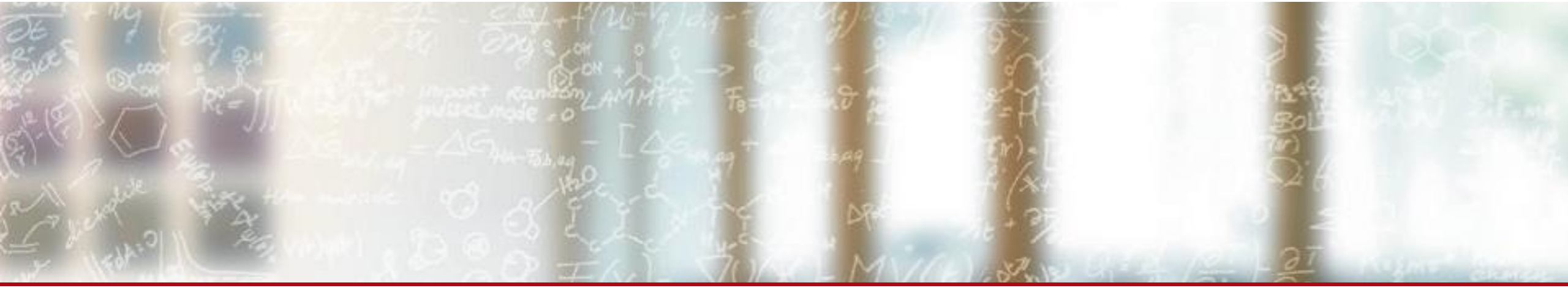
CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

esiwace
CENTRE OF EXCELLENCE IN SIMULATION OF WEATHER AND CLIMATE IN EUROPE

ETH zürich



Introduction to containers on HPC with the Sarus container engine

Summer School on Effective HPC for Climate and Weather

Alberto Madonna, CSCS

August 27, 2020

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- Slides and code available at https://github.com/eth-cscs/containers-hands-on

- *Disclaimer: This material reflects only the author's view and the EU-Commission is not responsible for any use that may be made of the information it contains*

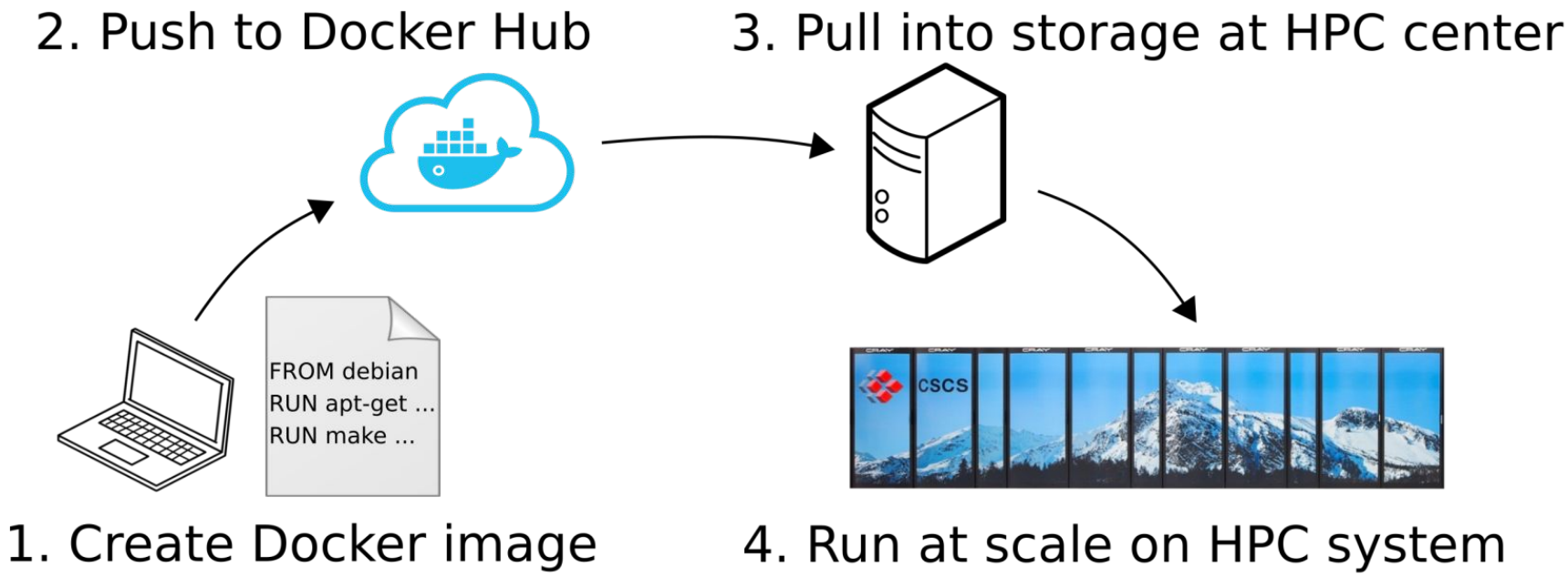
Docker and HPC: not a good fit

- Security model assumes root privileges
- No integration with workload managers
- Missing support for diskless nodes
- Very limited support for kernel bypassing devices (e.g. accelerators and NICs)
- No adequate parallel storage driver

Sarus container engine

- OCI-compatible container engine engineered by CSCS
- Designed for the requirements HPC
- Consistent UX with Docker: small learning curve
- Transparent native performance through hooks
- Enables use of standard, open, upstream components on HPC systems
- Extensible architecture encourages vendor engagement and improves maintainability

Typical user workflow at CSCS



Highlights of Sarus from a user perspective

- Consistent experience
  - With Docker: closely resembling CLI
  - With host environment: env variables, uid/gid, file permissions, working directory
- Pull images from Docker registries (e.g. Docker Hub, NVIDIA NGC)
- Import images from local tar archives (no cloud upload required)
- Integration with the workload manager (Slurm)
- Native performance from GPUs and high-speed interconnects
- Access to parallel filesystems inside containers

Sarus CLI

- Sarus

```
# pull image
$ sarus pull [options] <image>[<:tag>]

# load image
$ sarus load [options] <file> <image>

# show list of images
$ sarus images

# remove image
$ sarus rmi <image>[<:tag>]

# run container
$ sarus run [options] <image>[<:tag>]
<command> <args>
```

- Docker

```
# pull image
$ docker pull [options] <image>[<:tag>]

# load image
$ docker load [options] -i <file>

# show list of images
$ docker images [options] [repo[<:tag>]]

# remove image
$ docker rmi [options] <image> [image...]

# run container
$ docker run [options] <image>[<:tag>]
<command> <args>
```

Live demo!

Piz Daint: our host for the demo

- Flagship system for the Swiss National HPC Service, installed at CSCS Lugano
- #10 in the June 2020 TOP500 list
- Hybrid Cray XC40/XC50 supercomputer
  - 5704 hybrid nodes: Intel Xeon E5-2690 v3 + NVIDIA Tesla P100
  - 1813 multicore nodes: 2 x Intel Xeon E5-2695 v4
- Cray Aries high-speed interconnect
- OS: Cray Linux Environment

Further reading

- Sarus user documentation: https://sarus.readthedocs.io/en/latest/user/user_guide.html
- Sarus on GitHub: https://github.com/eth-cscs/sarus

- Slides and Lab material: https://github.com/eth-cscs/containers-hands-on
- Lab intro video: https://youtu.be/dv74sFb3cVc
- Contact: alberto.madonna@cscs.ch

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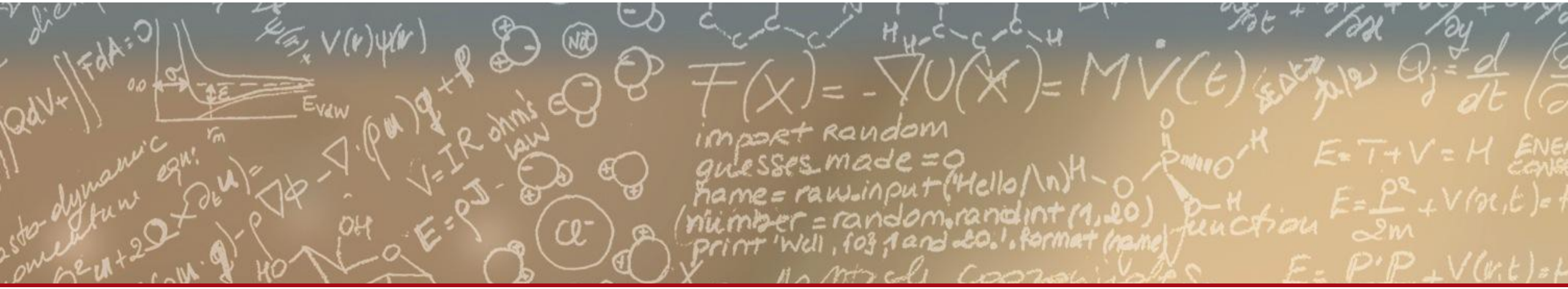

Thank you for your attention.