Parallel Macro for Non-Programmers
and HPC Workflow Manager for Fiji

Stefanos Velissariou [1], **Michal Krumnikl** [1,2], **Jan Kožusznik** [1,2], **Pavel Moravec** [1,2], **Vladimír Ulman** [1]

[1] IT4Innovations National Supercomputing Center, VŠB - Technical University of Ostrava, Ostrava, Czech Republic
[2] Department of Computer Science, FEECS VŠB - Technical University of Ostrava, Ostrava, Czech Republic

Introduction

Running image processing algorithms in parallel is desirable for image analysts and a major challenge for developers. As microscopy technology advances, users are facing ever larger data volumes. One way to tackle the analysis of big image data is to split the image processing tasks into smaller sub-tasks and organize them for parallel execution in a High-Performance Computing (HPC) facility.

While the cost of computational equipment decreases, making it possible to readily build or simply gain access to large HPC resources, the software able to exploit such hardware in a straightforward and user-friendly manner is lacking. We addressed this problem in Fiji by building a bridge to a prevalent HPC parallelization framework - the Open MPI.

Grand Scheme of Things
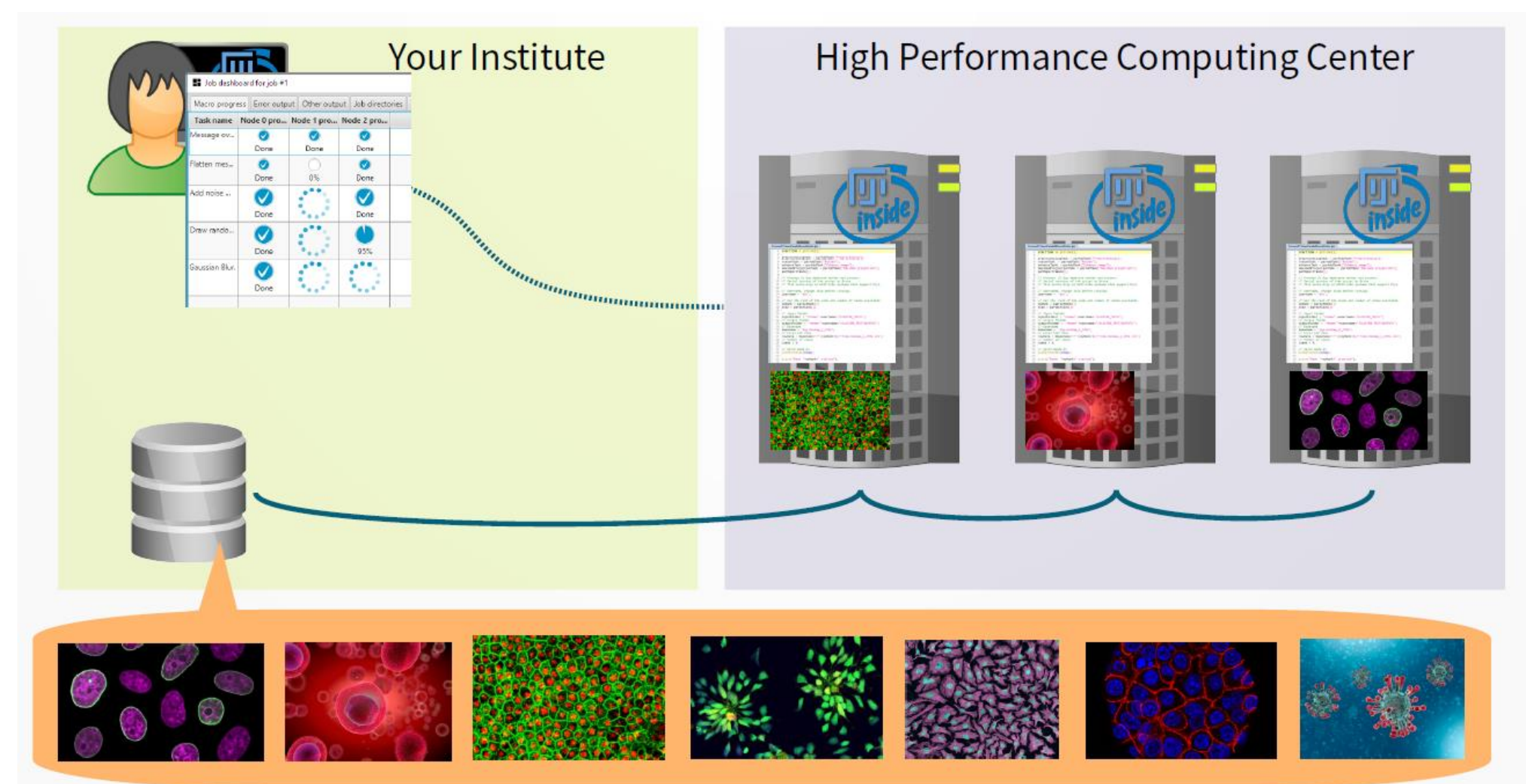
Accelerate Fiji Macros in a Few Easy Steps with Our Parallel Macro

1 Prepare serial workflow

```
function work(i) {
  load(i);
  … my macro code …
  store(i);
}

for (i = 1; i <= 42; i++) {
  work(i);
}
```

2 *Make it parallel*

```
function work(i) {
  load(i);
  ... my (recorded) code ...
  store(i);
}

for (i=parGetRank(); i <= 42; i+=parGetSize()) {
  work(i);
}
```

3 Add Progress Reporting Functions (optional)

```
for (i=parGetRank(); i <= 42; i+=parGetSize()) {
  parAddTask("Img:" + i);
}
parReportTasks();

function work(i) {
  load(i);
  taskNo = floor(i / parGetSize());
  parReportProgress(taskNo, 20);
  ...my macro code...
  parReportProgress(taskNo, 80);
  store(i);
  parReportProgress(taskNo, 100);
}

for (i=parGetRank(); i <= 42; i+=parGetSize()) {
  work(i);
}
```

4 *Run by HPC Workflow Manager*

Tutorials, Videos
Documentation
Software
Source code
Virtual Machines

https://fiji-hpc.github.io/hpc-parallel-tools/

Summary

Our newly developed HPC Workflow Manager framework for Fiji delivers flexibility in parallelizing image processing tasks on large image sets or spatially large individual images without introducing additional complexity for casual users of ImageJ macro language or for experienced Java developers.

VSB TECHNICAL UNIVERSITY OF OSTRAVA | IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research, Development and Education

MINISTRY OF EDUCATION, YOUTH AND SPORTS