

Certification Strategy and Contributions

HPCCF Virtual Workshop

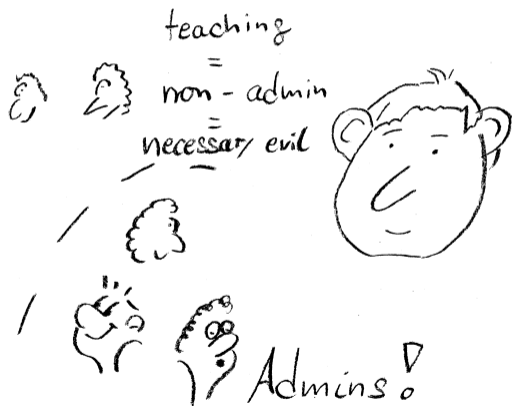
Christian Meesters (+ HPC Certification Forum)

HPC Group – Johannes Gutenberg-University of Mainz

2020-05-18

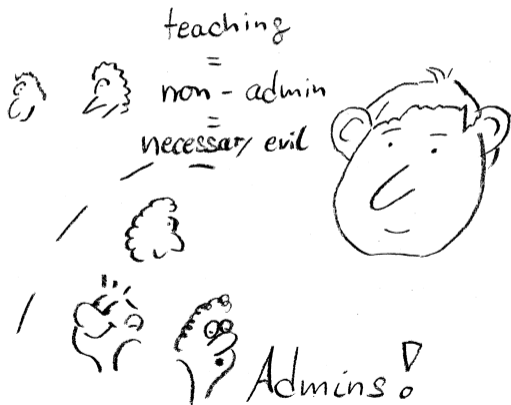
How the Site Manager looks on HPC Education

⚠ **Exaggeration Warning** ⚠



How the Site Manager looks on HPC Education

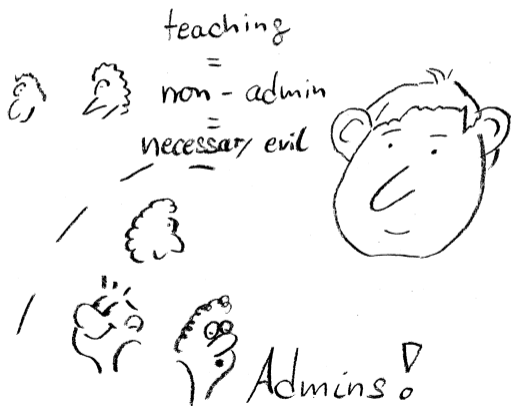
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- ressources are always limited

How the Site Manager looks on HPC Education

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- ressources are always limited
- teaching ressources even more

How the Site Manager looks on HPC Education

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- resources are always limited
- teaching resources even more
- integration into HPCCF might offer more (still needed) courses

HPCCF Adoption by Sites

| Name | Typ | Inhalt | Datum | Kursleitung | Kursraum | HPCCF Skillset (only main skillset) | Anmeldelink |
|------------------------|------|---|--------------------------|----------------------------|--|-------------------------------------|----------------------|
| Introduction to Python | Kurs | Einführung für Programmieranfänger | 23.-27. März 2020 | Palao (HPC Hessen) | Goethe Universität, Campus Riedberg (Frankfurt am Main) Max-von-Laue-Straße 1, Physics Building, Room 01.120 | SD1.1B | |
| Einführung in C++ | Kurs | Einführung in das Programmieren mit C++ | 9. März - 13. März 2020 | Baumgartner / Meesters | KR4 | SD1.1B | link |
| MPI/OpenMP | Kurs | Einführung in die Parallelisierung mit MPI und OpenMP | 30. März - 2. April 2020 | Rabenseifner (HLRS) | N33 | SD1.2B | link |
| Cython in depth | Kurs | Cython in Depth | 30./31. März 2020 | Behnel (Behnel Consulting) | wird bekannt gemacht | SD1.1B | link |

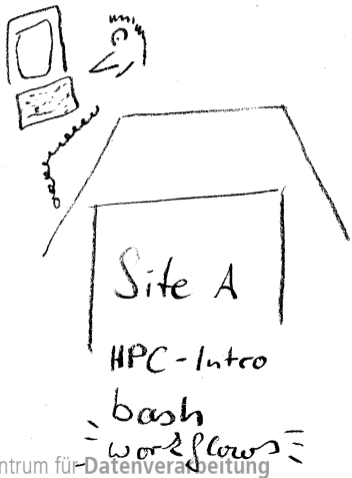
Mainz course overview [↗](#)

Assigning HPCCF skill labels to courses is without cost, yet they are an asset for participating sites:

- enhanced transparency of own course portfolio
- own portfolio can be complemented by linking to courses nearby ↷ (for smaller sites) not so thin anymore
- with transparency a plus for users
- with HPCCF certificates new users may have some HPC experience other than “submitted a job” once

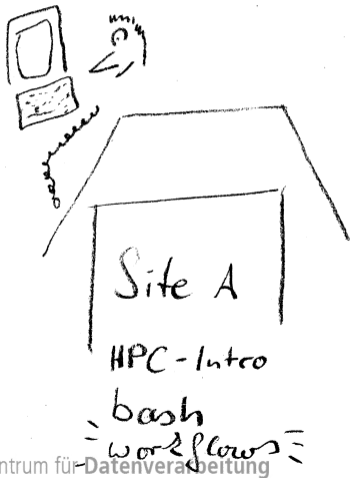
How Joe User looks on HPC

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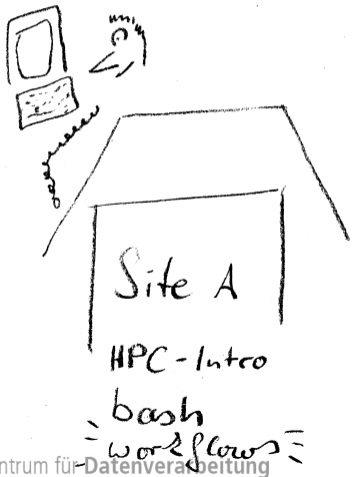


Most users

- ... use 3rd party applications ...

How Joe User looks on HPC

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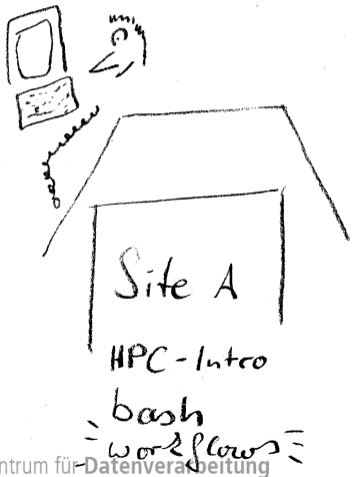


Most users

- ... use 3rd party applications ...
- ... will need (yet not always visit) an intro course ...

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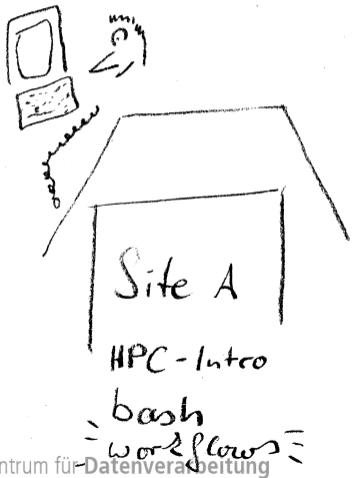


Most users

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- ... perhaps a scripting course ...

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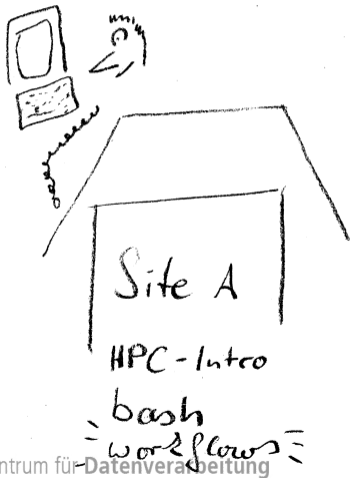


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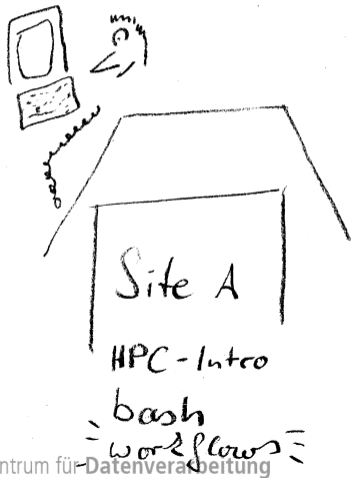


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Most users

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- ... will need (yet not always visit) an intro course ...
- ... perhaps a scripting course ...
- ... only *really* interested in workflows tailored for their need.

And will never leave their site for other HPC courses!

HPCCF Adaption as a Plus for Newbies

| | | | | | | | |
|-----------------|----------|---|--------------------|----------------------------|----------------------|------------------------|------------------------------|
| Cython in Depth | Kurs | Cython in Depth | 30./31. März 2020 | Behnel (Behnel Consulting) | wird bekannt gemacht | SD1.1B | |
| Bash-Intro | Kurs | Einführung in das Shellscripting mit Bash | 22./23. April 2020 | HPC-Gruppe (Meesters) | KR4 | USE1-B | link |
| HPC-Intro | Kurs | Einführung in die Nutzung unserer Cluster | 29./30. April 2020 | HPC-Gruppe (Meesters) | KR3 | K4-B | link |
| SeqAn-Workshop | Workshop | Nutzung der SeqAn-C++-Bibliothek zur Sequenzanalyse | 6. Mai 2020 | Meesters | KR4 | not applicable | noch keine Anmeldung möglich |

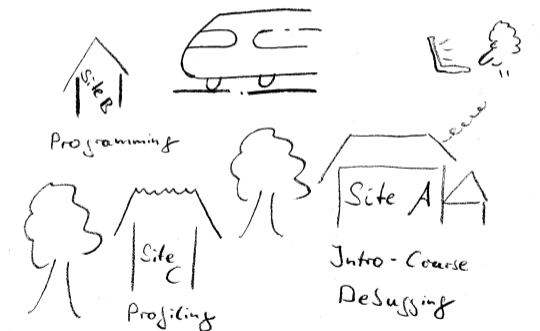
Mainz course overview [↗](#)

Assigning HPCCF skill labels to courses is no of cost, yet it will be a plus for “only-users”:

- will broaden horizons
- “*Maybe* some other course might be interesting, too?”
- “Hm, perhaps more knowledge in this field will be an asset when applying?”

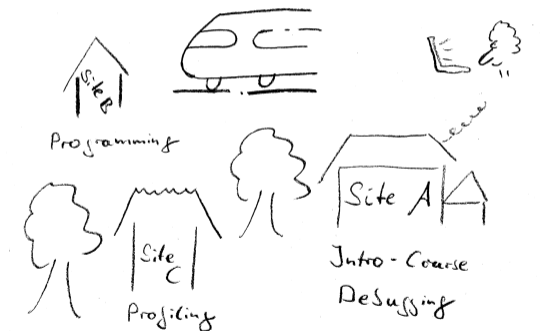
How Bruce Coder looks on HPC

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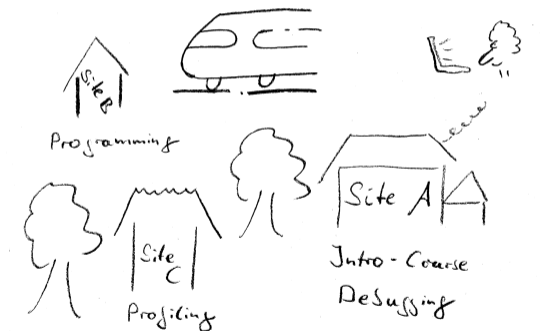


Only power users

- ... will select *their* topics ...

How Bruce Coder looks on HPC

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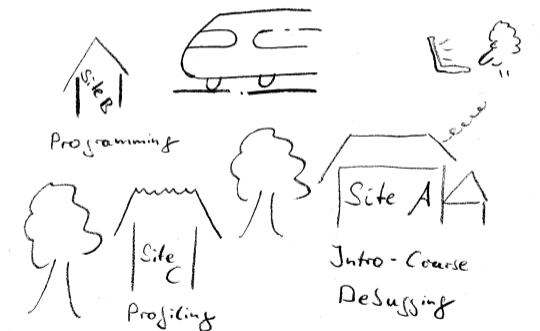


Only power users

- ... will select *their* topics ...
- ... will care to travel for computing topics ...

How Bruce Coder looks on HPC

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Only power users

- ... will select *their* topics ...
- ... will care to travel for computing topics ...
- ... will rarely need intro courses ...

HPCCF a Plus for Power Users

Advanced Users already use HPC resources, incl. training. They are aware of

- their local courses
- PRACE and other (in-)ternational training resources

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Still, they too, will have been newbies at some point *and*

- transparency will help them select appropriate courses, too.

HPCCF a Plus for Power Users

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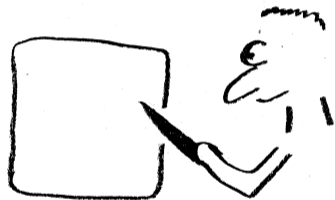
Still, they too, will have been newbies at some point *and*

- transparency will help them select appropriate courses, too.
- “Complement my portfolio!”

HPCCF for Teachers – Anyway

Teachers, basically, get two benefits:

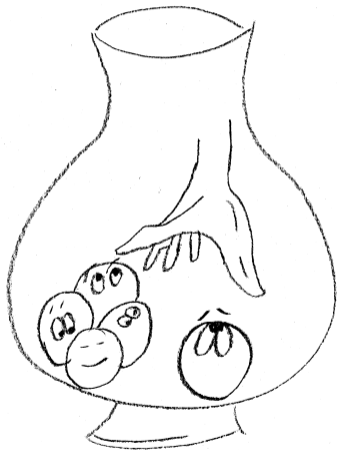
- 1 simpler / better content and course objective transparency
- 2 feedback from HPCCF with regard to course quality (“Did my students pass? How good?”)
- 3 Plus: We have learned, that users appreciate when a course content apparently is not conceived in isolation.



Strategy

When conceiving a Certification Strategy the different views are in our mind.

Selecting Questions



Questions are randomly chosen from a pool:

- the pool may itself be a bundle of sub-branches of the skill tree
- each question will have a number of right and wrong answers in case of multiple choice questions

↪ All examinations will be based on different sets of questions.

On Cheating

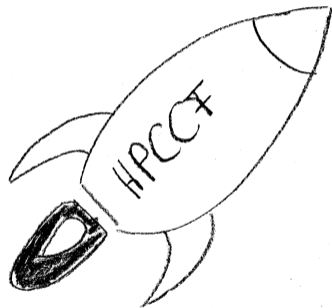
- 1 By confronting with random questions no perfect preparation can be accomplished.
- 2 There is a time-limit per question.
- 3 A registration prior to a test session is required.

No online system without ID checks and other measures is safe against cheating!
Yet, our measures will raise awareness.



Boosting Acceptance

Want to hire a scientist?
We intend to provide a (sub)set of question
for prospective employers. This way they
will have an idea of the background, if a
solicitant waves a HPCCF-certificate.



Disclaimer

Some examples are inspired by Greg Wilsons book

Teaching Tech Together (CRC Press, 2020)

Some ideas are based on own experience, some on other sources.

Purposes ...

Before diving into Question Design, note:

- a question can be asked with a certain aim
- different courses ask for different knowledge / skills
- ↻ questions need to be designed and chosen with care

Multiple Choice – When?

Multiple Choice Questions (MCQs) are popular when designing e-learning tests . . .

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? Question

| When are they most suitable?

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Multiple Choice Questions (MCQs) are popular when designing e-learning tests ...

? Question

| When are they most suitable?

Suppose you are teaching children and you give them this MCQ:

🔧 Exercise – Type: Testing Conceptions

What is $37 + 15$?

- a) 52 correct
- b) 42 child did not understand “carrying”
- c) 412 child treated every column separately
- d) 43 knows she has to carry 1, but to wrong column

Multiple Choice – When? (continued)

The Young-Child question rephrased for newbies to the SLURM batch system:

Exercise – Type: Testing Conceptions about SLURM

Think of a cluster with 20 core nodes. If a job is submitted with the following parameterisation, how many nodes are reserved?

```
#SBATCH -n 20
```

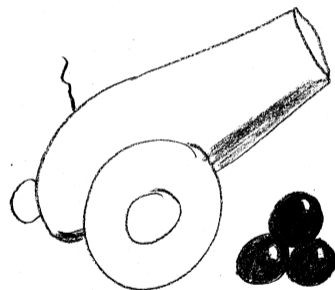
```
#SBATCH -c 2
```

- a) 2 correct
- b) 4 user did correctly multiply, but is not aware of the 20 cores
- c) 1 user did not multiply by `-c 2`
- d) unknown without N-flag user did not understand the concept

What is in the Arsenal?

MCQs aren't everything:

- 1 Freetext (if short and explicit)
- 2 Filling in blanks (for code; to be implemented)
- 3 Parson Problem (can be done as MCQ; in a minute)
- 4 Tracing (can be done as MCQ; in a minute)



Freetext

Freetext question need to be *very* much restricted to simple words or characters. For example:



Excercise – Type: Changing Permissions

If a script file 'foo.sh' has the permissions '-rw-r--r--', how do make it executable for your group for sharing the script?

Here, only two possible answers are allowed, in octal or explicit mode.

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Most Suitable

This kind of question is most suitable to test actual knowledge. As we can expect only few students to memorize all nifty details, it primarily tests for gained experience and is to be used with great care (not too frequent).

Fill in Blanks

Filling Blanks is a (technical) variation on Freetext. It is more specific and the *blank screen of horror* issue is avoided, whilst the test might be testing “vocabulary”. An example:



Exercise – Type: Bash Operators

Which operator has to be filled in the place of ‘_’ to print the statement in line 3?

```
1: number=4
```

```
2: if [ $(number _ 2) -eq 0 ]; then
```

```
3:     echo "$number is even"
```

```
4: fi
```



Hint

The answer is a single character.

Parsons Problems

Parsons Problems, too, avoid the *blank screen of horror* problem and also the vocabulary testing. Instead they allow the examinee to concentrate on the control flow.

Exercise – Type: Bash Loop & Math

Rearrange these lines to sum the values.

1: done

2: values=(1 2 3 4)

3: for v in \$values[@]; do

4: total=\$((total + v))

Real tasks can be longer and intricate - allowing test of control flow understanding.

Note

The answer can be a free text, e. g.: “2 3 4 1”, which is easy to parse and check.

What else?

We could go on ...

Exercise Type

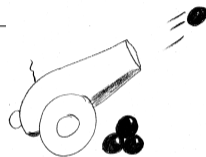
Technical Implementation

Tracing Code Execution

Labelling Diagrams

Fixing Code

etc



What else?

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Exercise Type

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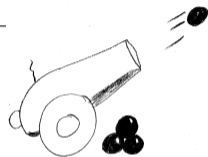
Tracing Code Execution

Freetext or MCQ

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etc



What else?

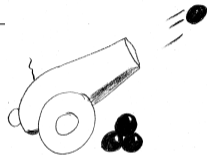
We could go on ...

Exercise Type

Tracing Code Execution
Labelling Diagrams
Fixing Code
etc

Technical Implementation

Freetext or MCQ
MCQ



What else?

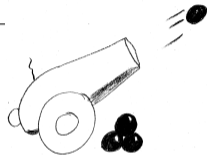
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Exercise Type

Tracing Code Execution
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Technical Implementation

Freetext or MCQ
MCQ
Freetext



What else?

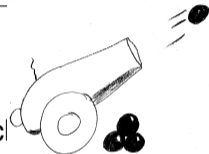
We could go on ...

Exercise Type

Tracing Code Execution
Labelling Diagrams
Fixing Code
etc

Technical Implementation

Freetext or MCQ
MCQ
Freetext
Variety of types with minimal technical effort.



Contributions via the HPCCF-Wiki

The screenshot shows a web browser window displaying the HPCCF-Wiki page for 'K4-B Job Scheduling'. The page is titled 'K4-B Job Scheduling' and has a sub-section 'Background'. The 'Background' section contains a paragraph explaining that parallel computers are operated differently than a normal PC, and users must share the system. It mentions that various operative procedures are in place, and users must understand these concepts and procedures to be able to use the available resources of a system to run a parallel application. A workload manager/job scheduler controls how available hardware resources are distributed among the user requests (jobs).

The page also has sections for 'Aim', 'Outcomes', 'Subskills', and 'Links'. The 'Links' section contains a single link: 'Submit a proposal for an examination question', which is circled in red. The 'Table of Contents' on the right side of the page lists the following items: K4-B Job Scheduling, Background, Aim, Outcomes, Subskills, and Links.

K4-B Job Scheduling Edit

Background

Parallel computers are operated differently than a normal PC, all users must share the system. Therefore, various operative procedures are in place. Users must understand these concepts and procedures to be able to use the available resources of a system to run a parallel application. A workload manager/job scheduler controls how available hardware resources are distributed among the user requests (jobs). Edit

Aim

To enable practitioners to comprehend and describe the basic architecture and concepts of resource allocation for an HPC system Edit

Outcomes

- explain the concepts and procedures for resource allocation and job execution in an HPC environment
- run interactive jobs and batch jobs
- comprehend and describe the expected behavior of job scripts
- change provided job scripts and embed them into shell scripts to run a variety of parallel applications
- analyze the output generated from a job scheduler and describe the cause of typically generated errors
- comprehend accounting principles (billing for the jobs)
- comprehend scheduling strategies that increase productivity

Edit

Subskills

- [K4.1-B Introduction to job scheduling](#)
- [K4.2-B SLURM Workload manager](#)

Edit

Links

- [Submit a proposal for an examination question](#)

Edit

Contributions via the HPCCF-Wiki II

Each HPCCF wiki [↗](#) page contains a link. It leads to a little form asking for:

- contact mail
- to select a learning objective from a pre-formatted list
- to supply the question you thought of
- and (in case of a multiple choice question) the possible answers.

Contributions via the HPCCF-Wiki II

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Evaluation Process

Now, HPCCF-member evaluate the submitted question. If approved, it will be formatted and merged into the pool of questions for the chosen topic / skillset.

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
 - By submitting questions the related usage-allowance is granted to HPCCF
 - In case of sufficient numbers the system draws from a pool of different possible answers (MCQ-case).
 - 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 is created about certification of skills
 - Return a text version with GPG signature
 - Return a link that can be verified on hpc-certification.org
 - 5 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



Thank You for Your Attention!

