Toward a Globally Acknowledged and Free HPC Certification

Julian Kunkel (+ HPC Certification Forum)

https://hpc-certification.org   HPCCF Virtual Workshop

2020-05-20

Workshop

University of **Reading**

Goals

- ■ Establish globally acknowledged HPC certification
  - ▶ Discuss opportunities and roadmap, foster collaboration

Agenda

- ■ Introduction to the HPC Certification Forum (20 min)
- ■ Invited speakers (10 min each)
- ■ Examination and certification (20 min)
- ■ Discussion

Interactivity

- ■ Q&A time slot after each talk
- ■ Please feel free to ask questions ASAP in the chat
- ■ Critical discussions are welcome!

Outline

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1 The Workshop

2 The Forum

3 Skills

4 Conclusions

Challenges for HPC Training

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- Not all users possess the right level of training
  - Inefficient usage of systems, frustration, lost potential
  - Good training saves compute time and costs!
- Diverse user background and goals
  - Science is the goal, HPC is the vehicle
  - Need to run an application to complete the PhD
- 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 Forum

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Goals

- ■ Fine-grained standardizing HPC knowledge representation
  - ▶ What competences exist, how are they defined?
  - ▶ Puzzle of competences for everyone (practitioners, students, admins)
  - ▶ Supporting navigation and role-specific knowledge maps
- ■ Establishing international certificates attesting knowledge
- ■ Supporting an ecosystem around the HPC competences

Scope of the forum

- ■ Central authority for competence representation, certification, and support
- ■ Purposeful limitations of the forum:
  - ▶ We do not compete with content providers
  - ▶ We do not create a curriculum (university/centers responsibility)

The **HPC** **Certification Forum**

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Organization Details

- An independent international body
- Organized into
  - ► Steering board (elected)
  - ► Full members (with voting rights)
    - Contributors to the project (e.g., 1-2 hours per month)
  - ► Associate members (anyone and any institution)
  - ► Collaboration with e.g., SIGHPC Education Chapter

Responsibilities

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

Membership

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Mandate and Election

- Steering board is elected for one year (period of activity)
- Period June – June
- Take over of new steering board during general assembly at ISC HPC

Current election

- We will soon start with the voting for next year's period
- Join our Slack channel and election channel if you are interested

Governance

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We have governance rules splitting responsibility across roles

Steering Board

- General chair: Julian Kunkel (University of Reading)

- Skill-tree curator: Kai Himstedt (University of Hamburg)

- Topic curators:
  - 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: Cristiana Dinea (NVIDIA)

- Examination curator: Christian Meesters (University of Mainz)

- Publicity chair: Weronika Filinger

Organization

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Organization of the members

- Webpage is the central hub (https://www.hpc-certification.org)
- Mailinglists (news, members, board)
- Monthly public meetings on our Slack channel
- Annual general assembly (form of a BoF at ISC or workshop)

Data handling

- Everything* is developed/available in the open
  GitHub (https://github.com/HPC-certification-forum)
- Exception are examination questions (later talk)

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Classification of Competences == Skills

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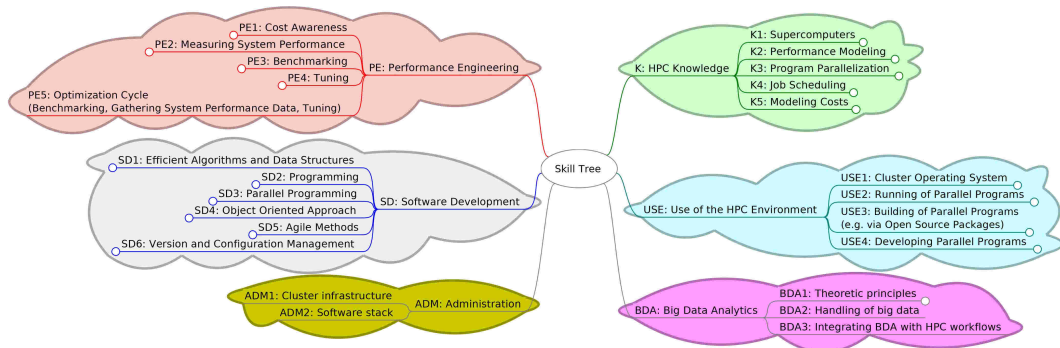- Certificates bundle several skills into attestable unit

Figure: Top-levels of the skill tree (Initial ADM and BDA branches)

Example High-Level Skill (Excerpt)

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- Name: SLURM Workload manager
- Id: USE4.2.2-B
- Background: SLURM is a widely used open-source workload manager providing various advanced features.
- Aim:
  - ▶ comprehend and describe the basic architecture of SLURM and its tools
  - ▶ use relevant tools to run and monitor (parallel) applications

Learning outcomes (these must be examinable)

- run interactive jobs with salloc, a batch job with sbatch

- explain the architecture of SLURM, i.e., the role of slurmd, srun

- explain the function of the tools: sacct, sbatch, salloc, ...

- explain time limits and the benefit of a backfill scheduler

- *see https://www.hpc-certification.org/wiki/*

Classification of HPC Competences

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- 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 1-4 hour lecture/workshop
- 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 (basic, ..., expert)
- Verification of skill tree and certification approach
  - ▶ Feedback by the HPC community/practitioners justify the approaches

Further Considerations

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- Certificate definition
  - ▶ Bundles a set of useful skills together
  - ▶ A users' HPC qualification is certified by successful exams
  - ▶ Testing a single (fine-grained) skill may be too easy with a cheat sheet
- 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 skills X, Y, Z"
- 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?

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Status / Previous Activities

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- Released a version of the skill tree (v0.5)
- Released technical representations of the HPC skills
  - ▶ XML and Markdown versions (embedded on a Wiki)
- Released JavaScript for visualization of skill tree (demo)
  - ▶ Enables views: adjustable/embedable in your webpage
- Developed prototype for exam process and framework
- Developed a tree-versioning strategy
- Designed seal of endorsement
- Engaged with various stakeholders (e.g., SIGHPC Edu)
- Conducted survey to verify the skill tree (more to come!)

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

HPC CF
Endorsed
Training

1.0

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

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Wiki for Skills

Contribution to the Skill-Tree High-Level Editing

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How can members contribute?

■ Webpage with Markdown version controlled in Git

  ▶ https://www.hpc-certification.org/wiki/skill-tree/b
  ▶ GitHub: https://github.com/HPC-certification-forum/skill-tree
    • Pull requests, reviews, comments, …

■ Editing a MindMap, the structure of Skills

  ▶ Synchronized with the skill tree in Git
  ▶ Uses the OpenSource tool Freemind

■ Discussion on our Slack

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Outlook and Expected Benefits

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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

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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