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PRACE Third Phase Implementation Phase Project

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Technical Framework for Evaluation of PCP Results

Final

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[7] HPL - A Portable Implementation of the High-Performance Linpack Benchmark for Distributed-Memory Computers: http://www.netlib.org/benchmark/hpl/

[8] Green500 project web-site: www.green500.org

[9] PRACE-2IP D7.4, Unified European Applications Benchmark Suite

List of Acronyms and Abbreviations

AISBL	Association International Sans But Lucratif (legal form of the PRACE RI)
API	Application Programming Interface
BLAS	Basic Linear Algebra Subprograms
CFD	Computational Fluid Dynamics
CINECA	Consorzio Interuniversitario, the largest Italian computing centre (Italy)
CPU	Central Processing Unit
CSC	Finnish IT Centre for Science (Finland)
CUDA	Compute Unified Device Architecture (NVIDIA)
EC	European Community
EPCC	Edinburg Parallel Computing Centre (represented in PRACE by The Engineering and Physical Sciences Research Council, United Kingdom)
FZJ	Forschungszentrum Jülich (Germany)
GENCI	Grand Equipement National de Calcul Intensif (France)
GNU	GNU's not Unix, a free operating system
GoP	Group of Procurers
GPU	Graphic Processing Unit
HPC	High-Performance Computing; computing at a high performance level at any given time; often used synonym with Supercomputing
HPL	High-Performance LINPACK
Hz	Hertz, frequency = 1 period or clock cycle per second
I/O	Input/Output
JSC	Jülich Supercomputing Centre (FZJ, Germany)
LINPACK	Software library for Linear Algebra
LQCD	Lattice QCD
MD	Molecular Dynamics
MKL	Math Kernel Library (Intel)
MPI	Message Passing Interface
NDA	Non-Disclosure Agreement. Typically signed between vendors and customers working together on products prior to their general availability or announcement.
OpenMP	Open Multi-Processing
PFlop/s	Peta (= 10^{15}) floating-point operations (usually in 64-bit, i.e. double precision) per second, also PF/s
PCP	Pre-Commercial Procurement
PRACE	Partnership for Advanced Computing in Europe; project acronym
PRACE RI	PRACE Research Infrastructure; permanent European HPC service
PRACE-2IP	PRACE project, 2nd implementation phase
PRACE-3IP	PRACE project, 3rd implementation phase
QCD	Quantum Chromodynamics
R&D	Research and Development
TB	Tera (= 240 ~ 1012) Bytes (= 8 bits), also TByte
TCO	Total Cost of Ownership. Includes other costs (personnel, power, cooling, maintenance, etc.) in addition to the purchase cost of a system.
TFlop/s	Tera (= 10^{12}) floating-point operations (usually in 64-bit, i.e. double precision) per second, also TF/s.
Tier-0	A set of the largest HPC systems currently operational in Europe that serve as the backbone of the PRACE RI.
Tier-1	Slightly smaller HPC systems at national HPC centres that contribute to the PRACE RI.

T2.1	Task 2.1 of PRACE-3IP: Support for Pre-Commercial Procurement.
T8.2	Task 8.2 of PRACE-3IP: Technical framework for evaluating the results of PCP phases.
T8.3	Task 8.3 of PRACE-3IP: Technical evaluation of the results of the PCP phases.
WP8	Work package 8 of PRACE-3IP: responsible for the preparation, specification, and execution of the pre-commercial procurement.

Executive Summary

This deliverable provides a description of the organization, framework and items needed to perform the evaluation of the PRACE-3IP pre-commercial procurement (PCP) results. The responsibilities, tasks and overall process for performing the evaluation will be discussed in detail and the key elements involved in the implementation will be identified. The document will be updated as necessary during the progress of the PCP.

The PCP partners have formed an entity called the Group of Procurers (GoP) to supervise the PCP. Within this group, committees, working groups and roles have been designated for different tasks within the PCP process. A three-fold organization is to be used: steering of the PCP by a GoP Committee, execution of the evaluations by an Assessment Committee together with work package 8 and task 2.1 of PRACE-3IP, and coordination of the work by a pair of coordinators.

The PCP process has been organized into two major stages, the tendering stage using an "open procedure" and the execution stage which consists of three progressive phases where the candidates are evaluated. During the PCP, there are four evaluation milestones, one in the tendering stage and three at the end of each of the phases in the execution stage.

For the evaluation of the pilot systems to be developed, a set of representative applications and synthetic benchmarks have been selected to assess the solutions with realistic workloads. In order to quantify the energy-efficiency of the solution in a reliable and consistent way, we have also developed a set of procedures and requirements for analyzing the energy consumption of each proposed system using a virtual data centre concept.

1 Introduction

Pre-commercial procurement [1] is a multi-phase competitive research and development effort where multiple alternative solutions are pursued in parallel. At the end of each phase the proposals are evaluated based on results achieved and plans for future development. The most promising solutions are selected for continued development with the aim of ultimately leading to the best solution to the target problem.

In PRACE-3IP, the PCP model will be applied for the first time in Europe in the field of High Performance Computing (HPC) [2] by a group of European HPC centers. The objective of the PCP is to promote the development of new, highly energy efficient HPC technologies to tackle the power and cooling challenges of multi-petascale and exascale systems.

This document describes the organization, framework, and related items needed to perform the evaluation of the interim and final results of the PRACE-3IP PCP. The overall organization and process of the PRACE-3IP PCP is described in detail in deliverable D2.1.1 [3] together with further background information on pre-commercial procurement. The technical specifications and rationale for targeting energy-efficiency as well as the criteria for evaluation are provided in deliverable D8.1.1 [4].

The PCP process is a two stage process that is composed by a tendering stage and an execution stage. The tendering stage deals with the tender submission, the qualification of the bidders and the selection of tenders to sign a framework agreement with the procuring entity for the provision of the services required in the execution stage. In the execution stage, the proposed solutions are designed and developed in parallel by the participants over three

phases. Interim evaluations and selections at the end of each phase serve to narrow the focus to the most promising solutions under development.

The services procured under the PCP fit in the list of exemptions to Directive 2004/18/EC [5] and therefore there is no requirement to use one of the tendering procedures defined therein. Nevertheless, PRACE has decided to implement a procedure similar to the "open procedure" defined in the directive. Similar to an "open procedure", there is no "pre-qualification" phase to select appropriate candidates for the tendering, but instead all interested parties are able to submit a tender at the tendering stage.

The evaluation of the tenders at the tendering stage will be done according to technical and financial criteria while the evaluation of the results at the execution stage will use technical criteria. Closer details of the criteria and methods for each evaluation will be provided as part of the corresponding calls for bids to give all participants advance knowledge of the relevant factors. The tenders will be assessed by a panel of experts, called Assessment Committee, with support from PRACE-3IP WP8.

This document is structured in such a way that first the organization of the evaluation group, and the roles and responsibilities therein, are described in Section 2. Then in Section 3 the evaluation process at each milestone is explained followed by a detailed description of the benchmark codes and data sets in Section 4. Section 5 outlines the process, requirements and training needs for measuring the energy consumption of pilot systems. Procedures for procuring additional hardware or software that may be needed for the evaluation are described in Section 6 followed by a brief summary in Section 7.

2 Organization

The PRACE-3IP PCP will be implemented following closely the approach recommended by the European Commission (EC) in 2007 in its communication related to the organisation of a PCP [6].

A Group of Procurers (GoP), consisting of representatives from all HPC centers involved in the PCP, has been created to supervise the PCP process, to ensure the overall performance of the PCP, and to facilitate and safeguard the overall procurement process especially with respect to the public procurement rules and related regulations. The GoP will also monitor the compliance of the PCP process execution with the principles of fairness and transparency, and look after the interests of the entities funding the PCP and the efficient utilisation of their cash contributions.

The members of the GoP are:

- CINECA (Italy), acting also as the Procuring Entity
- CSC – Tieteen Tietotekniikan Keskus Oy (Finland)
- University of Edinburgh - EPCC (UK)
- Forschungszentrum Jülich GmbH (Germany)
- Grand Equipement National de Calcul Intensif (France)

The PRACE AISBL (Belgium) has participated in the preparation of the PCP, acts as an observer and supports its implementation as an advisory entity.

The GoP has organised the work in the following way (Figure 1). A steering group, called the GoP Committee, has been established to oversee the process and to make any decisions regarding the PCP. The execution of the actual procurement is to be done by CINECA acting as the Procuring Entity. Work package 8 (WP8) and task 2.1 (T2.1) of PRACE-3IP have laid

the groundwork for the PCP and will provide the necessary work force to implement the PCP process. The evaluation of the PCP results, as well as the initial tenders, will be performed by an Assessment Committee with the support of WP8. To coordinate the whole process and to serve as a link between the GoP Committee and the implementation team, a Coordinator will be appointed by the GoP Committee and to assist him a Deputy Coordinator will be appointed by the Procuring Entity.

In the following sections, the various actors are described in more detail and their role in the evaluation process is elaborated upon.

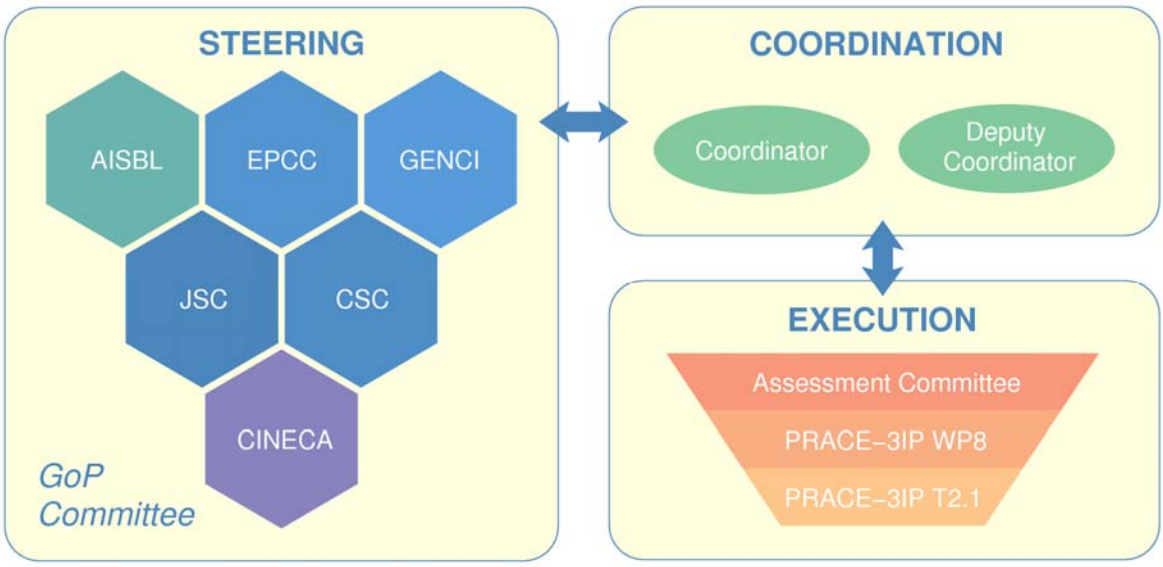

Figure 1: An overview of the organisation of the PRACE PCP. The GoP Committee steers the process, the Assessment Committee and PRACE-3IP execute it, and the coordinators act as a link between the various entities to ensure a smooth process. It is noteworthy that unlike other members of the GoP Committee (blue), CINECA (purple) acts also as the Procuring Entity and that PRACE AISBL (cyan) has only an advisory role.

2.1 GoP Committee

The GoP Committee shall be the general coordinating and representative body of the GoP. It shall give the overall direction of the PCP and be the ultimate decision-maker on any matter related to the PCP.

The GoP Committee shall in particular be responsible for:

1. establishing the goals of the PCP in line with the Grant Agreement of PRACE-3IP;
2. reviewing and approving documents concerning the PCP prior to publication or negotiation with possible suppliers;
3. taking the award decisions for the tendering stage and at each phase of the PCP execution stage, based on the documents of the Assessment Committee provided by the Coordinator;
4. proposing the members of the Assessment Committee to the Procuring Entity;
5. appointing and dismissing the Coordinator, providing guidance to this Coordinator on implementation approaches and required actions;
6. ensuring, as far as reasonably possible, that no decision is taken which would be unduly detrimental to any GoP Member, put it at risk of incurring any liability towards any person whatsoever or would violate any decision of any of its governing bodies, its articles of association or any legal or contractual provisions applicable to it, provided due notice of the same shall have been received from such GoP Member;

7. ensuring, before signing any contract, that the adequate funding has been obtained both from the European Commission and the GoP members at the start of each phase;
8. instructing the Procuring Entity in accordance with all of the above to implement its decisions.

2.2 Assessment Committee

The Assessment Committee will be a panel of experts, nominated by the GoP Committee and appointed by the Procuring Entity, in charge of evaluating the bids made by PCP participants and the result of each phase of the PCP Process.

The mission of the Assessment Committee is the following:

- During the PCP tendering stage after the reception of all tenders: analyze the offers, interact with vendors and prepare decisions for the GoP Committee,
- During the PCP execution stage: monitor the work of the vendors, evaluate the outcome of each PCP phase and proposals for the next phase and prepare decisions for the GoP Committee.

The Assessment Committee, in accordance to Italian regulation, is chaired by the Deputy Coordinator (appointed by CINECA as the Procuring Entity) and co-chaired by the Coordinator. In addition, it includes one person and a substitute per GoP member (none of them can be a delegate to the GoP committee) and one representative of the CINECA administrative department. The chair of the assessment committee is the unique reference for the procurement procedure.

For the avoidance of doubt, PRACE AISBL shall be entitled to attend the Assessment Committee in a learning position with a consultative voice only and without voting powers.

The appointment of the Assessment Committee must only take place after the reception of all tenders. However, since legal and technical expertise is already needed during the tendering stage to answer any questions regarding the tendering, PRACE-3IP will ensure that suitable experts are available for this prior to the appointment of the Assessment Committee.

Once the Assessment Committee is set up, right after the opening of the envelopes at the end of the tendering stage, it will follow pre-defined working rules. These rules will be defined by PRACE-3IP WP8 and T2.1 in consultation with the GoP Committee and proposed to CINECA.

2.3 PRACE-3IP WP8

Task 8.2 (T8.2) will define the technical framework, procure and operate the additional components required to perform the technical evaluation and to permit the procurers to install and operate the pilot systems developed. In the case of hardware components, this may include software required for operating the hardware, such as compilers, development tools etc. If these components are elements of a supercomputer environment, adequate provision and training will also be defined by the task to ensure a safe working environment. If needed, this task will also define any training requirements to operate the pilot systems deployed during Phase III of the Execution stage. T8.2 working group will also update this document as necessary to reflect any changes or additions to the work plan.

Task 8.3 (T8.3) will provide the technical expertise to perform the evaluations during the PCP and will support the Assessment Committee and coordination team as necessary. This will include the analysis of benchmark results, energy measurements, technical design etc. T8.3

will analyze all technical details regarding the PCP and provide a comprehensive report to the Assessment Committee. In the case of repeat measurements to validate the results submitted by the participants, these will also be carried out by the T8.3 working group. If needed, they will also partake in any training specified by T8.2 to facilitate the safe operation of the pilot systems.

For each benchmark, a code manager has been identified within T8.3 who is responsible for setting up the benchmark code, input data and documentation that will be provided to the contractors at the beginning of Phase I. This work may require consultation support from the code developers, which are typically not part of this project. When selecting the benchmark codes it has been checked that such support is available.

3 Evaluation at each milestone

The PCP process is a two-stage process consisting of a tendering stage and an execution stage (Figure 2). The tendering stage deals with the tender submission, the qualification of the bidders and the selection of tenders to sign a framework agreement with the Procuring Entity for the provision of the services required in the execution stage. [1]

The execution stage has three distinct phases:

Phase I Solution Design (6 months),

Phase II Prototype development (10 months),

Phase III Pre-commercial small scale product/service development (16 months).

Thus, in addition to the evaluation done in the tendering stage there will be three evaluation milestones in the execution stage, one at the end of each phase, to evaluate the work and future plans of each competing candidate solution. In order to ensure timely delivery, the progress of work will also be monitored and an interim review will be done during each execution phase.

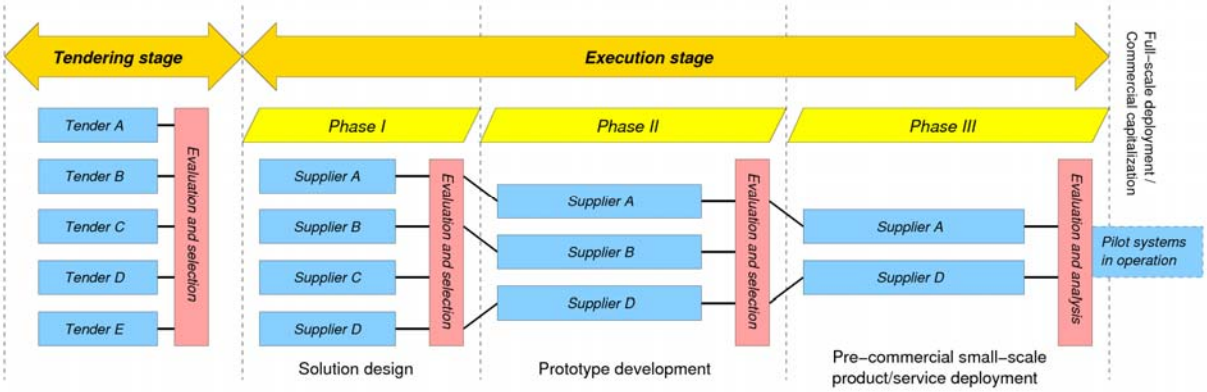

Figure 2: Timeline of the PCP with two stages: a tendering stage and an execution stage. The execution stage is further divided into three phases with evaluations at the end of each. Based on the evaluations, the focus is narrowed to the most promising solutions under development.

Major goals for each execution phase are described below:

- Phase I: High-level specification of the new technology to be developed as well as specification of the HPC architecture, in which this technology is integrated

- Phase II: Development of all design documents and realisation of lab-level prototypes to demonstrate feasibility of realization of pilot system during next phase
- Phase III: Integration of the component(s) in a system that can be tested with "real" applications
    - Test in a/several computer centre(s) (complementary tests if several sites)
    - Involvement of real users as much as possible
    - Quarterly progress meetings in order to assess the good progress of the work
    - Result expected to meet a sustainable market (larger than HPC)

3.1 Evaluation process

There are two types of evaluations to be performed during the PCP. First, there is the evaluation of the bids at the end of the tendering stage as well as the bids for Phase II and Phase III of the execution stage. Based on these evaluations it will be decided whether the bidders are eligible to sign the framework contract as well as the contracts for Phase I, II and III, respectively. Second, the results produced by each participant will be evaluated at the end of each phase of the execution stage to assess the performance of the contractor, the compliance with technical requirements and the fulfilment of commitments included in their bid. Compliance with technical requirements is mandatory to be awarded a contract for the next phase. Interim evaluations are also foreseen for Phase II and III to monitor work progress.

Even though the criteria and focus may differ between evaluations, they will all follow the process shown in Figure 3. To begin with the Assessment Committee will distribute the work by delegating the analysis of technical details, and any other issues beyond their expertise, to PRACE-3IP WP8. After this the Assessment Committee and WP8 will analyze their portion of the work in parallel. Within the work package, the work is further distributed to the code managers and other relevant experts who will produce an analysis of their respective part. In addition, WP8 may seek assistance from T2.1 on non-technical aspects of the analysis. The aim of the work package is to produce a joint, balanced analysis that will be presented back to the Assessment Committee.

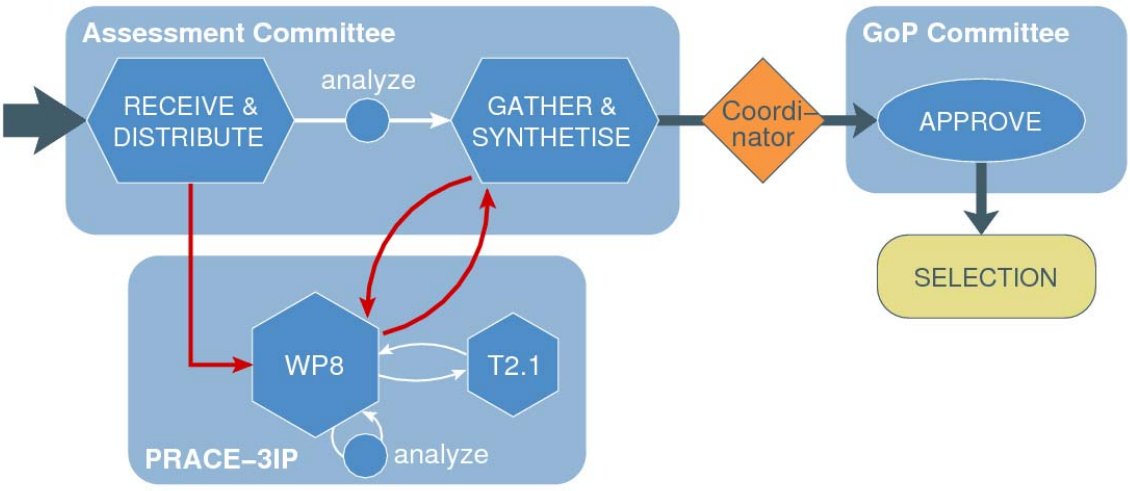

Figure 3: Evaluation process to be used in the PCP. The Assessment Committee will do the analysis with the support of PRACE-3IP WP8 and T2.1 and produce a comprehensive evaluation for the approval of the GoP Committee. Using the *a priori* published criteria, the most promising solutions will be selected based on the evaluation results.

The Assessment Committee will then combine the analysis with their own findings to produce a single, comprehensive evaluation for the perusal of the GoP Committee. If there is need for further clarifications or additional analysis by WP8, the Assessment Committee will request these from the work package before finalizing the evaluation. Once the evaluation is finished, the Assessment Committee will present it to the Coordinator, who will then submit it to the GoP Committee. Finally, based on the evaluation the GoP Committee will make a selection of the winning entries according to the guide-lines published in the respective call.

3.2 Responsibilities and tasks

The Assessment Committee is responsible for carrying out the evaluation tasks during the PCP. This will include the evaluation of the tenders at the tendering and the execution stages and the assessment of their adequacy, the evaluation of the end of phase reports and any interim reports, and the evaluation and testing of the early prototypes in Phase II and of the pilot systems deployed in Phase III. The Assessment Committee is also responsible for monitoring the progress of the contractor's R&D work during the execution stage.

The PRACE-3IP WP8 is responsible for supporting the Assessment Committee in its task of performing the evaluations. Within the work package the responsibilities are as follows.

Benchmark code managers are responsible for their respective benchmarks and any preparatory and analysis work related to them. They will identify a suitable code base and, if necessary, adapt the code for benchmarking purposes. They will prepare suitable input parameter sets, input data etc. that are necessary for the benchmark runs and test the runs on existing systems to generate reference output and reference execution time and energy consumption figures. Benchmark code managers are also responsible for producing sufficient documentation on how to build and run the benchmark and how to verify the correct execution of the benchmark.

Task 8.3 working group is responsible for providing the technical expertise to perform the technical evaluation during the PCP. They will support the Assessment Committee in its evaluation task by providing technical analysis of the results of each phase in the execution stage. It will guide and collect the analysis from the benchmark code managers and produce a detailed report to the Assessment Committee. T8.3 is also responsible for providing any clarifications or additional analysis required by the Assessment Committee.

Task 8.2 working group is responsible for setting up the evaluation framework and processes as well as updating them during the PCP if necessary. It will also procure any additional hardware or software necessary to carry out the evaluation as outlined in Section 6.

4 Benchmarks

The outcome of this PCP should be HPC solutions which are suitable for being operated within the PRACE RI and significantly reduce energy-to-solution for typical scientific applications.

Such improvements in energy efficiency will be demonstrated through the use of real production application codes and a benchmark in use by PRACE. These codes will stress both compute and I/O performance and be supplied with both small and large representative datasets. Applications as well as synthetic benchmarks have been selected to define a metric which is on the one hand justified by the goals of this PCP and on the other allows for a fair comparison between different solutions. Each contractor will be requested to provide results

for time-to-solution as well as energy-to-solution for solving four specified computational tasks using real scientific applications.

The source code for the applications as well as the input decks for the tasks will be provided to the contractors at the beginning of Phase I. The amount of changes allowed to be made to the source codes provided to the contractors is limited to avoid them spending significant amount of time on optimizing particular codes instead of improving their solutions.

Additionally, the contractors will be asked to provide results on the power-efficiency of their solutions while execution the High-Performance Linpack (HPL) benchmark [7]. It has been established by the Green500 list project [8] as a widely accepted metric for comparing different systems. It should, however, be noted that the HPL benchmark reflects the behaviour of scientific applications running on PRACE systems only to a very limited extent.

Vendors must compare their total wall-clock time and total energy consumed during execution by each of the above codes while running each of the representative datasets against benchmark measurements taken by PRACE on current (2013) PRACE systems. It is expected that all applications must be demonstrated on the final pilot systems executing to completion in equal or less wall-clock time than these baseline measurements.

Until the 1 PFlop/s peak performance pilot systems will become operational during Phase III neither time-to-solution and energy-to-solution for the scientific applications nor power-efficiency for the HPL benchmark can be measured. The contractors will thus be asked to provide estimates based on models to evaluate the solutions during the tendering stage and early execution phases.

In order to fit into the expectations of real production systems expected around 2017 by the HPC community, such pilot systems should be designed to be scalable to up to 100 PFlop/s. Again contactors will be asked to provide a model of performance that enables the total energy consumed for each code on a 100 PFlop/s peak system to be predicted. Contractors may replicate the four PRACE application codes across the model system as if they were executing as an ensemble. Vendors should quote a result for HPL scaled to the full system.

The quality of these models will be analyzed and rated by the Assessment Committee.

4.1 Selected scientific application benchmark codes and data sets

To select the benchmarks based on scientific applications the following overall selection criteria have been applied:

- The selected applications should be chosen such that as many as possible of the scientific areas are represented that have been identified in the PRACE scientific case [2] because of their need for leadership class computing systems.
- The computational requirements of the different applications should be as diverse as possible.
- At least some of the applications must feature non-trivial I/O requirements.

Furthermore, each of the scientific applications should meet the following requirements:

- As of today the application must be extensively used on PRACE Tier-0 systems by a wide community of users.
- It has to be expected that the particular research is still relevant and the application still in use at the end of this PCP when the developed solutions will become commercially available.
- The application must be highly portable and scalable according to today's standards, i.e. it must scale to at least 50,000 cores based on the x86 architecture or 75,000 Blue Gene/Q cores.

- The code must be publically available, either unlicensed or with a suitable open license agreement.
- Application developers should be available for consultation on benchmark setup and choice of input parameters.

A good initial selection of applications was given by the "Unified European Applications Benchmark Suite for Tier-0 and Tier-1" (UEABS) [9]. The main purposes of the unified benchmark suite are the following:

- To provide a resource of application codes and datasets that PRACE partners can draw on for procurement purposes.
- To provide performance data on existing PRACE systems to assist users when choosing which system to apply for time on.
- To provide data for "currency conversion" of CPU hours between PRACE systems

The codes were evaluated against the following criteria:

- The code must be publically available, either unlicensed or with a suitable open license agreement.
- Suitable datasets must be publically available.
- The code must not have any significant barriers to portability.
- The code must demonstrate good scalability.
- The code must have active support by the developers.

The initial version of UEABS comprised the following codes (listed by scientific area):

- Particle Physics: BQCD and other Lattice QCD kernels
- Classical MD: NAMD, GROMACS
- Quantum MD: Quantum Espresso, CP2K, GPAW
- CFD: Code_Saturne, ALYA
- Earth Sciences: NEMO, SPECFEM3D
- Plasma Physics: GENE
- Astrophysics: GADGET

Details of these application codes can be found in [9]. For reasons of confidentiality the set of applications chosen for the benchmarks will be presented in a later version of this document to be published after the launch of the tendering procedure.

5 Energy measurements

The goal of the PCP is to enable HPC solutions which feature significant better energy efficiency for realistic, i.e. not synthetic, workloads at the whole system level. To be able to assess this, it will, first of all, require the ability to measure the energy consumption of the HPC system with a reasonable level of precision. For this reason we foresee that all proposed solutions will include an energy measurement sub-system.

Furthermore, the energy consumed by the hosting data centre infrastructure has to be taken into account. Since this part of the energy consumption depends not only on the provider of a particular solution but also on the local conditions at the site that will host such a solution, we have introduced the concept of a "virtual data centre". This allows us to perform a fair comparison of different solutions. The total energy consumption is determined by the measured (or initially projected) energy consumption times a factor >1 determined by the virtual data centre model.

5.1 Energy measurement sub-system

The solutions developed within the PCP must provide facilities to measure non-intrusively the continuously integrated total energy for the whole pilot system. In practice, energy is determined by integrating the power consumption over time. Accurate determination of the energy consumption thus requires power consumption to be measured with a sufficient level of precision and at a sufficiently high frequency. The minimal requested sampling rate is 100 Hz.

5.2 Virtual Data Centre concept

The virtual data centre provides the entire infrastructure a typical HPC system needs and comprises in particular different options on how to provide cooling. It furthermore comprises a model for the energy consumption based on the requirements of the system. To simplify this model it is restricted to the energy consumed by the cooling infrastructure, which typically is the main consumer beyond the HPC system itself. The parameters of the data centre are fixed such that they are representative for the data centres operated by PRACE sites. The model input variables are properties of the HPC system like the amount of output heat, the coolant and the coolant's temperature.

6 Procurement of additional hardware or software

Since the exact requirements of the evaluation task are not known before the evaluation criteria are defined more closely, there remains the possibility that additional hardware or software will be needed to perform one or more of the evaluations. Even though at the moment there are no such needs foreseen or even anticipated T8.2 is prepared to facilitate such needs should they arise. If any actor involved in the PCP identifies such a need, they are to inform the Coordinator and the Deputy Coordinator immediately. The coordination team will then inform WP8 leader and any other relevant parties to either discuss the actuality of the identified need or to start preparations for its procurement. Before procurement is commenced, the WP8 leader will get an approval for the purchase from the GoP Committee and invite comments from the Assessment Committee and the Procuring Entity to avoid unnecessary investments. The procurement will be prepared and executed by T8.2 according to guide-lines provided by the WP8 leader in consultation with the Coordinator and Deputy Coordinator.

7 Summary

The PCP process is a two stage process that is composed by a tendering stage and an execution stage. The tendering stage deals with the tender submission, the qualification of the bidders and the selection of tenders to sign a framework agreement with the Procuring Entity for the provision of the services required in the execution stage. In the execution stage, the proposed solutions are designed and developed in parallel by the participants over three phases. Interim evaluations and selection of new bids at the end of Phase I and Phase II serve to narrow the focus to the most promising solutions under development that will ultimately be piloted in Phase III.

The evaluations are performed by the Assessment Committee together with the support of PRACE-3IP WP8 and T2.1 and approved by the GoP Committee that acts as a steering group and ultimate decision maker for the PCP. To facilitate information exchange and timely

execution of the process, a Coordinator and a Deputy Coordinator will actively coordinate the work. Benchmarking using four real applications in addition to a synthetic one will be a crucial metric to test the real-life performance of the pilot systems to be developed and will be the remit of Benchmark managers appointed from the GoP. The total energy consumption of the developed solutions will be assessed using a virtual data centre concept to ensure a fair comparison of different solutions.

Since some of the details and requirements of the PCP will, by necessity, be defined more closely during the PCP once more information of the respective solutions are known, it may be that this document needs to be updated or additional material needs to be included. Thus, it should be noted that this deliverable will be a living document to be updated as necessary at a later date. The most up-to-date version will always be made immediately available once it is finalized.

For reasons of confidentiality the set of applications chosen for the benchmarks will be presented on a later version of this document to be published after the launch of the tendering procedure.