



ROMEO HPC CENTER: RESEARCH AND TEACHING

The ROMEO HPC Center - Grand-Est region, France - is a High Performance Computing academic platform hosted by the University of Reims Champagne-Ardenne (URCA) since 2002. It provides :

- HPC resources for researchers with entire ecosystem of services like secured storage, software, support or cloud.
- Expertise in application domains like mathematics, computer science, physics, molecular modeling, chemistry, biology, ...
- Artificial Intelligence and Deep Learning Compute Center Infrastructure,
- Advanced visualization solution and service,
- small and medium-sized companies Services,
- Innovation in HPC architectures, algorithms, network and future applications.
- **Teaching, trainings and master degree courses with romeOLAB**



ROMEO HYBRID SUPERCOMPUTER @ TOP500

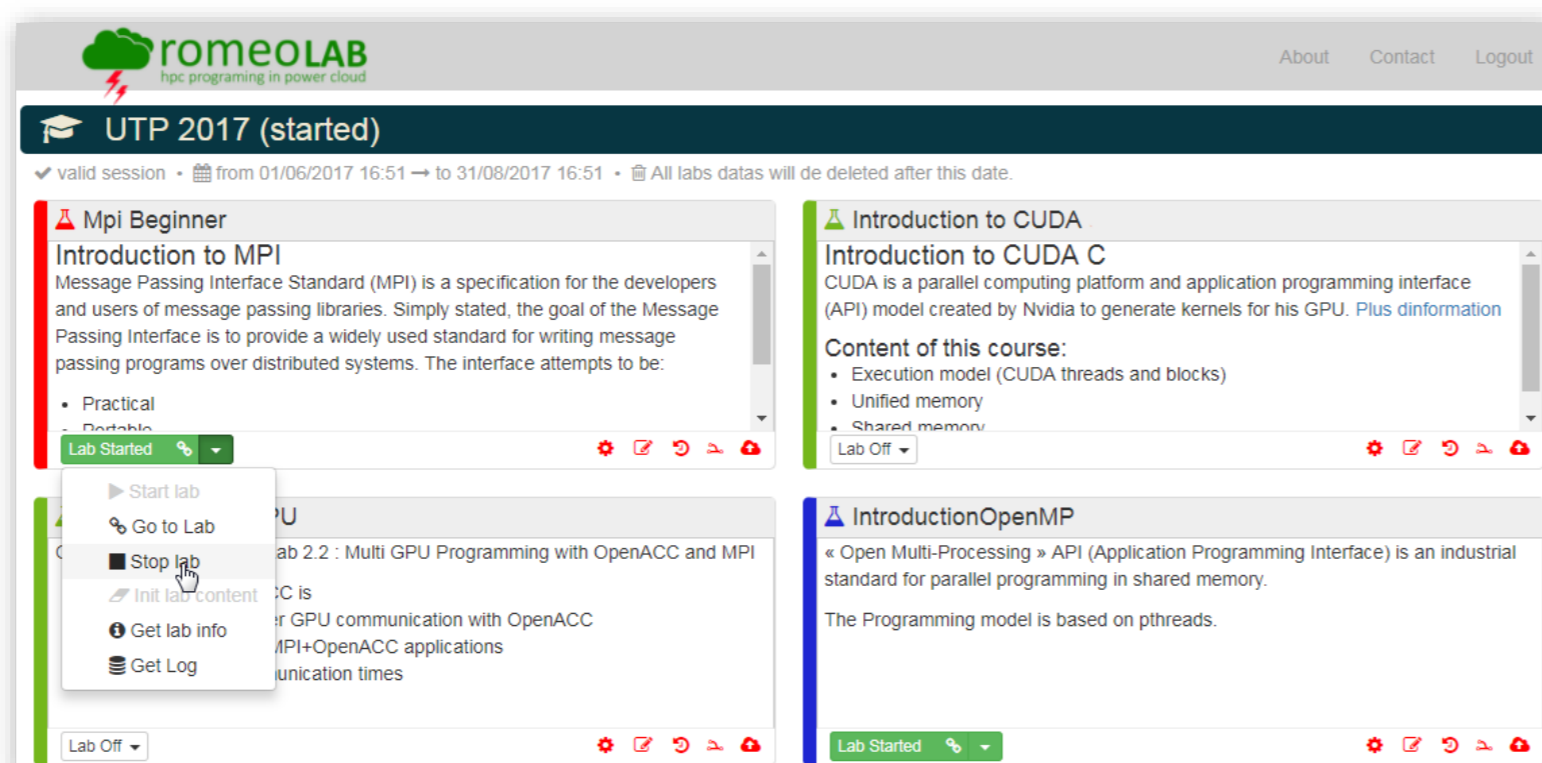
ROMEO supports research and innovation in HPC that lead to our full hybrid CPU-GPU cluster in 2013 :

- Designed by Atos-Bull
- Powered by 260 GPU Cards and 260 Intel CPU
- Ranked 151th @TOP500 & 5th @Green500 in Nov, 2013
- Operated by RedHat, Lustre & Slurm,
- 350 000 experiences each year, 240 users, 123 projects
- 2,5 M€, funded by :

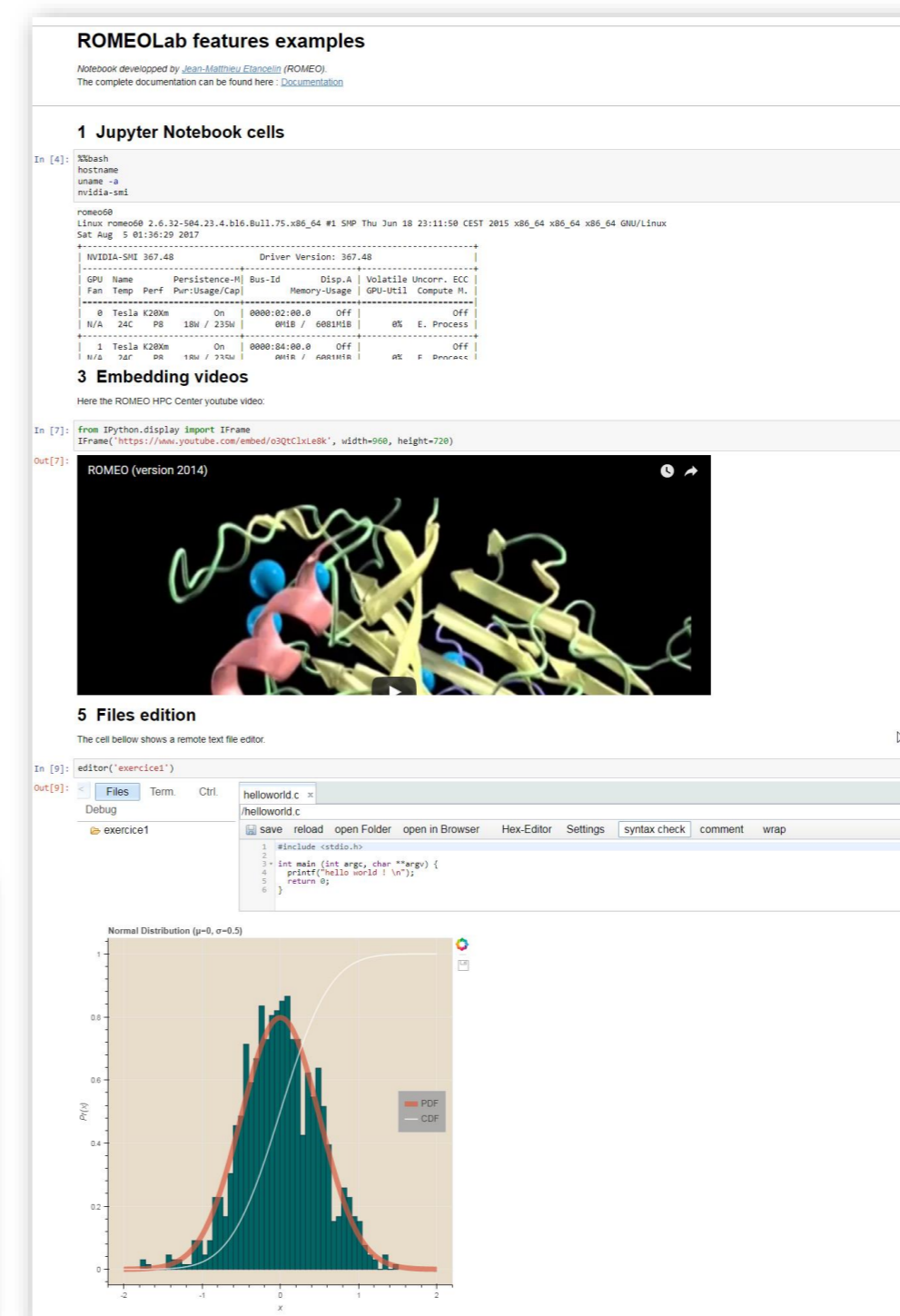
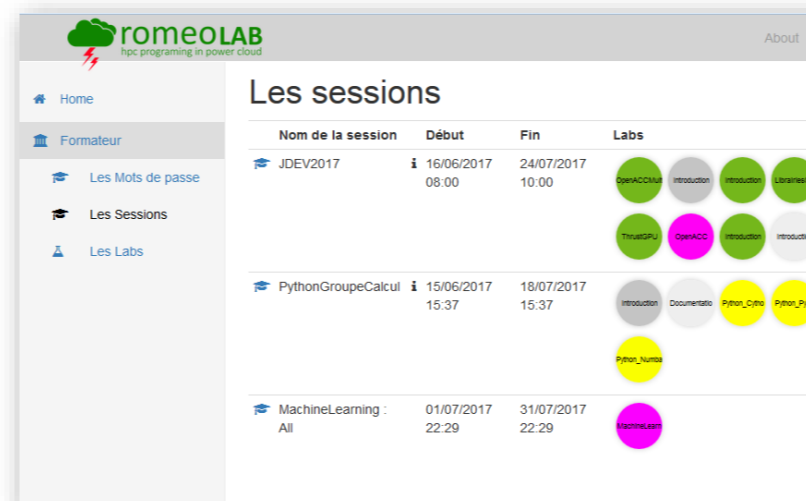
romeOLAB MOTIVATIONS

We build romeOLAB with precise requirements :

- **Powerfull** : we want to execute code on a real HPC facility, because ours works perfectly and we've got all the software already installed and supported. Where're using a proxy for external users to access to compute nodes.
- **Easy** : romeOLAB is a modern MOOC platform making it possible to run HPC in a simple web browser. Ssh, ftp and job managers (Slurm) are not part of courses educational objectives nor prerequisites.
- **Pedagogic** : on the same web page, student must find lessons (video, pdf, images, ...) and the edition / compilation / execution interfaces. Jupyter Notebook (figure on right) is our solution for strong interactivity. Teacher can create his courses on the same platform and manage attendees to his courses,
- **Multi-Application** : Compiling and executing code is not enough. We must run profilers, GUIs, and other scientific software.



Teachers can manage users, sessions and labs with description and parameters.



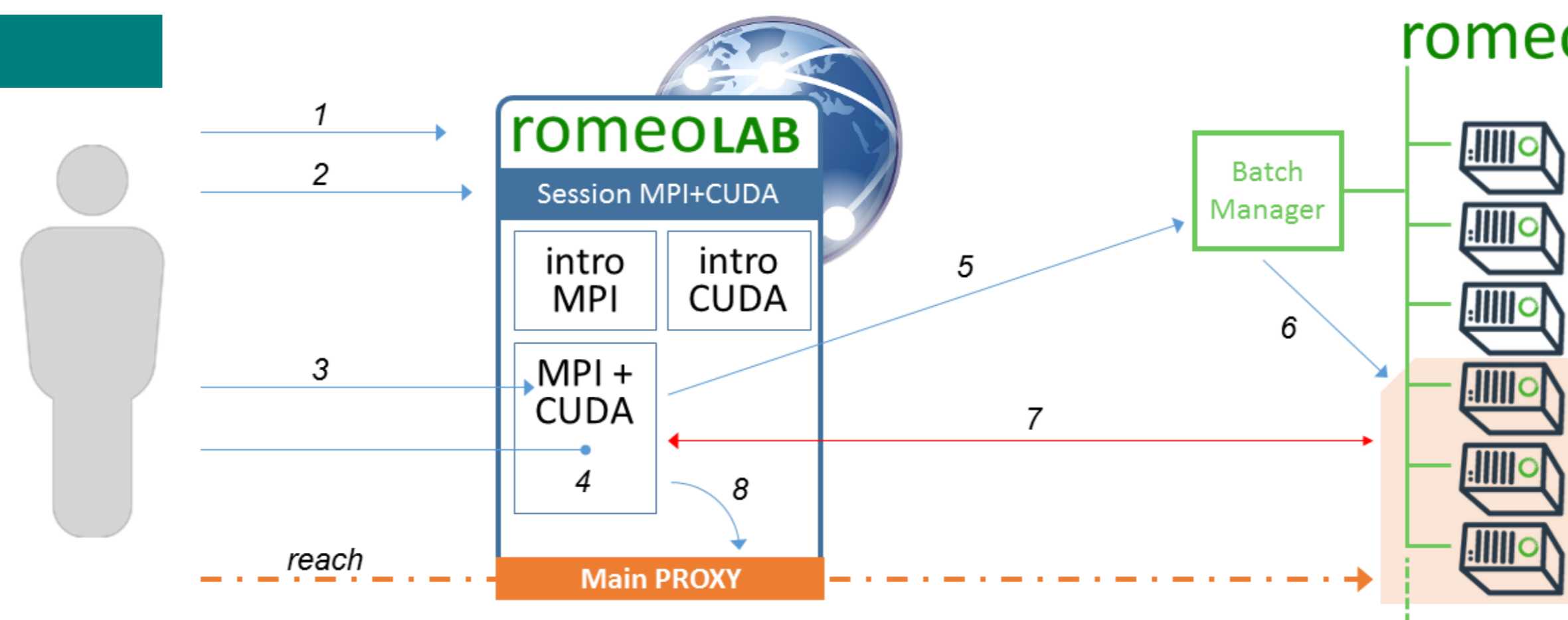
romeOLAB BIG PICTURE

As described on the figure , the user :

1. create an account, and log in to the platform. By Default, no session is available;
2. reach a Session with a link or an access code provided by teacher. A session correspond to a temporal event : training, school, master degree course, ...

The user can now list available labs and their descriptions (figure above) ;

3. start a lab and wait his kick-off. After a short time, the user can reach the lab to work in his IPython Notebook, watch videos and documents, fill tables with performance results, edit and compile (top right figure). He can also run software with graphical interface via a remote desktop.



The **internal behavior** of the platform :

4. assign a temporary cluster-user to the romeOLAB-user and dynamically load initial content of the lab from dedicater GIT ;
5. launch a job through the cluster workload scheduler and possibly via reserved dedicated resources;
6. set-up all resources parameters and start all services (notebooks, editors, VNC, ...), through the job;
7. probe the start of the services with websockets;
8. create a secured route in the proxy in order to provide a direct access to those services , once everything is started.

romeOLAB: SESSIONS

romeOLAB has been successfully used in instructor-led or self-led session, with a number of participants varying from 10 to 60 :

- JDEV2017, 07/2017, 4 days, GPU programming,
- Groupe Calcul, 07/2017, 3 days, Advanced Python for HPC.
- Profiler Days, 05/2017, 3 days, Profiling tools for parallel codes.
- OpenFOAM School, 10/2016, 3 days, OpenFOAM software.
- Master Courses, 2016/17, 4 months, GPU/ HPC programming.
- 10th LoOPS day, 09/2016, 2 days, Advanced Python,
- GTCEU2016, 09/2016, 90 minutes, MPI multi GPU OpenACC.
- GPU Spring School, 05/2016, 1 week, GPU programming.
- GTC2016, 04/2016, 90 minutes, Advanced Multi GPU tools.

romeOLAB: AVAILABLE CONTENTS

romeOLAB is addressing a wide range of technologies and audience levels. As we encourage mutualization, this list is growing :

Beginner :

- Introduction to: Python, OpenMP, MPI , CUDA, OpenACC, ...
- GPU accelerated applications: CUDA, OpenACC, Python, ...
- GPU accelerated libraries: cuBLAS, cuRand, cuFFT, ...

Intermediate

- OpenFOAM
- OpenCL, CUDA Asynchronism

Advanced

- Profiling: TAU, MAQAO
- Advanced Python: Cython, Numba, Pythran
- CUDA Optimizations
- Multi-GPU with CUDA
- Multi-GPU with OpenACC and MPI

