

The HPC Certification Program



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<https://hpc-certification.org>

ISC HPC

2019-06-18

The HPC Certification BoF: Agenda



Short presentations

- Introduction to the HPC Certification Program (10 min)
- HPC tools and usage: a view from the community (5 min)
- Skill tree introduction (7 min)
- Mapping content to skills: a case study from PeCoH (3 min)
- Certification process introduction (3 min)

Community discussion (20 min)

We prepared several stations in the room allowing you to give feedback

Wrapup (10 min)

- Roadmap, Summary & Conclusion
- Questions to the audience & joint discussion

Outline



- 1** The Program
- 2 The HPC Certification Forum
- 3 Certification Process
- 4 Roadmap & Conclusions

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
 - ▶ What competences exist, how are they defined?
 - ▶ Supporting navigation and role-specific knowledge maps
- Establishing international certificates attesting knowledge

Important!

- We do not compete with content providers
- We do not intent to create a curriculum



Content of the Certification Program

- A **skill** defines background, objectives, learning outcomes
- The **skill tree** organizes the competences as hierarchical skills
- Certificates bundle several skills into attestable unit

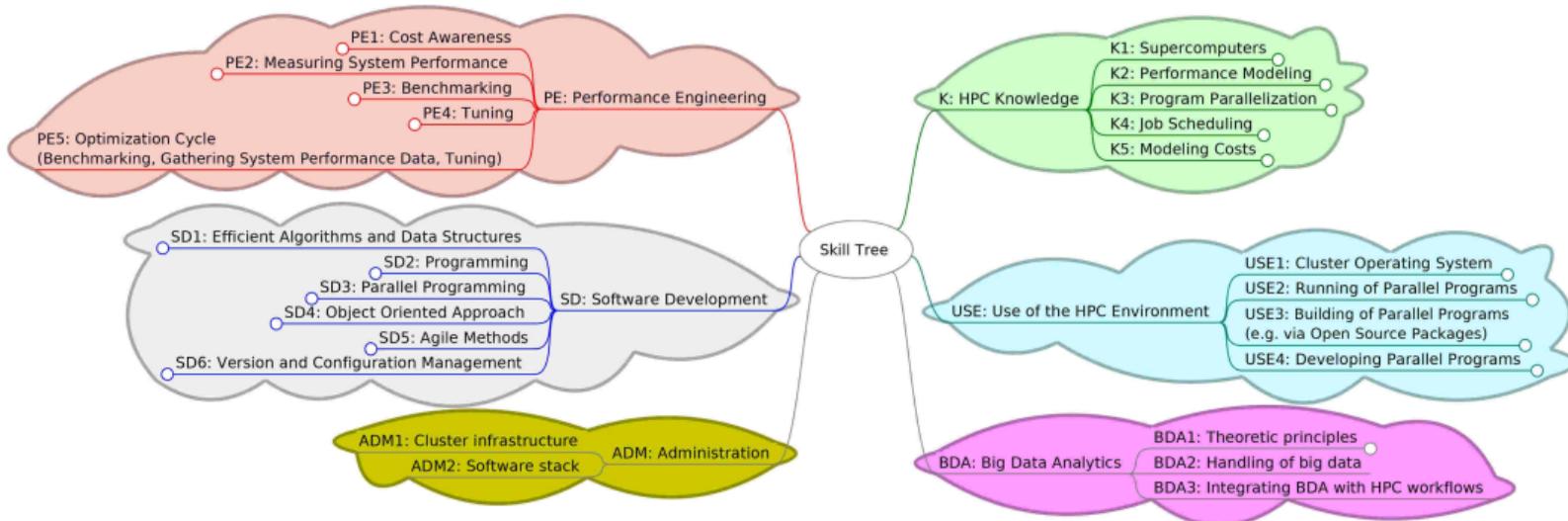


Figure: Top-levels of the skill tree (We are working on ADM and BDA branches)

Classification of HPC Competences



- Organization of HPC skills
 - ▶ Skills are typically depending on sub-skills \Rightarrow tree structure
 - ▶ References to skills are possible; still skills are building blocks for various tasks
 - ▶ One skill can have multiple instances for different skill levels
- 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
 - ▶ Guiding principle: leaf node should be coverable in 2-4 hour lecture/workshop
- External information can be linked to the skills providing different **views**
 - ▶ Suitability for a user role (Tester, Builder, Developer)
 - ▶ Suitability for a scientific domain (Chemistry, Physics, ...)
 - ▶ View: purpose-specific representation / coloring / content
 - Groups/institutions can derive a new skill tree with their own emphasis
 - What should people know to effectively work in your environment?

Further Considerations



- Certificate definition
 - ▶ Bundles a set of useful skills together
 - ▶ 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"
- Verification of skill tree and certification approach
 - ▶ We utilize the HPC community/practitioners to justify approaches

Status



- Organizing regular meetings (see our webpage)
- Released a first skill tree (we will discuss this after the talks)
- Released technical representations of the HPC skills
- Released JavaScript for visualization of skill tree ([demo](#))
 - ▶ Enables views: adjustable/embedable in your webpage
- Developed prototype for exam process: legal framework
- Designed seal of endorsement
- Engaged with various stakeholders (e.g., SIGHPC Edu)
- Conducted survey to verify the skill tree (more to come!)



This training covers (partially)
- K1.1 System architectures
- K1.2 Hardware architectures
See <https://hpc-certification.org/c/1.0>

All our developments are under open licenses (except the exam questions)

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The HPC Certification Forum



The HPC-CF is 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



We have an initial set of governance rules splitting responsibility across 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: Sharan Kalwani (DataSwing)
 - ▶ Big Data Analytics: Julian Kunkel // Interim
- Examination chair: was not seated in 2018
- Publicity chair: Weronika Filingier

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Certification: Assessment Prototype



1. User takes multiple-choice test online (any time!)
 - ▶ A combination of JavaScript and a web service
 - ▶ System selects number of questions randomly from a pool
 - The questions are managed with rigorous license agreement
 - ▶ System draws 4-5 responses from 10 possible responses (some randomized)
 2. Choices are submitted to the web server
 3. *Manual approval* of the result
 4. Automatic creation of certificate and returned by email
 - ▶ Permanent computer-verifiable proof that skill is created
 - Return a text version with GPG signature
 - Return a link that can be verified on hpc-certification.org
- Privacy: minimize information stored on servers, keep some for statistics
- Includes some measure to prevent cheating and brute forcing (e.g., delay)

Certification: Certificate



Text representation

```
-----BEGIN PGP SIGNED MESSAGE-----  
Hash: SHA512  
HPC Certification Forum Certificate  
This text confirms that "Jane Doe" has  
successfully obtained the certificate  
"HPC driving license" (id: 1) at 02/2019.  
Verification URL: https://hpc-certification.org/\[...\]  
-----BEGIN PGP SIGNATURE-----  
[...]  
-----END PGP SIGNATURE-----
```

Certificate



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Roadmap: Supercomputing 2019



- Finalizing documentation how to create views with the JavaScript
 - ▶ This will allow to outsource roles (e.g., tester) but also links to material
- Completing the online exam for the certification (of some base courses)
 - ▶ Explore the use of interactive input, e.g., simulate shell for job submission
- Link third-party workshop material (of some base courses)
- Discuss affiliation program for institutions/companies
- Map out content by the *SIGHPC Education Chapter Content Committee*

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

Questions and Open Issues for Discussion



- Naming, e.g., Software engineering vs. software development
- How easy should editing of a skill be for members?
- How relevant are different branches of the tree (dev. vs. testers)?
- Who would be willing to create a data center/user specific view?
- How willing are people to share teaching material and what formats?
- How shall we link to it?
- Would a site like to get feedback about the examination of their users?
- What would be expected from HPCCF to support teaching?

Summary



HPC Certification Program

- Effort to standardize representation/certification 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
 - ▶ Make certain skills a mandatory requirement?
- Customizable representation and navigation for data centers/domains
 - ▶ Interactive viewer to browse skills and related content
 - ▶ We will use the viewer to link good content to the skills, too!
- Visit us and join our Slack/ mailing lists: <https://hpc-certification.org>