

Introducing the HPC Certification Program



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<https://hpc-certification.org>

Webinar

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Outline



- 1 The Program
- 2 The HPC Certification Forum
- 3 Presentations from Representatives
- 4 Conclusions & Roadmap

HPC Certification Program



Motivation

- Not all users possess the right level of training
 - ▶ Inefficient usage of systems, frustration, lost potential
 - ▶ Good training saves compute time and costs!
- Learning is not easy
 - ▶ Users need to understand beneficial knowledge for tasks
 - ▶ There exist various different training material
 - ▶ Teaching of different data centers is hard to compare
- Data center have difficulties to verify the skills of users

The HPC Certification Program



Goals

- Standardizing HPC knowledge representation
 - ▶ Supporting navigation and role-specific knowledge maps
- Establishing international certificates attesting knowledge

The work was bootstrapped and is supported by the PeCoH project

Contributions by the PeCoH Project¹



Past contributions

- 1 Initial classification of competences
- 2 Initial development of a certification program

The program will be curated by the **HPC Certification Forum**

Pending contributions

- Creation of workshop material for basic certificates
- Providing an online tutorial for basic certificates
- Enabling an online examination

¹PeCoH was supported by the German Research Foundation (DFG) under grants LU 1353/12-1, OL 241/2-1, and RI 1068/7-1.

Content of the Certification Program



- Skill is characterized by unique key, background, knowledge covered
- Skill tree defining the organization of the competences
- Certificates bundle several skills into attestable unit

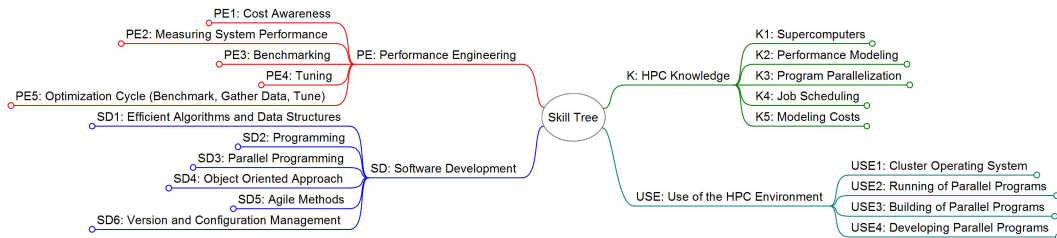


Figure: Top-levels of the skill tree

- Content is **NOT** covered and subject to content providers
 - We may link good content on our page

Example High-Level Skill (Version 0.5)



- Name: Hardware Architectures
- Id: K1.2-B
- Level: Basic
- Category: HPC Knowledge

Description of knowledge, i.e., what will the user learn

The skill delivers a high-level overview of:

- Elementary processing elements like CPUs, GPUs, many core architectures
- Vector systems, and FPGAs
- The NUMA architecture used for symmetric multiprocessing
- Network demands for HPC systems (e.g. high bandwidth and low latency)
- Typical network architectures like fast Ethernet (1 or 10 Gbit) or InfiniBand

Classification of HPC Competences



- HPC skills are generally built upon one another
 - ▶ Skills are typically depending on sub-skills \Rightarrow tree structure
 - ▶ References to skills are possible; still skills are building blocks for various tasks
- Additional attributes are used to describe:
 - ▶ Level of a skill (Basic, Intermediate, Expert)
 - ▶ Suitability for a user role (Tester, Builder, Developer)
 - ▶ Suitability for a scientific domain (Chemistry, Physics, ...)
- Skill tree supports different "views" on the content
 - ▶ View: purpose-specific representation / coloring / content

Considerations



- Granularity of skill descriptions
 - ▶ Too fine \Rightarrow content of a skill is predefined at leaf level
 - ▶ Too coarse \Rightarrow no help for structuring the material
 - ▶ Actual skill tree contains 76 skills
- Certificate definition
 - ▶ Bundles a set of skills
 - ▶ A users' HPC qualification is certified by successful exams
- Separation of skill, certificates and content provider
 - ▶ Similar to the concept of a high school graduation exam
 - ▶ Learning material can be provided by different institutions
 - ▶ Teachers can put badges on material: this "trains XYZ"
- Support flexible usage (views on skill tree) and skills is key
 - ▶ Institutions can derive new skill tree with own groups
e.g. users in weather/climate, single program, testers

Status



- A first version of the skill tree is released (35 basic skills)
- Idea been discussed to DKRZ user group; they want it yesterday
- Technical representation of the HPC skills
 - ▶ Database for the HPC certification program
 - ▶ Implementation is based on XML
 - ▶ Corresponding XML Schema (XSD) assures consistency
 - ▶ Contribution is available on GitHub

<https://github.com/HPC-certification-forum/curriculum>
- JavaScript for visualization of skill tree
 - ▶ Can be embedded in your webpage and adapted
 - Role/software-specific knowledge
 - What should people know to effectively work in your environment?

■ Live Demo

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The HPC Certification Forum



The HPC-CF the central authority for the development of the program

Organization Details

- An independent international body
- Organized into
 - ▶ Steering board
 - ▶ Full members with voting rights
 - ▶ Associate members

Responsibilities

- Curating and maintaining the skill tree and certificates
- Providing tools and ecosystem around the competences

Governance – 2018



Governance Rules

- We have an initial set of governance rules
- Splitting responsibility across different roles

Current Chairs

- Program chair: Julian Kunkel (University of Reading)
- Curriculum chair: Kai Himstedt (University of Hamburg)
- Topic chairs:
 - ▶ HPC Knowledge: Lev Lafayette (University of Melbourne)
 - ▶ Performance Engineering: Anja Gerbes (University of Frankfurt)
 - ▶ Use of the HPC Environment: Jean-Thomas Acquaviva (DDN)
 - ▶ Software Development: Waseem Kamleh (University of Adelaide)
 - ▶ Administration (to be confirmed by the board): Sharan Kalwani (DataSwing)
- Examination chair: not seated this year
- Publicity chair: Weronika Filinger

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Outlook and Expected Benefits



HPC practitioners

- Increase motivation to participate as the certificates are recognized in a CV
- Validate knowledge via tests
- Browse relevant competences
- Identify recommended and required skills related to certain tasks
- Understand and compare teaching offers across sites

Data centers

- Increase sharing of teaching materials
- Simplifies documentation of taught skills
- Identify missing teaching activities
- Tailor skill-representation specifically to users
- Correlate lack of skills with efficient use

Summary



HPC Certification Program

- Effort to standardize representation of relevant HPC skills
 - ▶ Hierarchical definition of skills for practitioners
 - ▶ Building blocks that can be cherry-picked for different tasks
- It's goal is **NOT** to provide content or a linear curriculum
- Perspective for data centers
 - ▶ Use statistics and machine learning to direct users to right skills
 - ▶ Mandatory requirements
- Customizable navigation for compute centers
 - ▶ Interactive viewer to browse skills and related content
- Visit us and join our mailing lists: <https://hpc-certification.org>

Roadmap: ISC-2019



- Finalizing the first version of the skill-tree (V1)
- Finalizing the seal that can be added to training material
 - ▶ We are looking forward to work with together with anyone to link material!
- Finalizing documentation how to create views with the JavaScript
 - ▶ This will allow to outsource roles (e.g., tester) but also link to material
- Adding a "Big Data for HPC" skill subtree
- Creating a markdown version of the skill-tree (with converters)
- Embed a version that can be edited in an online Wiki (by members)
- Creation of workshop material (of some base courses)
- Creating an online certification (of some base courses)

Certification



Approach

- User takes online multiple-choice test
 - ▶ Likely to use a combination of JavaScript and a web service
 - ▶ System selects number of questions randomly from a pool
 - ▶ System draws 4-5 responses from 10 possible responses
 - Some responses may be parameterized (random)
- Choices are submitted to the web server
- Manual approval of scores
- Automatic creation of certificate + permanent record
- Permanent record proves that a certain user has a skill

Open Questions



- Affiliation program for companies?
- Examination
 - ▶ Cheating has been a discussion, but we won't focus on this right now
 - ▶ How to ensure that a person does not brute force the exam?
 - Delay between retry?
- Determine legal constraints for exams (help welcome)
- Create a unique proof that a user has a skill
 - ▶ Hash instead of person name?