



**SEVENTH FRAMEWORK PROGRAMME
Research Infrastructures**

**INFRA-2010-2.3.1 – First Implementation Phase of the European High
Performance Computing (HPC) service PRACE**



PRACE

Partnership for Advanced Computing in Europe

Grant Agreement Number: RI-261557

**D3.2.1
Training Plan**

Final

Version: 1.0
Author(s): Pekka Manninen (CSC), Tim Robinson (CSCS)
Date: July 20, 2010

Project and Deliverable Information Sheet

PRACE Project	Project Ref. №: RI-261557	
	Project Title: Training Plan	
	Project Web Site: http://www.prace-project.eu	
	Deliverable ID: < D3.2.1 >	
	Deliverable Nature: <DOC_TYPE: Report >	
	Deliverable Level: PP *	Contractual Date of Delivery: 31 / 07 / 2010
		Actual Date of Delivery: 30 / 07 / 2010
EC Project Officer: Bernhard Fabianek		

* - 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: <Training Plan >	
	ID: <D3.2.1>	
	Version: 1.0	Status: Final
	Available at: http://www.prace-project.eu	
	Software Tool: Microsoft Word 2007	
	File(s): PRACE-1ip-D3.2.1-final.docx	
Authorship	Written by:	Pekka Manninen (CSC), Tim Robinson (CSCS)
	Contributors:	Ari Turunen, Anni Jakobsson (CSC), Simon Wong (ICHEC)
	Reviewed by:	F. Berberich, D. Erwin; FZJ
	Approved by:	Technical Board

Document Status Sheet

Version	Date	Status	Comments
0.1	28 May 2010	Draft	First draft
0.2	5 June 2010	Draft	Implementing comments of a WP3 meeting at ISC' 10
0.3	5 July 2010	Draft	Implemented comments from partners
0.4	10 July 2010	Draft	Version for internal review
1.0	20 July 2010	Final	Version for approval

Document Keywords and Abstract

Keywords:	PRACE, HPC, Research Infrastructure, Training
Abstract:	A sustained, high-quality training and education programme is a prerequisite to ensure that the PRACE research infrastructure will remain productive. This document describes the plan for building a permanent network for training in the field of Tier-0 computational science. In the first implementation phase, the most visible actions are a top-quality face-to-face training event curriculum and an establishment of an online training portal together with various education outreach activities. The task will also develop the concept of European training hubs.

Copyright notices

© 2010 PRACE Consortium Partners. All rights reserved. This document is a document of the PRACE project. All contents are reserved by default and may not be disclosed to third parties without the written consent of the PRACE partners, except as mandated by the European Commission contract RI-261557 for reviewing and dissemination purposes. All trademarks and other rights on third party products mentioned in this document are acknowledged as own by the respective holders.

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. User competencies	1
3. Development of competencies by PRACE	2
3.1 Face-to-face training events	2
3.2 Remote learning initiatives	4
3.3 PRACE training portal	4
4. Education outreach initiatives	4
5. Developing the concept of PRACE Advanced Training Centres	5
6. Coordination of work	5
7. Initial agenda for training	5

List of Figures

Figure 1: An "onion model" of HPC competencies.	2
--	---

List of Tables

Table 1: Competency development actions.....	3
Table 2: PRACE face-to-face training seminars	3
Table 3: Planned events for 2010-2012.....	6

References and Applicable Documents

- [1] PRACE - First Implementation Phase Project PRACE-1IP (The Description of Work)
- [2] Stitt, T.;& Robinson, T. (2008). *A Survey on Training and Education Needs for Petascale (D3.3.1)*. PRACE.
- [3] Robinson, T.;& Jakobsson, A. (2008). *Proceedings of First Scientific Conference (D3.1.6)*. PRACE.
- [4] Jakobsson, A.;& Messing-Klopstra, N. (2009). *Proceedings of second scientific conference (D3.1.7)*. PRACE.

List of Acronyms and Abbreviations

BSC	Barcelona Supercomputing Center, Spain
CaSToRC	Computation-based Science and Technology Research Centre, Cyprus
CINECA	Consorzio Interuniversitario, Italy
CSC	CSC - IT Center for Science Ltd, Finland
CSCS	Swiss National Supercomputing Centre, Switzerland
DEISA	Distributed European Infrastructure for Supercomputing Applications; EU project by leading national HPC centres.
EC	European Commission
EGI	European Grid Initiative
EPSRC	Engineering and Physical Sciences Research Council, the United Kingdom
FZJ	Forschungszentrum Juelich GmbH, Germany
GENCI	Grand Equipement National de Calcul Intensif, France
GRNET	Greek Research and Technology Network S.A., Greece
HPC	High Performance Computing; Computing at a high performance level at any given time; often synonymous with supercomputing.
HPC-Europa	Consortium of six leading (HPC) infrastructures and five centres of excellence providing transnational access; EU funded project.
ICHEC	The Irish Centre for High-End Computing, Ireland
ISV	Independent Software Vendors
PATC	"PRACE Advanced Training Centre"; yet to be established concept of European training hubs
PRACE	Partnership for Advanced Computing in Europe; project acronym.
PSNC	Instytut Chemii Bioorganicznej Pan W Poznaniu, Poland

SNIC Tier-0	Swedish National Infrastructure for Computing, Sweden Denotes the apex of a conceptual pyramid of HPC systems. In this context the Research Infrastructure would host the tier-0 systems; national or topical HPC centres would constitute tier-1.
VSB WP	Vysoka Skola Banska, Czech Republic PRACE Work Package

Executive Summary

"Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime." Chinese Proverb

PRACE, the Partnership for Advanced Computing in Europe created, created a persistent pan-European high-performance computing (HPC) service infrastructure. The service will comprise several HPC hubs strengthened and supported by regional and national supercomputing centres working in tight collaboration. The users of the infrastructure need to be in a position to fully exploit the strengths of existing and future hardware and software resources. The HPC users of tomorrow will need to harness the massive parallelism of petascale computing architectures containing hundreds of thousands of cores. Needless to say, this activity will be nontrivial, but unavoidable for researchers who wish to remain competitive and continue to make discoveries in their field. A sustained, high-quality training and education programme is a prerequisite to ensuring that the PRACE infrastructure will remain productive.

The training programme of the first implementation phase of PRACE, as described in detail in this document, will feature the following activities

- Top-quality face-to-face training events organized around Europe, aiming to improve the skills necessary for the use of the PRACE ecosystem. These include eight large-scale seasonal schools.
- Establishment of a training portal, which will provide e-learning technologies to facilitate self-learning and teaching.
- Education outreach activities to address the next generation of scientists.

In addition, preparatory work for establishing European training hubs, here referred to as "PRACE Advanced Training Centres", will be initiated.

1. Introduction

In the first implementation phase of PRACE [1], the training task will continue to build a European HPC training network that is second to none. The key to this network is the close collaboration among PRACE partners and the research community, as well as the European education sector from which the next generation of scientists will emerge.

In this report we first categorize the competencies necessary for ensuring that the Tier-0 infrastructure is utilized as effectively as possible to produce first-class science. Next, we describe the activities within the PRACE training programme that will enable and support the development of these competencies. These activities range from traditional face-to-face training events to modern e-learning initiatives, including the establishment of an online training portal. In Section 4, we briefly describe an educational outreach programme; and in Section 5 we discuss the concept of "PRACE Advanced Training Centres", which will be implemented in the latter phases of PRACE. Sections 6 and 7 outline the deliverables along with remarks on practical matters regarding coordination of work across the partner sites.

2. User competencies

The PRACE training programme is based on identifying competencies that researchers require to exploit the PRACE Tier-0 ecosystem, followed by activities to develop and

enhance such competencies. We categorise the competencies into four classes: core, porting, programming and advanced levels, as defined by the following:

Core: the basic use of a system; logging in, manipulating files, using editors, preparing and submitting a batch job script and so on. The use of grid and cloud computing interfaces may also be regarded to belong to this category. This core class of skills is assumed for PRACE users; thus it is not addressed by the training plan.

Porting (“Application Enabling”): taking the source code of an application and building a working, and desirably efficient, binary out of it for a Tier-0 system.

Programming (“Application Developing”): parallel programming skills; i.e. working knowledge of most common HPC languages (Fortran, C/C++), knowledge of parallelization with the message-passing interface (MPI) parallel programming paradigm and/or OpenMP, and of aspects of parallel scalability, serial performance, and so on.

Advanced: In-depth understanding of processor architectures, modern HPC programming techniques (e.g. OpenMP/MPI hybrid programming), and emerging HPC programming paradigms (e.g. the partitioned global address space (PGAS) languages); the ability to assess and improve the performance of applications, either through optimization or algorithmic refactoring; knowledge of emerging technologies and programming for accelerators (e.g. GPGPU).

In addition to these “generic” competencies, there is also the requirement for training in specific application and scientific domains. PRACE is, to some extent, responsible for maintaining a high standard of training for the European scientific communities.

3. Development of competencies by PRACE

The aim of the PRACE training activities is to encourage and facilitate the users of the European HPC ecosystem, in all member states, to develop their competencies according to the “HPC skills onion model” as described in Figure 1. This is realized with a training programme based on face-to-face training events as well as remote- and e-learning technologies.

The requirement for porting, programming and advanced level training was clearly shown in the results of the training survey carried out in the PRACE preparatory phase [2]. It is worth noting that new partners have joined the consortium since this training survey was conducted, and it is envisaged that intermediate level skills are also lacking in some of these countries.

3.1 Face-to-face training events

The face-to-face training within the PRACE partner sites should address levels of competencies from intermediate level upwards, aiming to increase the participants' skill level to the next layer of the onion. The PRACE implementation phase training programme will have a number of roles as outlined in Table 1, where the “Events organized by PRACE” refer to pre-planned training activities organized by task 3.2 which focus on various competencies.

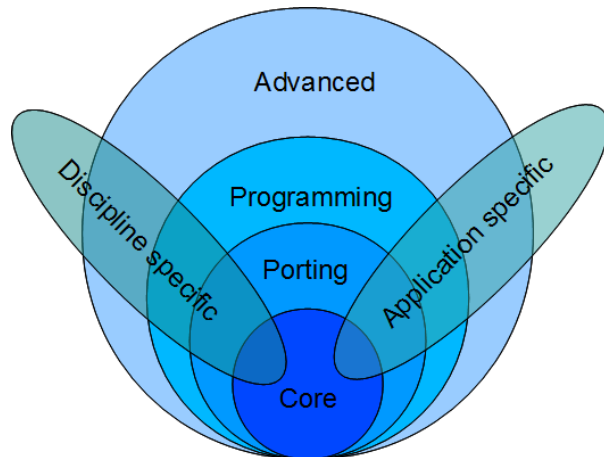


Figure 1: An "onion model" of HPC competencies.

Task 3.2 facilitates local training activities directed at improving “porting” and “advanced” competencies. The programming competence is supported by the seasonal schools, and the support for local training events is mostly meant for workshops with advanced topics. However, workshops focusing on the use of a Tier-0 system usually belong to the “porting” category and are very essential for the training plan, hence the possibility for support. The support usually means the possibility to use WP3 person-months for the event, as well as PRACE communication channels for advertising. Discipline or application-specific local training events (i.e. with less focus on the “generic” HPC competencies discussed above) may also be organized with task 3.2 support (see above), dependent on approval by the task leader and work package leader and reviewed on a case-by-case basis.

Competency focus	Events organized by PRACE	Support of local training activities by task 3.2
Core	No	No
Porting	No	Yes
Programming	Seasonal schools	No
Advanced	Seasonal schools	Yes
Scientific discipline	Seminars	Case dependent
Application specific	No	Case dependent

Table 1: Competency development actions

Eight seasonal schools will be held during the course of the first implementation phase as listed in Table 2: PRACE face-to-face training seminars. Some of the seasonal schools will be co-organised by two member sites, in part to encourage collaboration and communication across sites. The physical location of the event may be chosen by the organizing partners.

Table 2 includes details of two Scientific Seminars that will be held in the implementation phase following the successful preparatory phase seminars in Lyon in 2008 [2] and in Amsterdam in 2009 [3].

School	Time	Organizer	Competence focus
1st Autumn school	Sep-Oct 2010	BSC	Advanced
1st Winter school	Jan-Feb 2011	GRNET & CaSToRC	Programming
1st Scientific seminar	Feb-Mar 2011	SNIC	Discipline specific
1st Spring school	Mar-Apr 2011	EPSRC & ICHEC	Advanced
1st Summer school	Jun-Jul 2011	CSC & SNIC	Programming
2nd Autumn school	Sep-Oct 2011	GENCI	Advanced
2nd Winter school	Jan-Feb 2012	CINECA	Programming
2nd Scientific seminar	Feb-Mar 2012	ICHEC	Discipline specific
2nd Spring school	Mar-Apr 2012	VSB & PSNC	Advanced
2nd Summer school	Jun-Jul 2012	CSCS	Advanced

Table 2: PRACE face-to-face training seminars

The outcomes of the seasonal schools and Scientific Seminars will be documented in upcoming deliverables. For each school a project manager will be appointed who will be in charge of coordinating all the practical and local arrangements of a school, and subsequently contribute to the abovementioned deliverables.

All face-to-face training events supported or organized by PRACE will be carried out in English, and it will be a requirement of the hosting sites to make the associated training material available through the PRACE training portal (see below).

3.2 **Remote learning initiatives**

As the resources available for face-to-face training courses are limited, and the courses themselves not necessarily accessible to all users, the face-to-face training events will be recorded and broadcast online where possible. Some recordings will be edited later on for the purposes of the training portal (see below). The suitability of various delivery technologies will be evaluated (e.g. AccessGrid, H.323, flash stream, webinar technologies).

Finally, it is envisaged that PRACE will contribute to HPCEuropa2's programme of "Virtual Surgeries", which are monthly online broadcasts on different topics in HPC.

3.3 **PRACE training portal**

The major effort of this task will be the establishment and maintenance of a PRACE training portal. This will be a central hub on the Internet for HPC training, containing top-quality material for self-learning and teaching. It will feature content for various competency levels.

The training portal will include at least the following:

- Training material, including presentation slides and/or video from various training events (from PRACE events, from events organised by partner sites or from third parties such as ISVs)
- A discussion forum for peer-to-peer discussion and problem solving in various issues related to Tier-0 computing and HPC in general
- A comprehensive, up-to-date database of seminars, workshops and other events relating to HPC and computational science in Europe
- Blogs related to training and HPC
- Self-learning material: online exercises, tests, quizzes, and so on.

Building and developing the portal form a subtask of its own, and the launch will take place in the first quarter of 2011.

All partner sites with person months in WP3 will be expected to contribute to the development and maintenance of the information and material made available through the portal, while the content will necessarily be provided by all relevant WPs. CSCS will coordinate the development of the portal.

4. **Education outreach initiatives**

It is important that HPC education begins at as early a stage as possible. For this reason, the PRACE training programme will outreach to secondary school science classes, by providing science teachers with hands-on expertise and theoretical know-how to bring concepts of scientific computing into the classroom. There will also be an event in Sweden aimed at secondary school science teachers.

As part of this education outreach, partners will be encouraged to distribute the printed material highlighting their activities to the secondary schools in their countries. This activity is not compulsory and requires no commitments from the partners, and will not be supported financially by PRACE. An email or a letter will be sent to sites publishing such material at an early stage of the project plan.

The educational outreach also includes a programme where university students may apply to cover expenses incurred from attending seasonal schools. These expenses are in practice covered by WP3. There are several other activities targeted at university students within task 3.1.

5. Developing the concept of PRACE Advanced Training Centres

The longevity of the training network described is ensured by establishing PRACE Advanced Training Centres (PATCs) to provide top-class training events in many fields of scientific computing, not only in HPC methodology. They will follow a coordinated, joint curriculum. The PATCs will serve as European hubs of advanced training for researchers working in the PRACE countries. They will also develop and lead outreach efforts relating to education. The possibility of offering pan-European MSc and PhD programmes in HPC coordinated by the centres will be investigated.

The purpose of the centres is to consolidate experience and know-how, create synergies, promote the status and importance of training within PRACE, and make this expertise available to other partner institutions. The PATCs will promote joint advanced training activities between the PRACE partners, between PRACE and other European research collaborations (DEISA, HPCEuropa2, EGI, etc.), and between the research organizations and networks within the PRACE member states.

Guidelines for the establishment of the PATCs, covering issues such as their management, business models and processes for hosting the centres and their locations, will be discussed in detail during the project and reported in the deliverable D3.2.3 in project month 18 (denoted M18). Final decisions relating the establishment of the PATCs will be made by the Council of the PRACE Research Infrastructure with input from this deliverable.

6. Coordination of work

Task 3.2 will have a video/telephone conference every two weeks, as well as biannual face-to-face meetings. The WP3 mailing list will be employed for day-to-day communication. All activities will be carried out in close collaboration with the dissemination task 3.1.

Task 3.2 is lead by Pekka Manninen (CSC). Tim Robinson (CSCS) is the subtask manager for the training portal. More subtask managers may be appointed during the course of work.

Contributions from WPs 5 and 7 will be invaluable with respect to the structure and content of the training portal.

7. Initial agenda for training

Table 3 lists the deliverables by task 3.2, and for the sake of completeness, also the planned training and education outreach activities. At this point the plan is indicative and includes all major milestones. The plan will be updated periodically and reported on management reports and the annual dissemination report.

Date		Activity
July 2010	M1	Deliverable: Training plan (D3.2.1)
September 2010	M3	1st Autumn school
December 2010	M6	1st Winter school
March 2011	M9	1st Spring school
May 2011	M11	Training portal kick-off
June 2011	M12	1st Summer school
June 2011	M12	Deliverable: First Training Report (D3.2.2)
September 2011	M15	2nd Autumn school
December 2011	M18	2nd Winter school
December 2011	M18	Second scientific conference
December 2011	M18	Deliverable: Outline of the PRACE Advanced Training Centres (D3.2.3)
March 2012	M21	2nd Spring school
June 2012	M24	2nd Summer school
June 2012	M24	Deliverable: Education outreach report (D3.2.4)
June 2012	M24	Deliverable: Final training report (D3.2.5)

Table 3: Planned events for 2010-2012