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PRACE

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Analysis of the HPC Ecosystem

Final

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Abstract:	The PRACE project has a mandate to build the horizontal supporting infrastructure layer for the future permanent world class HPC infrastructure for the European Research Area (ERA), and to improve the knowledge needed to fully employ available resources for the European research. To efficiently contribute in the building of the European HPC Ecosystem it is necessary to reach the various stakeholders, such as national governments and research councils, and policy level stakeholders, such as ESFRI, e-IRG, European Research Council and European Science Foundation. This Deliverable presents a stakeholder analysis framework to support the creation of the petascale HPC services in Europe. Successful utilization of such complex HPC resources requires major collaboration across country and scientific disciplines borders with huge economical and human resource investments from a variety of different sources and stakeholders. The analysis of the HPC Ecosystem includes – in addition to defining the scope itself – a framework for stakeholders and discussion on collaboration possibilities. Conclusions for directing the future work are presented, as well as proposals for contacting the stakeholders.

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References and Applicable Documents

[1]   The PRACE project web site http://www.prace-project.eu.

[2]   HPC in Europe Taskforce (HET) web site http://www.hpcineuropetaskforce.eu.

[3]   Towards a Sustainable High-Performance Computing Ecosystem through Enabling Petaflop Computing in Europe, HET final recommendation paper. http://www.hpcineuropetaskforce.eu

[4]   Report of the ERA Expert Group on Developing World-class Research Infrastructures for the European Research Area (ERA), http://ec.europa.eu/research/infrastructures/pdf/ri_era-expert-group-0308_en.pdf

[5]   HET Scientific case document, http://www.hpcineuropetaskforce.eu.

[6]   ESFRI Roadmap, http://cordis.europa.eu/esfri/roadmap.htm

[7]   e-IRG Roadmap, http://www.e-irg.org/publ/

List of Acronyms and Abbreviations

AAA   Authorization, Authentication, Accounting.

AHTP   Advanced HPC Technology Platform. To be created in this project as permanent groups to identify and work on future technologies for multi-petaflop/s systems.

BELIEF   BELIEF-II, funded by the EU's Seventh Framework Programme, is a one stop shop for finding out about e-Infrastructures and a platform for communicating e-Infrastructures activities and results.

BOF   Bird of Feathers session. Ad hoc session at conferences to solicit interest to work on specific topics.

COREGRID   European Network of Excellence for Grid and Peer-to-Peer technologies.

DEISA   Distributed European Infrastructure for Supercomputing Applications. EU project by leading national HPC centres.

EGEE   Enabling Grids for E-sciencE; EU Grid project lead by CERN and successfully completed in 2006. Followed-up by EGEE-II, completed in 2008 and EGEE-III starting May 2008.

EGI   European Grid Initiative; aims to create a long-term sustainable European grid infrastructure.

e-IRG   e-Infrastructure Reflection Group; created roadmaps and white papers for pan-European Research e-Infrastructure.

e-IWG   The e-Infrastructure Working Group of ESFRI responsible for preparing the e-Infrastructure matters for the update of the ESFRI Roadmap.

ERC   The ERC complements other funding activities in Europe such as those of the national research funding agencies, and is a flagship component of the 'Ideas Programme' of the European Union's Seventh Research Framework Programme (FP7).

ESFRI   European Strategy Forum on Research Infrastructures; created roadmap for pan-European Research Infrastructure.

GÉANT   Collaboration between National Research and Education Networks to build a multi-gigabit pan-European network, managed by DANTE. GÉANT2 is the follow-up as of 2004.

HET   High Performance Computing in Europe Taskforce. Taskforce by representatives from European HPC community to shape the European HPC Research Infrastructure. Produced the scientific case and valuable groundwork for the PRACE project.

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.

ICT   Information and communications technology includes the Internet, computers, mobile telephony, satellite and communications. ICT as such is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data.

ISC   International Supercomputing Conference; European equivalent to the US based SC0x conference. Held annually in Germany.

ITER	Joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power. Also used as the name for the reactor.
MoU	Memorandum of Understanding.
NDA	Non-Disclosure Agreement. Typically signed between vendors and customers working together on products prior to their general availability or announcement.
NREN	National Research and Education Network
OGF-Europe	The EC-funded OGF-Europe project aims towards global standardisation efforts and best practices in the EU computing environment.
PRACE	Partnership for Advanced Computing in Europe; Project Acronym.
SSC	Scientific Steering Committee
SIRENE	Cooperative association of countries forming a pan-European group and policy framework for strong cooperation towards the initial setup and deployment of interoperable Grid infrastructures.
Ter@tec	Ter@tec is a European competence centre that promotes the exchange and the collaboration between different actors in high performance numerical simulation: researchers, ICT companies and industry.
Tier-0	Denotes the apex of a conceptual pyramid of HPC systems. In this context the Supercomputing Research Infrastructure would host the tier-0 systems; national or topical HPC centres would constitute tier-1.
TCO	Total Cost of Ownership. Includes the costs (personnel, power, cooling, maintenance, ...) in addition to the purchase cost of a system.
UNICORE	Uniform Interface to Computing Resources. Grid software for seamless access to distributed resources.
WP3	PRACE work package in charge of Dissemination, Outreach and Training.
WP4	PRACE work package in charge of the Distributed System Management.
WP5	PRACE work package in charge of the Deployment of Prototype Systems.
WP6	PRACE work package in charge of the Software Enabling for Petaflop/s Systems.
WP7	PRACE work package in charge of the Petaflop/s Systems for 2009/2010.
WP8	PRACE work package in charge of the Future Petaflop/s computer technologies beyond 2010.

Executive Summary

Europe is facing challenges due to environmental and societal change. In order to sustain and develop European welfare, new approaches are necessary in which the research community uses scientific computing and reliable simulation models to make trustworthy predictions. This is only possible through wide ranging collaboration, crossing science disciplines and country borders. In the Roadmap published in 2006, the European Strategy Forum for Research Infrastructures (ESFRI) identified new Research Infrastructures (RI) of pan-European interest corresponding to the long term needs of the European research com–munities, and cover all scientific areas, regardless of possible location. The PRACE project [1] has a mandate to build the horizontal supporting infrastructure layer for the future permanent world class HPC infrastructure for the European Research Area (ERA), and to improve the knowledge needed to fully employ available resources for European research.

This Deliverable presents a stakeholder analysis framework to support the creation of a petascale HPC services in Europe. Successful collaboration to utilize such complex resources requires major economic and human investments from a variety of different sources and stakeholders. To be able to benefit from such a major investment it is of high importance to promote the enablers for a highly sustained capability computing infrastructure by focusing on scalable code development, integration with national infrastructures, sufficient data repositories, high capacity networking based on global standardisation efforts and education and training efforts to get enough competent people – just to name a few actors. The only way to succeed in creating the Research Infrastructure is to address the whole HPC Ecosystem by linking the Petaflop/s systems and related services closely to the existing infrastructures. PRACE builds on the mandate given through the ESFRI Roadmap from 2006 to build a horizontal tier-0 HPC layer for the European Research Area (ERA)

The HPC Ecosystem can be interpreted as a pyramid with consecutive HPC service layers glued together by a network of trust and technology: the future European level capability computing centres (tier-0), the national and regional computing centres (tier-1), the local computing centres (tier-2) and the personal computer or terminal resources (tier-3).

The higher tier-layers contain HPC systems and services of different capabilities and the lower levels provide ways to access and enable them, when so desired. Utilizing the resources at the top of the pyramid requires always major software development investments while the analysis through pre- and post-processing will be most successfully performed at the lower levels of the service pyramid. It is also of high importance to understand that the hardware, software development and support and training and educational layers should not be seen as independent entities. While the hardware is very physical both in location and size, software, training and education can be seen as virtual support layers being supplied over the e-Infrastructure from anywhere in Europe and thus constitute a true possibility for broad pan-European collaboration.

Creating the European HPC Ecosystem is a multi-dimensional challenge due to the broad range of stakeholders and their essential contributions to the HPC Ecosystem. Building the pan-European HPC service is as much policy work as it is a technical challenge. The stakeholders in the HPC Ecosystem with links to PRACE include:

- Providers of HPC services;
- European HPC and grid projects;
- Networking infrastructure providers;
- Hardware vendors;
- Software vendors and the software developing academic community;
- End users and their access through related Research Infrastructures;
- Funding bodies on a national and international level;
- Policy setting organisations directly involved in developing the research infrastructure and political bodies like parliaments responsible for national and international legislation.

To efficiently influence the building stage of the European HPC Ecosystem it is necessary to put a major effort into the outreach and communication activities to create the necessary trust between the various stakeholders. The benefits of computational science and high end computing for the society in general are not always understood by the decision makers, requiring a more thorough discussion and the demonstration of the proof of concept. The collaboration opportunities and impact of horizontal HPC services are not fully known by users, which also sets further requirements for the outreach effort. Including and activating the key stakeholders in the discussion is one of the key targets for the success of the PRACE work.

Different stakeholders need to be addressed in different ways, suitable for reaching each target group. The stakeholders have different requirements and expectations ranging from pure computational capacity to advanced support on code scaling and tuning. PRACE should address all the potential scientific users of tier-0 systems, ESFRI, e-IRG, other political or standardisation bodies, key national governments and major European projects, such as DEISA2.

The purpose of this document is to describe the European HPC Ecosystem and landscape and elaborate on the special role of the PRACE project among the 35 research infrastructures in the ESFRI Roadmap, and within the other scientific communities.

1 Introduction

This Deliverable presents a stakeholder analysis to support the creation of petascale HPC services in Europe. The successful collaboration to utilize such complex HPC resources requires major economic and human investments and involvements from a variety of different sources and stakeholders. The purpose of this Deliverable is to introduce the rather broad range of stakeholders, to make an analysis based on their possible impact to briefly describe how they are being involved in PRACE and to recommend further actions. Interaction with stakeholders is being carried out by several work packages of the PRACE project with the project management acting as the steering mechanism.

Throughout this document we use the following definitions of a stakeholder and the stakeholder analysis:

- Stakeholder: a person, group, organization, or system who affects or can be affected by an organization's actions;
- Stakeholder analysis is a form of analysis that aims to identify the stakeholders that are likely to be affected by the activities and outcomes of a project, and to assess how those stakeholders are likely to be impacted by the project. Stakeholder analysis has the goal of developing cooperation between the stakeholder and the project team and, ultimately, assuring successful outcomes for the project.

This Deliverable brings further and makes an effort to map the rather abstract level of stakeholder analysis presented in D2.3.1 (Document on Procurement Strategy) into real organisations and commercial companies.

Looking at the effort from the PRACE initiative it is of high importance to understand that the hardware, software development and support and training and educational layers should not be seen as independent entities.

Chapter 2 of the document describes HPC Ecosystem and the role of PRACE in it. Chapter 3 lists the different stakeholder categories and points out the major research infrastructures subject to PRACE activities. Chapter 4 describes some of the collaboration opportunities and Chapter 5 how the contacts to stakeholders will be made. Annexes list in addition the concrete contact persons in each side, points out the expected results and planned contents of the discussions (Annex 1) and a draft presentation of PRACE (Annex 2).

2 The HPC Ecosystem

2.1.   Description of the HPC Ecosystem

Research is becoming increasingly international, which means that the only way for national research groups to succeed and introduce major breakthroughs in science is to collaborate internationally and to be able to access world class infrastructures supporting their research work. This includes not only supercomputers, but also other parts of this 'Ecosystem', such as skilled people, data infrastructures, high-speed networks, and applications. Thus the definition for HPC Ecosystem can be seen as a wide construction including all aspects stimulating the efficient usage of various kinds of computational resources providing high-class scientific results.

The HPC service is often described by the Performance Pyramid (**Figure 1**), which consists of multiple layers:

- The European level capability computing centres (tier-0), which represent the highest available computing power, providing computing services to the top research groups across national borders and scientific disciplines;
- The national and regional computing centres (tier-1) with sufficient computing services for the HPC users and to facilitate the access ramp to the resources of the European level centres;
- The local computing centres (tier-2) in the university environments, research labs or in other organisations;
- The personal computer or terminal resources (tier-3) available to the individual researchers.

In terms of this pyramid, the higher tier-layers contain HPC systems of different capabilities and the lower levels ways to access them, since moving towards the high end of the pyramid often requires development work in lower levels. The pyramid includes all relevant building blocks and the interconnection grid network enabling distributed resource sharing. In addition to the relevant computing power, this kind of service requires, e.g. also efficient storage systems, networks, middleware and scalable software. HPC services provided by different levels of centres require also expertise to manage and operate the systems and to develop, optimize, or enable the applications in each of the levels.
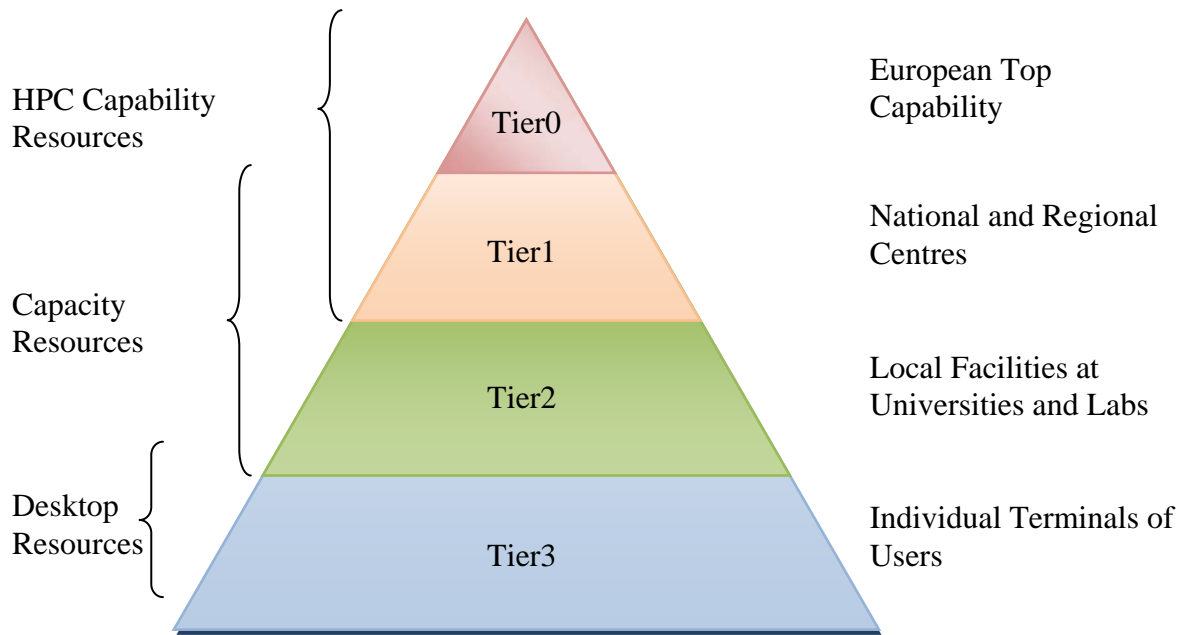
Figure 1: The performance pyramid with different layers

In addition to providing sufficient resources in each of the tier-layers, it is important to enable and support flexible and efficient interoperability, in some cases even strong integration, between the different layers of the pyramid. Interactions between the different layers should be reinforced by enabling active contacts between stakeholders in each level, such as scientists with various scales of research projects, ESFRI- and other research infrastructures and European HPC/grid projects, to name a few examples.

The HPC Ecosystem concept was introduced during the European HPC strategy work completed by the HPC in Europe Taskforce (HET) [2] in January 2007 (www.hpcineuropetaskforce.eu). During the HET work the HPC Ecosystem [3] was considered to span the whole spectrum, from departmental computing to high end, and not only the hardware, but also enabling issues such as software development or competence development through education and training opportunities. However, it was decided that HET would mainly concentrate on the parts that deliver or enable the HPC opportunities, with a specific focus on petaflop computing. The PRACE project is a continuation and evolution of the HET work, even though the HPC Ecosystem as such is a much wider concept. The focus of PRACE is in the high end of computing and the enabling issues for it, i.e. tier-0 and the HPC part of tier-1 as depicted in Figure 1. This does not mean that the lower layers are not important nor ignored; PRACE will coordinate and collaborate with other projects operating in those domains, most notably the DEISA2, EGEE-III and EGI_DS projects. DEISA2 covers the HPC integration of the tier-1 layer, EGEE-III covers the capacity resources in the tier-1 and tier-2 layers, whereas EGI_DS considers also the lower layers.

2.2. PRACE objectives

The PRACE project has the overall objective to create the prerequisites for a pan-European HPC service and to move into its implementation phase as early as the end of 2009 or beginning of 2010. In more detail, the following is being carried out:

- Selection of an appropriate legal form, the definition of its statute, its governance in relation with the partners, the European Commission [4] and the scientific users [5][4]. The targets are signature ready contracts for the creation of a permanent European HPC service.
- Establishment of funding strategies and usage models to ensure sustained funding.
- Definition of a peer review process to support leading edge science and optimal use of the resources, ensuring open, fair and unbiased access to the Research Infrastructure.
- Definition a consistent operational model across the distributed tier-0 sites.
- Management of the PRACE project using principles suitable for the permanent infrastructure.
- Dissemination of project achievements, establishing and maintaining links with selected industries both as users of capability systems, technology providers, and creators of new HPC technologies and training of potential users.

In addition to the legal work and the creation of the administrative structures, PRACE is performing accompanying technical work to prepare for the production phase:

- Provision of tools for a consistent management of the tier-0 systems and for the integration of the tier-0 infrastructure into the European HPC Ecosystem. (WP4)
- Deployment of prototypes of leadership class systems at selected sites that are likely to become productions level systems in 2009/2010. (WP5)
- Porting, optimising, and petascaling selected application to ready them for production on the tier-0 systems. Creating benchmark suites. (WP6)
- Definition of a consistent procurement strategy, associated technical specification, selection criteria for the current and future generations of HPC services, and the requirements for the physical infrastructure to host tier-0 systems. (WP7)
- Starting a permanent process of technology evaluation to transform user requirements into specifications for future leadership class systems. This process that will last throughout the lifetime of the infrastructure will be done in close relations with vendors of components, systems, and software. (WP8)

Integrating Petaflop/s resources into the European computing environment is a complex task, which requires successful involvement of different stakeholders. The impact for the whole community forming the HPC Ecosystem is targeted, with a specific focus on the top end. PRACE has the mandate and the capability to achieve this goal through its leading position in Europe. The recent European Commission report also clearly supports the actions taken by PRACE [4]. However, a successful implementation of PRACE will not be possible without the national support in resourcing all layers of the performance pyramid in an appropriate manner.

2.3. Requirements for developing the HPC Ecosystem

In order to develop an efficient European HPC Ecosystem with appropriate resources a number of issues have a key role, especially:
- Clear scientific need of the computing services as provided for the very high end: HET Scientific case, http://www.hpcineuropetaskforce.eu/deliverables)
- Efficient collaboration between all relevant stakeholders (see Chapter 3)
- Interoperability with or service for key European infrastructure projects
- Support by national governments and funding bodies

- Involvement of the national infrastructures, such as national supercomputer centres

The European projects during the 6th Framework Programme have started a number of initiatives and paved the way towards pan-European collaboration. However, most of the previous activities have been (and still are) working on a project basis. In the 7th Framework Programme a target is to create sustainable entities which can guarantee the HPC services beyond a project's timeframe.

The development of the European HPC Ecosystem requires a change in attitude. It is of utmost importance that the workload division between the researchers and those providing computing infrastructure and related services is mutually agreed. The synergy potential of the same HPC infrastructure serving multiple disciplines needs to be utilized more efficiently than today. It is also important that the collaboration in various levels is developing to closer relations: those providing computer services need to understand the needs of the scientists and the scientists need to consider the strategic importance of HPC in their work.

3. Establishing links with stakeholders in the HPC Ecosystem

This Deliverable builds on D2.3.1, which presented the results for an overall procurement process and an abstract stakeholder analysis, by carrying further and identifying the stakeholders involved in building and maintaining the pan-European HPC service Ecosystem.

The partners involved in building the European HPC Ecosystem have to pay careful attention to the different stakeholder groups and their important roles in the various interfacing layers of this Ecosystem. The level of trust created is essential for building sustainable collaboration with and between the stakeholders. This is also clearly shown in the results of D2.3.1 and D4.1.1 (Requirements analysis for tier-0 systems management) and has also been addressed in D3.1.1 (Final plan for the use and dissemination of foreground). Especially the very important links to the industrial fields must be addressed together with the people responsible for dissemination and outreach (WP3). In this chapter the results of an analysis are presented based on a linkage between the stakeholders and their nature of interface, field of interest, description, impact and potential forms of collaboration in the HPC Ecosystem.

The analysis is based on the assumption that the available resources enable a focused approach for a limited number of groups of stakeholders to identify their roles, needs and functions while in the more broad range contacts are taking place as a collaborative effort across the different Work Packages. For the identified groups, the most important actors are listed, and their impact for the European HPC Ecosystem is analyzed. Actual and potential forms of collaboration with the stakeholders are also considered. The overall knowledge adopted from D6.2.1 (Preliminary report on application requirements) and D7.2 (Report on systems compliant with user requirements) will be employed extensively in the fine graining of the stakeholder analysis to be carried out over the next 6 months.

3.1. Stakeholders in the HPC Ecosystem

It is very important for the success of the PRACE project to map the stakeholder groups into real user groups, organisations and commercial companies. The first draft of identifying the commercial companies on a broader scale was done by WP3 in D3.1.1. WP3 is also an important sensor in receiving and interpreting responses from a broad range of stakeholders through their dissemination and outreach activities. The activities of WP2 will always by nature be much more focused. A thorough analysis has lead to the following categorization of stakeholders in the European HPC Ecosystem:

- Providers of HPC services;
- European HPC and grid projects;
- Networking infrastructure providers;
- Hardware vendors;
- Software vendors and the software developing academic community;
- End users and their access through related Research Infrastructures;
- Funding bodies on a national and international level;

- Policy setting organisations directly involved in developing the research infrastructure and political bodies like parliaments responsible for national and international legislation.

3.1.1. Providers of HPC services

The current HPC service providers are mostly academic and national computing centres in the Ecosystem on all tier levels, i.e., on tier1 and tier-2. The centres provide computer capacity, data storage, databases and software. They also offer technical expertise in running, developing, optimizing and enabling applications and are engaged in scientific partnerships with specific user communities. tier-1 centres in the PRACE partner countries are represented in the PRACE consortium and as such are part of the future PRACE infrastructure. These tier-1 centres are also part of national grid initiatives and are in close contact with tier 2 centres. As a result, HPC service providers have been limited to non-PRACE EU countries. The goal is to get more EU countries involved in the process, through membership in the PRACE initiative.

The message PRACE intends to transmit to HPC service providers focuses on opportunities to collaborate through joint activities, such as enabling access from the computing centre's HPC infrastructure to PRACE services, training activities or collaboration in scaling application codes. For that purpose PRACE needs information about the targets of the HPC service provider, the potential needs of their customers and the goals of the provider for international HPC collaboration. This requires the stakeholder's interest towards European HPC collaboration resulting them to allocate suitable contact persons to further discuss the topics.

3.1.2. European HPC and Grid projects

European HPC and grid projects have already for quite some years had a strong focus on international collaboration established especially during Framework Programmes 6 and 7. Examples of successful collaborations include the establishment of the DEISA and EGEE infrastructures, and a number of preparatory phase projects for ESFRI roadmap infrastructures [6] with the support from the e-IRG roadmap supporting the development of the e-Infrastructure [7].

Many of the projects are run by national centres as service providers, so most of the issues listed in 3.1.1 apply also to them. HPC and Grid projects do have a set of partners and a collaboration network established among them. In addition, during the lifetime of the projects a number of collaboration networks have been created with external parties. There is a potential of sharing information and utilizing synergy in multiple levels between PRACE and another HPC/grid project. The message PRACE is delivering is our willingness to collaborate and search for synergy in building the European HPC Ecosystem together. This requires openness from both sides and serious intent to joint activities where possible. The workload allocated in outreach and collaboration activities in projects can be utilized to pursue concrete actions.

3.1.3. Network infrastructure providers

The centres and their services are connected via high-speed networks maintained by networking infrastructure providers, typically represented by European research network organizations operating the pan-European research network GEANT. Growing amounts of data generated in HPC projects and international collaboration which requires that data be transferred over the network are setting higher demands on the communication network. Light paths enabling cost efficient high volume data transfer are being built by national network providers.

It is probable that specific dedicated network connections between major sites in PRACE and between PRACE centres and the main user communities will be needed. For that reason PRACE needs to maintain close contacts with network providers and GEANT organisation to be able to discuss the required developments. In addition, collaboration bodies such as TERENA and DANTE should be addressed.

3.1.4. Hardware vendors

Hardware vendors are key stakeholders for PRACE since their solutions will eventually provide the high end computing platforms deployed in Europe. PRACE and vendors collaborate in various areas including prototyping activity, application benchmarking and other technical development. In addition, PRACE partners individually and vendors work together in commercial basis.

The message PRACE intends to deliver to the hardware vendors includes:

- PRACE partners represent the majority of European HPC resources (indicated by TOP500 list for example) and form a major market potential in Europe
- PRACE partners target to establish a set of world class HPC centres with major contribution to HPC development
- PRACE partners are established in Europe and funded by the European Union and national funding agencies and the volume of European activities improving European economy, employing people and increasing the level of Europe-based R&D activities of each vendor is important for the collaboration

PRACE expects the vendors being able to share technical and other relevant information, which might be helpful in developing the PRACE collaboration or services in the current computing environment. This processsa has already started in WP7 and WP8. The actions shareholders need to take include active participation in various European HPC forums, proactive interest towards PRACE work and open attitude towards new ideas how to develop HPC activities in Europe.

Multiple WPs in PRACE collaborate with hardware vendors, for example through prorotype activities or software optimisation (WP5-8).

A permanent research platform "Advanced HPC Technology Platform (AHTP)" is being implemented in WP8. This includes the designation of the partners of AHTP from PRACE partners and collaborating industrial partners. Working groups will be established in a suitable

organisational structure and a legal and financial framework to include industry will be implemented. AHTP will also participate in developing components for future multi-petascale systems and early prototypes.

Agreements of AHTP with cooperation partners, i.e. Consortia for HPC development consisting of vendors and research institutions, are made. AHTP will actively seek cooperation with European projects with the potential to contribute to petascale computers and communication components and will support similar activities in order to take benefit from all experiences and innovative ideas available throughout Europe.

PRACE will also collaborate with recently established HPC collaborations targeting European industry, such as PROSPECT and TALOS.

3.1.5. Software vendors and the software developing academic community

Software vendors intending to scale their codes to parallel computing, potentially over several thousands of processor cores, are key stakeholders of PRACE. The software developing academic community is equally or even more important stakeholder, especially since due to the access to the source code and related expertise it is often easier to adjust the code to new architectures. The software includes both applications and middleware solutions targeted to enable more efficient utilisation of the available systems.

The key messages PRACE wil deliver to the software vendors and the major expectations by PRACE hasa from them are similar to what is mentioned in the previous section for hardware vendors. However, the message to academic community can be deepened to the level of collaboration in individual cases. If for example the academic community is developing a software with the potential of scaling to the Petaflop/s level, the community and PRACE can work together in benchmarking or optimisation of the code (WP6). This requires the academic community to invest expertise to pursue the joint targets. Some of these activities have already taken place in WP6.

The PRACE project undertakes several activities which enable inclusion of software vendors or academic communities. These include seminars, workshops, surveys and practical work such as code scaling.

3.1.6. End users

End users represent academic, research and industrial organizations and communities. Their applications in engineering, human, social and natural sciences are typically compute and/or data intensive. In some of the areas there are long traditions in using HPC, but in some areas computational science is just entering the domain. User communities vary in their maturity in using high end computing. Depending on the user community, different instruments to tackle the major issues will be needed: extensive training and code development on one end to providing a suitable computing platform on the other end.

PRACE is using different methods to identify the real needs of user and their maturity to exploit HPC – quality of scalable applications being one useful measure. A scientific case for

petasale computing has already been prepared during the previous projects (HET strategy work 2006-2007)[2]. This is addressed by contacts made by WP6 for scientific applications and benchmarking. In addition PRACE work for discussing peer review process and establishment of scientific advisory committee help in end user collaboration.

However, even though currently only a fraction of end users would be able to utilize petaflop computing resources efficiently, PRACE needs to ensure continuity by addressing potential new users at the same time. PRACE training and education activities (WP3) are planned to contribute to this topic.

In addition, different industry sectors with potential HPC needs are being addressed, examples include automotive, energy, aerospace and other areas. Two industry seminars are being organized during the PRACE project.

3.1.7. Funding bodies

Funding bodies, such as the European Union, national ministries, academic research funding organizations, technology agencies and foundations, act on the European and national level. They fund pure and applied research and research infrastructures. The funding may be directed towards research or framework programmes or individual projects.

For PRACE to be successful it is mandatory to gain wide European acceptance and support. Adequate funding or other in-kind contribution is naturally required, and this needs discussion with the national funding bodies, since EU is expected to fund only a minor part of the full cost of the infrastructure. In addition, maintaining a sustainable infrastructure requires funding beyond the EU Framework Programme duration.

PRACE is in contact with the governments of the PRACE partners. In addition, contacts to the governments of non-PRACE EU countries will be established with a target to widen the participation in PRACE collaboration by inviting them to sign the Memorandum of Understanding of the PRACE initiative or participating in the work with other kinds of commitment.

The message PRACE intends to deliver to funding organisations and governments includes the benefits created through investments in computational science, such as social and economic development and increased competitiveness of the European industry and better cost efficiency achieved through synergy in multinational collaboration. It is expected that to confirm funding bodies requires solid proof, thus success stories and cost/benefit calculations need to be included.

The actions stakeholders need to take include willingness to discuss the PRACE benefits and commit infrastructure funding. It will be necessary to organize a set of meetings between the funding bodies and/or governmental organisations of European countries and PRACE to discuss the individual national targets and opportunities in detail. The expected result is a consensus among the PRACE partners, the national funding bodies and the EC on the funding and usage model to be implemented by PRACE for a sustainable funding of the future Research Infrastructure.

3.1.8. Policy making organisations

Political bodies, such as EC, ESFRI, e-IRG or TERENA contribute to political decisions and have an impact to future strategies in research and research infrastructures. Many of them are already involved in PRACE work and require up-to-date information during the project. Since PRACE is in the ESFRI roadmap and funded partly by EU, these bodies follow the PRACE development actively through their normal processes. Additional policy boards should be addressed proactively by PRACE, examples including very important organisations such as the European Science Foundation (ESF), the European Research Council (ERC) and the Open Grid Foundation (OGF) in Europe.

The message PRACE wants to deliver to policy making organisations is the willingness by PRACE to collaborate with them and the expectation to include the PRACE targets in the policy group's agenda and enter the discussion about HPC benefits within the domain of each policy group. From the policy group we need in return their opinion pointing out the possible challenges and opportunities to strengthen PRACE.

A more detailed table of stakeholders and concrete plans for contacting them is available in Appendix 1.

3.2.   Stakeholders and forms of potential collaboration

The stakeholders in the European HPC Ecosystem comprise a wide variety of actors constituting service providers, policy- and decision-makers as well as academic and industrial research organisations and last but not least the scientists themselves. In the following, key-actors for the Ecosystem are listed, and their key impacts are described. Promising potential forms of collaboration between the Ecosystem and stakeholders are proposed based on their importance for PRACE.

Stakeholder	Nature of interface	Stakeholder's field of interest	Description, impact and potential forms of collaboration
ESFRI	Political	Research infrastructures	• European Strategy Forum on Research Infrastructures. Advises the European Commission on future European research infrastructures. • High impact. • Forms of collaboration: discussions (political), information, dissemination.
EGI	Political, technical	Grid	• Grid consortium. Aims to implement a future sustainable European grid infrastructure. Currently executing a Design Study. • Medium impact. • Forms of collaboration: discussions (also technical on interoperability), information, dissemination.

Stakeholder	Nature of interface	Stakeholder's field of interest	Description, impact and potential forms of collaboration
e-IRG	Political	Research infrastructures	• Policy maker. Aims at supporting the creation of a framework (political, technological and administrative) for the easy and cost-effective shared use of distributed electronic resources across Europe. • High impact. • Forms of collaboration: discussions (political), information, dissemination.
TERENA	Political	Networking	• Policy maker. Advises the EC on networking for the European research and academic communities. Maintains data repository on research networks. • Low impact • Forms of collaboration: discussions (political), information, dissemination.
EC FP7	Political, financial	European research and innovation area	• Policy maker. Executes European R&D agenda (in FP7). Funds R&D projects. • High impact. • Forms of collaboration: discussions (political), information, dissemination.
DEISA2	Technical, collaborative	HPC	• Infrastructure project. Provides distributed European HPC environment for supercomputing applications. • High impact. • Forms of collaboration: technical issues in HPC and networking.
ESF	Political	Political issues in science and research	• Promotion of high-quality science in Europe. • Medium impact. • Forms of collaboration: discussions (political), information, dissemination.
EGEE	Technical	Grid	• Provides grid infrastructure for e-Science. • Medium impact. • Forms of collaboration: technical issues in Grid and networking.
ERC	Political		• Research Council. Policy maker. Funding agency for investigator-driven frontier research. • Medium to high impact. • Forms of collaboration: discussions (political), information, dissemination.
OGF	Technical	Grid	• Global grid standardisation. • High impact. • Forms of collaboration: technical issues in Grid and standardisation.

Stakeholder	Nature of interface	Stakeholder's field of interest	Description, impact and potential forms of collaboration
DANTE	Technical, collaborative	Networking	• A body established by European NRENs to operate the pan-European research network GEANT. • Medium impact. • Forms of collaboration: technical issues in networking.
Academic HPC community	Research	Research, research infrastructure	• Academic HPC-users. Applications in engineering, human and social as well as natural sciences. • High impact. • Forms of collaboration: technical issues in computational sciences.
Industrial HPC community	Research	Research, research infrastructure	• Industrial HPC-users. Applications in aerospace, automotive, metallurgy, electronics, chemical, pharmaceutical, energy, medical, bioinformatics, telecommunication, finance, etc. • High impact. • Forms of collaboration: technical issues in computational sciences.
HPC vendors	Technical, collaborative	Hardware in HPC	• Commercial actors providing computer architectures and environments. • High impact. • Forms of collaboration: technical issues in HPC.
HPC Software companies	Technical, collaborative	Software in HPC	• Commercial actors providing software in HPC environments. • High impact. • Forms of collaboration: technical issues in HPC and computational sciences.

Table 1: List of key stakeholders analysed through their description, impact and form of collaboration in the European HPC Ecosystem

3.3.   Collaboration with Research Infrastructures

Most important, the success of the European HPC Ecosystem and the leading role of PRACE depend on the successful level of collaboration with the research infrastructures and the end users. PRACE has to proactively reach the HPC service providers in all tier levels to be able to communicate with and reach the end users. The stakeholder involvement and input when translating the user requirements (D6.2.1) into architecture and configuration specifications (D7.2) should be encouraged. While most of the risks are analyzed in D7.4.1 from a technological point of view it is necessary to consider also the contractual and funding risks involved with the broad range of interests expressed by the stakeholders.

Besides the existing local and national end users, the EU has identified research areas and infrastructures which may bring potential end users into the European HPC Ecosystem. The identification has been carried out by ESFRI in its 2006 roadmap for research infrastructures. PRACE must follow the work carried out by ESFRI to update this roadmap with new research infrastructures. The ESFRI e-Infrastructure Working Group (e-IWG) is the group to track. Important results will also come out of the planned e-IRG workshop in October 2008, where all the ESFRI list projects will be invited to discuss their e-Infrastructure needs to fulfil their successful commitments.

The current ESFRI roadmap lists the following research infrastructures. The contact details are given in 7.6.1.

- **CESSDA** - Council of European Social Science Data Archives
- **CLARIN** - Common LAnguage Resources and technology Initiative
- **DARIAH** - DigitAl Research Infrastructure for the Arts and Humanities
- **The European Social Survey**
- **SHARE** - Survey of Health, Ageing and Retirement in Europe
- **EROHS** - European Resource Observatory for the Humanities and Social sciences
- **AURORA BOREALIS** - European Polar Research Icebreaker
- **EMSO** - European Multidisciplinary Seafloor Observation
- **EUFAR** - Infrastructure Cooperation Network of the European Commission
- **EURO ARGO** - Global Ocean Observing in Infrastructure
- **IAGOS -ERI** - In-service Aircraft for a Global Observing System – European Research Infrastructure
- **ICOS** - Integrated Carbon Observation System
- **LIFE WATCH** - Research Infrastructures Network for Research in Biodiversity
- **HiPER** - High Power Experimental Research Facility
- **IFMIF** - International Fusion Materials Irradiation Facility
- **EATRIS** - The European Advanced Translational Research Infrastructure in Medicine
- **JHR** – Jules Horowitz Reactor
- **BBMRI** - European Biobanking And Biomolecular Resources
- **Infrafrontier** - Infrastructure for Phenomefrontier and Archivefrontier
- **ECRIN** - European Clinical Research Infrastructures Network
- **INSTRUCT** - Integrated Structural Biology Infrastructure
- **ELIXIR** - Upgrade Of European Bioinformatics Infrastructure
- **ELI** - Extreme Light Infrastructure
- **ESRF Upgrade** - European Synchroton Radiation Facility
- **ESS** – European Spallation Source for Producing Neutrons
- **European XFEL** – X-ray Free Electron Laser
- **ILL 20/20 Upgrade** - Institute Laue Langevin
- **IRUVX-FEL** - Infrared to Ultraviolet and soft X-rays Free Electron Lasers
- **PRINS** – Pan-European Research Infrastructures for Nano-Structures
- **ELT** - European Extremely Large Telescope
- **FAIR** - Facility for Antioproton and Ion Research
- **KM 3NeT** - Cubic Kilometre Neutrino Telescope
- **SKA** - Square Kilometre Array
- **SPIRAL2** - Système de Production d'Ions RAdioactifs en Ligne
- **EU-HPC** – European High-Performance Computing Service

The coordination of the current ESFRI infrastructures is shown in Figure 2. The situation will change by the time ESFRI will introduce its updated Roadmap in late 2008.
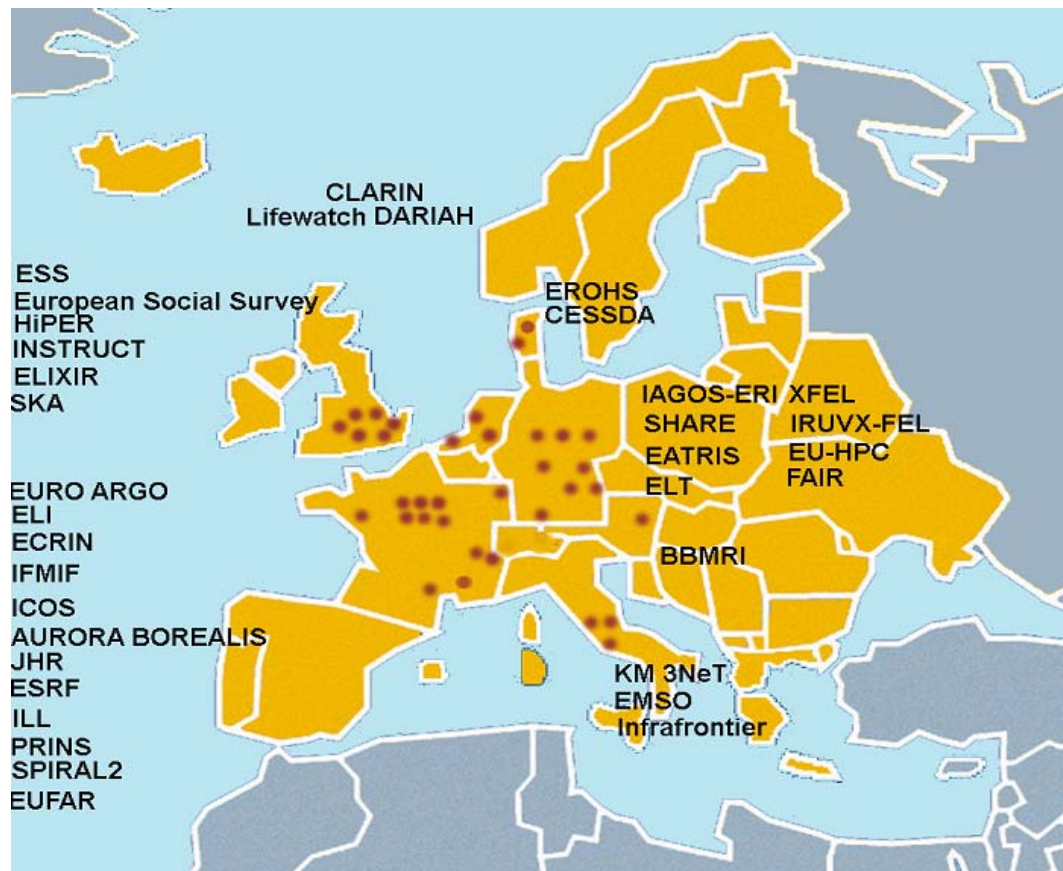

Figure 2: ESFRI Research infrastructures and their location of coordination

In addition to the ESFRI list projects there are a number of existing infrastructures, many of which include an active user community in the various fields of computational sciences. The analysed list of 10 most promising infrastructures as potential collaborators or PRACE customers is presented in Figure 3.

- **CERN** – European Organization for Nuclear Research
- **EBI** - the European Bioinformatics Institute
- **ECMWF** - European Centre for Medium-Range Weather Forecasts
- **EMBL -** the European Molecular Biology Laboratory
- **ESA –** European Space Agency
- **ESO -** European Organisation for Astronomical Research in the Southern Hemisphere
- **ESRF -** European Synchrotron Radiation Facility
- **ICOS** – Integrated Carbon Observation System
- **ICTP -** International Centre for Theoretical Physics
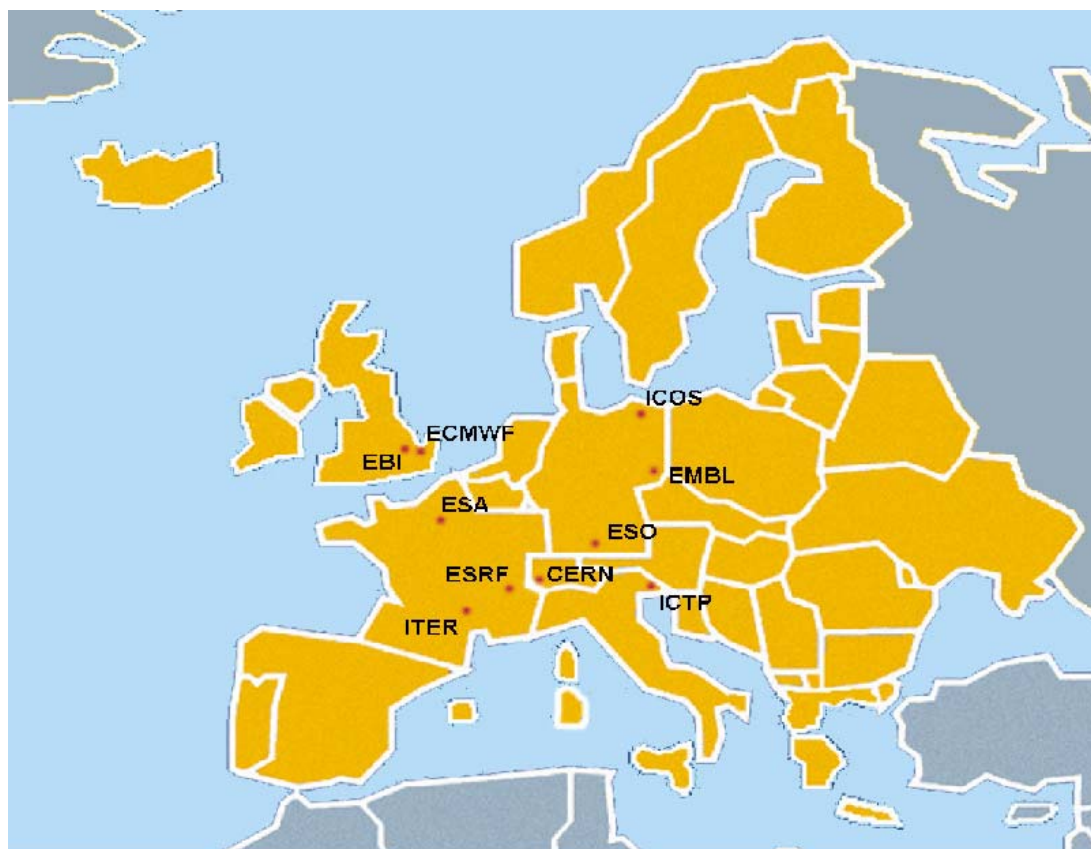- **ITER -** International Fusion Energy Organization

Figure 3: European centres and communities using computational science

3.4. Contacts with Research Infrastructure stakeholders

It would not be possible for PRACE to assume a leadership role in shaping the European HPC scene without an extensive effort to build confidence and trust among the various stakeholders. It is at the same time of utmost importance to understand the different demands and expectations between the academic and the industrial communities but being still able to approach them on a common level to achieve a maximum synergy effort. The following list of past and coming events gives a snapshot of the extensive work carried out to contact stakeholders within the research infrastructure for spreading the message about high performance computing in general and PRACE in particular.

Date	Event
11 – 14 February, 2008	EGEE-II User Forum in Clermont-Ferrand, France.
14 February, 2008	HP HPC Executive Forum in Divonne, France.
3 – 4 March, 2008	Nordic Data Grid Facility (NDGF) strategy meeting in Copenhagen, with a strong emphasis on high performance computing.
5 – 6 March, 2008	European Research Area (ERA) Research Infrastructure (RI) meeting in Slovenia, where the Expert Group report has been published. The report is an important part in the work for the European e-Infrastructure with a strong contribution from the HPC and PRACE community.
13 – 14 March,	EGI_DS Workshop in Rome. Important part of building the HPC

2008	Ecosystem with sustainable different computation layers.
9 – 11 April, 2008	The annual NORDUnet conference in Helsinki with a strong contribution in Grid computing. Meeting with the scientists and stakeholders in Grid computing.
10 April, 2008	Nordic eScience meeting in Helsinki initiated by the Nordic stakeholders. Nordic collaboration in HPC at the eScience level.
24 – 25 April, 2008	The e-IRG Workshop with the purpose to bring together the European Grid, HPC and stakeholder communities in Zurich.
28 – 29 April, 2008	PRACE-DEISA collaboration meeting in Edinburgh
April, 2008	PRACE panel in Intel EMEA HPC roundtable in Munich
5 – 7 May, 2008	Cray User Group (CUG) meeting in Helsinki. Meeting with the scientists and bringing together different communities
13 - 16 May, 2008	State-of-the-Art in Scientific and Parallel Computing - PARA'08 conference in Trondheim, Norway
15 May, 2008	Finnish seminar on "eScience changes the research landscape" in Helsinki. Speaking for the Finnish scientists about HPC and eScience.
2 - 4 June, 2008	Grand Challenges in Computational Biology in Barcelona.
3 – 4 June, 2008	Les Journées Ter@tec 2008 conference in France.
12 June, 2008	CESGA-Finis Terrae Computational Science Conference 2008 in Santiago de Compostela, Spain.
17 – 20 June, 2008	International Supercomputing Conference '08 in Dresden provides opportunities through presentations, "Building the HPC Ecosystem" BoF and PRACE awards a prize for an outstanding scientific paper submitted to ISC'08.
26 – 29 August, 2008	The PRACE project hosts Petascale Summer School at the Royal Institute of Technology, KTH, in Stockholm, Sweden.
3 – 4 September, 2008	The first industry workshop hosted by NCF and held in collaboration with NCF, GENCI and GAUSS in Amsterdam, the Netherlands.
15-19 September, 2008	WP8 Processing Unit Meeting
22 - 26 September, 2008	EGEE conference in Istanbul, Turkey.
29 September, 2008	*Research Infrastructures - information day on the reporting requirements, payment modalities and communications aspects, Brussels*
21 – 22 October, 2008	The e-IRG Workshop with the purpose to bring together the European Grid and HPC stakeholder communities together in Paris, France.
25 – 27 October, 2008	ICT'08 in Lyon
15 – 21 November, 2008	Supercomputing 2008 (SC'08) in Austin, USA.
9 – 10 December, 2008	Fifth European Conference on Research Infrastructures 2008 in Paris.
February 2009	PRACE Winter school in Athens
June 2009	ISC'09 in Hamburg
September 2009	2nd PRACE industry seminar
November 2009	SC09

Table 2: List of contacts established or to be established to reach the stakeholders.

The more detailed plan for dissemination events for 2009 will be available only later in 2008.

4. Collaboration opportunities

4.1.   PRACE services

In order to build a tier-0 HPC infrastructure, the PRACE project is defining an extensive set of services to make such an infrastructure operable, sustainable and manageable. This will be achieved through a broad collaboration between several PRACE Work Packages, a clear interface to the stakeholders and a strong link to the needs of the user communities. Apart from rather obvious HPC issues like providing the computing and storage services, there is also an urgent need to deal with the managerial or political issues.

Typical HPC services include the hardware as well as provisioning of thorough knowledge and expertise in the development and support of parallel application software and program packages, data handling, pre- and post- processing, application tuning and optimisation for the effective use of specific hardware characteristics. The majority of the service support does not necessarily have to be provided at the same site where the hardware is located. Intelligent utilization of virtual structures or communities will be a key factor for PRACE to be able to provide the sustainable services. The availability of such a range of HPC services, on a pan-European level is a prerequisite for the success of the PRACE preparatory phase project. Until that, the services provided by PRACE depend on the project work plan and service portfolio of each PRACE centre separately.

4.2.   Requirements by the stakeholders

It is expected that the different stakeholders will impose different types of requirements for the HPC services, depending on their points of view. The stakeholder interests can be anything, from following up the return of the tax payer's investment into scientific instrumentation to the interests to protect the output intellectual rights from simulations due to economical interests. The stakeholder requirements can thus be roughly divided between those of the academic and commercial communities. In D2.3.1 the results for the overall procurement process are presented both from the process point of view and an abstract stakeholder analysis.

The different stakeholders that have been listed in Section 3 have different requirements ranging from needs for pure computational capacity resources to advanced support on code scaling, or from political influence to access on high end computing systems. The computational requirements of the user community are described by HET Scientific case [4].

4.3.   Opportunities for Synergy

Most of the user communities listed in Figure 2 and Figure 3 have computing and data management environments in use – either by their own community or in collaboration with some other computing centres. Since new research infrastructures are being prepared through ESFRI roadmap projects, it is of utmost importance to ensure collaboration between PRACE, other grid projects and roadmap projects. The same issue applies to existing user communities. Better collaboration through joining forces in the information and

communication technology arena can save valuable human resources and investments for infrastructure.

One of the potential dangers we have to avoid is the creation of disciplinary ICT silos – resulting in computing, data handling and networking environments that are incompatible with each other. Due to major investment requirement for the emerging new research infrastructures and maintenance of the existing ones, we can not afford overlapping work for computational science part. Figure 4 illustrates the horizontal axis for European collaboration described by e-Infrastructure Reflection Group [7].
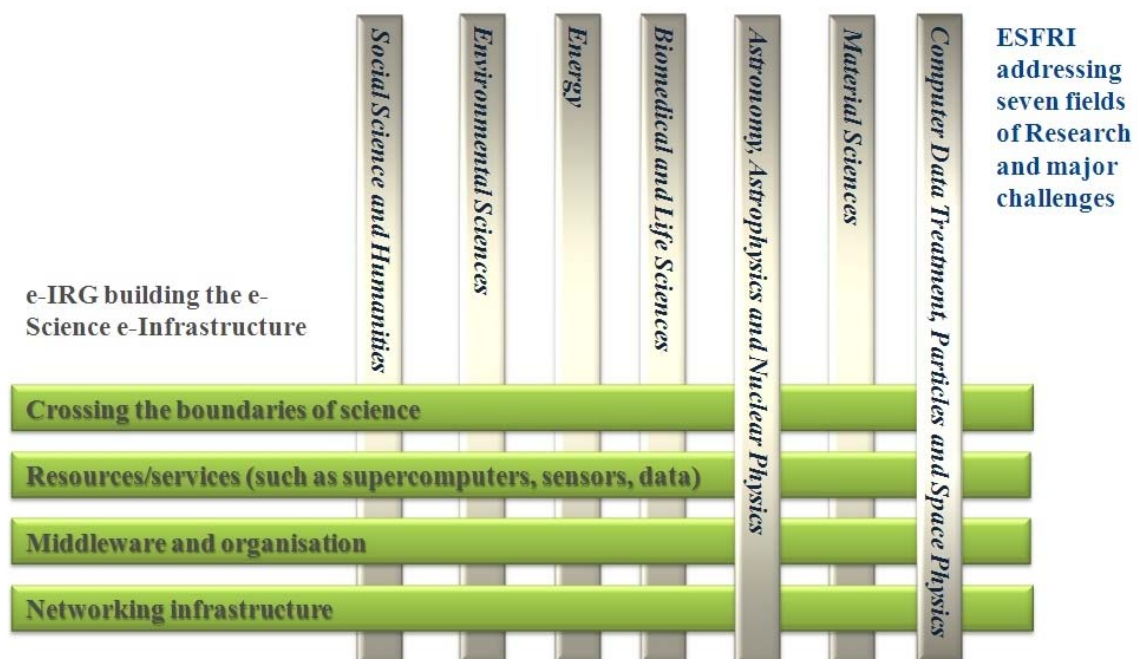

Figure 4: Horizontal services for synergy in building the research infrastructures

5. Contacting stakeholders

The effort to reach the different scientific communities started during the HET stage of the project in 2006[5] contacts with the hardware vendors in WP7 and the extensive list of person to person contacts shown in Section 3. The mandate for the PRACE project has been set during the preparatory work in HET and the scientific case outlined during this work.

5.1.   Dissemination and outreach

PRACE has a work package (WP3) dedicated to dissemination, outreach and training activities. WP3 has put together a dissemination plan, which includes seminars, presentations and other activities directed for contacting various groups. Examples of PRACE dissemination activities include industry seminars, booths at major supercomputing events and training courses for petascaling – as well as other related activities. Most of the outreach activities will be carried out by implementing the dissemination plan.

Different stakeholders have different priorities in collaboration with PRACE. Thus discussions need to be applied to the individual needs of the stakeholders. WP3 has developed a dissemination package, which can be used as a base material to support the stakeholder relations.

5.2.   Plan for contacting stakeholders

Parallel to the dissemination plan, an HPC Ecosystem contact plan has been developed to maximise contact and exchange of information with key stakeholders. The plan includes details of all stakeholders, broken down into the eight groups. A main PRACE contact has been assigned for each organisation, normally someone who has an existing relationship with it. Similarly, a single point of contact has been or is being established to represent the organisation or community, gather any information that might be required and coordinate any action that may be needed from that stakeholder.

Clear reasons and objectives for contacting each group have been documented as has the message that PRACE wishes to transmit to the group. This includes in some cases, dissemination material specifically designed for that stakeholder.

More detailed information for contacting stakeholders is available in Appendix 1.

5.2.1. Providers of HPC services

The national and regional computing centres provide compute capacity, data storage, databases and software. They also offer technical expertise in running, developing, optimizing and enabling applications. As ttier-0centres from the PRACE partner countries are intimately involved in the project, non-PRACE EU countries are the focus of the communication plan.

The following activities take place for contacting the stakeholder group:
- Contacts through presentations in seminars as listed in Table 2.

- Discussions carried out with European grid project (for example DEISA2 and EGEE) partners, which are mostly computing centres.
- Contacts through conference participation as listed in Table 2.
- Discussions with major centres, both within PRACE and with centres not included in PRACE.

See also section 7.1 in Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.2. European HPC and Grid projects

European HPC and grid projects have since many years already a strong focus on international collaboration established especially during Framework Programmes 6 and 7. Examples of successful collaborations include the establishment of the DEISA and EGEE infrastructures, and a number of preparatory phase projects for ESFRI roadmap infrastructures [6] with the support from the e-IRG roadmap supporting the development of the e-Infrastructure [7].

The following activities are planned for contacting the stakeholder group:
- Contacts through presentations in seminars as listed in Table 2.
- Discussions and collaboration meetings carried out with European grid projects. Especially close relations are expected with DEISA2, which collaboration including for example interoperability work, joint seminars/meetings and technology collaboration.
- Contacts through conference participation as listed in Table 2. One example is a collaboration meeting with major projects, such as DEISA2, EGEE and EGI, which is planned to take place during the EGEE conference in September 2008.

See also section 7.2 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.3. Network infrastructure providers

The centres and their services are connected via high-speed networks maintained by networking infrastructure providers, typically represented by European research network organizations operating the pan-European research network GEANT. Growing data amount generated in HPC projects and the international collaboration requiring data to be transferred over network set higher demand on communication network. Light paths enabling cost efficient high volume data transfer are being built by national network providers.

The following activities are planned for contacting the stakeholder group:
- Contacts through presentations in seminars as listed in Table 2.
- Discussions and collaboration meetings.
- Possible demonstrators of data transfer between PRACE centres and/or between PRACE centres and end users.

See also section 7.3 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.4. Hardware vendors

Hardware vendors are key stakeholders for PRACE since their solutions will eventually provide the high end computing platforms deployed in Europe. PRACE and vendors collaborate in various areas including prototyping activity, application benchmarking and other technical development. In addition, PRACE partners and vendors work together on a commercial basis.

The following activities are planned for contacting the stakeholder group:
- Joint work included in PRACE description of work, such as collaboration with prototype vendors and the discussions with vendors carried out before the prototype selection (WP7/8, for example WP7/8 Process Unit Meeting on September 18th in Paris)
- Advanced HPC Technology Platform developed in WP8.
- Participation in user groups, listed in Table 2.
- Participation in conferences, listed in Table 2.

See also section 7.4 of Appendix 1 section for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.5. Software vendors and the software developing academic community

Software vendors with an interest to scale their codes to parallel computing, potentially over several thousands of processor cores, are key stakeholders of PRACE. Software developing academic community is equally or even more important stakeholder, especially since due to the access to the source code and related expertise it is often easier to adjust the code to the new architectures. The software includes both applications and middleware solutions targeted to enable more efficient utilisation of the available systems.

The following activities are planned for contacting the stakeholder group:
- Joint work as included in the PRACE description of work, such as scalable application development and benchmarking of applications (WP6).
- Participation in conferences, listed in Table 2.
- Summer and winter schools including code optimization work.
- Existing contacts between PRACE centres and their academic customers with code development activities.

See section 7.5 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.6. End users

End users represent academic, research and industrial organizations and communities. Their applications in engineering, human, social and natural sciences are typically computationally or data-intensive. In some of the areas there are long traditions in using HPC, but in some areas computational science is just entering their domain. User communities vary in their maturity in using high end computing. Depending on the user community, different instruments to tackle the major issues might be needed: extensive training and code development in other end and just providing a suitable computing platform in another end.

The following activities are planned for contacting the stakeholder group:
- Joint work as included in PRACE description of work, such as scalable application development and benchmarking of applications (WP6), and also other Work Packages.
- Activities listed in Table 2 and dissemination plan.
- Utilisation of PRACE prototypes for user code.
- Contacts and collaboration meetings with ESFRI Roadmap projects (Chapter 3.3).
- Contacts and collaboration meetings with European centres using high end computing resources (chapter 3.3).
- Follow-up contacts to industry after each PRACE industry seminar.

See also section 7.6 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.7. Funding bodies

Funding bodies, such as the European Union, national ministries, academic research funding organizations, technology agencies and foundations, act on the European and national level. They fund pure and applied research and research infrastructures. The funding may be directed towards research or framework programmes or individual projects.

The following activities are planned for contacting the stakeholder group:
- Dissemination material and activities included in the dissemination plan.
- Meetings between PRACE partners and national funding bodies.
- Creation of a working group in month 10, involving the PRACE MB and representatives of national funding bodies, to discuss funding and usage.
- Contacts with EU countries, which are not currently in PRACE.

See also section 7.7 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.2.8. Policy setting organisations

Political bodies, such as EC, ESFRI, e-IRG or TERENA contribute to political decisions and have an impact to future strategies in research and research infrastructures. Many of them are already involved in PRACE work and require uptodate information during the project. Since PRACE is in ESFRI roadmap and funded partly by EU, these bodies follow the PRACE development actively through their standard processes. Some of the policy boards should be addressed proactively by PRACE.

The following activities are planned for contacting the stakeholder group:
- Meetings between PRACE and policy setting organisations.
- Participation in e-IRG conferences.
- Participation in concentration meetings and events organized by the EU.

See also section 7.8 of Appendix 1 for detailed breakdown of specific stakeholders within this group and details on contact plan.

5.3.   Priorities

As can been seen from the rest of the document, all of the stakeholders have an important part to play in the HPC Ecosystem and their involvement is crucial in order to take maximum advantage of the future PRACE infrastructure. However, it is also clear that contact with certain stakeholders is amply covered by the completion of the tasks contained in the work packages. These include:

- European HPC and grid projects – A close working relationship has been set up with Deisa, including sharing of DoW and representation of PRACE in the DEISA board. PRACE is also present as an observer on the EGI board and has made presentatioins to and initiated discussion with EGEE. The partners involved in HPC-Europa are all also PRACE partners as are many of those involved in EUFORIA.

- Hardware vendors have already been contacted in the prototype work and at various meetings organised by WP7 and WP8. Software vendors and the software developing academic community who are coordinating with WP6 and attended meetings in September.

- Consultation with industry users is taking place through the Industrial Seminar Organising Committee.

- Close contact with funding bodies is being maintained at national level and a joint PRACE managmenet Board/National Ministry working group on funding and usage will be created in M10/11.

- PRACE is already in close contact with policy making organisations such as e-IRG, ESFRI and EU DG INFSO. The key message is to demonstrate the need for high end computing resources for European computational science, the role of horizontal IT services – such as supercomputing, data management, networks and application development – in building the European HPC Ecosystem, and the planned peer-review process enabling scientists to use computing capability offered by PRACE.

The remaining stakeholders are perhaps less easiliy covered by the normal activities of the eight work packages and as such they have been prioritised and specific actions have been designed in order to open and improve lines of communication with them. Contact is being coordinated between the Task 2.5 leaders, the WP2 leader and the chair of the Initiative:

- The non-PRACE EU (and candidate country) providers of HPC services are being contacted by the chair of the initiative, initially by email, in order to inform them about the project and gauge their interest in signing the PRACE MoU. This process has already begun, with Ireland and Turkey already having signed the MoU in May, 2008, and the entry of Cyprus officially approved by the management board and due to sign at the end of October.

- The networking infrastructure providers are covered by Geant/Dante and Nordunet. These organisations will be contacted through collaborators who have a history of

working with them (for Geant/Dante Ralph Niederberger of FZJ and for Nordunet, Kimmo Koski of CSC).

- The end users are obviously a crucial stakeholder and work is concentrating on: eleven of the thirty-five ESFRI projects have been prioritised. SKA, HIPER, ELI, PRINS, ICOS, LIFEWATCH, EMSO, ECRIN, ELIXIR, CLARIN and SHARE, but all 35 will be contacted in order to understand their HPC needs.

- Eleven Existing RI have been prioritised and will be contacted.

- Finally, following through the Scientific Case for a European Supercomputing Infrastructure made by the HET project and bringing it up to date will be a priority. Contact is being made with the moderators of each of the five main areas in order to update the scientific case and needs of each area. This is supplemented by the contacts being made in order to create the Scientific Steering Committee (SSC).

PRACE activities are mainly in European research area. However, since much of the science is global, it is important to create links outside Europe with the similar activities, such as the petaflop initiatives in USA and Japan. PRACE will participate in Supercomputing'08 and Supercomputing'09 conferences in US, which opportunity will be used in addition to build up the global collaboration.

6. Conclusions

This document targets to analyse the HPC Ecosystem and indicate stakeholders (Section 3), which PRACE should address during the preparatory phase project in 2008-2009. Since the number of stakeholders in HPC is large, careful of prioritization is required including the selection of appropriate methods for contacting – meeting, dissemination material, conference presentation, etc. PRACE WP3 focuses on outreach and dissemination and supports this work. However, a number of individual meetings with stakeholders are required in addition to the dissemination work to make the interaction efficient.

The PRACE preparatory phase project has set its target to build the legal and management framework of European computing centres to be resourced with world class computing performance available to the European Research Area. Efficient utilization of such resources requires input from many different sources. Enablers for highly sustained computing performance include scalable code development, integration with national infrastructures, sufficient data repositories, high capacity networking and competent people – just to name a few. Thus the only way to succeed in deploying the European centres is to address the whole HPC Ecosystem by linking the Petaflop/s systems and related services closely to the existing infrastructures.

To efficiently contribute in building the European HPC Ecosystem it is necessary to focus on outreach and communication between various stakeholders. The benefits of computational science and high end computing are not always understood by decision makers requiring more discussion and proof of concept. The collaboration possibilities and impact of horizontal HPC services are not fully known by users, which also sets requirement for outreach. Including the appropriate stakeholders in the discussion is one of the key targets for PRACE.

The HPC Ecosystem is about enabling science on a European scale. It needs to incorporate all stakeholders in order to provide a European Research Infrastructures for supercomputing which assures that European research remains competitive on a global scale. These stakeholders have been identified in this document. All of the layers of the performance pyramid in Figure 1 have to be integrated in order to enable the access of the European researchers to the PRACE Research Infrastructure.

Prioritization of the stakeholders in the hardware vendor's field has to be done in collaboration between WP2, WP7 and WP8. The same procedure for the software side is more complex but still manageable in a collaboration between WP2 and WP6.

7. Annex 1 - HPC Ecosystem Contact Plan

The following tables show the contact plans for the stakeholders in the HPC Ecosystem. Stakeholders are broken down into the 8 groups:

1. Providers of HPC services
2. European HPC and grid projects
3. Networking infrastructure providers
4. Hardware vendors
5. Software vendors and the software developing academic community
6. End users and their access through related Research Infrastructures
7. Funding bodies on a national and international level
8. Policy making organisations directly involved in developing the research infrastructure and national and international political bodies

The HPC Ecosystem contact plan has been developed to maximise contact and exchange of information with key stakeholders. The plan includes details of all stakeholders, broken down into the 8 groups. A main PRACE contact point has been assigned to each organisation, normally someone who has an existing relationship with it. Similarly, where possible, a single point of contact has been established to represent the organisation or community, gather any information that might be required and coordinate any action that may be needed from that stakeholder.

Clear reasons and objectives for contacting each group have been documented including the message that PRACE intends to transmit to the group. This covers dissemination material which in some cases is specifically designed for that stakeholder.

For each stakeholder a contact plan with a timetable will be written detailing the expected results, the deliverables which the stakeholders will be able to contribute to and a vision how communication will be maintained during the implementation phase of the research infrastructure.

Many of the stakeholder contacts are being made as a natural part of the project, such as contacting Tier1 centers and hardware vendor collaboration, and are already included in the work plan. Some of the stakeholder groups will be integrated into the project work through concepts defined in work plan. One example is the scientific communities which will be addressed through the creation of the PRACE scientific committee in 2009 and through their inclusion in benchmarking and application scaling work in WP6.

7.1. Providers of HPC services;

Tier-1 PRACE members are not included here as they are internal to the project. Similarly, they are all members of national grid initiatives and as such are in close contact with Tier-2. The following are Tier-1 national centres of EU states which are not members of PRACE (plus the official candidate countries Turkey, Croatia and Macedonia). The objective in all cases is the signature of the PRACE Initiative MoU. Expected results include collaboration leading to integration and interoperability and optimal workload division.

Organization Name	Contact Person	comment
Belgium	Pierre Bruyere , BELNET	
Bulgaria	Prof. Atanassov, Institute for Parallel Processing	Contact established
Cyprus	Prof. C. Alexandrou Chair, Interim Governing Board, CSTRC	Due to sign PRACE MoU on Oct 29, 2008
Czech Republic	Jan Gruntorad, Cesnet	
Denmark	René Belsø, DCSC	
Estonia	Jaak Anton, Ministry of Education and Research	
Hungary	Lajos Bálint, NIIF/Hungarnet Tamás Máray, NIIF	
Ireland	James Slevin, ICHEC	Member of initiative since May 29, 2008
Latvia	Ilmars Slaidins, Riga Technical University	
Lithuania	Laimutis Telksnys, LITNET/Institute of Mathematics and Informatics	
Luxembourg	Antoine Barthel, Restena	
Malta	Robert Sultana, University of Malta	
Romania	Dorin Carstoiu, Polytechnical University of Bucharest	
Slovakia	Ladislav Hlucý , Ústav informatiky SAV Tomáš Lacko, Computing Centre of the Slovak Academy of Science	
Slovenia	Andreja Umek Venturini, Ministry of Higher Education, Science and Technology	
Turkey	Serdar CELEBI UYBHM	Member of initiative since May 29, 2008
Croatia	Ivan Marić SRCE, University of Zagreb	
Macedonia		

7.2. European HPC and grid projects

Various members of the PRACE consortium are members of the following European HPC and grid projects. PRACE maintains very close collaboration with DEISA and several agreements and coordinating measures have been established. PRACE also has an official observer on the EGI board.

Organization Name	Contact Person	Main Interlocutor from PRACE	Content of Communication[1]	Objectives & Expected Results
DEISA	Stefan Heinzel (MPI)	Achim Bachem FZJ	Integration, interoperability, collaboration	Collaboration, interoperability, joint activities, shared activities in many areas
EGI	Dieter Kranzlmuller (LRZ), Per Öster (CSC)	Peter Kunszt CSCS	interoperability, collaboration	Collaboration, interoperability Information sharing, joint policy work
EGEE	Bob Jones (CERN), Per Öster (CSC)	Peter Kunszt CSCS, Kimmo Koski CSC	interoperability, collaboration	Interoperability, information sharing, working collaboration
OMII-Europe	Alaister Dunlop (University of Southampton)	Achim Streit, FZJ	Collaboration possibilities	Software development, Information sharing, code development
HPC-Europe	Sanzio Bassini (CINECA)	Sergi Girona BSC	Collaboration possibilities	Collaboration, resourcing visiting researchers HPC Europe researchers to use PRACE services
EUFORIA	Pär Strand (Chalmers)	Kimmo Koski, Leif Laaksonen CSC, JM Cela BSC	Fusion as one user community for PRACE	Collaboration, political support, potential PRACE customer Joint activities

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[1] Based on what message PRACE wants to communicate (e.g. service that PRACE will provide) using available dissemination material.

7.3.   Networking infrastructure providers;

Networking infrastructure providers which cover the whole of Europe have been included. Both Dante and Geant have been included as, although they overlap in many ways, there are some differences.

Organization Name	Contact Person	Main Interlocutor from PRACE	Content of Communication	Objectives & Expected Results
GEANT	Dai Davies, Hans Döbeling, Klaus Ullmann	Ralph Niederberger FZJ	Need for high speed network	Network for PRACE requirements for networking understood
DANTE	Dai Davies, Hans Döbeling, Klaus Ullmann	Ralph Niederberger FZJ	Collaboration possibilities	Information sharing
Nordunet	Rene Buch (Nordunet), Janne Kanner (CSC)	Kimmo Koski CSC	Need for high speed network	Network for PRACE requirements for networking understood

7.4.   Hardware vendors

Contact with vendors was started early in the project, through workpackage 7 at the start of the prototype process. This contact has been continued in the workpackage 8 prototype process and the exact way that vendors will interface with PRACE is being defined in the STRATOS MoU. In all cases the content communicated includes the objectives and needs of PRACE and how the vendor can contribute. The objectives and expected results include roadmaps, technical work, development PRACE requirements understood

Organization Name	Contact Person	Main Interlocutor from PRACE
AMD	François Challier	Kimmo Koski, CSC
Bull	Jean-François Lavignon	François Robin, GENCI
Clearspeed	Michal Harasimiuk	François Robin GENCI, Axel Berg NCF, LRZ
Cray	Ulla Thiel, Vincent Pel	Kimmo Koski CSC
Dell	Mellenbergh Bart	Lennart Johnsson, KTH
Fujitsu	Philippe Haye	François Robin, GENCI
Hitachi	WP7 POC	Kimmo Koski, CSC
HP	WP7 POC	Kimmo Koski, CSC
IBM	Philippe Bricard	Sergi Girona BSC, Thomas Lippert FZJ, Axel NCF
Intel	Marc Dollfus	Thomas Lippert, FZJ
NEC	Philippe Gire	Stefan Wesner, HLRS
nVIDIA	Jean-Christophe Baratault	François Robin GENCI, Thomas Lippert FZJ
SGI	Robert Uebelmesser	François Robin, GENCI
SUN	WP7 POC	Thomas Lippert, FZJ

PROSPECT	Francesc Subirada (BSC),	Thomas Lippert (FZJ)	Collaboration, how industry can use PRACE	Industry relations Industry contacts, integration to PRACE work
TALOS	Claude Camozzi, Bull	Stefan Wesner, HLRS	Collaboration, how industry can use PRACE	Industry relations Industry contacts

7.5. Software vendors and the software developing academic community

The application codes used in WP6 are categorized into scientific area (see D6.1). Each application code has a Benchmark Code Owner (BCO) responsible for the management of that application code within WP6. The interlocutor from PRACE is the centre in which the relevant BCOs work from. The BCO is responsible for the contact between PRACE and the code authors for each application.

The content of the communication in all cases is the requirements for code development in using high-end systems. Expected results and objectives in all cases is collaboration in code development between the BCO and the code developers. In addition, the resulting applications should have datasets to enable petascale testing and should be including in an integrated benchmark suite. In all cases, objectives and expected results include: Scalable code available, inclusion in benchmark suite, suitable dataset for petascaling tests.

7.5.1. The software developing academic community

Application Name	Contact Person(s)	Main Interlocutor from PRACE
Astronomy and Cosmology		
Gadget	Orlando Rivera	LRZ
ENZO	Claudio Gheller	CINECA
Computational Chemistry/Condensed Matter Physics		
CP2K	Pekka Manninen	CSC
CPMD	Albert Farres	BSC
GROMACS	Sebastian von Alfthan	CSC
GPAW	Jussi Enkovaara	CSC
VASP	Albert Farres	BSC
Computational Engineering		
TRIPOLI_4	Jean Christophe	CEA
Computational Fluid Dynamics		
ALYA	Albert Farres	BSC
AVBP	Betrand Cirou	CINES
Code_Saturne	Andrew Sunderland	DL
N3D	Harald Klimach	HLRS
Earth and Climate Sciences		
BSIT	Albert Farres	BSC
ECHAM5	Mark Cheeseman	CSCS
NEMO	John Donners	SARA
Life Sciences		
NAMD	Joachim Hein	EPCC
Particle Physics		
QCD Benchmark	Lukas Arnold	FJZ
Plasma Physics		
PEPC	Lukas Arnold	FZJ
Torb	Albert Farres	BSC
Other		
HELIUM	Xu Gou	EPCC

7.5.2. Software Vendors

In all cases, the content of communication issued will cover what is needed for PRACE and how the vendor can contribute and the objectives include joint projects and collaboration on technology.

Organization Name	Contact Person	Main Interlocutor from PRACE
Allinea	*Michael* Rudgyard	EPSRC
CAPS	Laurent Bertaux François Bodin	GENCI
CEA-DRT-LIST	Didier Juvin	GENCI
Ecolib		CINECA
PARAVER	Jesus Labarta	BSC
SCALASCA	Felix Wolf FZJ	FZJ
Unicore	Achim Streit FZJ	FZJ
TotalView	Brian Bonenfant	CINECA, BSC
Vampir	Wolfgang E. Nagel	CINECA
RapidMind	Kevin Boon	CINECA

7.6. End users and their access through related Research Infrastructures;

7.6.1. ESFRI

The ESFRI projects will be contacted with information on the aims and progress of PRACE project. Objectives in all cases will be to understand the ESFRI project's HPC needs, discuss possible access routes for their usage of PRACE and potential collaboration opportunities. It will also be possible to exchange best practice in the preparation stage. In all cases, initial contact will be coordinated by the Task 2.5 leader and WP2 leader. Emails will be sent to the contacts before the *Research Infrastructures - information day on the reporting requirements, payment modalities and communications aspects* held in Brussels on Sep 29, asking for feedback on the projects' HPC needs and offering to meet and further discuss these. A presentation on PRACE will also be made at the *Open Workshop on e-Infrastructures* meeting in Paris on October 21-22, 2008 to which representatives of all of the ESFRI projects have been invited.

Organization Name	Contact Person
NeutronSourceESS	Peter Allenspach
ILC-HiGrade	Eckhard Elsen
INSTRUCT	David Ian Stuart
E-ELT Prep	Roberto Gilmozzi
IRUVX-PP	Joseph Feldhaus
LIFEWATCH	Wouter Los
FAIR	Juergen Eschke
INFRAFRONTIER	Martin Hrabé de Angelis
ESRFUP	Michael Krisch
ICOS	Philippe Ciais
ICOS	Cécilia Garrec
EURO ARGO	Pierre Yves Le Traon
EURO ARGO	Ramiro Gonzales
ELIXIR	Janet Thornton
PRE-XFEL	Massimo Altarelli
HiPER	Mike Dunne
ECRIN-PPI	Jacques Demotes-Mainard
ERICON-AB	Paul Egerton
EMSO	Paolo Favali
SHARE-PREP	Axel Börsch-Supan
ILL20/20	Richard Wagner
ELI-PP	Gérard Mourou
BBMRI	Kurt Zatloukal
SLHC-PP	Lyn Evans
IAGOS-ERI	Andreas Volz-Thomas
COPAL	Jean-Louis Brenguier
CESSDA-PPP	Hilary Beedham
CLARIN	Steven Krauwer
PrepSKA	Keith Mason
PrepSKA	Philip Diamond
ESSPrep	Roger Jowell
EATRIS	Rudi Balling

Organization Name	Contact Person
KM3NeT-PP	Emilio Migneco
SPIRAL2PP	Marek Lewitowicz

7.6.2. Existing RI

Eleven existing research infrastructures have been prioritised and will be contacted with information on the aims and progress of PRACE project. Objectives in all cases will be to understand the RI's HPC needs, discuss possible access routes for their usage of PRACE and potential collaboration opportunities.

Organization Name	Contact Person	Main Interlocutor from PRACE
CERN	Robert Aymar	Achim Bachem, FZJ
EBI	Janet Thornton	Kimmo Koski, Leif Laaksonen CSC, Modesto Oruzco BSC
ECMWF	Walter Zwiefelhofer	Kimmo Koski, Leif Laaksonen CSC
EFDA	Jerome Pamela, Frank Jenko	Thomas Lippert FZJ
EMBL	Iain Mattaj	Achim Bachem FZJ
ESA	Maurici Lucena	Achim Bachem FZJ, Francesc Subirada BSC
ESO	Tim de Zeeuw	Achim Bachem FZJ
ESRF	A. Lichnewsky	Catherine Riviere GENCI
ICOS	Philippe Ciais	Achim Bachem FZJ
ICTP	Katepalli R. Sreenivasan	Achim Bachem FZJ
ITER	L. Crouzet	Catherine Riviere GENCI

7.6.3. User Communities (by discipline)[2]

Contact with the discipline-specific user communities will be coordinated through two lines of action:

1. A review of the scientific case established by the HET Project will be coordinated through the moderators of the original five areas (see table below).

2. Planning for the Scientific Steering Committee (SSC) will begin. The SSC will consist of experienced scientists or engineers spanning all scientific and technological areas which may benefit from the tier-0 HPC Infrastructure. Its members will be designated for their achievements and status in the scientific community or HPC user industries.

The user communities have been priorities and will be re-contacted with information on the aims and progress of PRACE project. Objectives in all cases will be to understand their HPC needs, discuss possible access routes for their usage of PRACE. In all cases, the task 2.2 leader will make contact.

User Community	Contact Person
Engineering	Ken Badcock (University of Liverpool)

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[2] Classification taken from HET Scientific Case. The contents will be filled more in detail as the planning for establishment of PRACE scientific committee proceeds. Panels of former HPCEUR project will be reviewed and possible points of contact used.

Life sciences	Modesto Orozco (UB/BSC)
Materials science, chemistry and nanoscience	Gilles Zerah (CEA-DAM)
Astrophysics, HEP and plasma physics	Wolfgang Hllebrandt (MPI für Astrophysik)
Weather, climatology and earth sciences	Vicky Pope (Meteorological office

7.6.4. Industry

Official dialogue with industry was begun when preparing the industrial seminar. Exchange of views and information during the seminar and the feedback received after it have been very useful in transmitting to industry the potential that PRACE will offer them and in transmitting to PRACE the needs and concerns of industry. This was done both in the talks given by industrial users, through conversation, and through an evaluation form which was competed at the end of the seminar as part of WP3. This contact will be extended and deepened over the following months and in the next industrial seminar. The official point of contact for PRACE is the Industrial Seminar Organizing Committee. Names of the contact people can be found in the deliverable 3.2.1 on the First Industry Seminar. Objectives and Expected results in all cases are to ensure that PRACE takes industry's need for tier-0 resources into account ; to enable efficient technology and knowledge transfer; Increased industrial interest for high-end computing; strengthening of contact networks between industry and providers of computing services. Objectives & Expected Results in all cases are information on how industry is interested in using PRACE and closer Collaboration. The main interlocutor from PRACE in all cases will be the industry seminar organization committee.

User Community	Contact Person
Automotive	PORSCHE, SCANIA
Aerospace	AIRBUS, EADS, SNECMA, BAE, VOLVO AERO
Materials	ARCELOR MITTAL, HUTCHINSON
Biotech	NOVARTIS, SCHERING PLOUGH, AKZONOBEL
Energy	EDF, TOTAL, ENI, CEA, IBERDROLA, REPSOL
Finance/Insurance	BNP PARIBAS, SOCIETE GENERALE
Electronics	PHILIPS, NXP
IT/SMEs	CS, TSYSTEMS, EDS, NUMTECH, NAG, MEDIT

7.7.   Funding bodies on a national and international level;

All PRACE members are in close contact with the funding bodies in their countries, and this contact will be taken a step further through the creation of a working group made up of the PRACE MB and the relevant representatives of the national ministries which will be a forum to discuss the requirements of these ministries concerning funding and usage. This will happen in November 2008. Objectives & Expected Results in all cases are for PRACE to become better known by the national authority leading to increased national support.

Organization Name	Contact Person	Main Interlocutor from PRACE
Austria	Peter Kowalski, Austrian Ministry of Science and Research	Martin Polak, GUP
Finland	Anita Lehikoinen (Ministry of Education), Markku Mattila (president of Research Council),	Kimmo Koski, CSC
France	Dany Vandromme, Research Ministry	C. Riviere GENCI
Germany	Helmut Loewe, BMBF	GAUSS

Greece	Ministry of Development, Prof. TsouKalas	Fotis Karayannis GRNET
Italy	Dr. Mari Alí, Ministry of University and Research	Sanzio Bassini, CINECA
Netherlands	PP ,t Hoen ICTRegie Advisory Council	Patrick Aerts, NCF
Norway	Ole Henrik Ellestad, Research Council of Norway	Jacko Koster, UNINETT
Poland	Ministry of Science and Higher Education Krzysztof Jan Kurzydlowski	Norbert Meyer, PSNC
Portugal	Joao Sentieiro, Fundação para a Ciência e Tecnologia	Pedro Alberto, UC-LCA
Spain	Montserrat Torne - Directora General de Cooperación Internacional Ministry of Science and Innovation	Francesc Subirada, BSC
Sweden	Swedish Research Council, Par Omling	Lennart Johnsson, SNIC
Switzerland	Dr. Marie-Christine Sawley, ETH Zurich	Peter Kunszt, CSCS
UK	Jane Nicholson, EPSRC	Jane Nicholson, EPSRC
Ireland		James Slevin ICHEC
Turkey		Serdar CELEBI UYBHM
Cyprus	Andreas Moleskis, Planning Bureau of the Republic of Cyprus	Prof. C. Alexandrou, CSTRC

7.8.   Policy making organizations directly involved in developing the research infrastructure and national and international political bodies

Organization Name	Contact Person	Main Interlocutor from PRACE	Content of Communication	Objectives & Expected Results
e-IRG	Leif Laaksonen	Kimmo Koski, CSC Patrick Aerts, NCF Segi Girona, BSC	Policy discussion, HPC needs for Europe	Policy, outreach, standardization High end computing to e-IRG roadmap
ESFRI	Carlo Rizzuto	Achim Bachem, FZJ	Policy discussion, HPC requirements for European science	Policy, user communities, scientific case HPC visibility in ESFRI, concrete collaboration projects
EU DG INFSO	Mario Campolargo, Antti Peltomäki, Kyriakos Baxevanidis	All	Progress of PRACE	Policy, support, funding
EU DG Research	Herve Pero, Anneli Pauli	All	Progress of PRACE and HPC need for research	Policy, support, funding, scientific case
TERENA	Dorte Olesen	Leif Laaksonen CSC	Networking collaboration	Networking policies and requirement PRACE requirements understood by TERENA, PRACE visibility
ESF	Marja Makarow	Leif Laaksonen, Kimmo Koski, CSC	PRACE impact for science	Political support, funding issues PRACE impact understood, ESF support for PRACE
ERC	Fotis Kafatos	Achim Bachem, FZJ	PRACE impact for research	Political support, funding issues PRACE impact understood, ERC support for PRACE
OGF/OGF-	Silvana Muscella	Rossend Llurba,	Communication of	Collaboration on Standardisation

Europe		NCF Peter Kunszt, CSCS	PRACE requirements	

8. Annex 2 – Example of Customised PRACE Presentation

Below is an example of a presentation of PRACE which has been adapted to a specific stakeholder audience, in this case industrial users.

PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

PRACE – Europe goes HPC

Achim Bachem, Forschungszentrum Jülich
Amsterdam, September 3 2008, Europe goes HPC

HPC is a "Key Technology"

- Supercomputers are *the* tool for solving most challenging problems through simulations

- Access to capability computers of leadership class is essential for international competiveness in science and engineering

- Providing competitive HPC services is a continuous endeavor

- This has been acknowledged by leading industry nations such as USA and Japan since the 1990'ies
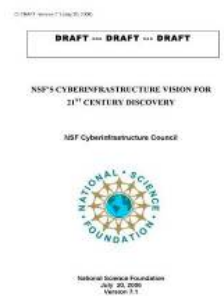
- And in Europe ?

Europe's current position in HPC

PFlops

Aggregated LINPACK Performance in PetaFlops in November Top 500 Lists

- USA
- Europe
- PRACE PP
- Asia
- Japan
- China+India

75% of European HPC-power is within PRACE
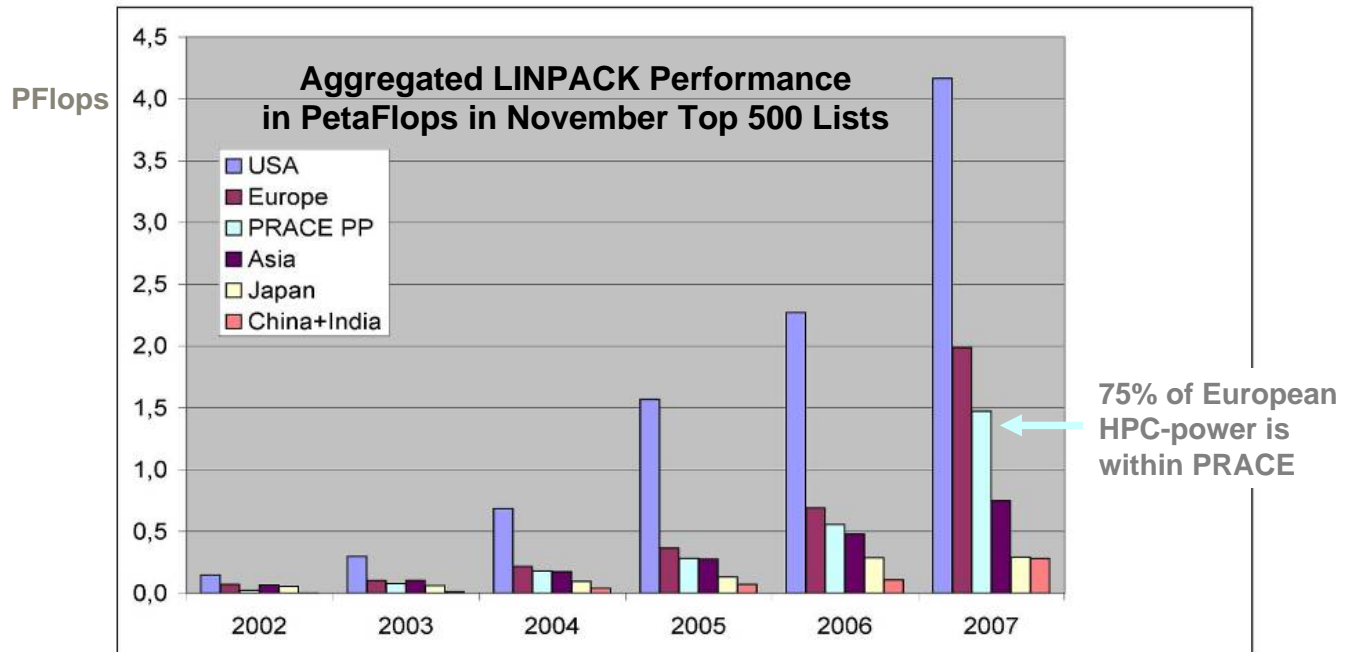
3

PRACE: The European Access to HPC-Technology

tier 0

ECMWF
epcc
sara
GENCI
GCS
Gauss Centre for Supercomputing

European Ecosystem

finance

aerospace

automotive

virtual power plant

4

6 years technolgy advantage with a #1 system

Top 500 list 11/07
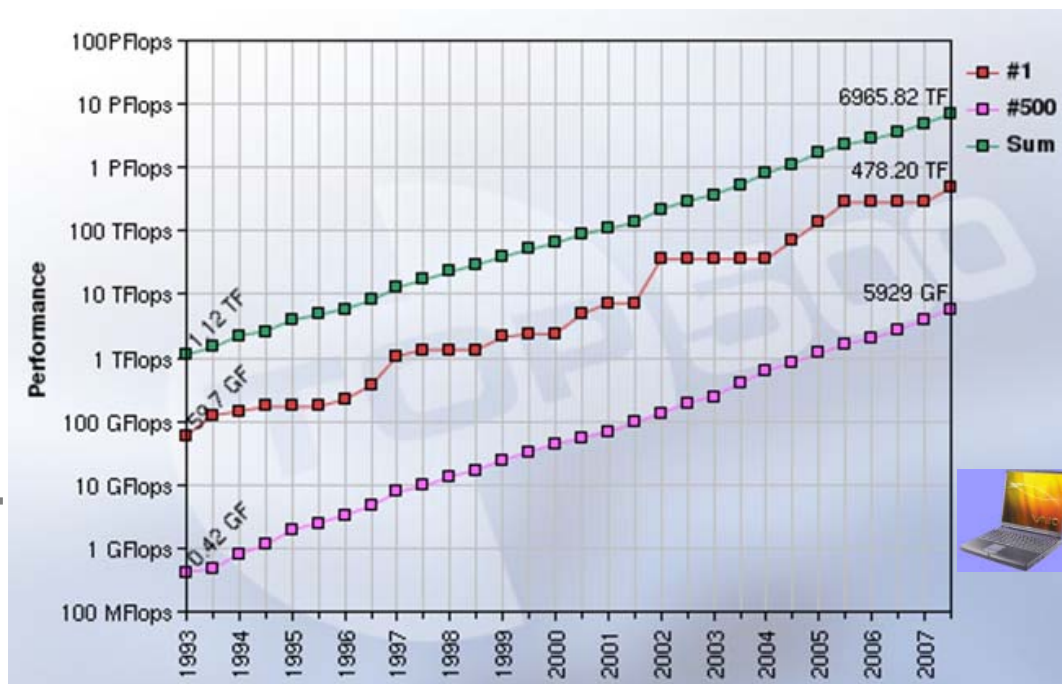
5

Computational science infrastructure in Europe

The European Roadmap for Research Infrastructures is the first comprehensive definition at the European level

Research Infrastructures are one of the crucial pillars of the European Research Area

A European HPC service – impact foreseen:
- strategic competitiveness
- attractiveness for researchers
- supporting industrial development

6

The ESFRI Vision for a European HPC service

- European HPC-facilities at the top of an HPC provisioning pyramid
  - Tier-0: 3-5 European Centres
  - Tier-1: National Centres
  - Tier-2: Regional/University Centres

- Creation of a European HPC ecosystem involving all stakeholders
  - HPC service providers on all tiers
  - Grid Infrastructures
  - Scientific and industrial user communities
  - The European HPC hard- and software industry
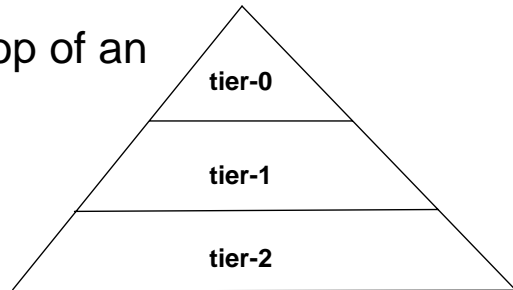
7

ESFRI – Estimated costs

- Unlike other European Research Infrastructures:
  - Tier-0 resources have to be renewed every 2-3 years
  - Construction cost 200 – 400 Mio. € every 2-3 years
  - Annual running cost 100 – 200 Mio. €

- A truly European challenge – also in terms of funding

- PRACE – The Partnership for Advanced Computing in Europe
  - An Initiative created to implement the ESFRI vision of a European HPC service

8

First Steps and Achievements

Production of the HPC part of
the ESFRI Roadmap;
Creation of a vision,
involving 15 European countries

Signature of the MoU

Submission of
an FP7 project proposal

Bringing scientists together
Creation of the Scientific Case

Approval of the project
Project start

| HPCEUR | HET | PRACE Initiative |

2004 2005 2006 2007 2008

9

First Steps and Achievements

Production of the HPC part of
the ESFRI Roadmap;
Creation of a vision,
involving 15 European countries

Signature of the MoU

Submission of
an FP7 project proposal

Bringing scientists together
Creation of the Scientific Case

Approval of the project
Project start

| HPCEUR | HET | PRACE Initiative |

2004 2005 2006 2007 2008

10

HET: The Scientific Case

- Weather, Climatology, Earth Science
  - degree of warming, scenarios for our future climate.
  - understand and predict ocean properties and variations
  - weather and flood events
- Astrophysics, Elementary particle physics, Plasma physics
  - systems, structures which span a large range of different length and time scales
  - quantum field theories like QCD, ITER
- Material Science, Chemistry, Nanoscience
  - understanding complex materials, complex chemistry, nanoscience
  - the determination of electronic and transport properties
- Life Science
  - system biology, chromatin dynamics, large scale protein dynamics, protein association and aggregation, supramolecular systems, medicine
- Engineering
  - complex helicopter simulation, biomedical flows, gas turbines and internal combustion engines, forest fires, green aircraft,
  - virtual power plant
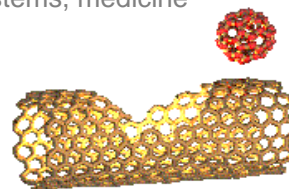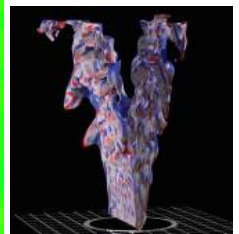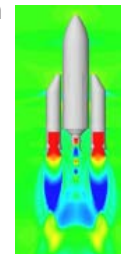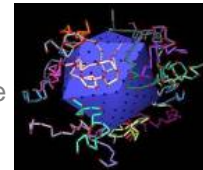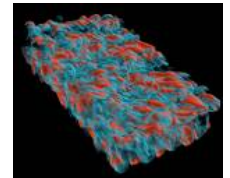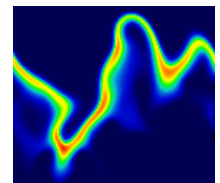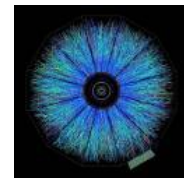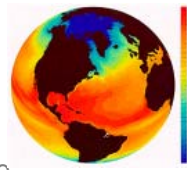
Supercomputing Drives Science through Simulation
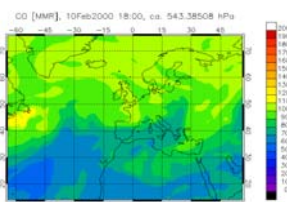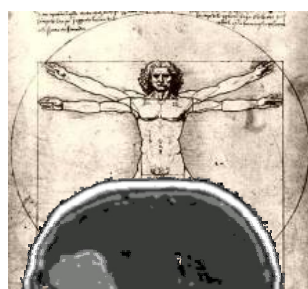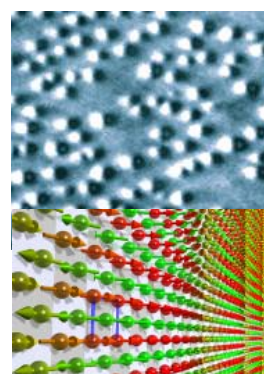
Environment	**Ageing Society**	**Materials/ Inf. Tech**	**Energy**
Weather/ Climatology	Medicine	Spintronics	Plasma Physics
Pollution / Ozone Hole	Biology	Nano-science	Fuel Cells

First Steps and Achievements

Production of the HPC part of
the ESFRI Roadmap;
Creation of a vision,
involving 15 European countries

Signature of the MoU

Submission of
an FP7 project proposal

Approval of the project
Project start

Bringing scientists together
Creation of the Scientific Case

HPCEUR

HET

PRACE Initiative

2004   2005   2006   2007   2008
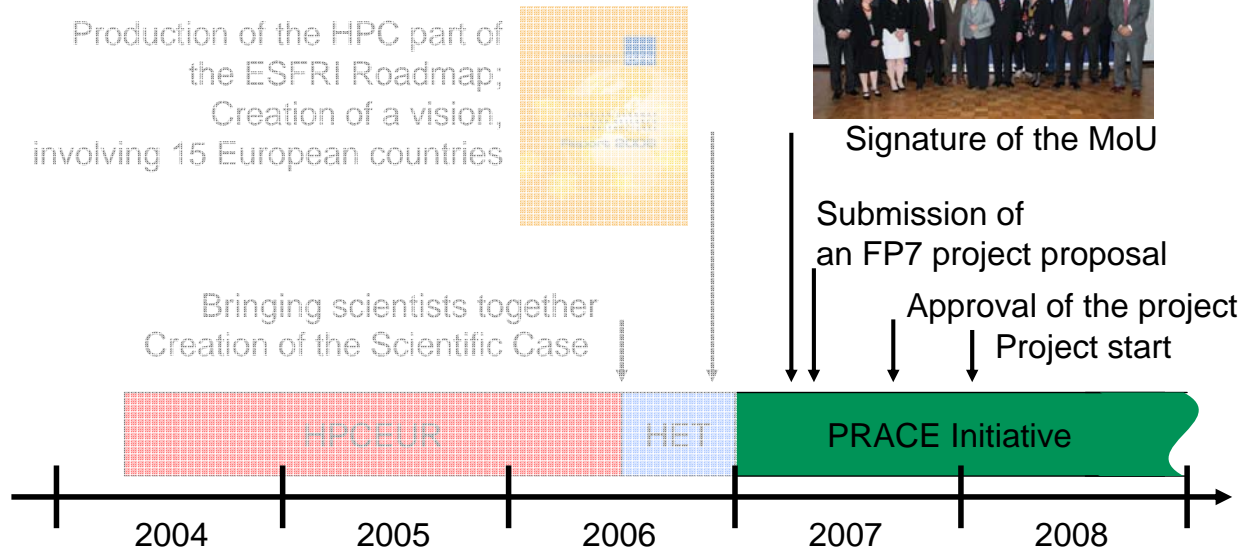
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PRACE – Project Facts

- Objectives of the PRACE Project:
  - Prepare the contracts to establish the PRACE permanent Research Infrastructure as a single Legal Entity in 2010 including governance, funding, procurement, and usage strategies.
  - Perform the technical work to prepare operation of the Tier-0 systems in 2009/2010 including deployment and benchmarking of prototypes for Petaflops systems and porting, optimising, peta-scaling of applications
- Project facts:
  - Partners: 16 Legal Entities from 14 countries
  - Project duration: January 2008 – December 2009
  - Project budget: 20 M € ,   EC funding: 10 M €

PRACE is funded in part by the EC
under the FP7 Capacities programme
grant agreement INFSO-RI-211528

CAPACITIES

e-infrastructure

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PRACE – Project Consortium

New Partners - since May 2008 - of the PRACE Initiative :

Improved performance through software technology

It is not only the hardware!

Software technology doubles speed every 6 years!
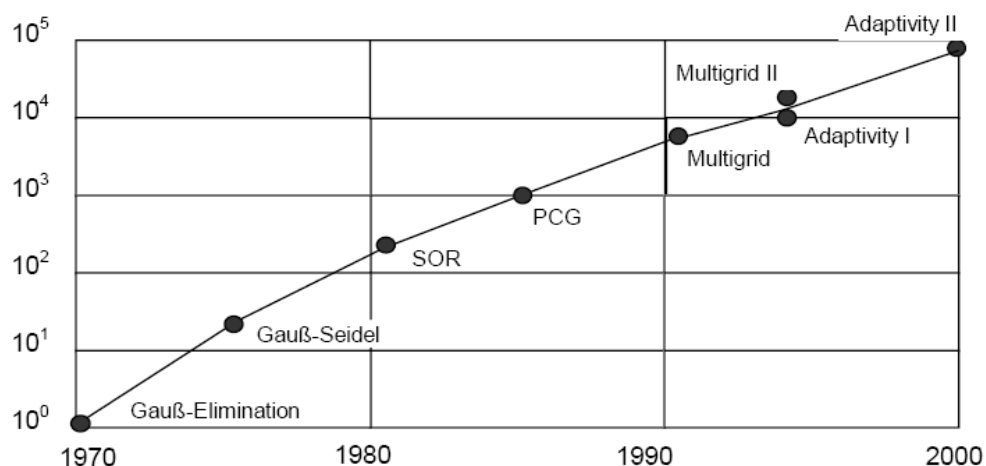
HPC Services for the European Industry

- Usage of HPC technology in industry is 6-8 years behind technology frontier – as available to top research
- The USA undertakes to boost competitiveness of local industry by shortening this period
  - free-of-charge access to HPC resources through INCITE program
- PRACE is striving towards a similar model
  - Understand industrial needs
  - Raise awareness for competitive advantages of tier-0 HPC usage
  - Design a usage model suited for European industry and SMEs
- Impact of PRACE foreseen for European industry
  - Competitive advantage through simulations in development of new or optimized materials, processes, and products like cars, airplanes, drugs, …
  - Technology and knowhow transfer through scientific support and partnerships

Goals of the seminar

- Understanding industrial needs and expectations
  - Hard- and software requirements
  - Support
  - Security and privacy
  - Usage model, e.g. pay-per-use vs. long term commitments
  - …

- Discussing options for industry involvement in PRACE
  - Contribute to scientific steering and governance to ensure suitability of PRACE services also for industrial needs
  - Contribute to financing though purchase of PRACE services

HPC in the automotive industry
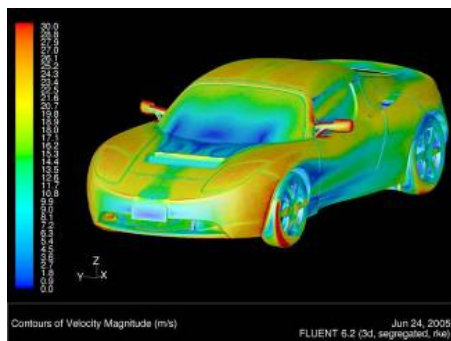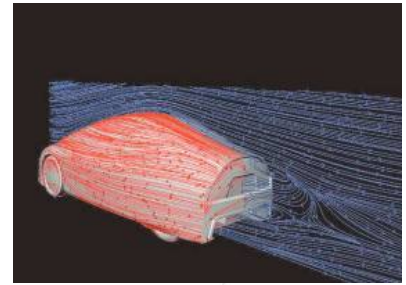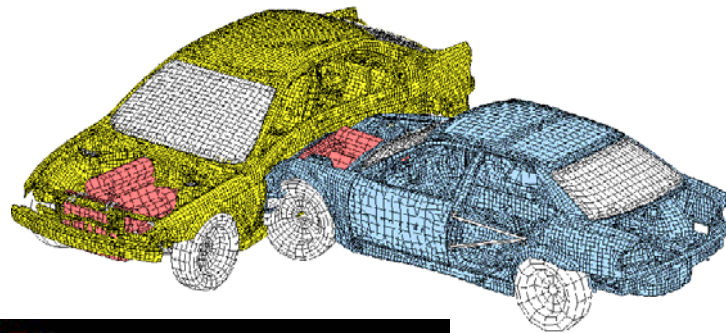
Crashworthiness
Development of a FKV-Crash box
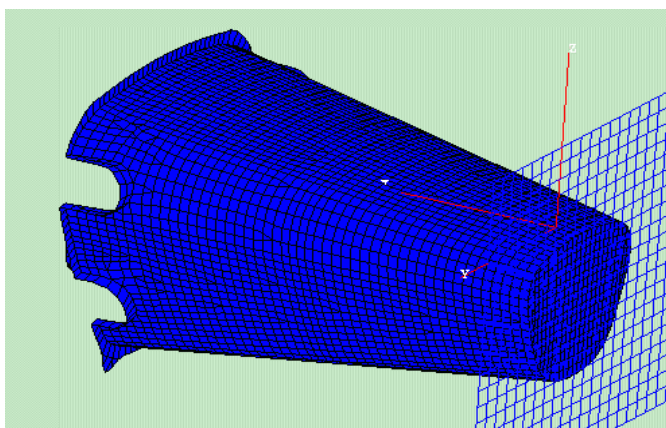
simulation of the front crash box
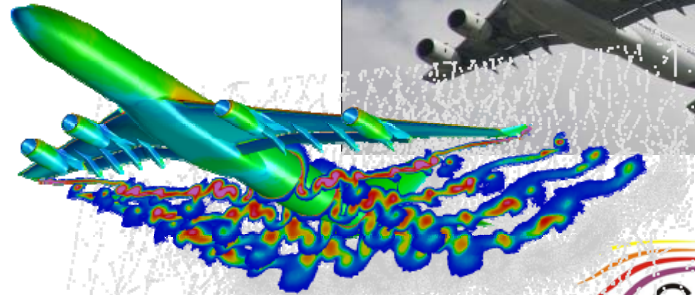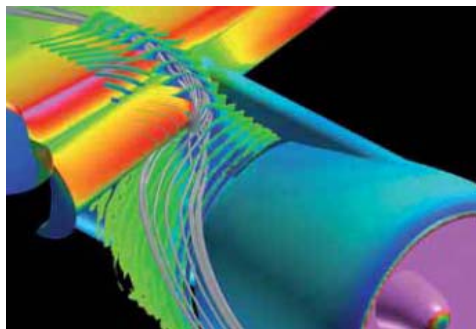
validation of the front crash box
v_0=13 m/ s, m=1200 kg

The virtual airplane

C²A²S²E
Center for Computer
Applications in
AeroSpace Science
and Engineering

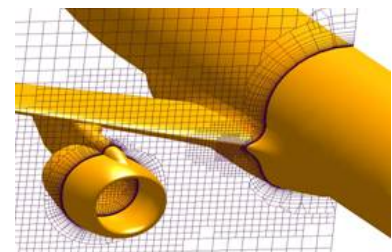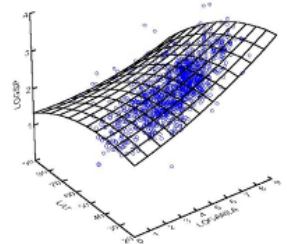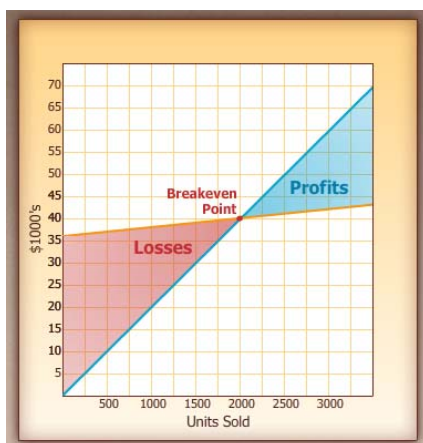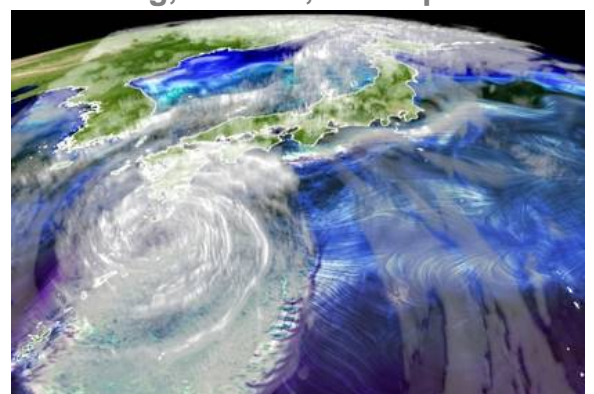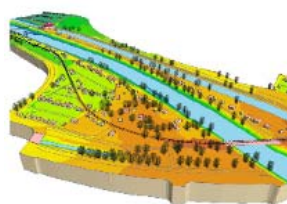# HPC and the finance sector

financial modelling

risk simulation

Insurance: simulating a flooding, a taifun, an eruption

The next tasks:

… growing into a persistent Research Infrastructure

- Identify architectures and vendors capable of delivering Petaflops systems by 2009/2010
- Install prototypes at partner sites to verify viability
- Define consistent operation models and evaluate management software
- Capture application requirements and create a benchmark suite
- Port, optimize and scale selected applications
- Define an open, permanent procurement process
- Define and implement a strategy for continuous HPC technology evaluation and system evolution within the RI
- Foster the development of components for future multi-petascale systems in cooperation with European and international HPC industry
- ***Start a process of continuous development and cyclic procurement of technology, software and systems for the permanent PRACE Research Infrastructure***

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Fostering European HPC Industry

- Most HPC vendors today are US- or Japan-based
- An independent access to HPC-technology is a strategic issue for Europe
- PRACE will foster European developments by
  - Translating user requirements to architectural specifications for future multi-petascale HPC systems
  - Supporting the creation of consortia of industrial and academic stakeholders to develop future components and systems
    - Europe-based and international companies with R&D activities in Europe
    - European HPC centres
  - Example: PROSPECT INTEL, IBM, QUADRICS, ParTec, BSC, DWD, FZJ, LRZ, …
  - Example: TALOS BULL, CEA, HLRS, INTEL, QUADRICS

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PRACE Roadmap
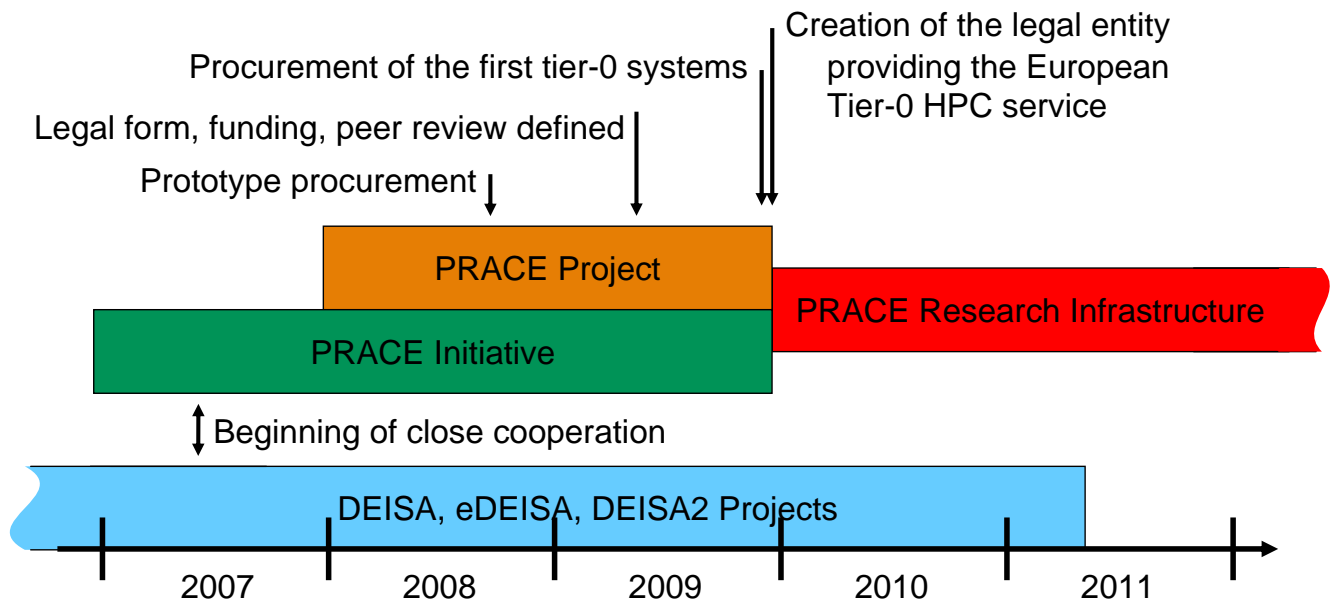
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Opportunities ahead

- **PRACE builds upon**
  - the HPC expertise of 14 European countries in HPC service provisioning and on projects like DEISA
  - the expressed support of our national governments, the European Commission and many scientific communities
  - an excellent team-spirit grown during the past years of HPCEUR, HET, PRACE and other joint endeavors

- **The time is right to**
  - boost competitiveness of European research and economy through HPC
  - create services to fulfill the HPC requirements of the upcoming ESFRI infrastructures
  - create and shape the European HPC ecosystem

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