SEVENTH FRAMEWORK PROGRAMME
Research Infrastructures

INFRA-2007-2.2.2.1 - Preparatory phase for 'Computer and Data Treatment' research infrastructures in the 2006 ESFRI Roadmap

PRACE

Partnership for Advanced Computing in Europe

Grant Agreement Number: RI-211528

D3.3.2
PRACE Summer School

Final

Version: 1.1
Author(s): Ulf Andersson, KTH
Date: 26.09.2008

Project and Deliverable Information Sheet

PRACE Project	**Project Ref. №: RI-211528**	
	Project Title: Partnership for Advanced Computing in Europe	
	Project Web Site: http://www.prace-project.eu	
	Deliverable ID: **D3.3.2**	
	Deliverable Nature: Other	
	Deliverable Level: PU	**Contractual Date of Delivery:** 30 / 09 / 2008
		Actual Date of Delivery: 30 / 09 /2008
	EC Project Officer: Maria Ramalho-Natario	

* - The dissemination level are indicated as follows: **PU** – Public, **PP** – Restricted to other participants (including the Commission Services), **RE** – Restricted to a group specified by the consortium (including the Commission Services). **CO** – Confidential, only for members of the consortium (including the Commission Services).

Document Control Sheet

Document	**Title: PRACE Summer School**	
	ID: D3.3.2	
	Version: 1.1	**Status:** Final
	Available at: http://www.prace-project.eu	
	Software Tool: Microsoft Word 2003	
	File(s): D3.3.2.doc	
Authorship	**Written by:**	Ulf Andersson, KTH
	Contributors:	Mike Hammill, KTH
	Reviewed by:	Manuel Fiolhais, UC-LCA Thomas Eickermann, FZJ
	Approved by:	Technical Board

Document Status Sheet

Version	Date	Status	Comments
0.1	05/09/2008	Draft	
0.9	17/09/2008	Second draft	Internal review
1.0	19/09/2008	Final version	
1.1	26/09/2008	Final version	Formatting fixed

Document Keywords and Abstract

Keywords:	PRACE, HPC, Research Infrastructure, Training, Education, Petascale, Summer School
Abstract:	The PRACE Petascale Summer School was given by KTH, CSC and FZJ at the main campus of KTH during August 26th to 29th. It attracted 31 students, representing all 14 PRACE member countries plus Ireland and South Africa. In the anonymous feedback answered by 26 students, the School received excellent grades.

Table of Contents

Project and Deliverable Information Sheet i

Document Control Sheet i

Document Status Sheet i

Document Keywords and Abstract ii

Table of Contents iii

List of Figures iv

List of Tables iv

References and Applicable Documents iv

List of Acronyms and Abbreviations iv

Executive Summary 1

1 Introduction 1

2 Preparation 2

2.1 **Initial planning** 2

2.2 **The Program Committee** 2

2.3 **The Budget** 3

2.4 **The Admission Committee** 5

2.5 **The Local Organizing Committee** 6

3 Carrying out P2S2 8

3.1 **Registration and Opening** 8

3.2 **The two Blue Gene/P days** 8

3.3 **The two Cray XT4 days** 9

3.4 **Summing-up** 9

4 Synergy effects 10

4.1 **The IHPCSS** 10

4.2 **WP3 face-to-face meeting** 10

4.3 **WP6 gromacs kick-off meeting** 10

4.4 **WP6 synthetic benchmark subtask meeting** 10

5 Evaluation 11

5.1 **Feedback from students** 11

5.2 **Feedback from lecturers** 12

6 Conclusions and recommendations for the Winter School 12

7 Annex 14

7.1 **Person Months spent on the PRACE Summer School** 14

7.2 **The Agenda** 14

7.3 **Student Evaluation of the PRACE Petascale Summer School (P2S2)** 18

7.4 **Massively parallel computations for the solution of the Helmholtz equation in homogeneous media** 35

List of Figures

Figure 1: Speed-up versus number of cores for a fixed problem size of 2048^3 on the Blue Gene/P computer Jugene. 36
Figure 2: Speed-up versus number of cores for a fixed problem size of 1024^3 on the Cray XT4 computer Louhi. 37

List of Tables

Table 1: Members of the Program Committee (PC). 2
Table 2: Budget for each student. 4
Table 3: Fee for academic participants depending on chosen accommodation. 4
Table 4: Brief summary of the budget. 5
Table 5: Members of the Admission Committee (AC). 6
Table 6: Students by country. 6
Table 7: Members of the Local Organizing Committee (LOC). 7
Table 8 Additional PDC staff that contributed to P2S2. 7
Table 9: Rating system used. 11
Table 10: Feedback from students on overall questions. 11
Table 11: Feedback answers on the question: “What topic would you like to see covered at the PRACE Petascale Winter School?”. 12
Table 12: Person Hours spent. 14

References and Applicable Documents

[1]The PRACE project, http://www.prace-project.eu
[2]http://www.iceage-eu.org/issgc07/
[3]Jugene, the Blue Gene/P in Jülich, http://www.fz-juelich.de/jsc/jugene/
[4]P2S2 website, http://www.pdc.kth.se/systems_support/training/2008/PRACE-P2S2/
[5]PRACE D3.3.1 “Survey of HPC Training and Educational Needs”

List of Acronyms and Abbreviations

CEA	Commissariat à l’ènergie atomique (The French Atomic Energy Commission)
CSC	The Finnish IT center for Science.
DoW	Description of Work for PRACE.
EPCC	Edinburgh Parallel Computing Centre.
FDTD	Finite-Difference Time-Domain Method (for the Maxwell equations)
FZJ	Forschungszentrum Jülich.
GRNET	Greek Research and Technology Network.
HPC	High Performance Computing; Computing at a high performance level at any given time; often used synonym with Supercomputing.

HPC-Europa	Consortium of six leading (HPC) infrastructures and five centres of excellence providing transnational access; EU project.
IHPCSS	Introduction to High-Performance Computing Summer School. (This abbreviation has been created for this document.)
KTH	Royal Institute of Technology in Stockholm, Sweden.
LOC	Local Organizing Committee of P2S2.
PC	Program Committee of P2S2.
PDC	Center for Parallel Computers at KTH.
PRACE	Partnership for Advanced Computing in Europe; Project Acronym.
P2S2	PRACE Petascale Summer School.
SC08	International Conference for High Performance Computing, Networking Storage and Analysis.

Executive Summary

The PRACE Petascale Summer School (P2S2) was carried out by PDC, CSC and FZJ at the main campus of KTH in Stockholm during August 26th to 29th. The first two days focused on the Blue Gene/P in Jülich and the final two days focused on the Cray XT4 at CSC. P2S2 also included invited lecturers from WP6 and WP7. This four-day event of advanced training targeted students from research groups with the ambition of becoming users of future Petascale systems in Europe. The primary goal was to give the participants hands-on experience on porting codes to massively parallel computers.

P2S2 attracted 31 students from 16 different countries, including all 14 PRACE countries. Attracting students from all over Europe to fill the 30 available places was one of the two main goals of this event. The other main goal was to organise a summer school with an agenda of advanced training material that suited experienced HPC users, and lived up to their expectations. The anonymous online feedback shows that we achieved this goal. 26 participants answered and on a scale from one to four (poor-fair-good-very good) the course received a rating of 3.30. The PRACE Summer School thus successfully fulfilled its two main goals.

1 Introduction

This document will describe preparation for, and the carrying out of, the PRACE Petascale Summer School (P2S2).

The PRACE DoW stipulates that PRACE [1] shall organize a Summer School in 2008 and a Winter School in 2009. The total budget for this is 30 000 Euro. (The DoW states 60 000 Euro but this has been changed by WP3.) It was agreed within WP3 that the Summer School and the Winter School should share the budget equally. The DoW also states that the Summer School shall be "on use of Petaflop/s systems".

PDC has a strong history in organizing summer schools. An annual two-week Introduction to High-Performance Computing Summer School (IHPCSS) has been given in August since 1996. In 2007 PDC hosted a very successful grid Summer School, ISSGC07, in Mariefred, close to Stockholm. [2] These were the merits that lead CSC to invite PDC to co-organize the PRACE Summer School. When it was later decided to include access to the Blue Gene/P in Jülich in the curriculum, FZJ was included among the organizers.

Since P2S2 ended on August 29th, there has not yet been time for the PC or the entire WP3 to make a detailed analysis and evaluation of the outcome. Such a discussion is of course very important and will take place when planning for the PRACE Winter School.

2 Preparation

2.1 Initial planning

In order to prepare a high-quality event in an efficient and effective manner, three committees with clearly defined tasks and responsibilities have been set up. A Programme Committee (PC) prepared the programme and had the overall responsibility for the event. In addition to that a Local Organizing Committee (LOC) was created with the responsibility for the on-site organisation. An Admission Committee (AC) was responsible for the selection of applicants. WP3 decided that the target group for the PRACE Summer School should be the researchers in the top-ten-user-groups of each PRACE site, i.e., the persons who had been invited to answer the PRACE "Survey of HPC Training and Educational Needs." [5] It was thus logical to conclude that the prerequisites for the PRACE Summer School would be experience with HPC.

It was a stated goal of WP3 to attract participants of many countries to P2S2, rather than filling it with Scandinavian students.

2.2 The Program Committee

The PC was populated with individuals that contributed the experience needed for this event and was extended to include additional competences as the programme evolved. The chairs took the overall responsibility and maintained close connections to the local site. Experienced persons involved in similar events in France and the UK were added as well as experts on BlueGene/P and Cray XT4, the machines used in the training sessions. It also turned out to be very useful to include a person that was involved in the "Survey of HPC Training and Educational Needs" [5] carried out by PRACE. Preliminary results from this Survey were already available and were taken into account in the agenda. Representatives from GRNET, which will organise the PRACE Winter School were included in the PC in order to maintain a close relation between the two events. Table 1 contains a list of persons and their main role in the PC.

Ulf Andersson, **PDC/KTH**, Sweden, *Chair*
Lennart Johnsson, **PDC/KTH**, Sweden, *Vice Chair*
Marina Bouianov, **CSC**, Finland, *Economy*
Wolfgang Frings, **FZJ**, Germany, *Blue Gene/P*
Jussi Heikkonen, **CSC**, Finland, *Cray XT4*
Fotis Karayannis, **GRNET**, Greece, *Winter School*
Dimitra Kotsokali, **GRNET**, Greece, *Winter School*
David Henty, **EPCC**, Great Britain, *WP6*
Jean-Philippe Nominé, **CEA**, France, *WP7*
Timothy Stitt, **CSCS**, Switzerland, *Training Survey [5]*

Table 1: Members of the Program Committee (PC).

The first phone meeting of the PC was held on April 17th. In total, the PC held ten phone meetings and one face-to-face meeting in Edinburgh on April 29th.

The PC decided that P2S2 should be a four-day event with the first two days focusing of the Blue Gene/P in Jülich [3] and the last two days focusing on the Cray XT4 at CSC, and that

hands-on experience should be the main focus. It was also decided to recommend the participants to bring their own codes and port them to the Blue Gene/P and/or the Cray XT4.

The format was decided to be lectures before lunch and hands-on exercises in the afternoon. Mark Bull was selected to give the WP6 related presentations, and Aad van der Steen and Jean-Phillipe Nominé shared the WP7 lectures. The complete agenda is available on the webpage [4] and is given in Annex 7.2.

The final agenda was set on the seventh phone meeting on May 19th. The webpage was published and a Press Release was issued on May 21st. The Local Organizing Committee (LOC) decided on the name PRACE Petascale Summer School (P2S2) in order to emphasize the Petascale aspect. In many cases we used the abbreviation PRACE P2S2 even though this technically is a repetition of PRACE. We did this in order to avoid confusion with another event in the US called P2S2, which stood for "First International Workshop on Parallel Programming Models and Systems Software for High-End Computing".

Individual e-mail invitations to P2S2 were sent on May 22nd to all the people selected for the Survey. [5] Registration was opened on May 26th. The deadline for registration was set to June 23rd, and the number of seats at P2S2 was set to 30. The limiting factor here was how many students it was possible to handle at the same time on either the Blue Gene/P or the Cray XT4. Jülich and CSC reported that they could most likely handle 40 students, but that 30 would be a more convenient number. In the end we allowed all the 31 qualified applicants access.

Registration was of course done online. The possibility to register is now closed but the registration procedure can still be seen on the P2S2 webpage [4]. The data from the registration was stored in a database so that we could easily update it if there were request for changes, e.g. a change of wanted accommodation. All accepted applicants were asked to fill in a second online form called "Additional Questions for Accepted Participants".

It has already been decided that the Summer School PC will serve as PC for the Winter School. We recommend that the PC shall be expanded with a representative of WP8.

2.3 The Budget

In order to make the event attractive for students from all countries it was decided to make P2S2 an inexpensive event to attend. It was thus decided that PRACE should subsidize each applicant, and that inexpensive accommodation should be available. Thus the hotel choice fell on a decent but rather low-budget hotel, Haga Kristineberg, and hostel accommodation was available. We also avoided having expensive lunches and dinners. The subsidy was not available to industrial participants. Table 2 contains a brief version of the budget. A more detailed budget is available from PC member Marina Bouianov, CSC. The fee of 1750 SEK (1 € = 9.474 SEK on Sept. 4th) included four nights in a four-bed room at the hostel STF Zinkensdamm. Choosing another accommodation option affected the fee. The different fees are listed in Table 3. Roughly two thirds of the students chose the most expensive option. Of the seven students who chose to fix accommodation themselves, three lived in Stockholm. This turnout indicates that we were overly concerned about making P2S2 as inexpensive as possible.

Four nights were included in the fee, with check-in on August 25th which was the day before registration. This was done since registration was between 8.30 and 9.15 on August 26th. A drawback with this setup was that check-out was the same day as the final Summer School day. This of course meant that some of the students had to leave early on the final day in order to catch their flights. In hindsight, it would have been better to let the applicants choose between four and five nights stay when registering.

Item	Cost (SEK)
Hostel, 4 nights	1120
Coffee, 4 days, twice a day	240
Summing-up Dinner	350
Lab room, 18 hours	1080
Lecture room, 12 hours	240
Lunches	320
Handouts	100
Miscellaneous	50
Total	**3500**
Subsidy	1750
Fee	1750

Table 2: Budget for each student.

Accommodation chosen	Fee (SEK)[1]	#participant
Hostel, **four**-bed room	1750	4
Hostel, **two**-bed room	2070	0
Hotel, single room	4330	18
Hotel, double room	6030	1
None	1000	7
Hotel paid for by P2S2 since this participant (Nikos Tsakiris) was also a lab helper.	1000	1

Table 3: Fee for academic participants depending on chosen accommodation.

The invited lecturers from WP6 and WP7 paid for their trips from their WP budgets. Their stay in Stockholm was paid for by the Summer School budget. A similar arrangement was done for Wolfgang Frings and Nikos Tsakiris.

The PC chair and the WP3 leader decided to subsidize a maximum of 20 non-Swedish participants of IHPCC with 950 SEK each, which was a little more than half the fee of 1700 SEK. This was a symbolic subsidy since the major cost for attending IHPCSS for foreign student are accommodation and travel that are not included in the fee.

A very brief summary of the total budget can be found in Table 2. It should be noted that these are not the final numbers but an estimate at the time of writing. They do however reflect the actual turnout, and not the initial budget. Again, a detailed budget is available from Marina Bouianov, CSC.

Item	SEK
Subsidy, 30 students of P2S2	52 500
Subsidy, 4 student of Intro to HPC	3 800
Hotel, visiting lecturers, excluding CSC, 17 nights	17 850
Coffee, lecturers and lab helpers	2 160
Lunch, lecturers and lab helpers	2 640
Summing-up dinner, lecturers and lab helpers, 10 persons	3 500
Picnic	3 420
Total, to be billed from PDC to CSC	**85 870**
Hotel, visiting lecturers from CSC, 10 nights	15 000
Travel, visiting lecturers from CSC, 2 lecturers	7 400

[1] **Industrial participants paid 1750 SEK more since no PRACE subsidy was available for them.**

Total, visiting lecturers from CSC (paid directly by CSC)	**22 400**
Total cost charged on PRACE WP3 Summer School budget	**108 270**
Available (15 000 Euro, 1 EURO=9.475 SEK on Sept. 4th)	**142 125**
Outcome	**+33 855**

Table 4: Brief summary of the budget.

The participants received a PRACE Heavy Computing T-shirt, a PRACE brochure and PRACE candy was available during the coffee breaks. This material was supplied by Anni Jakobsson of CSC and did not charge the Summer School budget.

It is our recommendation that the PRACE Petascale Winter School should not spend its budget on a general subsidy to all the students. The available resources should be spent on bringing in good lecturers and preparing good exercise material, and possibly on grants for selected applicants.

Furthermore, it is our recommendation that the Introduction to High-Performance Computing Summer School 2009 at PDC shall be offered as a PRACE summer school, and that a symbolic sum should again be used to subsidize each PRACE participant, perhaps half the fee. Just as this year, this subsidy should target students from outside Sweden.

2.4 The Admission Committee

In order to be prepared for the case of having more applicants than available places, WP3 decided to form an Admission Committee (AC). The members of the AC are listed in Table 5. The purpose of the AC was two-fold. It should

1. certify that the applicants were qualified, and
2. select applicants if we had more applicants than available places.

The second function was never needed. At registration deadline we had 24 applicants representing 9 PRACE Project countries and PRACE Initiative member Ireland. It was then decided to extend the deadline to July 2nd and to intensify the advertisements in the PRACE countries not represented.

To prepare for the ACs work, each applicant was instructed to submit a one page mini CV which certified that they were indeed experienced HPC users. Most of the applicants clearly fulfilled the prerequisites.

The AC held a phone meeting on June 25th. Prior to this meeting, the Working Group (WG) of the AC screened the CVs and decided which applicants that needed to be discussed in detail during the meeting.

One applicant was an Iranian citizen. Since Iranian citizen are not allowed to use the Blue Gene/P in Jülich or the Cray XT4 at CSC, he withdrew his application. In order to get an account at PDC, each accepted applicant had to submit a proof of nationality. Each participant did this and that made sure that there were no violations of the access rules for the Blue Gene/P in Jülich or the Cray XT4 at CSC. These proofs of nationalities are archived at KTH.

The participants did not need to access any PDC HPC systems. The user accounts were needed to login at the terminals in the lab rooms, named Yellow, Green and Brown, at CSC/KTH. (The School of Computer Science and Communication (CSC) at KTH is the school that hosts PDC, and user accounts at PDC are also valid in CSC lab rooms.)

Ulf Andersson, **PDC/KTH**, Sweden, *member of Working Group*
Ari Turunen, **CSC**, Finland, *member of Working Group*
Dimitra Kotsokali, **GRNET**, Greece

Dietmar Erwin, **FZJ**, Germany
Michel Masella, **CEA**, France
Tim Robinson, **CSCS**, Switzerland

Table 5: Members of the Admission Committee (AC).

In the end we had 31 accepted applicants representing all 14 PRACE Project countries, and one participant from PRACE Initiative partner Ireland. We were very pleased with this turn-out. All the 31 accepted applicants participated. There was no late drop-out. The participants are listed on the P2S2 webpage [4]. Table 6 lists their country, i.e., the country they work in, not their nationality. All but one participant were from PRACE countries (incl. Ireland). The exception was a student from South Africa. This student was also the only female student. Only one student was from industry, all the others were from academia. The industry participant was from the UK.

Country	#students
Austria	1
Finland	1
France	5
Germany	4
Greece	2
Ireland	1
Italy	2
Netherlands	1
Norway	1
Poland	1
Portugal	1
South Africa	1
Spain	3
Sweden	3
Switzerland	1
United Kingdom	3
Total	**31**

Table 6: Students by country.

Payment Procedure

An e-mail confirming that they had been accepted as participants were sent to all accepted applicants on June 26th. (Late applicant received this mail later of course.). Instructions on how to pay was sent on June 30th. The preferred method of payment was faxing in a completed payment sheet with a credit card number, but it was also possible to pay by bank transfer. The forms used for payment by credit card and fax are available at http://www.pdc.kth.se/systems_support/training/2008/PRACE-P2S2/register/
When payment had been received each accepted applicant was promoted to being a confirmed participant.

2.5 The Local Organizing Committee

The Local Organizing Committee (LOC) handled all the practical stuff such as booking lecture halls, lab rooms, coffee, lunches and dinner. It also handled the accommodations for the participants. Further tasks included ordering of binders, name tags and administrating the

copying of handouts. Mike Hammill was in charge of creating the webpage, which used the same format as the webpage for IHPCSS

The members of the LOC are listed in Table 7. Besides the actual members of the LOC, work was also performed by PDC staff listed in Table 8.

IBM Sweden supplied Nils Smeds as lab helper during the Blue Gene/P exercises. He was also partly present during the exercises on Thursday afternoon.

Ulf Andersson, **PDC/KTH**, Sweden, *chair*
Sebastian von Alfthan, **CSC**, Finland
Wolfgang Frings, **FZJ**, Germany
Peter Graham, **PDC, KTH**, Sweden
Mike Hammill, **PDC, KTH**, Sweden, *webmaster*
Michael Hanke, **CSC, KTH**, Sweden
Pekka Manninen, **CSC**, Finland
Nikos Tsakiris, **GRNET**, Greece

Table 7: Members of the Local Organizing Committee (LOC).

Name	Hours spent	Tasks
Elisabeth Hegrad	40	Handling payments
Susanne Bergman	20	Registration, booking accommodation, ordering dinner, lunches and coffee, handling coffee breaks.
Mattias Claesson	4	Creating user accounts & backup lab helper
Elisabeth Molin	4	Creating user accounts, machine room tour
Gert Svensson	2	Machine room tour
Tomas Oppelstrup	10	Lab helper on the Blue Gene/P exercises

Table 8 Additional PDC staff that contributed to P2S2.

Annex 7.1 contains a listing of the time spent by other PRACE members when contributing to P2S2.

3 Carrying out P2S2

3.1 Registration and Opening

All the 31 accepted and confirmed participants showed up at the registration. At registration each participants received:

- A binder with a PRACE cover. This binder was intended for the handouts, which mainly were copies of the presentations. All presentations are now available online on the webpage under "Course Work".
- A map of the KTH main campus.
- A printed version of the agenda.
- A list of participants in alphabetical order, where each participant had a number. This was the student roster that is now available on the P2S2 webpage [4] under the link Participants.
- A PRACE T-shirt.
- A KTH pencil.
- Three lunch coupons for lunches at the restaurant Syster o Bror Tuesday-Thursday. (Lunch the fourth day was a buffet at the restaurant Quantum and did not warrant a coupon.)
- A user account at PDC, if they did not already have one.
- A PRACE brochure.
- A copy of the Aad van der Steen report "Overview of recent supercomputers, 2007".

WP3 leader Ari Turunen from CSC opened P2S2 and Professor Lennart Johnsson held an introductory lecture about KTH and PDC. Ulf Andersson welcomed the students to P2S2 and covered the practicalities, see the Course Work link on the webpage [4]. As fun items during the summer school he listed:

1. The get-together picnic.
2. The summing-up dinner.
3. The machine room tour.
4. Porting of your own code to exciting architectures.

The final item was included with the genuine hope that most participants would indeed consider it fun to port a code to the Blue Gene/P and/or the Cray XT4.

A get together picnic was held at 18.30 on Tuesday evening. This was held in the main courtyard at PDC.

3.2 The two Blue Gene/P days

The first two days focused on the Blue Gene/P in Jülich with Wolfgang Frings as lecturer and lab leader. Technical staff in Jülich was standing by to assist the lab leader.

The prime option was for students to work on porting their own applications. For those who did not want to do so, there were exercises available. These instructions can be found on the course webpage under Course Work.

The students were given the guest accounts kurs1-kurs31, where the number was given by their number in the participant list.

Students who were able to show that their application scaled well on two racks were given the opportunity to run their code on all sixteen racks during Thursday afternoon. Two students did that. They were Benson Muite and Xavier Vassuer. The latter is from CERFACS and he worked together with his colleague Xavier Pinel. Annex 7.4 contains a brief description of their very successful runs.

Benson Muite's runs on sixteen racks during P2S2 were not successful due to a miscalculation in the amount of memory required. He was checking scaling for a two-dimensional computation of a spectral model of a Martensitic phase transformation. Successful runs were done on up to 16 384 processors with tracing done on up to 4092 processors. Results showed very good load-balancing characteristics but that even at 4092 processors a significant portion of the time was spent on communication. Further work continues on this in order to try and get better scalability. This is being done together with Brian Wylie at Jülich. A description of the algorithm and model can be found at http://people.maths.ox.ac.uk/~muite/.

The amount of time used at the Blue Gene/P was 3.71 Rack Days (= 365 kCPU hours). 2.26 Rack Days were spent on jobs running on the entire 16 racks. A total of 1175 jobs were submitted.

3.3 The two Cray XT4 days

The following two days focused on the Cray XT4 at CSC (Louhi) with Sebastian von Alfthan and Pekka Manninen as lecturers and lab leaders. In addition Olli-Pekka Lehto from CSC worked as a lab helper.

The students had the option of using the Cray XT4, or continue to work on porting their own code to the Blue Gene/P. The option of combining both work on the Cray XT4 and the Blue Gene/P was of course available and several students did this.

Again, the students had the option on porting their own application or working on prepared exercises that had been prepared by CSC. These exercises were on the subjects "Hybrid Programming" and "Performance Measurements Tools and Techniques." Like on the Blue Gene/P, participants received a guest account where the account name was based on their number in the participant list. A number of interactive nodes were reserved for the course which enabled a quick turnaround for launching small parallel jobs.

Several students had good success in porting their own codes to the Cray XT4 and took the opportunity to run large (up to 1000 cores) simulations with successful outcome.

In total the students used 14110555 CPU seconds on the Cray XT4. This equals 9200 CPU hours.

3.4 Summing-up

A Summing-up dinner was held at Thursday evening at Restaurant Jakthornet.

Each participant received a signed Certificate that they had attended the PRACE Petascale Summer School. These certificates were signed by the author of this document in his capacity as chair of the PC.

A machine room tour was offered during the exercise on Friday afternoon. This was done in conjunction with the machine room tour for IHPCSS students.

4 Synergy effects

Besides the PRACE Summer School itself, many other PRACE activities took place at KTH during the same week. A number of meetings were held in conjunction with the Summer School taking advantage of the fact that people working within PRACE were already at KTH. This means that a lot of progress for PRACE was achieved during the Summer School week. On the other hand, it became a very busy week for the staff at PDC.

4.1 The IHPCSS

Several of the lectures were also given to the Introduction to High-Performance Computing Summer School (IHPCSS). The P2S2 lectures on Tuesday by Wolfgang Frings were the only lectures not open to IHPCSS students. They had other compulsory lectures at that time. The advanced MPI, GPU Programming, Hybrid Programming and Performance Measurement Tools and Techniques lectures were compulsory to IHPCSS students. The lectures of Mark Bull were open to but not compulsory for IHPCSS students. This was done in order to keep the total schedule at 35 lecture hours and 35 lab hours.

4.2 WP3 face-to-face meeting

A WP3 face-to-face meeting was held on Tuesday afternoon. There were 12 participants plus one participant over the phone. Tuesday morning was used for a separate SC08-preparation meeting for WP3. On Monday evening PDC hosted a dinner for the attendants of the WP3 meeting. The Summer School lecturers who were already in Stockholm were invited to this dinner.

4.3 WP6 gromacs kick-off meeting

Summer school lecturer Sebastian von Alfthan is responsible for the PRACE benchmark code gromacs in WP6. One of the code developers of gromacs, Erik Lindahl lectured on IHPCSS on Monday, August 25 between 11.15 and 12.00, and Tim Robinson, CSCS, was also in Stockholm since he would attend the WP3 face-to-face meeting. Thus, it was very convenient to have a WP6 gromacs face-to-face kick-off meeting at PDC in the afternoon of that day. Lennnart Johnsson and Ulf Andersson from PDC were also present at this meeting.

4.4 WP6 synthetic benchmark subtask meeting

P2S2 lecturers Aad van der Steen and Mark Bull are also involved in the WP6 subtask on Synthetic benchmarks. The subtask leader Olli-Pekka Lehto, CSC, thus took the opportunity of having a face-to-face meeting at PDC after lunch on August 28th. Lennnart Johnsson, Daniel Ahlin and Ulf Andersson from PDC were also partly present at this meeting.

5 Evaluation

5.1 Feedback from students

In order to secure the opinions of the participating students, an online evaluation procedure was set up. A number of anonymous user accounts were created and the account information was printed on paper. Each of the 31 participants was then allowed to randomly select one paper. Thus, anonymity was assured and we were guarded against spammers and other attempts to misuse the feedback system.

Of the 31 participants 26 answered the online feedback forms. Table 9 lists the scale used and Table 10 lists the average rating on the different parts of P2S2. First, we note that the overall course rating was 3.3, which must be considered an excellent result.

Rating	4	3	2	1
Scale	Very Good	Good	Fair	Poor

Table 9: Rating system used.

The highest rating was given to the Computer resources which got 3.58. Considering that we had access to Europe largest computer this is not surprising, but it also shows that FZJ and CSC made an excellent job in making the Blue Gene/P and the Cray XT4 available and usable.

The lowest rating was given to handouts, which may be a reflection of the fact that some of the copies did not look so good after transforming them from ppts to pdfs. Most of them were also printed in black-and-white. Maybe some of students simply thought there was too much handouts.

	Average	Standard Deviation
Computer Resources:	3.58	0.61
Information:	3.45	0.69
Lunches, coffee, etc.:	3.40	0.60
Course:	**3.30**	**0.47**
Lectures:	3.15	0.49
Lecturers:	3.10	0.64
Labs:	3.10	0.55
Demonstrations:	3.00	0.76
Handout material:	2.80	0.77

Table 10: Feedback from students on overall questions.

Besides asking about quality and relevance of the different parts of P2S2 we also took the opportunity to ask the participants which subjects they would like to see taught on the PRACE Winter School. The result is listed in Table 11.

Topic	Yes	No	Not Selected
Introduction to Parallel I/O	13	1	12
Scientific Visualization	9	5	12
Introduction to Multi-Core Programming	16	3	7
Fundamental Unix/Linux skills	6	9	11
Programming Accelerators/GPUs	14	2	10
Introduction to PGAS Languages (UPC, Co-Array Fortran and Global Array Toolkit)	12	3	11
Software Carpentry with Fortran 65/2003	9	4	13

Table 11: Feedback answers on the question: "What topic would you like to see covered at the PRACE Petascale Winter School?".

It is hard to tell which subject is most wanted. Multi-Core Programming was given most votes, but is closely followed by Programming Accelerators/GPUs, Parallel I/O and PGAS Languages. It is however clear that Fundamental Unix/Linux Skills is the least wanted subject.

A significant portion of the survey is provided in the Annex to this document. The complete statistics are available under the non-public link "Teachers Only" on the P2S2 webpage. A detailed analysis of this feedback has not been performed yet. This will be done during the planning stages of the PRACE Winter School.

5.2 Feedback from lecturers

We did not have an automated system to collect feedback from the lecturers. They were instructed to share their view with the LOC or the PC by mailing them. To collect their impression of the Summer School it is advisable that the PC contacts them directly.

6 Conclusions and recommendations for the Winter School

The PRACE Petascale Summer School was a very successful event. It attracted the body of students it set out to attract, and it was well received by its attendants. This was mainly due to the excellent efforts of the participating lecturers and lab leaders. It was also due to the attitudes of the students, who were eager to learn and were keen to assist each other.

The Winter School will differ from the Summer School in some respects. The number of places (80) will be more than twice as many as the Summer School and it will be given at a hotel rather than on a university campus. It will also have the benefit of the full results of the Survey [5] and possibly access to Prototype systems. These differences mean that the planning and carrying-out cannot follow exactly the same track as the Summer School.

Having a four-day event was a successful approach, and we recommend a similar length for the Winter School. This recommendation is also supported by the results of the Survey.

More advertisement is needed. It was clear when we intensified our advertisements after the original deadline had passed that P2S2 was unknown in many places. Just sending e-mails to the target audience probably means that many of them never get the information because they

do not bother/have time to read the invitation e-mail. Our suggested solution to this challenge is to create an Advertisement Committee with a representative of each PRACE partner. Each Advertisement Committee member shall then be responsible for advertising the Winter School in his/her country.

7 Annex

7.1 Person Months spent on the PRACE Summer School

In Table 12 we summarize the efforts spent on this Summer School as reported from the contributors. Some of these numbers are estimates, and they also represent actual time spent, which might not be exactly the same as PRACE reported time. Some of this time will be charged against other Work Packages. The PRACE DoW stipulates that 8 PMs shall be used for the Summer School. Assuming 136 hours per PM we get 1088 Person Hours. This agrees well with actual time. Note however that not all the efforts of the PC and the AC members are included here.

Name	PRACE partner	Person Hours
Ulf Andersson	PDC	300
Mike Hammill	PDC	140
Elisabeth Hegrad	PDC	40
Susanne Bergman	PDC	20
Others	PDC	20
Pekka Manninen & Sebastian von Alfthan	CSC	281
Wolfgang Frings et al.	FZJ	130
Mark Bull	EPCC	43
J.-P. Nominé	CEA	16
Aad van der Steen		24
Nikos Tsakiris	GRNET	75
Paschalis Korosoglou	GRNET	16
Total		1105

Table 12: Person Hours spent.

7.2 The Agenda

(imported from http://www.pdc.kth.se/training/2008/PRACE_SummerSchool/Agenda/)

Lecturers:

SvA

Sebastian von Alfthan, CSC/Helsinki

UA

Ulf Andersson, PDC/KTH/Stockholm

MB

Mark Bull, EPCC/Edinburgh

WF

Wolfgang Frings, FZJ/J√ºlich

MH
Mike Hammill, PDC/KTH/Stockholm
MH2
Michael Hanke, KTH/Stockholm
LJ
Lennart Johnsson, PDC/KTH/Stockholm and Univ. of Houston.
PM
Pekka Manninen, CSC/Helsinki
JPN
Jean-Phillipe Nomin√©, GENCI/France (Unable to attnend, AvdS gave JPNs talk)
TO
Tomas Oppelstrup, KTH/Stockholm
NS
Nils Smeds, IBM
GS
Gert Svensson, PDC/KTH/Stockholm
AvdS
Aad van der Steen, Utrecht University/Netherlands.
AT
Ari Turunen, CSC/Helsinki.

General Remarks

- This scedule is subject to change. The dates and the main content are fixed and will NOT change, but single lectures may be moved and/or replaced.
- Generally, classes are from 9.15 to 18.00, with lectures in the morning and labs in the afternoon. However, there may be exceptions, so review the schedule carefully.
- Lectures are in lecture halls D2 (Lindstedtsv. 5, 3rd floor) and B2 (Brinellv. 23, ground floor) on KTH main campus.
- All the labs are in computer rooms Gul and Grön on KTH main campus. The computers in these rooms are Suns. Students may if they prefer bring a portable computer of their own and use the wireless network.
- A PDC machine room tour will take place on Friday, August 29th starting at 13.00. You will leave from computer room Gul in pre-arranged groups. Someone from PDC will come by to announce that the tour will begin. You will follow that person to the machine room. The tour is concurrent with the lab taking place at that time.
- Coffee breaks during lectures are just outside the lecture room; coffee breaks during labs are taken outside E3.
- The course Web site is: http://www.pdc.kth.se/systems_support/training/2008/PRACE-P2S2/
- Many of the lectures are concurrent with the ``Introduction to High-Performance Computing Summer School''.

Tuesday, 080826

8.30-9.15
Registration outside of D2
9.15-10.00, D2, AT,LJ,UA,MH
Welcome and Introduction
10.00-10.15
Coffee outside of D2
10.15-11.00, D2, WF

Lecture in Petascale Programming: The Blue Gene/P at Jülich, Introduction

11.15-12.00, D2, WF

Lecture in Petascale Programming: The Blue Gene/P at Jülich, A Case Study

12.00-13.15

Lunch at Syster o Bror

13.15-15.00, Gul/Grön, WF, NS

Lab in Petascale Programming: Porting a code to the Blue Gene/P.

15.00-15.15

Coffee outside of E3

15.15-18.00, Gul/Grön, WF, NS

Lab continued

18.30

``*Get-together" picnic* Meeting point is in front of D3

Wednesday, 080827

9.15-9.20, D2, UA

Message of the Day

9.20-10.00, D2, MB

Lecture in Petascale Programming: Petascaling of application and the PRACE benchmark suite.

10.00-10.15

Coffee outside of D2

10.15-11.00, D2, SvA

Lecture in Programming Languages: Advanced MPI 2, user defined datatypes, MPI I/O etc.

11.15-12.00, D2, TO

Case study: GPU Programming

12.00-13.15

Lunch at Syster o Bror

13.15-15.00, Gul/Grön, WF, NS

Lab in Petascale Programming: Porting a code to the Blue Gene/P.

15.00-15.15

Coffee outside of E3

15.15-18.00, Gul/Grön, WF, NS

Lab continued

Thursday, 080828

9.15-9.20, D2, UA

Message of the Day

9.20-10.00, D2, SvA

Lecture in Advanced Parallel Programming: Hybrid (MPI+OpenMP) programming

10.00-10.15

Coffee outside of D2

10.15-11.00, D2, SvA

Lecture in Advanced Parallel Programming: Hybrid (MPI+OpenMP) programming cont.

11.15-12.00, D2, MB

Lecture in Advanced Parallel Programming: Hybrid (MPI+OpenMP) programming cont.

12.00-13.15

Lunch at Syster o Bror

13.15-15.00, Gul/Grön, SvA, PM

Lab in Advanced Parallel Programming

15.00-15.15

Coffee outside of E3

15.15-17.00, Gul/Grön, SvA, PM

Lab continued

18.00

``Summing up'' dinner at a restaurant Jakthornet, (Fiskartorpsvägen 16)

Friday, 080829

9.15-9.20, B2, MH2, UA

Message of the Day

9.20-10.00, B2, PM

Lecture in Advanced Parallel Programming: Performance Measurement Tools and Techniques

10.00-10.15

Coffee outside of B2

10.15-11.00, B2, PM

Lecture continued

11.15-12.15, B2, AvdS

Lecture in Computer Architectures: Petascale architectures and the PRACE prototypes

12.15-13.15

Lunch at Quatum

13.15-15.00, Gul/Grön, SvA, PM

Lab in Performance Measurement Tools and Techniques

13.15-17.00, PDC, GS

PDC machine room tours in parallel with Lab

15.00-15.15

Coffee outside of E3

15.15-17.00, Gul/Grön, SvA, PM

Lab continued

Ulf Andersson, 2008-08-30

7.3 Student Evaluation of the PRACE Petascale Summer School (P2S2)

Included below are the most significant portions of the evaluation statistics. In particular, the overall statistics for all students are shown, but only the breakdown for the two largest groups of students, Ph.D. and HPC center employee, are given here. The statistics were gathered into an SQL database. The material below was imported from an HTML report generated from the SQL database at <http://www.pdc.kth.se/training/2008/PRACE_SummerSchool/Internt/Enkat/>.

Summary Statistics for All Students

Please take the time to fill out this form. It's probably easiest to fill it out as you proceed through the course. The feedback allows us to improve the course for next year. Thank you!

About You

Please tell us what type of student you are:

Student types (All days)

category	count
Ph.D.	14
HPC center employee	8
Post doc or higher academic position	3
Specialized developer within a larger application team	1

Total evaluations (including non-categorized): **26**

What was your level of expertise on the following topics?

Expertise on topics

Topic	Master	Excellent	Good	Fair	Not Selected
Performance Measurements Tools and Techniques	1	3	8	11	3
OpenMP	1	2	7	11	5
Hybrid Programming	0	0	5	13	8
MPP Machine Architecture	1	3	10	8	4
MPI	1	8	14	3	0

Overall Comments

Please consider the entire course when you answer the following questions.

Overall comments

	Average	Standard Deviation
Computer resources:	3.58	0.61
Information:	3.45	0.69
Lunches, coffee, etc.:	3.40	0.60
Course:	3.30	0.47
Lectures:	3.15	0.49
Lecturers:	3.10	0.64
Labs:	3.10	0.55
Demonstrations:	3.00	0.76

Handout material:	2.80	0.77

Ratings legend

rating	scale
4	Very Good
3	Good
2	Fair
1	Poor

Upcoming Winter School in Greece

Do you plan/want to attend the PRACE Petascale Winter School in Greece in February?

Attendance Prediction

Category	Yes	No	Not Selected
All	8	7	11

What topics would you like to see covered at the PRACE Petascale Winter School?

Winter School Topics

Topic	Yes	No	Not Selected
Introduction to Parallel I/O?	13	1	12
Scientific Visualization?	9	5	12
Introduction to Multi-Core Programming?	16	3	7
Fundamental Unix/Linux Skills?	6	9	11
Programming Accelerators/GPUs?	14	2	10
Introduction to PGAS Languages (UPC, Co-Array Fortran and Global Arrays Toolkit)?	12	3	11
Software Carpentry with Fortran 95/2003?	9	4	13

Detailed Questions

Please consider each lecture and lab in the following questions.

[In the following tables **rel** *means average relevance;* **qual** *means average quality; and* **stdev** *means standard deviation.]*

Evaluations by day

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Welcome and Introduction	Lecture	3.09	3.25	0.73	0.53
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.50	0.51	0.51
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.22	3.22	0.67	0.74
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.52	3.04	0.67	0.82
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.83	3.17	0.72	0.78
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.17	3.09	0.72	0.85
2008-08-27	GPU Programming	Lecture	3.23	3.14	0.75	0.83
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.45	3.10	0.60	0.79

2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	2.91	3.00	0.75	0.62
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.18	3.41	0.80	0.67
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.32	3.14	0.57	0.71
2008-08-29	Performance Measurement Tools and Techniques	Lecture	3.12	2.12	0.62	0.81
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.31	2.88	0.48	0.89
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.07	2.80	0.70	0.41
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.91	0.00	0.30
2008-08-29	PDC machine room tours in parallel with Lab	Tour	3.00	3.25	0.82	0.50

Evaluations by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.52	3.04	0.67	0.82
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.50	0.51	0.51
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.45	3.10	0.60	0.79
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.32	3.14	0.57	0.71
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.31	2.88	0.48	0.89
2008-08-27	GPU Programming	Lecture	3.23	3.14	0.75	0.83
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.22	3.22	0.67	0.74
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.18	3.41	0.80	0.67
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.17	3.09	0.72	0.85
2008-08-29	Performance Measurement Tools and Techniques	Lecture	3.12	2.12	0.62	0.81
2008-08-26	Welcome and Introduction	Lecture	3.09	3.25	0.73	0.53
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.07	2.80	0.70	0.41
2008-08-29	PDC machine room tours in parallel with Lab	Tour	3.00	3.25	0.82	0.50
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.91	0.00	0.30
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	2.91	3.00	0.75	0.62
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.83	3.17	0.72	0.78

Only Lectures by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual

2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.50	0.51	0.51
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.31	2.88	0.48	0.89
2008-08-27	GPU Programming	Lecture	3.23	3.14	0.75	0.83
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.22	3.22	0.67	0.74
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.18	3.41	0.80	0.67
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.17	3.09	0.72	0.85
2008-08-29	Performance Measurement Tools and Techniques	Lecture	3.12	2.12	0.62	0.81
2008-08-26	Welcome and Introduction	Lecture	3.09	3.25	0.73	0.53
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.07	2.80	0.70	0.41
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	2.91	3.00	0.75	0.62
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.83	3.17	0.72	0.78

Only labs by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.52	3.04	0.67	0.82
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.45	3.10	0.60	0.79
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.32	3.14	0.57	0.71
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.91	0.00	0.30

Averages by Course Type

Averages by Course Type

	Relevance	Quality
Blue Gene	3.49	3.22
Case Study	3.22	3.18
Computer Architecture	3.19	2.84
Programming Languages	3.15	3.16
Computing Environment	3.07	3.25
Performance Engineering	2.96	2.78

Summary Statistics Only for Ph.D. Students

Please take the time to fill out this form. It's probably easiest to fill it out as you proceed through the course. The feedback allows us to improve the course for next year. Thank you!

About You

Please tell us what type of student you are:

Student types (All days)

category	count
Ph.D.	14

Total evaluations (including non-categorized): **14**

What was your level of expertise on the following topics?

Expertise on topics

Topic	Master	Excellent	Good	Fair	Not Selected
Performance Measurements Tools and Techniques	0	1	2	8	3
OpenMP	0	1	3	6	4
Hybrid Programming	0	0	2	7	5
MPP Machine Architecture	0	2	5	4	3
MPI	1	5	6	2	0

Overall Comments

Please consider the entire course when you answer the following questions.

Overall comments

	Average	Standard Deviation
Computer resources:	3.67	0.49
Lunches, coffee, etc.:	3.46	0.52
Information:	3.38	0.77
Course:	3.38	0.51
Lectures:	3.23	0.44
Lecturers:	3.15	0.69
Labs:	3.15	0.55
Demonstrations:	2.82	0.75
Handout material:	2.69	0.75

Upcoming Winter School in Greece

Do you plan/want to attend the PRACE Petascale Winter School in Greece in February?

Attendance Prediction

Category	Yes	No	Not Selected
Ph.D.	5	3	6

What topics would you like to see covered at the PRACE Petascale Winter School?

Winter School Topics

Topic	Yes	No	Not Selected
Introduction to Parallel I/O?	9	1	4
Scientific Visualization?	6	3	5
Introduction to Multi-Core Programming?	11	2	1
Fundamental Unix/Linux Skills?	5	6	3
Programming Accelerators/GPUs?	9	2	3
Introduction to PGAS Languages (UPC, Co-Array Fortran and Global Arrays Toolkit)?	8	3	3
Software Carpentry with Fortran 95/2003?	5	3	6

Detailed Questions

Please consider each lecture and lab in the following questions.

[In the following tables **rel** *means average relevance;* **qual** *means average quality; and* **stdev** *means standard deviation.]*

Evaluations by day

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Welcome and Introduction	Lecture	3.08	3.38	0.86	0.51
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.62	3.69	0.51	0.48
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.33	3.50	0.65	0.67
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.77	3.23	0.44	0.83
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.85	3.31	0.69	0.63
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.15	3.31	0.80	0.75
2008-08-27	GPU Programming	Lecture	3.00	3.25	0.74	0.75
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.64	3.36	0.50	0.81
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.17	0.85	0.39
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.17	3.58	0.94	0.51
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.58	3.42	0.51	0.67
2008-08-29	Performance Measurement Tools and Techniques	Lecture	2.88	2.25	0.64	0.71
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.25	3.00	0.46	1.07
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.00	2.86	1.00	0.38
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	3.00	0.00	0.00
2008-08-29	PDC machine room tours in parallel with Lab	Tour	2.50	3.00	0.71	0.00

Evaluations by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.77	3.23	0.44	0.83
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.64	3.36	0.50	0.81
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.62	3.69	0.51	0.48
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.58	3.42	0.51	0.67
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.33	3.50	0.65	0.67
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.25	3.00	0.46	1.07
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.17	3.58	0.94	0.51
2008-08-27	Advanced MPI 2, user defined datatypes,	Lecture	3.15	3.31	0.80	0.75

	MPI I/O etc.					
2008-08-26	Welcome and Introduction	Lecture	3.08	3.38	0.86	0.51
2008-08-27	GPU Programming	Lecture	3.00	3.25	0.74	0.75
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.17	0.85	0.39
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	3.00	0.00	0.00
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.00	2.86	1.00	0.38
2008-08-29	Performance Measurement Tools and Techniques	Lecture	2.88	2.25	0.64	0.71
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.85	3.31	0.69	0.63
2008-08-29	PDC machine room tours in parallel with Lab	Tour	2.50	3.00	0.71	0.00

Only Lectures by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.62	3.69	0.51	0.48
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.33	3.50	0.65	0.67
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.25	3.00	0.46	1.07
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.17	3.58	0.94	0.51
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.15	3.31	0.80	0.75
2008-08-26	Welcome and Introduction	Lecture	3.08	3.38	0.86	0.51
2008-08-27	GPU Programming	Lecture	3.00	3.25	0.74	0.75
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.17	0.85	0.39
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.00	2.86	1.00	0.38
2008-08-29	Performance Measurement Tools and Techniques	Lecture	2.88	2.25	0.64	0.71
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	2.85	3.31	0.69	0.63

Only labs by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.77	3.23	0.44	0.83
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.64	3.36	0.50	0.81
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.58	3.42	0.51	0.67
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	3.00	0.00	0.00

Averages by Course Type

Averages by Course Type

	Relevance	Quality
Blue Gene	3.68	3.43
Programming Languages	3.22	3.37
Case Study	3.17	3.38
Computer Architecture	3.13	2.93
Computing Environment	3.00	3.33
Performance Engineering	2.88	2.92

Summary Statistics Only for HPC Center Employee Students

Please take the time to fill out this form. It's probably easiest to fill it out as you proceed through the course. The feedback allows us to improve the course for next year. Thank you!

About You

Please tell us what type of student you are:

Student types (All days)

category	count
HPC center employee	8

Total evaluations (including non-categorized): **8**

What was your level of expertise on the following topics?

Expertise on topics

Topic	Master	Excellent	Good	Fair	Not Selected
Performance Measurements Tools and Techniques	1	2	5	0	0
OpenMP	1	1	4	2	0
Hybrid Programming	0	0	3	4	1
MPP Machine Architecture	1	1	3	2	1
MPI	0	3	5	0	0

Overall Comments

Please consider the entire course when you answer the following questions.

Overall comments

	Average	Standard Deviation
Demonstrations:	3.50	0.58
Information:	3.40	0.55
Computer resources:	3.20	0.84
Course:	3.20	0.45
Lunches, coffee, etc.:	3.00	0.71
Lectures:	3.00	0.71
Lecturers:	3.00	0.71
Labs:	3.00	0.71
Handout material:	3.00	0.71

Ratings legend

rating	scale
4	Very Good
3	Good
2	Fair
1	Poor

Upcoming Winter School in Greece

Do you plan/want to attend the PRACE Petascale Winter School in Greece in February?

Attendance Prediction

Category	Yes	No	Not Selected
HPC center employee	1	2	5

What topics would you like to see covered at the PRACE Petascale Winter School?

Winter School Topics

Topic	Yes	No	Not Selected
Introduction to Parallel I/O?	3	0	5
Scientific Visualization?	1	1	6
Introduction to Multi-Core Programming?	2	1	5
Fundamental Unix/Linux Skills?	1	2	5
Programming Accelerators/GPUs?	4	0	4
Introduction to PGAS Languages (UPC, Co-Array Fortran and Global Arrays Toolkit)?	3	0	5
Software Carpentry with Fortran 95/2003?	2	1	5

Detailed Questions

Please consider each lecture and lab in the following questions.

[In the following tables **rel** *means average relevance;* **qual** *means average quality; and* **stdev** *means standard deviation.]*

Evaluations by day

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Welcome and Introduction	Lecture	3.14	3.25	0.69	0.46
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.38	0.53	0.52
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.12	2.88	0.83	0.83
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.29	2.86	0.76	0.90
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	3.00	3.29	0.82	0.76
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.43	2.86	0.53	1.07
2008-08-27	GPU Programming	Lecture	3.43	3.00	0.79	1.15
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.17	2.83	0.75	0.75
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.00	0.58	0.82
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.14	3.43	0.69	0.79

2008-08-28	Lab in Advanced Parallel Programming	Lab	3.14	3.14	0.38	0.38
2008-08-29	Performance Measurement Tools and Techniques	Lecture	3.50	2.17	0.55	0.98
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.33	2.67	0.52	0.82
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.17	2.83	0.41	0.41
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.83	0.00	0.41
2008-08-29	PDC machine room tours in parallel with Lab	Tour	3.50	3.50	0.71	0.71

Evaluations by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-29	PDC machine room tours in parallel with Lab	Tour	3.50	3.50	0.71	0.71
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.38	0.53	0.52
2008-08-29	Performance Measurement Tools and Techniques	Lecture	3.50	2.17	0.55	0.98
2008-08-27	GPU Programming	Lecture	3.43	3.00	0.79	1.15
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.43	2.86	0.53	1.07
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.33	2.67	0.52	0.82
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.29	2.86	0.76	0.90
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.17	2.83	0.41	0.41
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.17	2.83	0.75	0.75
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.14	3.43	0.69	0.79
2008-08-26	Welcome and Introduction	Lecture	3.14	3.25	0.69	0.46
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.14	3.14	0.38	0.38
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.12	2.88	0.83	0.83
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	3.00	3.29	0.82	0.76
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.00	0.58	0.82
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.83	0.00	0.41

Only Lectures by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	The Blue Gene/P at Julich, Introduction	Lecture	3.50	3.38	0.53	0.52
2008-08-29	Performance Measurement Tools and	Lecture	3.50	2.17	0.55	0.98

	Techniques					
2008-08-27	GPU Programming	Lecture	3.43	3.00	0.79	1.15
2008-08-27	Advanced MPI 2, user defined datatypes, MPI I/O etc.	Lecture	3.43	2.86	0.53	1.07
2008-08-29	Petascale architectures and the PRACE prototypes (part 1)	Lecture	3.33	2.67	0.52	0.82
2008-08-29	Petascale architectures and the PRACE prototypes (part 2)	Lecture	3.17	2.83	0.41	0.41
2008-08-28	Hybrid (MPI+OpenMP) programming cont.	Lecture	3.14	3.43	0.69	0.79
2008-08-26	Welcome and Introduction	Lecture	3.14	3.25	0.69	0.46
2008-08-26	The Blue Gene/P at Julich, A Case Study	Lecture	3.12	2.88	0.83	0.83
2008-08-27	Petascaling of application and the PRACE benchmark suite.	Lecture	3.00	3.29	0.82	0.76
2008-08-28	Hybrid (MPI+OpenMP) programming	Lecture	3.00	3.00	0.58	0.82

Only labs by relevance, quality

day	title	type	rel	qual	stdev rel	stdev qual
2008-08-26	Porting a code to the Blue Gene/P.	Lab	3.29	2.86	0.76	0.90
2008-08-27	Porting a code to the Blue Gene/P.	Lab	3.17	2.83	0.75	0.75
2008-08-28	Lab in Advanced Parallel Programming	Lab	3.14	3.14	0.38	0.38
2008-08-29	Lab in Performance Measurement Tools and Techniques	Lab	3.00	2.83	0.00	0.41

Averages by Course Type

Averages by Course Type

	Relevance	Quality
Blue Gene	3.33	3.05
Case Study	3.27	2.93
Computer Architecture	3.25	2.75
Computing Environment	3.22	3.30
Programming Languages	3.18	3.11
Performance Engineering	3.16	2.79

Course Type Legend

Course type legend

grouping	title
Blue Gene	Porting a code to the Blue Gene/P.
Blue Gene	Porting a code to the Blue Gene/P.
Blue Gene	The Blue Gene/P at Julich, Introduction
Case Study	The Blue Gene/P at Julich, A Case Study
Case Study	GPU Programming
Computer Architecture	Petascale architectures and the PRACE prototypes (part 1)

Computer Architecture	Petascale architectures and the PRACE prototypes (part 2)
Computing Environment	Welcome and Introduction
Computing Environment	PDC machine room tours in parallel with Lab
Performance Engineering	Petascaling of application and the PRACE benchmark suite.
Performance Engineering	Performance Measurement Tools and Techniques
Performance Engineering	Lab in Performance Measurement Tools and Techniques
Programming Languages	Lab in Advanced Parallel Programming
Programming Languages	Hybrid (MPI+OpenMP) programming
Programming Languages	Advanced MPI 2, user defined datatypes, MPI I/O etc.
Programming Languages	Hybrid (MPI+OpenMP) programming cont.

o

Comments

Overall Comments on the Summer School

PRACE Petascale Summer School 2008, Overall Comments

id	category	comments
3ylx	Ph.D.	I would like to thank the organizers of the course for their hospitality and for having taken care of everything. I just would like to emphasize that perhaps the hands-on sessions could have been organized in a different manner, with lectures taking place at the same time.
ezau	Ph.D.	Ulf did a fantastic job organising the course.
n0la	HPC center employee	Thanks for hosting this course, was a great experience
xztd	Ph.D.	The best part is that you can work with your own project (which tends to be much more motivating than lab exercises) and that you get access to such great computers.

Suggested Improvements

What are your suggestions for improvement?

PRACE Petascale Summer School 2008, Improvements

id	category	comments
3ylx	Ph.D.	I would prefer the labs to be considered as part of a lecture, where the lecturer will give his talk on his subject, by presenting examples and exercises, which the students will try at the same time to solve and understand.
ezau	Ph.D.	Lectures could have been a little shorter. Would have been helpful to ask participants to indicate research area or website with research information.
n0la	HPC center employee	Group photo at the end of the course. Pre course access to systems with small portation guide to have ready to run executables at the beginning of the course. First evening event with little more guidance, e.g. meeting at a pub afterwards.
xjd1	Ph.D.	Perform labs more guided. Maybe go through basic exercises together and explain most important aspects.
zfvr	Ph.D.	maybe some more lectures about how to optimize the code, more skills or tricks about the MPI programming

Most Enhancing for Students' Professional HPC Development

What experiences during the PRACE Petascale Summer School do you think might have most enhanced your current and/or future professional HPC development?

PRACE Petascale Summer School 2008, Enhancements

id	category	comments
0uyz	HPC center employee	bluegene porting experience .
3ylx	Ph.D.	The hands-on sessions were very important. You don't get every day the opportunity to use a hpc.
ezau	Ph.D.	Meeting and talking with other researchers.
gozv	Ph.D.	interaction with the tutors
n0la	HPC center employee	OpenMP with MPI does not pay off. Beat MPI vendor with a stick, if library performs poorly. Big jobs are rare jobs.
ptyc	Ph.D.	Code porting opportunities
uofl	HPC center employee	hybrid programming
xjd1	Ph.D.	Instrumentation and Debugging
zfvr	Ph.D.	access to the Blue Gene/P lectures about the parallel I/O
zgx2	Ph.D.	GPU programming really seems to me an interesting area which really catch my eyes.

Winter School Desired Topics

Are there any other topics you would like to see covered at the PRACE Petascale Winter School in Greece?

PRACE Petascale Summer School 2008, Winter School Topics

id	category	comments
3ylx	Ph.D.	Perhaps it would be interesting to attend some lectures concerning the hardware and the architecture of the processors, the different memories.
ezau	Ph.D.	Participant research overview.
j1fv	Ph.D.	MPI software design (structuring of MPI communication and datatypes + portability design).
uofl	HPC center employee	Alternatives parallelel programming paradigms.
zgx2	Ph.D.	Cell processor architecture and programming

Comments on Individual Lectures and Labs

Comments on Welcome and Introduction (lec)

No comments

Comments on The Blue Gene/P at Julich, Introduction (lec)

id	category	comments
2gwm	HPC center employee	Very interesting talk
3ylx	Ph.D.	It was a very good talk and many details concerning the BG/P were presented. Moreover the slides were extremely helpful during the lab.
mp1t	Specialized developer within a larger application team	Good lecturer with an obvious enthusiasm for his subject.

Comments on The Blue Gene/P at Julich, A Case Study (lec)

id	category	comments
j1fv	Ph.D.	It would be nice to see more in detail what kind of changes were made.
mp1t	Specialized developer within a larger application team	Exactly the sort of information I was looking for when I signed up for the summer school.
zfvr	Ph.D.	maybe talking about the compiling options on Blue Gene/P are more interesting

Comments on Porting a code to the Blue Gene/P. (lab)

id	category	comments
2gwm	HPC center employee	The course is too focused on porting your own code...
3ylx	Ph.D.	It would have been nice if at the beginning of the hands-on lab we had a brief introduction to the exercises.
ezau	Ph.D.	Was able to port my code to Blue Gene P. Given the time available, the porting was not optimal, but the code worked and could run on two racks.
gozv	Ph.D.	took me to long to port my code, but i must admit that i should have asked sooner to get help
j1fv	Ph.D.	Exercises were not very well prepared, but their relevance made them very worthwhile. It would be better to have some more battletested exercises ready. I would also prefer to have exercises available in more than just Fortran.
mp1t	Specialized developer within a larger application team	It's a difficult topic, trying to teach students how to port a code in an afternoon. On the one hand the examples have to be small enough to comprehend quickly, on the other if they are too small they are unrepresentative. I think the examples erred towards being too small to be instructive.
zfvr	Ph.D.	It is a little bit unclear about how to log in to Blue Gene/P by just looking at the lecture notes

Comments on Petascaling of application and the PRACE benchmark suite. (lec)

id	category	comments
j1fv	Ph.D.	Difficult subject to present, especially given the conclusions.

mp1t	Specialized developer within a larger application team	Illuminating view of what is running on (a selection of) Europe's largest computers.
wclg	Post doc or higher academic position	too long for the subject and not many relevant conclusions

Comments on Advanced MPI 2, user defined datatypes, MPI I/O etc. (lec)

id	category	comments
ezau	Ph.D.	Have used these before. Seem to be architecture and MPI implementation dependent.
j1fv	Ph.D.	More detailed examples and applications would be nice, timing information as well. Still, this was more in detail than all before, and that was very appreciated.
jclm	Ph.D.	Motivation for the topic was missing, also the lecturer skipped over examples so fast that they were quite useless.
mp1t	Specialized developer within a larger application team	The overall conclusion seemed to be that MPI-2 provides few advantages over MPI-1
wclg	Post doc or higher academic position	A bit boring style of presentation.
zfvr	Ph.D.	maybe more about MPI I/O, or other topics about advanced MPI

Comments on GPU Programming (lec)

id	category	comments
3ylx	Ph.D.	It was a very good talk.
ezau	Ph.D.	Was an overview. Detailed analysis of an application or comparisons between CPU only and CPU+GPU implementations of a program would have been helpful.
gozv	Ph.D.	very interesting, but not supported by the labwork
j1fv	Ph.D.	Since these systems are not yet available, and everyone seems to agree that programming for them is very hard and portability is low, the main relevance here is probably awareness. But given the fact that we don't have much time for lectures anyway, I doubt we should have spent an hour on this.
s5im	Ph.D.	This topic would have needed more time to cover it more than just in a very basic overview, which is not so useful alone.

Comments on Porting a code to the Blue Gene/P. (lab)

id	category	comments
4ivj	Ph.D.	I could not run the third exercise since I hade some trouble with a library/path for mpi... The exercise material should have contained some more information how to

		interpret the results (e.g. run times etc). The distribution of the students in 3 different rooms made it difficult to ask all upcoming questions to the teachers (they were usually in another room ;)
ezau	Ph.D.	Needed to spend more time on understanding traces for my code. Would have been helpful to have more time on BG/P.
j1fv	Ph.D.	As before, the availability of the lab assistants to discuss your own code is very much appreciated.
mp1t	Specialized developer within a larger application team	Useful opportunity to use some performance analysis tools not currently available at my place of work.

Comments on Hybrid (MPI+OpenMP) programming (lec)

id	category	comments
ezau	Ph.D.	Was useful, however, the model seems to work best for thick node systems.
j1fv	Ph.D.	See below
mp1t	Specialized developer within a larger application team	When the lecturer is not convinced, it's hard for him to be convincing.
wclg	Post doc or higher academic position	Too many issues mentioned. The whole lecture was rather superficial and of not much use for a beginner in openMP. It would be better to say less but more precisely
xztd	Ph.D.	Since the performance of Hybrid programming is so poor it was not very motivating to listen to the talk. Could just have been mentioned and then the time could have been spent more on MPI which is known to yield good performance.

Comments on Hybrid (MPI+OpenMP) programming cont. (lec)

id	category	comments
ezau	Ph.D.	Useful summary that the model is very environment dependent - shows need for building good relationships with HPC centers and vendors.
gozv	Ph.D.	interesting to see things not work
j1fv	Ph.D.	These lectures were very relevant, but the main problem here is that it remains a bit unclear how the presented results carry over to different architectures and MPI implementations. Still the message was clear.
mp1t	Specialized developer within a larger application team	Even though the case study concluded that hybrid programming was not worth the effort, the reasons why this should be so were very interesting and useful in a wider domain.
wclg	Post doc or higher	Fair presentation of all pros and contras. Good ratio of number of new information to details.

	academic position	

Comments on Lab in Advanced Parallel Programming (lab)

id	category	comments
3ylx	Ph.D.	Very interesting and stimulating exercises.
ezau	Ph.D.	Was good, however I spent most of my time working on scaling my code on Jugene since there was a testing window.
j1fv	Ph.D.	I would have preferred more detail.
wclg	Post doc or higher academic position	Exercise material was not very helpful. I would expect more worked out example code.

Comments on Performance Measurement Tools and Techniques (lec)

id	category	comments
0uyz	HPC center employee	it was focused only in the CRAY performance tool, may be in the future will be useful to have a brief introduction to other performance tools available in multiple architectures.
c6vz	Post doc or higher academic position	The lecturer could be an expert, but he was not an experienced lecturer.
ezau	Ph.D.	Should have had this lecture first, for both Jugene and Cray systems. Users could then have chosen to port their code to one of the two systems and then work on them.
j1fv	Ph.D.	When discussing Cray specific tools, and mentioning the fact that these tools are limited to purely Cray machines, why then go into such extensive detail of the exact compilation and the precise format of output without even explaining what the program we are profiling is doing? How should we learn anything about how to profile effectively if we don't know the program, and won't use this profiling tool? More general please.

Comments on Petascale architectures and the PRACE prototypes (part 1) (lec)

id	category	comments
4ivj	Ph.D.	The slides were just a collection of "screen shots" and were hardly to read... The focus was too much on details and too little on more general aspects.
ezau	Ph.D.	Nice to know what the future holds and where to apply for computing time.
j1fv	Ph.D.	My only gripe is a question, why did we not start with this overview? It provided an excellent overview of where we are and where we are going.

Comments on Petascale architectures and the PRACE prototypes (part 2) (lec)

id	category	comments
ezau	Ph.D.	A good historical overview of the supercomputing cycle.
j1fv	Ph.D.	Too short

Comments on Lab in Performance Measurement Tools and Techniques (lab)

id	category	comments
ezau	Ph.D.	The lab was good, however I had problems porting my code to the CRAY system and should have concentrated on doing a similar exercise on Jugene. However, the CRAY measurement tools seemed more user friendly than those on Jugene, but perhaps not so suited to MPP systems. This is a nice addition, typically machine rooms cannot be accessed, and it is nice to know a little more about the machine that is being used. While I would have liked to attend, the time was better spent working on my code since access to the machines is limited.
j1fv	Ph.D.	Did not take part
ptyc	Ph.D.	Worked on code porting and performance in Jugene

Comments on PDC machine room tours in parallel with Lab (tour)

id	category	comments
j1fv	Ph.D.	Did not take part

Mike Hammill, 2008-09-19

7.4 Massively parallel computations for the solution of the Helmholtz equation in homogeneous media

by H. Calandra, S. Gratton, X. Pinel and X. Vasseur

During the PRACE Petascale Summer School held in Stockholm on August 26th-29th, it was possible for participants to port application codes to the Blue Gene/P computer Jugene at Jülich, Germany and the Cray XT4 computer Louhi at Espoo, Finland. A code for geophysical seismic imaging based on the implicit solution of the Helmholtz equation in the frequency domain was ported to both architectures at this time. Standard discretization methods such as finite-difference and finite-element methods lead to complex-valued linear systems of size depending linearly on the frequency. For the range of frequency of interest for geophysicists, we have thus to consider huge linear systems of size larger than one billion for realistic three-dimensional applications. Nevertheless, according to recent trends concerning massively parallel architectures, solving the implicit Helmholtz equation in the frequency domain seems now feasible, because large distributed memories and efficient interconnects become available. However for wave propagation problems at high frequencies, it is known that many iterative methods suffer from slow convergence due to the indefiniteness of the Helmholtz operator. Thus the development of fast iterative methods for high-frequency Helmholtz problems remains a subject of active research. The main challenge lies in designing an efficient numerical method on massively parallel architectures.

The proposed numerical method is based on a combination of multigrid and Krylov subspace methods, where multigrid is used as a preconditioner. The main motivation for this choice is the memory scalability property of all the components involved in the resulting algorithm. Strong scalability experiments (where the problem size is kept constant independently of the number of processors) have been performed on Jugene and Louhi respectively. Figure 1 and **Figure 2** below displays the speed-up of the code on both these platforms. It can be noticed that a superlinear speed-up is obtained due to cache effects. Weak scalability experiments (where the number of unknowns per processor is kept constant) have been also performed on both architectures. The solution time per iteration was found to be nearly constant on both platforms. The largest test case that has been considered is the solution of a linear system of size 4096^3 on 65 536 cores of the Blue Gene/P computer. 9634 seconds were required to

reduce the norm of the normalized residual by a factor of 10^6. The total memory required by our algorithm was about 10 892 GB for this challenging frontier calculation.

The ability to solve, for the first time, very large Helmholtz related problems with over 68*10^9 unknowns on a massively parallel platform has been notably shown during the PRACE summer school and will be reported in a forthcoming paper. This is a first step towards an efficient parallel solution method for the inverse problem which enables geophysicists to deduce from experimental data the structure of the subsoil.

We would like to thank Dr. Ulf Andersson (PDC/KTH, Sweden) for having organized such a successful summer school. We greatly acknowledge Wolfgang Frings (Jülich Supercomputing Centre, Germany) and Dr. Sebastian von Alfthan (Finnish IT Center for Science, CSC, Finland) for giving us the opportunity to have access to Jugene and Louhi and for their valuable help and support during code porting.

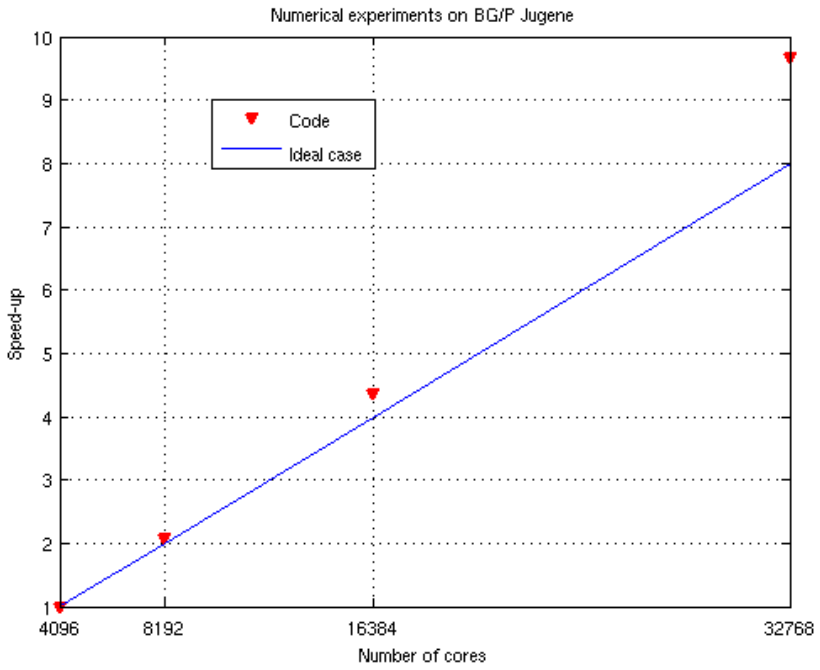

Figure 1: Speed-up versus number of cores for a fixed problem size of 2048^3 on the Blue Gene/P computer Jugene.

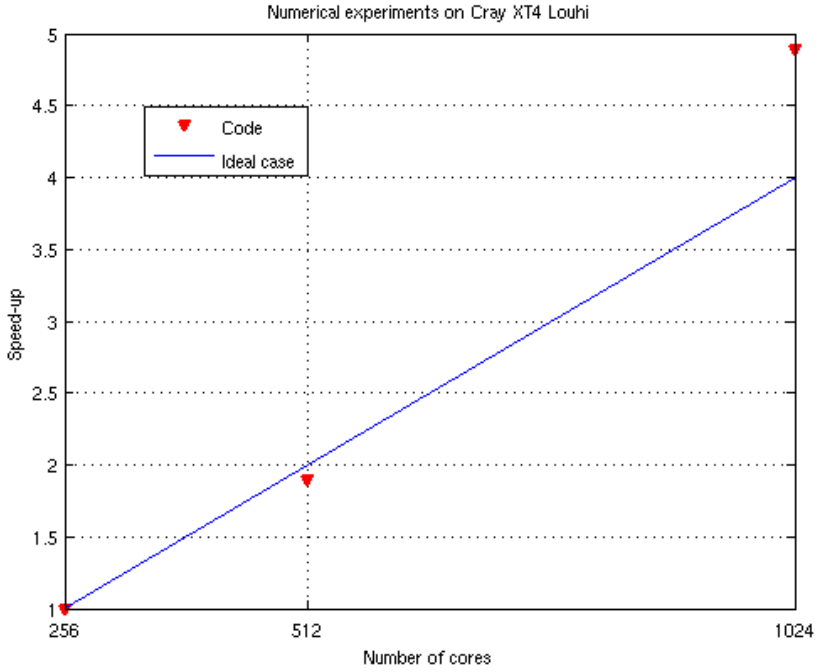

Figure 2: Speed-up versus number of cores for a fixed problem size of 1024^3 on the Cray XT4 computer Louhi.