

Presentation of TER project

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Project timeline

- Friday 12/01 (TP - Introduction)
- Friday 19/01 (TP - CPU implementation with 1D tiling)
- Friday 26/01 (TP - CPU implementation with 2D tiling)
- Friday 02/02 (TP - CUDA support)
- Friday 09/02 (TP - Scheduling and performance models)
- Friday 16/02 (presentations for M2 students GEMM only)
- Friday 23/02 (reports for M2 students GEMM only)
- Friday 01/03 (reports for M2 students GEMM and Cholesky)
- Monday 04/03 (TP - StarPU MPI with 2D algorithms)
- Monday 11/03 (TP - StarPU MPI with 3D algorithms)
- Monday 18/03 (TP - Parallel worker support)
- Monday 25/03 (TP - Catching up and optional work)
- Monday 08/04 (TP - Catching up and optional work)
- Monday 29/04 (presentations and reports for M1 students)

Evaluation

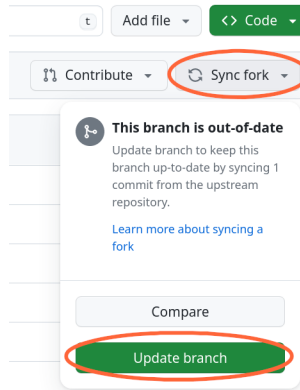
- Source code (use the repositories in the GitHub organisation)
- Written report of max 15 pages for M2 students and 30 pages for M1 students (description of your implementation strategies, pseudo-codes, and benchmarks for each feature that you add to your implementation (e.g., CPU only, CPU+GPU, distributed CPU only, distributed CPU+GPU, impact of the tile size, impact of the process grid, ...))
- A presentation of 15min + 10min of questions (pedagogical summary of your written report detailing your implementation and experimental results)
- Note: The report and presentation can be in English or French

Basic Git setup

- Main git repository
<https://github.com/TER-StarPU/ter-starpup-gemm>
- Private fork <https://github.com/TER-StarPU/ter-starpup-gemm-mX-binomeY> with X your year number and Y your group number

Pulling updates from main repository to private fork

Remember to update your private fork repository when updates are available (**Do it now**)



Adding ssh key to GitHub

The git repositories are private, thus you need to add the public ssh keys of the machines that you will work on to your GitHub account.

- Copy the ssh key found in `.ssh/id_rsa.pub` (**Copy the pub key not the private key !**)
- Add the key in your github account : Settings → SSH and GPG keys → New SSH key

Connecting to the machines

```
ssh qdcster_XX@chome.metz.supelec.fr  
salloc --exclusive --partition gpu_tp_resa --reservation [RESERVATION]  
salloc --exclusive --partition gpu_inter # ONLY WHEN AT HOME  
ssh [machine]
```

The [RESERVATION] code for this week is M1QDCS_TERSTARPU11
Note if you do not use -exclusive you may encounter some
problems with StarPU.

Documentation for the cluster is found at

<https://dce.pages.centralesupelec.fr/>

Remote development on vscode

<https://code.visualstudio.com/docs/remote/ssh>

Installing StarPU and other packages

Run the remote installer script in the setup directory

```
./setup/remote-install.sh
```

Add the following in your `.bashrc`

```
export PATH=$HOME/local/cmake/bin:$PATH
export PATH=$HOME/local/openblas/bin:$PATH
export LD_LIBRARY_PATH=$HOME/local/openblas/lib:$LD_LIBRARY_PATH
source $HOME/local/starpu/bin/starpu_env
export OMP_NUM_THREADS=1
```

Then use the command

```
source .bashrc
```


Project overview

The objective of this TER project is to implement a generalised matrix multiplication algorithm:

- Using the StarPU task-based runtime
- Works efficiently on CPU and GPU (part 1)
- Works on multi-machine clusters with MPI (part 2)
- 1D or 2D tiling
- 2D and 3D algorithms in MPI
- (Optional) out-of-core support and OpenMP support

Useful links for StarPU

- Documentation

<https://github.com/TER-StarPU/ter-starpu-gemm/blob/main/docs/starpu-documentation.pdf>

- Tutorials

<https://starpu.gitlabpages.inria.fr/tutorials.html>

- Source code

<https://gitlab.inria.fr/starpu/starpu>

We will have a quick overview of StarPU and its features, but you will have to read the documentation to learn more.

StarPU documentation

You should read these parts of the StarPU documentation during the project (~140 pages in total)

- Basics : chapters 5, 9, 10, 11, 12, 13, 14
- Advanced : chapters 18, 32, 33
- FAQ and CUDA : chapters 24, 25, 38
- Scheduling : 15, 34
- MPI Support : chapter 42
- Parallel Workers : chapter 49
- (Recommended for report) Profiling : chapters 20, 21, 22
- (Optional) Out-of-core support : chapter 41

Next

Take a look at the files in the git repository :

<https://github.com/TER-StarPU/ter-starpu-gemm>

Follow the tutorial :

<https://github.com/TER-StarPU/ter-starpu-gemm/tree/main/tutorial>

For next week read at least chapters 5, 9, 10, 11, 12, 13, 14 of the StarPU documentation

<https://github.com/TER-StarPU/ter-starpu-gemm/blob/main/docs/starpu-documentation.pdf>