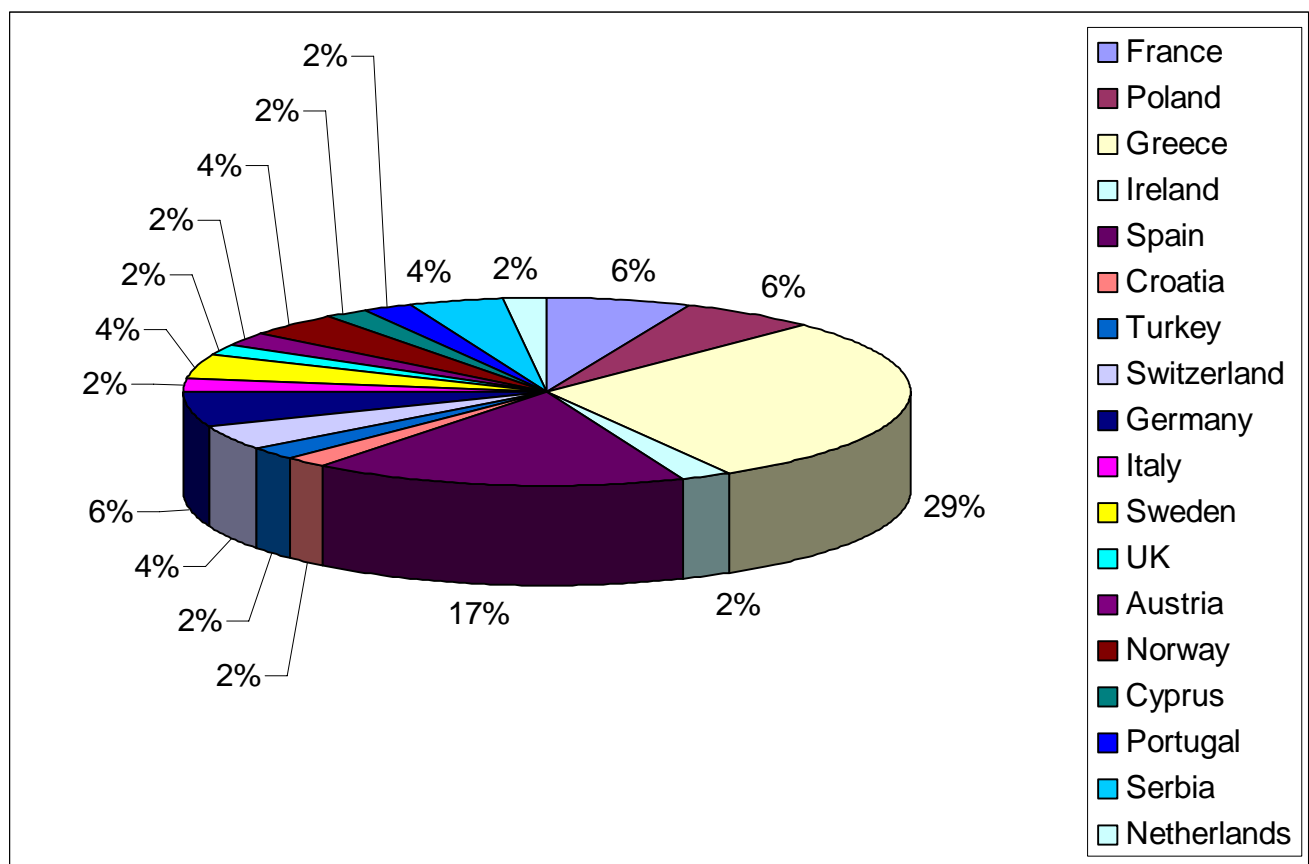

Figure 1: Pie Chart of the participants per country

Picture 1 : PRACE Winter School participants and trainers

Picture 2 : Hands-on session

Picture 3 : Winter School students participating at the training session

3.3 Program and Trainers

The objective of the PRACE Winter School was to offer to the participants' high quality training on HPC topics that the Training Survey indicated to be of great importance and on which the HPC Community has detected a lack of education. According to that Training Survey

- There is a significant need for mixed mode Hybrid programming, since many users believe that their level of expertise on this topic is poor (33%) or very low (66%)

- 93% of the HPC users are unfamiliar with the PGAS languages, such as UPC, despite their continuously increasing popularity

- 96% of the HPC users are unfamiliar with the next-generation HPC languages, such as Chapel. Since these languages have the potential to dominate HPC programming over the next decade, it is important that the HPC Community gets introduced to them.

- 90% of the users indicated that they would benefit from lessons on code optimization techniques.

- It is necessary to have the best educators, who are experts in their field of research and can ensure the transfer of their knowledge to their students.

The PRACE Petscaling Summer School had invited experts in MPI, OpenMP programming models and their combinations. Moreover there was a thorough presentation of profiling tools. The PRACE Winter School Program Committee had decided that this event would not be a repetition of the one that took place in Sweden, but rather an evolution of it. Since MPI, OpenMP and their combinations were one of the main topics of the Summer School, it was decided to offer an advanced 1day course on these topics and have it extended by presenting thoroughly the future

trends. Besides, the biggest training requirements identified through the Survey, were the Hybrid, PGAS, optimization and next-generation languages topics, so the Program Committee decided to emphasize on them. Moreover it was decided that the bonus day would be dedicated to the CELL system, which is a novel and intriguing architecture and the students would surely benefit from getting acquainted with it.

Table 8 : Overview of the PRACE Winter School program provides an overview of the PRACE Winter School program.

	1st Day	2nd Day	3rd Day	4th Day
Topic	MPI, OpenMP, Hybrid	Code Optimization, UPC	Next-Generation HPC languages - Tutorial on Chapel	CELL

Table 8 : Overview of the PRACE Winter School program

According to the general everyday schedule there would be lectures in the morning and hands-on sessions during the evening.

The PRACE Petascale Summer School had invited experts from within the PRACE project. Since most of them were the best qualified trainers and taking into consideration that there shouldn't be any repetition conflicts, the Winter School Program Committee decided to invite trainers of the highest value from the wider HPC Community, along with PRACE representatives. Among the lecturers there was a representative of the European Commission, Bernhard Fabianek, who presented the perspectives of HPC in Europe, four PRACE representatives and six non-PRACE ones. The Program Committee invited the most qualified trainers, based on

- Their scientific and training background
- Their ability to transfer their knowledge

It is very important to note that some of the people who were invited to prepare the lectures and the hands-on sessions are in fact leading experts in their field. Brad Chamberlain is leading the development of the Chapel language; Montse Farreras, who gave the tutorial on UPC, collaborates on developing the UPC runtime system for the IBM UPC compiler. The Program Committee considered that by inviting these two experts, the students would attend a high level training course on the PGAS and next-generation HPC languages and at the same time the requirements set by the Training Survey would be successfully met.

Two experts from IBM were also invited to the event, Costas Bekas from IBM Switzerland, whose expertise is on Hybrid programming, and Jordi Caubet, from IBM Spain, who gave a tutorial on programming with CELL. SARA was represented by John Donners, who is an expert on the POWER6 system, in order to provide support to students accessing the IBM POWER6 system. Paschalis Korosoglou is an application expert of the Grid Operation Center of AUTH, with important training experience on MPI and OpenMP. His talk and the ones of Costas Bekas' were complementary. William Jalby is an expert on optimization techniques. Tim Stitt from CSCS was assigned with the task of assisting the students during the Chapel hands-on

sessions, by answering their questions and by helping them to complete the exercises. Rosa Badia and Gabriele Cartneni presented in depth both the CELL system micro architecture and its programming models.

Table 9 : Trainers of the PRACE Winter School contains a list of the trainers who participated in the PRACE Winter School.

Name	Institute	Country	Topic
10: Bernhard *Fabianek*	EC	Belgium	HPC in Europe
1: John *Donners*	SARA	Netherlands	POWER6 system
2: Paschalis *Korosoglou*	AUTH	Greece	MPI, OpenMP, Hybrid
3: Costas *Bekas*	IBM	Switzerland	MPI, OpenMP, Hybrid
4: *William Jalby*	Univ. de Versailles	France	Code optimization techniques
5: Montse *Farreras*	UPC	Spain	PGAS, UPC
6: *Bradford Chamberlain*	CRAY Inc.	USA	Chapel
7: Timothy *Stitt*	CSCS-ETHZ	Switzerland	Chapel
9: Gabriele *Carteni*	BSC	Spain	CELL
Jordi Caubet	IBM	Spain	CELL
8:Rosa M. Badia	BSC	Spain	CELL

Table 9 : Trainers of the PRACE Winter School

The program of the PRACE Winter School can be found online, along with the presentations and the exercises of the hands-on sessions [9].

3.3.1 Program of the 1st Day

The first day of the PRACE Winter School was Tuesday, February 10th. The main topic was current parallel programming models (MPI, OpenMP and Hybrid). The Winter School opened with Bernhard Fabianek's presentation about the perspectives of HPC in Europe. John Donners made an introduction to the POWER6 PRACE prototype at SARA. For the rest of the day, the students attended a tutorial on Hybrid programming, both with lectures and hands-on sessions. The students were given a set of exercises and under the guidance of their trainers they were expected to solve them and understand in depth the concepts of the Hybrid parallel programming. The program of the 1st day can be seen at Table 10 : Program of the 1st Day.

Time	Title
09:00 – 09:30	**High-Performance Computing in Europe - A view from the European Commission** (Bernhard Fabianek; EC, Brussels)
09:30 – 10:30	**Introduction to the POWER6 system** (John Donners; SARA, Netherlands)
10:30 – 10:45	**Coffee Break**
10:45 – 11:45	**Current Parallel Programming Concepts** (Paschalis Korosoglou; AUTH, Greece)
11:45 – 12:00	**Coffee Break**
12:00 – 13:00	**Introduction to Parallel Computing: The Message Passing, Shared Memory and Hybrid paradigms** (Costas Bekas; IBM, Switzerland)
13:00 – 14:00	**Lunch**
14:00 – 15:45	**Hands-on Session : MPI, OpenMP and Their Hybrid** (Bekas, Korosoglou, Donners)
15:45 – 16:00	**Coffee Break**
16:00 – 18:00	**Hands-on Session : MPI, OpenMP and Their Hybrid** (Bekas, Korosoglou, Donners)

Table 10 : Program of the 1st Day

3.3.2 Program of the 2nd Day

The second day of the PRACE Winter School was on Wednesday, February 11th. The main topics of the day were the code optimization techniques and the PGAS languages, with an emphasis on UPC. Professor Jalby gave three talks on different optimization topics. Montse Farreras prepared an introduction to PGAS and an extensive hands-on session on UPC. The vast majority of the students had never attended a PGAS tutorial and considered Montse's presentations to be extremely beneficial for them. The program of the 2nd day can be seen at

Table 11 : Program of the 2nd day.

Time	Title
09:00 – 10:00	**Unicore/Pipeline Optimization** (William Jalby; Univ. de Versailles, France)
10:00 – 10:15	**Coffee Break**

Time	Title
10:15 – 11:15	**Introduction To PGAS Programming** (Montse Farreras; UPC, Spain)
11:15 – 11:30	**Coffee Break**
11:30 – 12:30	**Memory Hierarchy Optimization** (William Jalby)
12:30 – 14:00	**Lunch**
14:00 – 15:00	**Multicore Optimizations** (William Jalby)
15:00 – 15:15	**Coffee Break**
15:15 – 16:15	**Tutorial : Introduction to the PGAS Programming Paradigm with UPC** (Montse Farreras, John Donners)
16:15 – 16:30	**Coffee Break**
16:30 – 18:00	**Tutorial : Introduction to the PGAS Programming Paradigm with UPC** (Montse Farreras, John Donners)

Table 11 : Program of the 2nd day

3.3.2 Program of the 3rd Day

The third day of the PRACE Winter School was on Thursday, February 12th. The main topic of this day was the next-generation HPC languages, focusing on Chapel. Brad Chamberlain, the lead developers of Chapel, organized and presented the tutorial, with lectures and hands-on sessions. Tim Stitt offered to assist him on site. Most of the participants had no experience with the next-generation HPC languages and they were intrigued by Brad's presentation and felt enthusiastic with the programming model of Chapel. The program of the 3rd day can be seen at Table 12.

Time	Title
09:00 – 10:00	**Chapel Background and Base Language** (Brad Chamberlain; CRAY Inc, USA)
10:00 – 10:15	**Coffee Break**
10:15 – 11:15	**Task Parallel Features in Chapel** (Brad Chamberlain)
11:15 – 11:30	**Coffee Break**
11:30 – 12:30	**Data Parallel Features in Chapel** (Brad Chamberlain)

Time	Title
12:30 – 14:00	**Lunch**
14:00 – 15:00	**Locality, Status and Future Directions** (Brad Chamberlain)
15:00 – 15:15	**Coffee Break**
15:15 – 17:00	**Hands-on : Programming, Compiling and Executing Chapel Programs** (Brad Chamberlain, Tim Stitt; CSCS-ETHZ, Switzerland)
17:00 – 17:15	**Coffee Break**
17:15 – 19:00	**Hands-on : Programming, Compiling and Executing Chapel Programs** (Brad Chamberlain, Tim Stitt)

Table 12 : Program of the 3rd day

3.3.4 Program of the 4th Day

The fourth day of the PRACE Winter School was on Friday, February 13th. The main topic of the day was the presentation of the parallel programming models used for the CELL system. Two experts from BSC, along with one from IBM Spain, introduced the participants to this novel and intriguing system. The programming models used at CELL were presented along with paradigms. During the hands-on session, the students were assigned the task of programming and exploring the system. The 4th day was considered to be a bonus one and 41 participants attended it. The program of the 4th day can be seen at Table 13 : Program of the 4th day.

Time	Title
09:00 – 10:00	**Introduction to CELL + MariCel Prototype Presentation** (Gabriele Carteni; BSC, Spain)
10:00 – 10:15	**Coffee Break**
10:15 – 11:15	**Programming with the IBM SDK, OpenMP for CELL** (Jordi Caubet; IBM Spain)
11:15 – 11:30	**Coffee Break**
11:30 – 12:30	**Programming with DaCS and AlF - Introduction to programming with CellSs** (Jordi Caubet)
12:30 – 14:00	**Lunch**

Time	Title
14:00 – 15:00	**Programming the CELL with CellSs** (Rosa Badia; UPC, Spain)
15:00 – 15:15	**Coffee Break**
15:15 – 17:00	**Hands-On Session : Programming the CELL with the IBM SDK, CellSs and MPI** (Rosa Badia, Jordi Caubet)
17:00 – 17:15	**Coffee Break**
17:15 – 18:00	**Hands-On Session : Programming the CELL with the IBM SDK, CellSs and MPI** (Rosa Badia, Jordi Caubet)

Table 13 : Program of the 4th day

3.4 Budget

The available PRACE Winter School budget was 15,000 Euros, and the Program and Organizing Committee started working on the expenses allocation from July 2008, in such a way that all items would be covered, and the quality of the event would not be jeopardized.

Taking the above into consideration, as well as the fact that the cost of organizing such events in Greece is rather expensive, the budget plan aimed at covering first the basic costs of the Winter School, such as meals and coffee breaks, transportation of the participants from the hotel to the venue, the social events and the training material.

In order to keep the cost of the students' accommodation as low as possible, a special nightly rate has been negotiated with a local 4* hotel. Similar negotiations took place with the suppliers of the lunches and coffee breaks, dinners and transportation, as well as for the production of the training material that was given to the students. Additionally, with the provision of promotional material from PRACE project and GRNET, further expenses were avoided.

Considering the fact that the Winter School students' travel expenses would not be covered by the event's budget, and in order to minimize the cost of participation for each student, the fee for participation was arranged at 100 Euros for the PRACE members and 140 Euros for the non PRACE members, a low price compared to the overall costs of the Winter School.

The well planned allocation of the Winter School budget allowed for covering the travel expenses of the 10 lecturers and the Program Committee members. Half of the invited lectures paid for their flight tickets, while the accommodation expenses of all lectures were covered by the Winter School budget.

The initial budget for organizing the Winter School was not exceeded, due to the good management of the available financial resources and the registration fees which were received.

4 On Site

4.1 Registration and Opening

All the 48 registrants who had accepted and confirmed their participation showed up at the registration. At registration each participant received:

- A bag with the GRNET logo

- A binder with the handouts. Most of the trainers had sent their presentations prior to the opening and they were printed and placed in chronological order within the binders. The rest of the handouts were given to the participants on time during the PRACE Winter School.

- A printed version of the PRACE Winter School agenda.

- The evaluation form, which the participants were expected to fill in by parts everyday and hand it out by the end of the event.

- A form with the lunch options.

- A printed version of the bus schedule.

- A pencil.

- A copy of the report "Overview of Recent Supercomputers, 2007", by Aad Van der Steen. The report was kindly sent to the LOC from Dr. Peter H. Michielse and Naomi Messing from NCF.

- A badge with his/her name and the affiliation.

- A PRACE pin

- An announcement of the changes in the public transport, with a metro map and the bus schedules that could be used instead of the subway

- A notepad with the GRNET logo

- A pen

- The PRACE folder, containing the latest PRACE newsletter

- Information about the location of the social events' venues

The trainers also received a PRACE folder, which contained

- A usb flash memory of 1GB, with the GRNET logo

- A stencil

- A form with the lunch options

- A notepad with the GRNET logo

- Information about the location of the social events' venues

- The latest PRACE newsletter

- The PRACE brochure

- A PRACE pin

The PRACE Winter School agenda could also be found outside the lecture room, along with the menu and the bus schedule.

Each participant also received an invoice regarding the payment of the registration fee, and a signed Certificate of attending the PRACE Winter School, signed by the chair of the PC.

4.2 Hands-on Sessions

One of the objectives of the PRACE Winter School, apart from offering to the participants a deep insight on the current and the future HPC parallel programming trends, was to make them familiar with the novel HPC systems which have been installed in HPC centers all across Europe, within the PRACE framework. The Program Committee did not consider the POWER6 and the CELL systems as platforms for running the exercises, but as an opportunity to demonstrate to the students that the HPC Infrastructure can be easily accessible and that it is highly functional.

The participants were organized in groups of two, each one with an account to access the systems. The Program Committee decided that forming groups of two would be highly beneficial for the students in fostering cooperation and networking.

Exercises were prepared by Costas Bekas on Hybrid programming, Montse Farreras on UPC, Brad Chamberlain on Chapel and by Jordi Caubet and Rosa Badia on CELL programming. Paschalis Korosoglou (Hybrid), Tim Stitt (Chapel) and John Donners (Hybrid, UPC) were assistants during the exercises. Brad Chamberlain had created a webpage, specific to his exercises for the PRACE Winter School [10].

For the hands-on sessions, the administrators of the Huygens POWER6 system at SARA

- Sent John Donners on site, to present the system and a short introduction to the Loadleveler queuing and submission system

- Reserved 8 nodes which were exclusively dedicated to the PRACE Winter School students

- Created an account for every trainer and for each group of students prior to the PRACE Winter School, that would still be valid two weeks after the completion of the school

For the hands-on sessions, the administrators of the CELL system at BSC

- Decided to send Rosa Badia and Gabriele Carteni on site

- Invited Jordi Caubet from IBM

- Reserved the whole system for the PRACE Winter School

- Created 28 accounts for the students

- Prepared the presentations and the exercises for programming with CELL

The presentations and the exercises were handed out by the trainers before or during the PRACE Winter School and the LOC had uploaded them to the web page of the

event [4] **PRACE Winter School, http://pracewinterschool.grnet.gr**. The students could use their handouts to keep notes and check at the same time the uploaded presentations, in order to keep up with the lecturers.

4.3 Social events

Despite the short duration of the PRACE Winter School (3 + 1 bonus day), special care was taken for encouraging the bonding among the students. The cooperation was enhanced by urging them to work in groups of two during the hands-on sessions.

Additionally, two social events were organized:

- A dinner on Wednesday, February 11th, which took place in a restaurant in the picturesque area of Plaka in Athens. The participants enjoyed walking through the backstreets of this old neighborhood that extends at the foot of the Acropolis. The dinner venue was an old restaurant, known for high-quality food and the service that it offers. Two musicians played Greek music with their guitar and traditional instruments. Students, lectures and the members of all the Committees communicated on a different basis and enjoyed themselves, after two days of hard work and training.

- A night at a brewery. The Local Organizing Committee had decided that the second social event, that also signaled the end of the Winter School that proved to be highly successful, should not be an official dinner. The participants had the opportunity to discuss and exchange ideas.

5 Feedback from the Participants

In order to evaluate the quality of the PRACE Winter School both in terms of the quality of the lectures and its organization, a printed evaluation form was given to all students within the binder with the handout material that they received when they registered at the school reception on the first day of the event.

The students returned the questionnaires anonymously at the reception desk at the end of third day, for those that did not attend the 4th one of the PRACE Winter School and the end of the fourth day for those that attended the last day of the School.

From the 48 students that participated in the school, 38 returned the completed questionnaire anonymously to the reception desk at their last day of the school.

They were asked to use a rating as described in Table 14: Rating system used for the evaluation of the school's quality and Table 15 : Feedback from the students on overall questions shows the average rating achieved on the different parts of the PRACE Winter School. It must be noted that the overall course rating was 3.6, which must be considered as an excellent result.

Scale	Rating
Very Good	4
Good	3
Fair	2

Scale	Rating
Poor	1

Table 14: Rating system used for the evaluation of the school's quality

The highest rating was given to the Information desk, which got 3.86. One important finding from the evaluation statistics is the fact that the course, trainers, and lectures categories where rated as 3.68, 3.62 and 3.54 respectively, which is considered to be an excellent score and is highly rewarding for the PC's decision to choose the finest experts in their field.

The lowest rating was given to hands on sessions, which rated 3.41. Although the difference from the other categories is not significant based on the comments written in some of the questionnaires some students would prefer more time for the hands-on sessions. However due to the importance of the theoretical lectures and of the presentation of new advanced technologies it is the PC's general belief that the allocation of time between lectures and hands-on was optimal.

PC resources were also rated at the low end of the distribution of the various categories. We believe that this was due to the fact that there was 1 PC available for 2 students. Apart from practical reasons that would not allow 1 PC per student, it was decided from the beginning of the Winter School's organization that providing 1 PC for 2 students would facilitate the collaboration and the exchange between the students during the hands-on sessions. This was clearly visible at the time of the hands-on sessions, since the students where able to discuss in pairs and solve the exercises provided.

	Average	Deviation
Course	3.68	0.47
Trainers	3.62	0.49
Lectures	3.54	0.51
Hands-on sessions	3.41	0.55
Handouts	3.51	0.51
PC Resources	3.49	0.69
Material (bag, etc)	3.58	0.60
Registration	3.76	0.55
Information Desk	3.86	0.35
Lunch, coffee, etc	3.57	0.60
Social Events (dinner, etc)	3.73	0.45

Table 15 : Feedback from the students on overall questions

Students were also asked about their prior experience in various aspects of HPC programming. The rating is presented in Table 16 : Rating system used for the evaluation of the students' experience.

Scale	Rating
Master	4
Excellent	3
Good	2
Fair	1

Table 16 : Rating system used for the evaluation of the students' experience

Table 17 : Level of expertise on HPC programming models illustrates the average level of expertise of students in various aspects of HPC programming. On average students had fair to excellent knowledge of MPI programming, and Fair to good knowledge of OpenMP, Hybrid programming and optimization techniques. On the other hand the PGAS, Cell and next generation languages skills of the students were from none to fair before the PRACE Winter School, as it was demonstrated by the Training Survey.

It has to be noted that all students had knowledge of C and/or C++ as this was a prerequisite for the acceptance of students to the Winter School together with the knowledge of MPI and OpenMP parallel programming models

	Average
MPI Programming	2.22
OpenMP Programming	1.78
Hybrid Programming	1.46
Optimization Techniques	1.76
PGAS Programming	0.65
Next-Generation HPC languages	0.59
CELL Programming	0.95

Table 17 : Level of expertise on HPC programming models

The evaluation form also asked the students about their current professional status. Table 18 : Professional status of the students shows the number of students that declared one of the available options. Note that a few of the students used multiple answers to this question, i.e. Post Doc and Specialised Developer. We can see that most of the students where also Ph.D. students.

Professional Status	**Number of Students**
HPC Center Employee	8
Ph.D.	17
Post Doc	6
Specialized developer	3

Professional Status	Number of Students
Other	7

Table 18 : Professional status of the students

Further to the rating scheme used for the overall quality of the Winter School in the various aspects of its organization, the students were asked to comment on the quality of each lecture and hands-on session of the programme individually. All of the lecturers and courses were commented very positively and the overall comments follow the high rates that appeared in the overall evaluation as already shown in Table 15 : Feedback from the students on overall questions.

Besides asking about the quality and the relevance of the topics of the PRACE Winter School, we also took the opportunity to ask the participants which subjects they would like to be taught on any upcoming PRACE Schools. Although this question was not answered by all the students, by far the most desirable by far technology that they would like to see is GPU programming. The second choices were the profiling and optimizations tools. Finally some of the students also expressed interest in debugging, performance measurement tools, Blue Gene programming, use of Java in HPC, and parallel file-systems.

Finally it worth's noting that some of the students comments where related to the dense program of the school, that did not allow for enough free time. However we believe taking into account that the duration of the school was 4 days it was reasonable to give more emphasis on utilising most of the time for teaching.

6 Conclusion and Remarks on Upcoming PRACE Events

The PRACE Petascale Computing Winter School brought together 48 talented European HPC researchers and students that received four days of advanced training for four days on petascaling techniques. Leading experts on both current and future HPC programming trends, coming from Europe and the USA gave lectures on topics including MPI/OpenMP Hybrid programming, multicore optimizations, Partitioned Global Address Space (PGAS) programming with Universal Parallel C (UPC), next-generation HPC programming with 'Chapel', and programming the novel IBM CELL system. Apart from the high-quality training, the event provided a platform for discussion and future cooperation among the users of future Petascale systems in Europe.

Well-planned activities and the excellent cooperation between the members of all committees resulted in the materialization of a highly successful event that has greatly benefited the PRACE Winter School students, and encourages the enlargement of the European HPC Community. The topics that were included in the program, the high-level lecturers that delivered the training, as well as the background of the students were key-factors of the positive outcomes of the event.

The well-coordinated actions for the dissemination of the event attracted many high-qualified registrants from many European countries.

The sense of responsibility with which all organizational issues were arranged is depicted in the participants' very positive evaluation.

Successful training events constitute effective dissemination tools for future events. In this light, it is highly recommended that PRACE organises a summer school in the future, provided there are adequate human and financial resources. A large community is now aware of PRACE and its activities, and the positive outcomes of the Winter School can be used to attract a great number of people that would potentially participate in such an event.

With regards to the organizational issues, it is recommended that in future events, issues like the registration fee and the relevant payments should be planned and arranged well in advance. In the case of the Winter School, the members of the Organizing Committee had investigated various methods regarding the payment of the registration fee. Online payment was not feasible due to the fact that it is very expensive to implement; therefore it was decided that applicants should make a transfer to the PRACE Winter School dedicated bank account. Given this procedure, the members of the Organizing Committee had to check the list of the registrants that had completed the payment, in cooperation with the National Bank of Greece, which was time consuming, especially a few days before the commencement of the Winter School.

7 Annex

7.1 CVs of the Trainers

1: John Donners

John Donners is currently a member of the User Support staff for Huygens at SARA, Netherlands. He received his MSc in Computational Physics at the University of Nijmegen and his Ph.D. in Oceanography. The subject of his thesis was "Agulhas rings using high-resolution ocean models". He worked for two years (2005 – 2007) as a research scientist at the Earth Simulator Center in Yokohama, Japan. He is active in the PRACE and DEISA projects.

2: Paschalis Korosoglou

Paschalis Korosoglou is a member of the GRID Operations Center team of AUTH. He specializes on the administration of the GRID infrastructure, the study of applications, and the dissemination of knowledge, by preparing lectures and hands-on sessions. His expertise is parallel programming, by the implementation of the MPI and OpenMP protocols. Since 2006 he is the head of the User Support department of the Grid Operations Center of AUTH.

His research interests are focused on both scientific and computational issues. Currently he is working in major European projects. He was participating at the DYSONET project and his research targets on the study of social networks. He is also participating at the EGEE III and PRACE projects. In the latter he emphasizes on the study of HPC applications and his efforts concern the optimization and scaling of parallel codes in large HPC systems.

3: Costas Bekas

Costas Bekas is a Research Staff member with the IBM Zurich Research Lab.

He received his B. Eng., Msc and PhD, all from the Computer Engineering &Informatics Department, University of Patras, Greece, in 1998, 2001 and 2003 respectively. From 2003 to 2005, he worked as a postdoctoral associate with Professor Yousef Saad at the Computer Science & Engineering Department, University of Minnesota, USA. He has been with IBM since September 2005. His research interests involve numerical algorithms for high performance computing in computational science and engineering with an emphasis in massively parallel computations. Recent examples of his work involve ultra-scalable ab-initio molecular dynamics simulations within the context of the highly popular CPMD code, and massively parallel finite element simulations of human bone for the diagnosis and treatment of Osteoporosis.

4: William Jalby

William Jalby was appointed Associate Professor at University of Rennes in 1987, then promoted Full Professor of Computer Science in 1991 and moved in 1992 to University of Versailles. His areas of research are: performance evaluation, code optimization, memory hierarchies and embedded processing. From 1987 to 1992, W. Jalby has been working closely with CSRD (CEDAR project, University of Illinois). More recently, he is collaborating with CEA DAM (French equivalent of Los Alamos) on performance evaluation and with BULL on code optimization for Itanium and Xeon based SMP. He is the head of a joined Laboratory (LRC ITACA) between CEA DAM and University of Versailles, specialized in code optimization for High Performance Systems.

5: Montse Farreras

Montse Farreras received her MSc and PhD degrees in computer science at the Computer Architecture Department in UPC (Universitat Politecnica de Catalunya) in Barcelona in 2002 and 2008, respectively. She works as an associate professor at the same University, and an associate researcher in the Programming Models Team (Computer Science) at BSC (Barcelona Supercomputing Center). She has been collaborating with the Programming Models and Tools for Scalable Systems group at IBM Research since 2004, working on a scalable Runtime System for the XLUPC compiler. Her research interests are in programming models and languages for large scalable systems.

6: Bradford Chamberlain

Bradford Chamberlain is a Principal Engineer at Cray Inc., where he works on parallel programming models, focusing primarily on the design and implementation of the Chapel parallel language in his role as technical lead for that project. Before starting at Cray in 2002, he spent a year at a start-up working at the opposite end of the hardware spectrum to design a parallel language (SilverC) for reconfigurable embedded hardware. Brad received his Ph.D. in Computer Science & Engineering from the University of Washington in 2001 where his work focused on the design and implementation of the ZPL parallel array language, particularly on implementing and generalizing its region concept--a first-class index set representation for programming with distributed arrays. While at UW, he also dabbled in algorithms for accelerating the rendering of complex 3D scenes. Brad remains associated with the University of

Washington as an affiliate faculty member and recently co-led a seminar there that focused on the design of Chapel. He received his Bachelor's degree in Computer Science from Stanford University with honors in 1992.

7: Timothy Stitt

Timothy Stitt Ph.D. is currently an HPC Support Scientist with the Swiss National Supercomputing Centre (CSCS), Manno. Tim received his doctorate in computational physics from Queen's University, Belfast and subsequently spent five years lecturing in Computer Science at the University of the West Indies, Kingston, Jamaica. Prior to joining CSCS, Tim worked as an HPC Support Scientist with the Irish Centre for High-End Computing (ICHEC). His current research interests are primarily focused on evaluating novel HPC programming languages and paradigms.

8:Rosa M. Badia

Rosa M. Badia received the B.Sc. and Ph.D. degrees in computer science from the Technical University of Catalonia, Barcelona, Spain in 1989 and 1994. From 1989 to 2007 she has been lecturing at the Technical University of Catalonia on computer organization and architecture and VLSI design, both in undergraduate and graduate programs. She held an Associate Professor position at the Department of Computer Architecture, Technical University of Catalonia from 1997 till 2007. Since May 2008 she is a Scientific Researcher at the Spanish National Research Council (CSIC). Since year 2005 she is the manager of Grid computing and clusters Department at the Barcelona Supercomputing Center, a position that she currently holds at full-time. Her current research interest includes programming models for multi-core architectures, programming models for Grid environments and performance prediction and modeling of MPI applications. She has authored more than 70 publications in international conferences and journals.

9: Gabriele Carteni

Gabriele Carteni is an HPC System Administrator at the Operations Department of the Barcelona Supercomputing Center. He is fully involved in the PRACE Project (Distributed system management and deployment of prototype systems - WP4/WP5) and his work is related to the administration and technical assessment of a supercomputer based on the IBM PowerXCell processor. He holds a M.Sc. degree in Computer Engineering and a Ph.D. in Information Engineering from the University of Lecce (Italy). Gabriele Carteni has served on the staff of the Spaci Consortium (www.spaci.it) as system administrator of a HP 128CPUs IA64-based cluster and of the Euro-Mediterranean Center on Climate Change (www.cmcc.it) as the coordinator for the creation of a Supercomputing Center which hosts an IBM cluster of 30 IBM-P575 compute nodes and 5 NEC SX9 with vector CPUs. His interests include advanced management and performance evaluation of High Performance Computing systems.

10: Bernhard Fabianek

Bernhard Fabianek is since 1996 with the Information Society and Media Directorate-General of the European Commission, Brussels, Belgium, working as Networking Officer in the area of GÉANT and e-Infrastructures. His responsibilities include the supervision of the GÉANT2 project providing the world leading European research network. Recently he engaged in the area of High Performance Computing to facilitate the implementation of a peta-scale computing infrastructure in Europe.
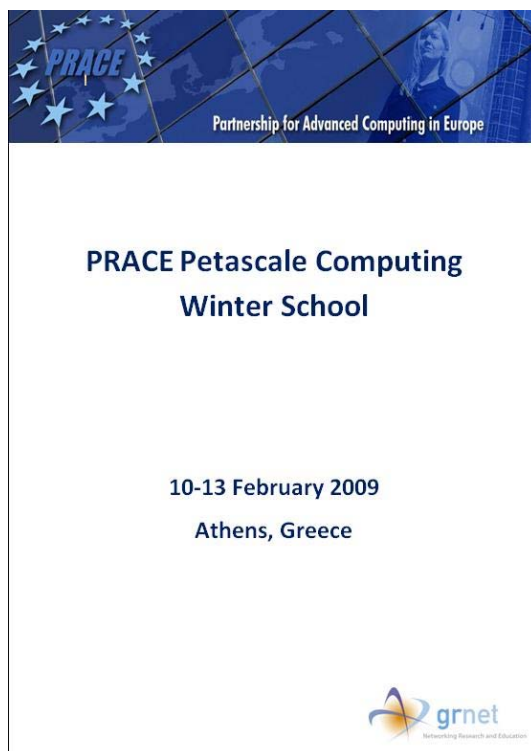
7.2 Promotional and other material which was produced and used during the Winter School:

7.2.1 Badges and Information for participants:

7.2.2 Cover page of binder & instructions for the social events

7.2.3 Program for each day

Tuesday, February 10th, 2009

[09:00-09:30]	High-Performance Computing in Europe - A view from the European Commission
Bernhard Fabianek, EC, Brussels	
[09:30-10:30]	Introduction to the POWER6 system
John Donners, SARA Netherlands	
[10:30-10:45]	Coffee Break
[10:45-11:00]	Current Parallel Programming Concepts
Paschalis Korosoglou, AUTH	
[11:45-12:00]	Break
[12:00-13:00]	Introduction to Parallel Computing: The Message Passing, Shared Memory and Hybrid paradigms
Costas Bekas, IBM Zurich	
[13:00-14:00]	Lunch
[14:00-15:45]	Hands-on Session : MPI, OpenMP and Their Hybrid
John Donners, SARA Netherlands, Paschalis Korosoglou, AUTH, Costas Bekas, IBM Zurich	
[15:45-16:00]	Coffee Break
[16:00-18:00]	Hands-on Session : MPI, OpenMP and Their Hybrid
John Donners, SARA Netherlands, Paschalis Korosoglou, AUTH, Costas Bekas, IBM Zurich	

Wednesday, February 11th, 2009

[09:00-10:00]	Unicore/Pipeline Optimization
William Jalby, Univ. de Versailles	
[10:00-10:15]	Coffee Break
[10:15-11:15]	Introduction To PGAS Programming
Montse Ferraras, UPC, Barcelona	
[11:15-11:30]	Break
[11:30-12:30]	Multicore Optimizations
William Jalby, Univ. de Versailles	
[12:30-14:00]	Lunch
[14:00-15:00]	Memory Hierarchy Optimizations
William Jalby, Univ. de Versailles	
[15:00-15:15]	Coffee Break
[15:15-16:15]	Tutorial : Introduction to the PGAS Programming Paradigm with UPC
Montse Farreras, UPC, Barcelona	
[16:15-16:30]	Break
[16:30-18:00]	Tutorial : Introduction to the PGAS Programming Paradigm with UPC
Montse Farreras, UPC, Barcelona	
[18:00-21:00]	Dinner

Thursday, February 12th, 2009

[09:00-10:00]	Chapel Background and Base Language
Brad Chamberlain, Cray Inc.	
[10:00-10:15]	Coffee Break

[10:15-11:15]	Task Parallel Features in Chapel
Brad Chamberlain, Cray Inc.	
[11:15-11:30]	Break

[11:30-12:30]	Data Parallel Features in Chpapel
Brad Chamberlain, Cray Inc.	
[12:30-14:00]	Lunch

[14:00-15:00]	Locality, Status and Future Directions
Brad Chamberlain, Cray Inc.	
[15:00-15:15]	Coffee Break

[15:15-17:00]	Hands-on : Programming, Compiling and Executing Chapel Programs
Brad Chamberlain, Cray Inc. Tim Stitt, CSCS-ETHZ	
[17:00-17:30]	Break

| [17:30-19:00] | Hands-on : Programming, Compiling and Executing Chapel Programs |
| Brad Chamberlain, Cray Inc. Tim Stitt, CSCS-ETHZ | |

Friday, February 13th, 2009

[09:00-10:00]	Introduction to CELL + MariCel Prototype Presentation
Gabriele Carteni, BSC	
[10:00-10:15]	Coffee Break

[10:15-11:15]	Programming with the IBM SDK, OpenMP for CELL
Jordi Caubet, IBM Spain	
[11:15-11:30]	Break

[11:30-12:30]	Programming with DaCS and AIF - Introduction to programming with CellSs
Jordi Caubet, BSC, Rosa Badia, BSC	
[12:30-14:00]	Lunch

[14:00-15:00]	Programming the CELL with CellSs
Rosa Badia, BSC	
[15:00-15:15]	Coffee Break

[15:15-17:00]	Hands-On Session : Programming the CELL with the IBM SDK, CellSs and MPI
Jordi Caubet, BSC Rosa Badia, BSC	
[17:00-17:15]	Break

| [17:15-18:00] | Hands-On Session : Programming the CELL with the IBM SDK, CellSs and MPI |
| Jordi Caubet, BSC Rosa Badia, BSC | |