Performance Conscious HPC (PeCoH)
Kickoff

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2016-08-22
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker &amp; Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00</td>
<td>Intro, concept and overview of WPs</td>
<td>Julian Kunkel, SC</td>
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<tr>
<td>14:20</td>
<td>WP 2 – Perf. Engineering</td>
<td>Mohamed Soliman, SWK</td>
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<td>15:00</td>
<td>WP 3 – Perf. Awareness</td>
<td>Julian Kunkel, SC</td>
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<td>15:25</td>
<td>WP 4 – HPC certification</td>
<td>Julian Kunkel, SC</td>
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<td>15:50</td>
<td>Coffee break</td>
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<td>16:10</td>
<td>WP 5 – Tuning</td>
<td>Hinnerk Stüben, SVPP/RRZ</td>
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<td>16:45</td>
<td>WP 6 – Dissemination</td>
<td>Hinnerk Stüben, SVPP/RRZ</td>
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<td>17:00</td>
<td>Plan for 2017 and discussion</td>
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<td>18:00</td>
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1Each Presentation is followed by a discussion.
Introduction

WP1 Management

WP3 Performance Awareness

WP4 HPC Certification Program

Planning of 2017

Goals

- Raise awareness and knowledge of users for performance engineering
  - Assist in identification and quantification of potential efficiency improvements
- Establish novel services to foster performance engineering
  - But also utilize existing capabilities
- Improve coordination of performance engineering activities in Hamburg
  - Establish the Hamburg regional HPC competence center (HHCC)
  - Support all three Hamburger data centers
Partners

Universität Hamburg

DER FORSCHUNG | DER LEHRE | DER BILDUNG

DKRZ

Technische Universität Hamburg-Harburg
Funding

- Each University of Hamburg partner is provided with
  - 12 PM PhD position
  - 12 PM Postdoc position
- Presumably hiring one PhD and Postdoc for 36 PM
- Employees will move between the involved data centers
- Collaboration in the University of Hamburg
  - Prof. Ludwig, **Scientific Computing (SC)** and **DKRZ**
  - Prof. Olbrich, **Scientific Visualization and Parallel Processing (SVPP)** and **Regionales Rechenzentrum (RRZ)**
  - Prof. Riebisch, **Software Construction Methods (SWK)**
We implement **services** provide basic support to users

We research **methods** to raise user awareness for performance engineering
Data Handling (In the Proposal)

- Open access, self-archiving if possible
- Deliverables will become public
- Code-base will be open source
  - HHCC entity on GitHub
Work Packages & Responsibilities

WP1 Management (SC)
- WP2 Performance Engineering (SWK)
- WP3 Performance awareness (SC)
- WP4 HPC Certification Program (SC)
- WP5 Tuning sw configurations (RRZ)
- WP6 Dissemination (RRZ)
Milestones

**M1**  Month 6: HHCC is established
- Web page and (distributed) help desk

**M2**  Month 12: First user workshop
- Promoting of results
- Dissemination of results
- Include users from HLRN and Gauß-Alliance

**M3**  Month 18: Success stories available

**M4**  Month 24: Second user workshop
Timeline

Assignments

- Red: Postdoc
- Blue: PhD
- Green: both
WP1 Management

T1.1 Project management (Ludwig, L1²)
- Biannual face-to-face meetings
- Biannual risk discussions
- Short monthly status (phone) calls (can be canceled if nothing happens)
- We use the Redmine of SC for preparing deliverables

T1.2 Coordination between data-centers (Olbrich, O1)
- Monthly status update of performance engineering activities
- Participation of the Postdoc in relevant meetings at TUHH, DKRZ, RRZ?
- Ongoing activities are tracked by the Postdoc and (potentially) documented on the web page

²Responsible PI, person months per PI (here Ludwig only).
WP1 Tasks in the Timeline
WP3 Performance Awareness

**Goal**  Capturing performance metrics and quantify costs

**T3.1** Modeling costs of running scientific applications (Ludwig, L3)
- Understand economics of performance engineering
  - Costs software development vs. costs for execution
- Costs metrics (deployment, configuring, optimization of hardware/software)

**T3.2** Reporting costs of user jobs (Ludwig, L3)
- Embed cost metrics into SLURM to quantify job execution costs
- How can we provide this information on the web-presence; sites and HHCC

**T3.3** Deploying feedback tools for user jobs (Ludwig, L2, O1)
- Deploy tools to collect performance info for jobs and quantify costs
- Additional tool for semi-automatically identify typical problems and costs/benefit for fixing them

**T3.4** Analyzing data and giving feedback to users (Olbrich, O1)
- Monthly check of the feedback tools to understand bottlenecks
- Postdoc can decide to pro-actively contact users
Deliverables

D3.1  Month 6: Report: Costs for running applications
D3.2  Month 12: Code: Integration of cost-efficiency in SLURM
D3.3  Month 30: Report: Tools for semi-automatic user feedback
Understanding the dynamic behavior is the foundation for optimization
WP4 HPC Certification Program

**Goal** Establish a HPC certification program to support users

**T4.1** Classification of competences (Riebisch, L1,R2)
- Identify relevant HPC competences (especially performance relevant)
- Alternative (domain-specific) views of competences are appreciated

**T4.2** Development of the certification program (Riebisch, L1,O1,R1)
- Overall HPC certification framework
- Identify relevant levels of expertise for competences

**T4.3** Workshop material (Olbrich, O4,R1)
- Assemble (own) material to achieve basic level for each competence

**T4.4** Online tutorial (Olbrich, O1)
- The tutorial will build upon workshop material but also references external (advanced) material

**T4.5** Online examinations (Ludwig, L3)
- Multiple-choice test to gain the HPC certificates
- Create a pool of questions for each topic
- Embed the multiple-choice test into SC developed tool
ICP: Platform Developed for Code (but also Supports Questions)

C Basics

A simple adder

Functions are helpful to organize code into easier to reuse snippets of code. Change the following program to return the sum of \( a \) and \( b \). The section that requires to be changed is marked with "TODO".

```
#include <stdio.h>
#include <stdlib.h>

int add(int a, int b) {
    //TODO: change so that the sum of \( a \) and \( b \) is returned
    return 0;
}

int main(int argc, const char *argv[]) {
    int a, b, result;
    a = atoi(argv[1]);
    b = atoi(argv[2]);
    result = add(a, b);
    printf("The sum of \( a \) and \( b \) is %d\n", a + b);
    return 0;
}
```
Deliverables

D4.1 Month 12: HPC competences and certification program
D4.2 Month 12: Workshop material
D4.3 Month 18: Online tutorial
D4.4 Month 18: Code: Online examination
WP4 Tasks in the Timeline

<table>
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<tr>
<th>Milestones</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tr>
<td>WP4: HPC certificate</td>
<td>M1</td>
<td>M2</td>
<td>M3</td>
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<tr>
<td>4.1 Classification</td>
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<tr>
<td>4.2 Dev. program</td>
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<td>4.3 Workshop</td>
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<td>4.4 Online tutorial</td>
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<td>4.5 Online examin.</td>
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Julian M. Kunkel
Planning of 2017 (Proposal: Ludwig 11 PM, O 7 PM, R 6 PM)

- Responsibilities of the PhD, and PMs for the PIs
  - 3.1 Modeling costs (Ludwig 3)
  - 3.2 SLURM extensions (Ludwig 3)
  - 2.1 Identification of concepts (Riebisch 2)
  - 2.4 Compiler (Ludwig 3)
  - 4.1 Classification of competences (Riebisch 1)
  - 2.5 Co-development (Riebisch 0)
  - 6.2 Success stories (Riebisch 0)

- Responsibilities of the Postdoc
  - 4.1 Classification of competences (R 1, L 1)
  - 4.2 Dev. certification program (L 1, R 1)
  - 4.3 Workshop material (Olbrich 4, Riebisch 1)
  - 4.4 Online tutorial (Olbrich 1)
  - 6.1 web presence (Olbrich 1)
  - 5.X Tuning of configurations (Olbrich 1)
  - 2.1 New concepts, co-devel (Riebisch 1)
  - 2.5 Co-development (Riebisch 0)
  - 6.2 Success stories (Riebisch 0)