

Plantage du décor

Pierre Aubert



IN2P3
transverse
project

~ 20 people

**IN2P3
transverse
project**

~ 20 people



IN2P3
transverse
project

~ 20 people



Fortran

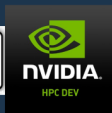


IN2P3
transverse
project

~ 20 people

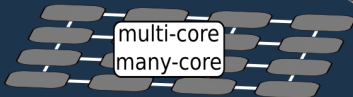
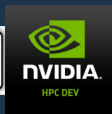
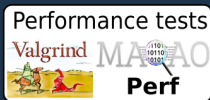


Fortran



IN2P3
transverse
project

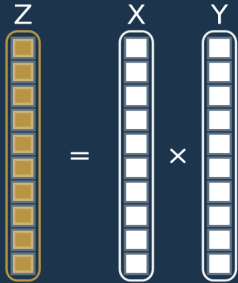
~ 20 people



multi-core
many-core

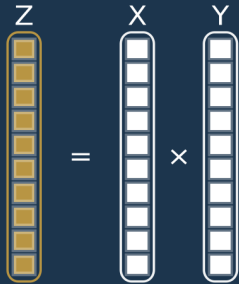
Simple Examples

Hadamard Product



Simple Examples

Hadamard Product

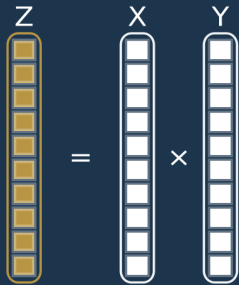


Reduction



Simple Examples

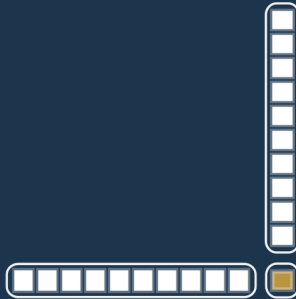
Hadamard Product



Reduction

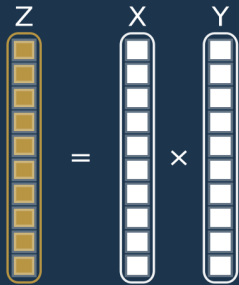


Dot Product



Simple Examples

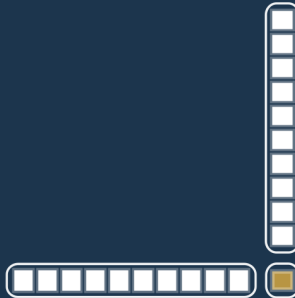
Hadamard Product



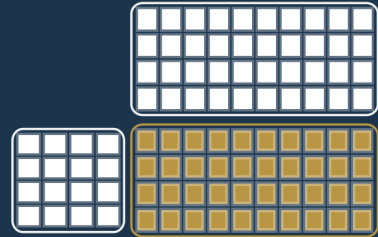
Reduction



Dot Product

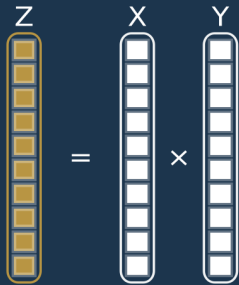


Matrix Product



Simple Examples

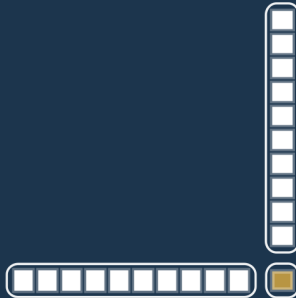
Hadamard Product



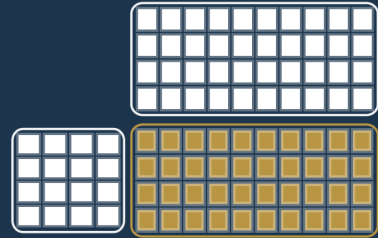
Reduction



Dot Product



Matrix Product

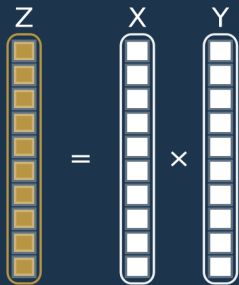


MKL



Simple Examples

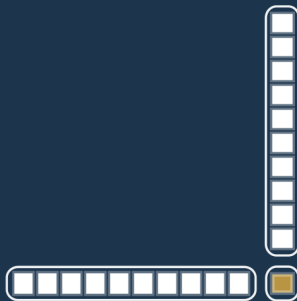
Hadamard Product



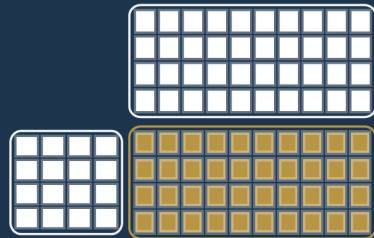
Reduction



Dot Product



Matrix Product



MKL

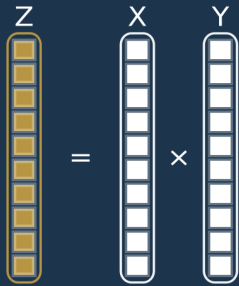


Eigen



Simple Examples

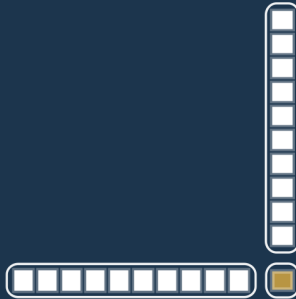
Hadamard Product



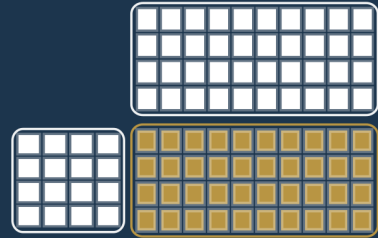
Reduction



Dot Product



Matrix Product



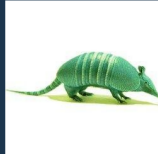
MKL



Eigen

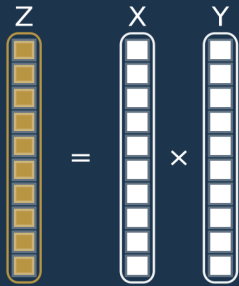


Armadillo



Simple Examples

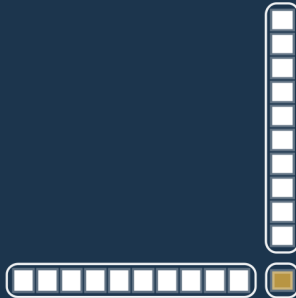
Hadamard Product



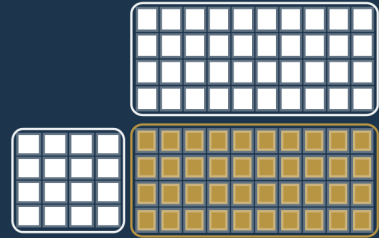
Reduction



Dot Product



Matrix Product



MKL



Eigen

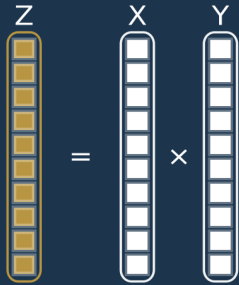


Armadillo



Simple Examples

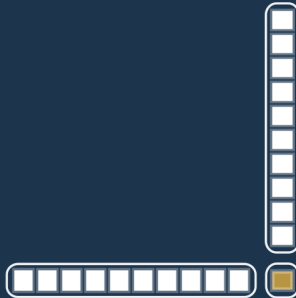
Hadamard Product



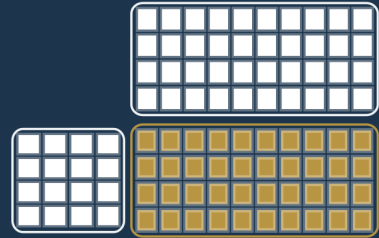
Reduction



Dot Product



Matrix Product



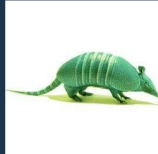
MKL



Eigen

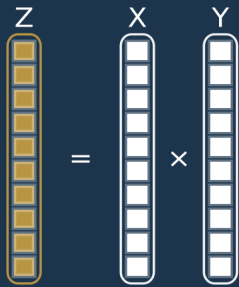


Armadillo



Simple Examples

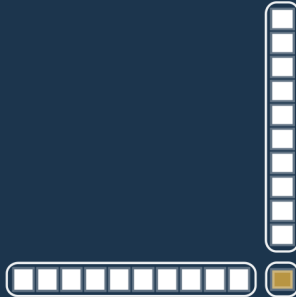
Hadamard Product



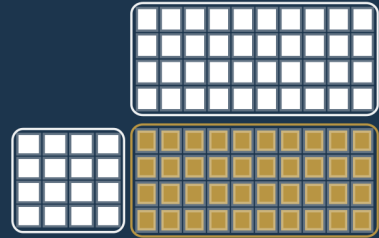
Reduction



Dot Product



Matrix Product



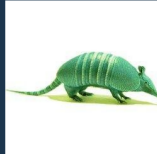
MKL



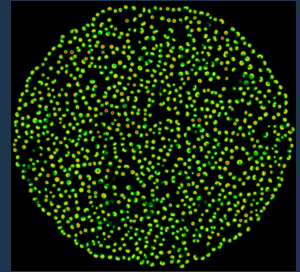
Eigen



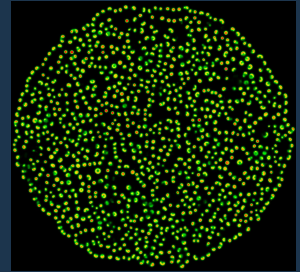
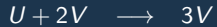
Armadillo



Gray Scott reaction (a chemistry game of life)



Gray Scott reaction (a chemistry game of life)



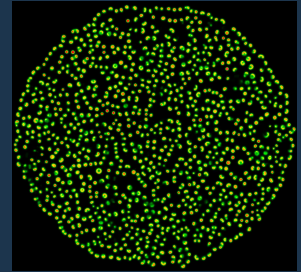
Gray Scott reaction (a chemistry game of life)



Computing :

$$\frac{\partial u}{\partial t} = r_u \nabla^2 u - uv^2 + f_r \times (1 - u)$$

$$\frac{\partial v}{\partial t} = r_v \nabla^2 v + uv^2 - (f_r + k_r) \times v$$



- ▶ u and v are concentration of product **U** and **V**
- ▶ r_u and r_v diffusion rate of **U** and **V**
- ▶ k_r (**Kill Rate**), conversion rate from **V** to **P**
- ▶ f_r (**Feed Rate**), speed of process which feed **U** and kills **V** and **P**
- ▶ $\nabla^2 u$ and $\nabla^2 v$ are différence of space concentration between current cell and its neighbours

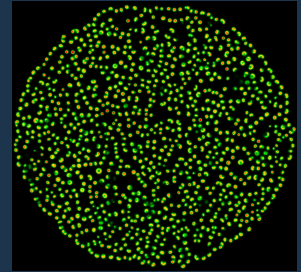
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- ▶ k_r (**Kill Rate**), conversion rate from **V** to **P**
- ▶ f_r (**Feed Rate**), speed of process which feed **U** and kills **V** and **P**
- ▶ $\nabla^2 u$ and $\nabla^2 v$ are différence of space concentration between current cell and its neighbours
- ▶ Easy to understand
- ▶ Not so easy for the compiler
- ▶ Possibility of high speed up





Fortran



Fortran





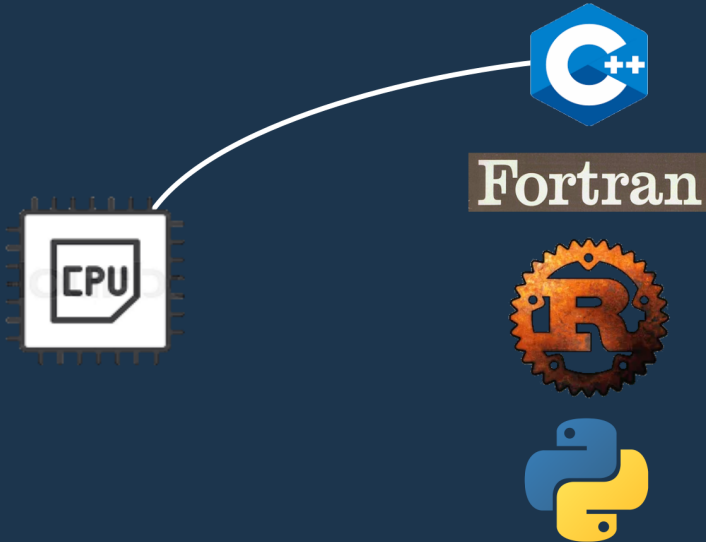
Fortran

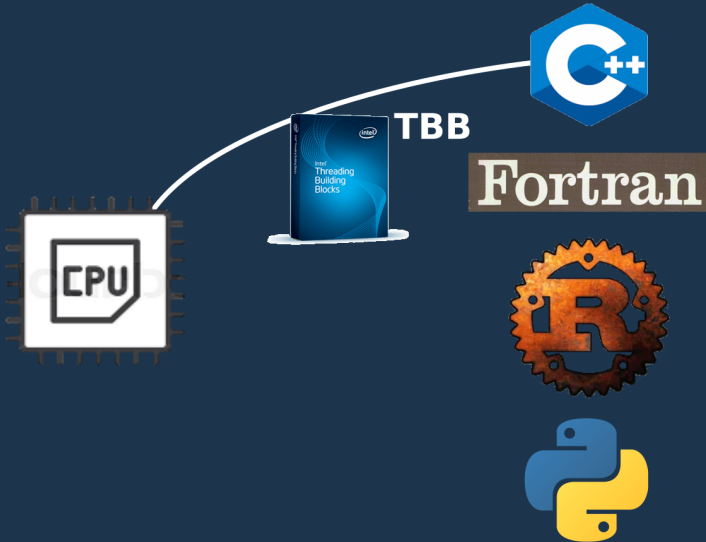


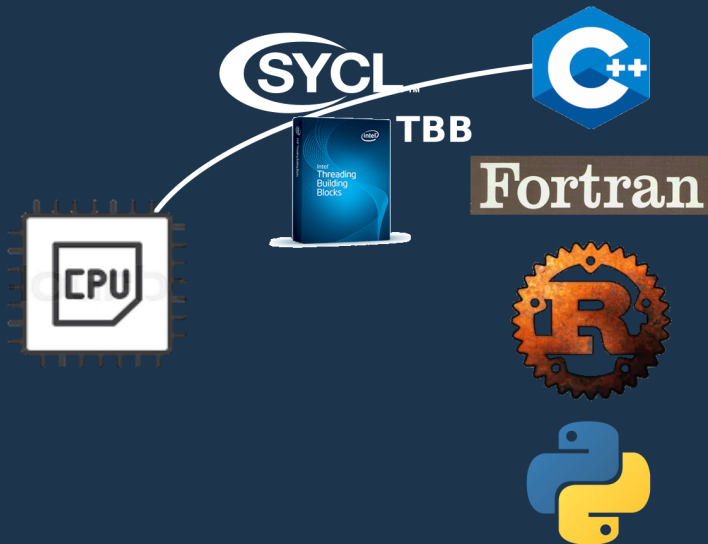


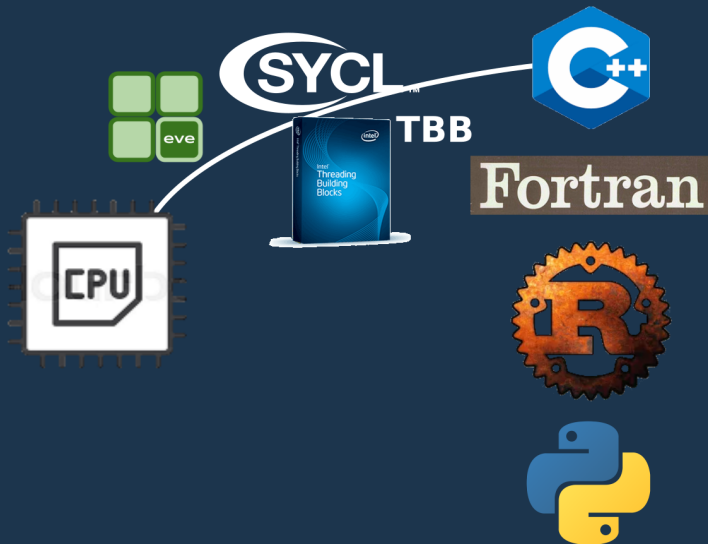
Fortran

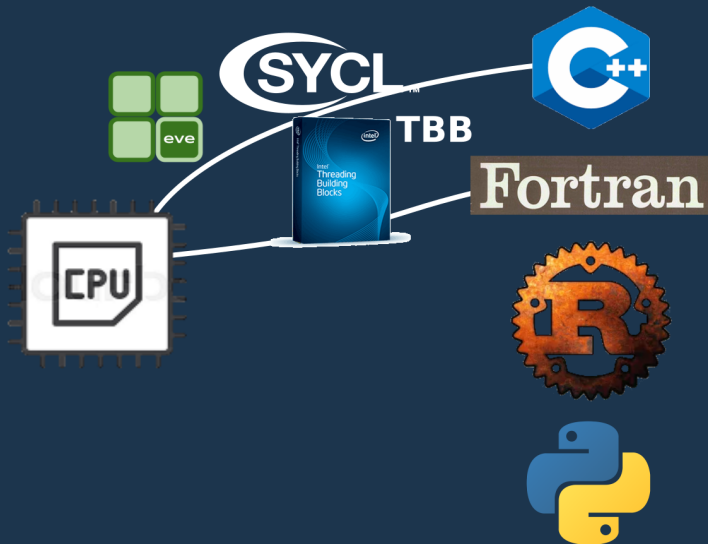


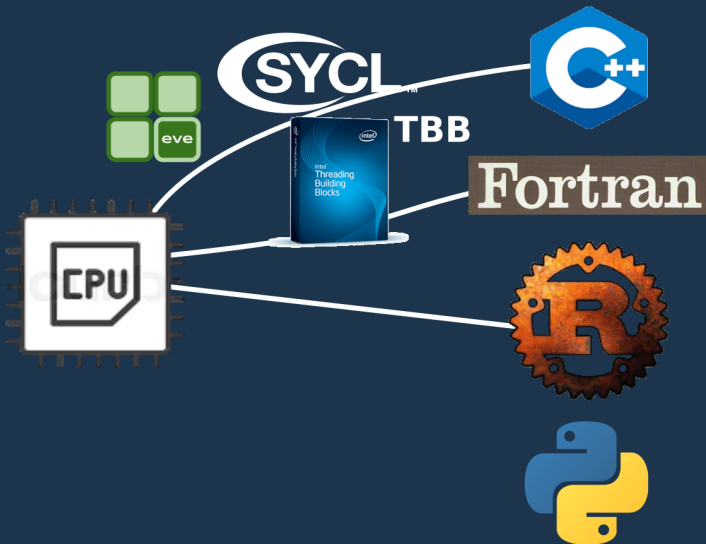


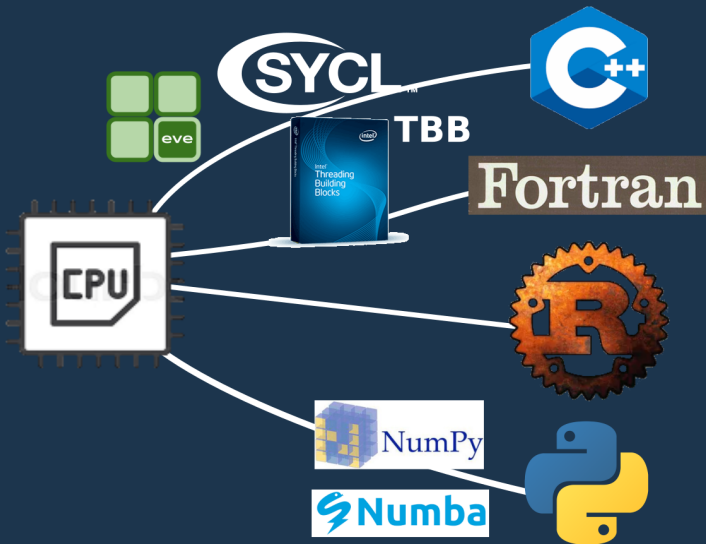


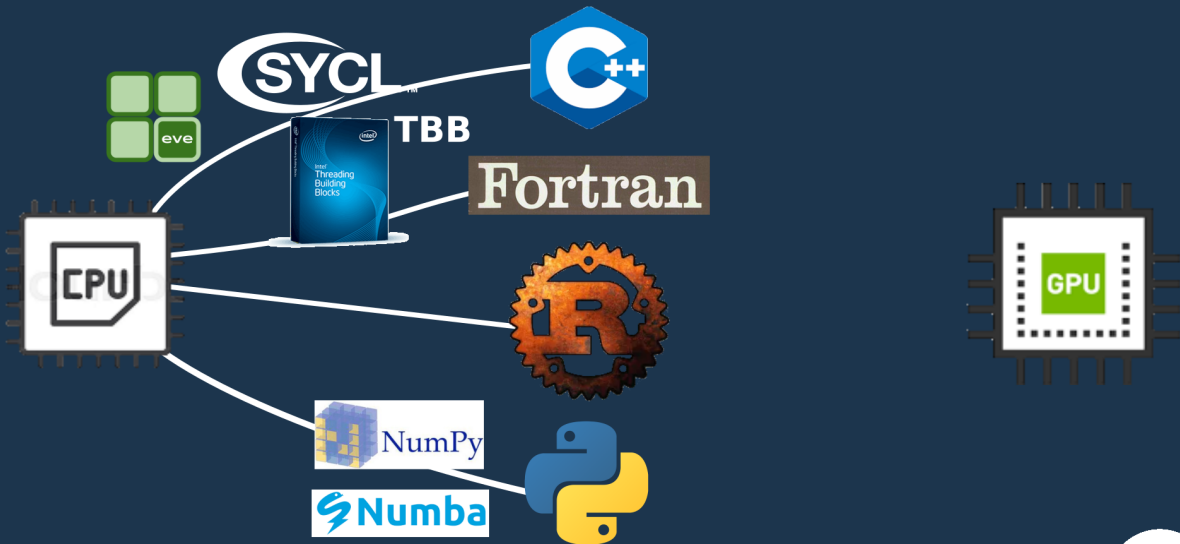


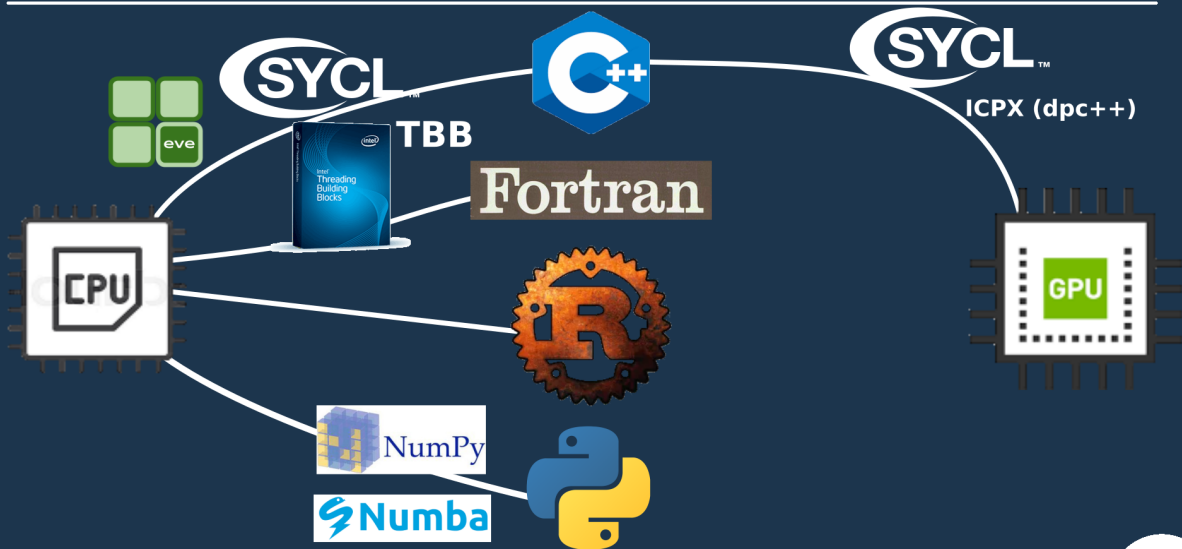


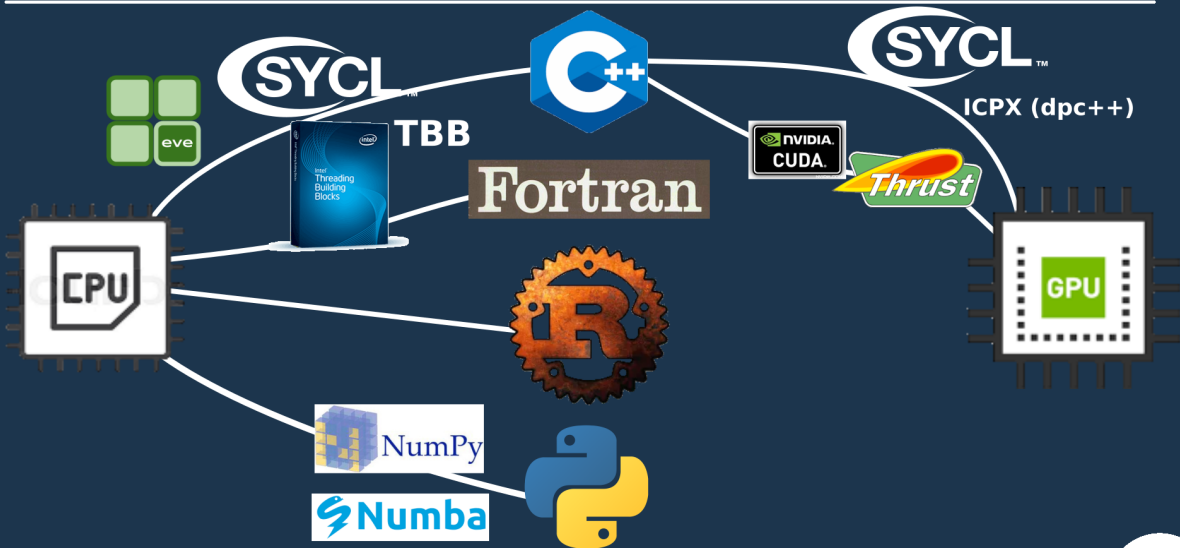


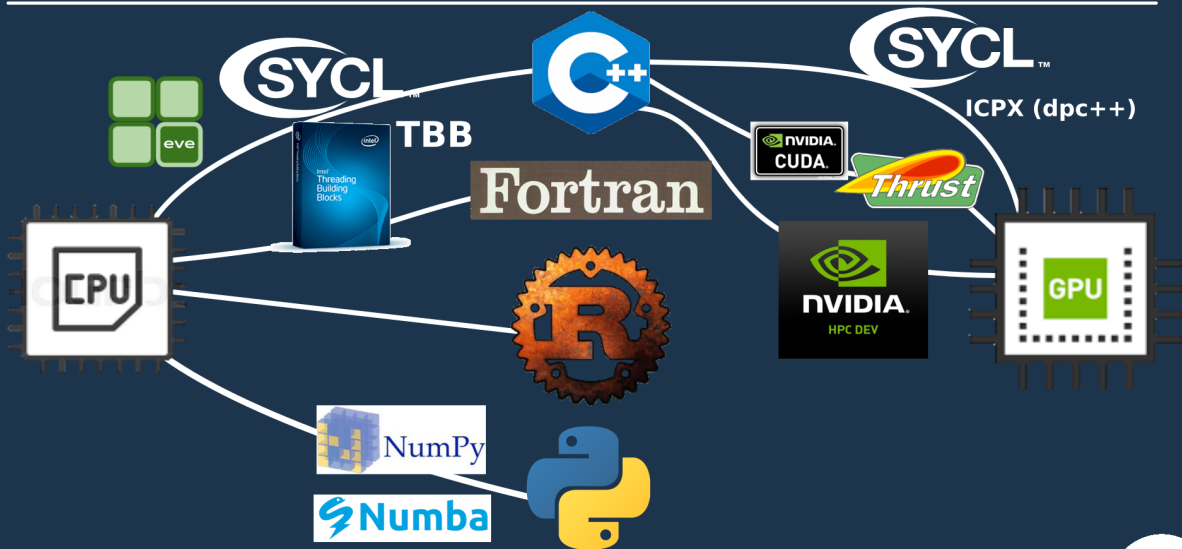


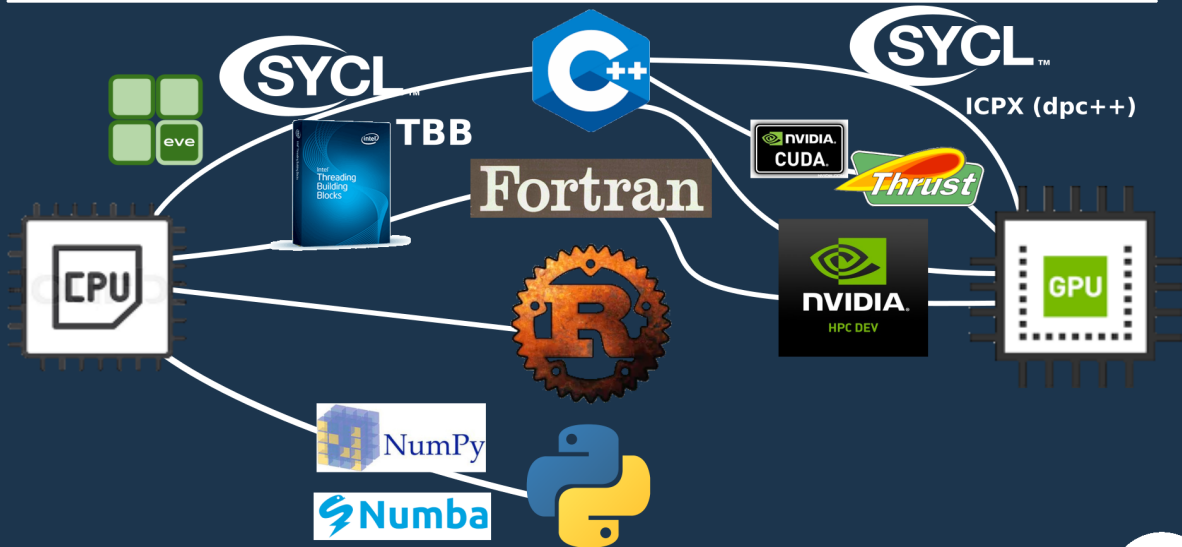


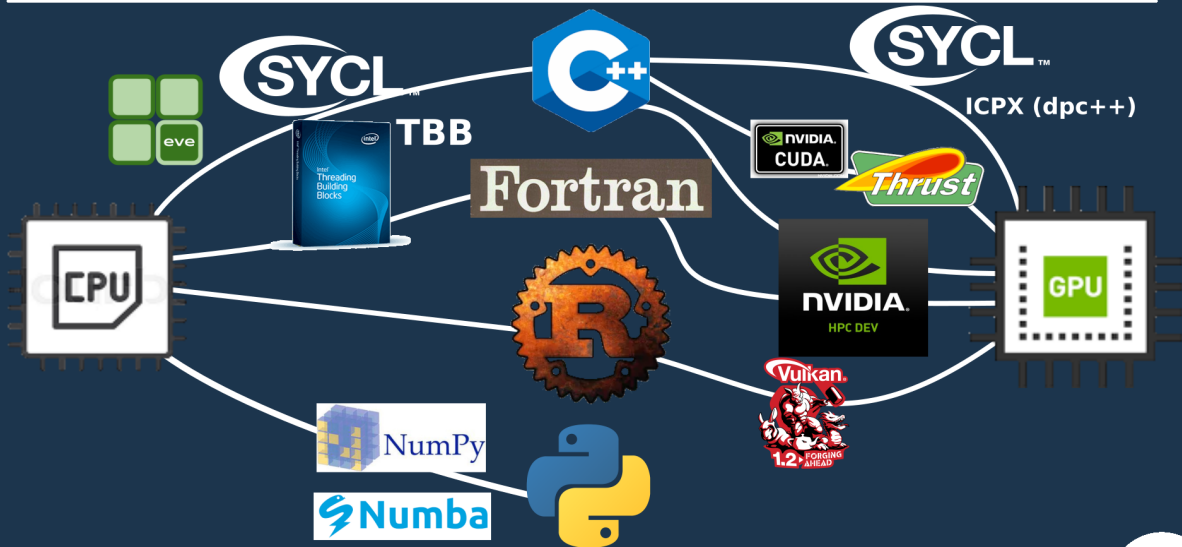


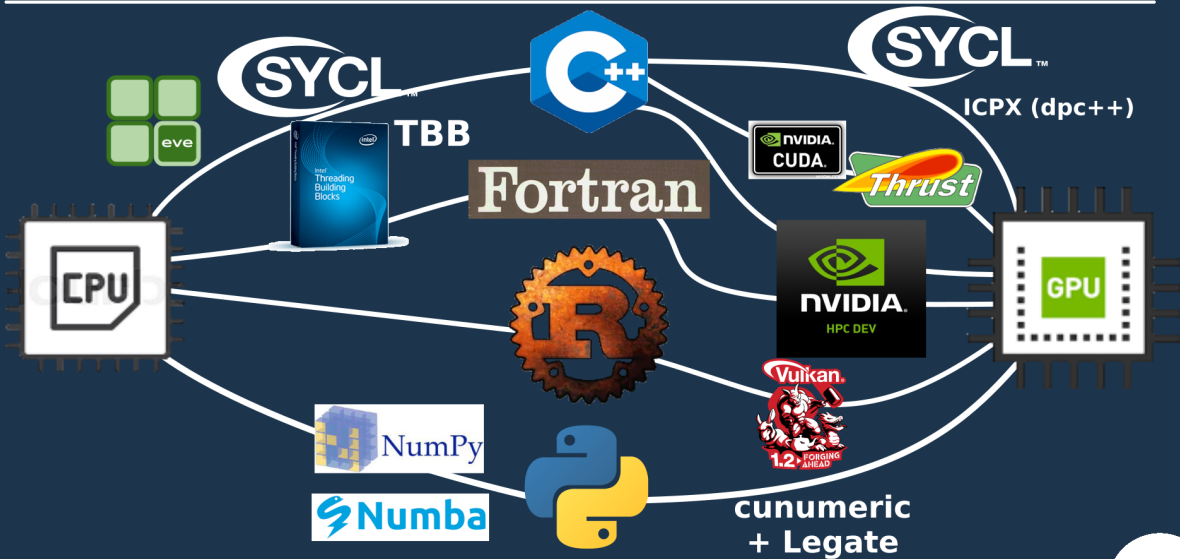


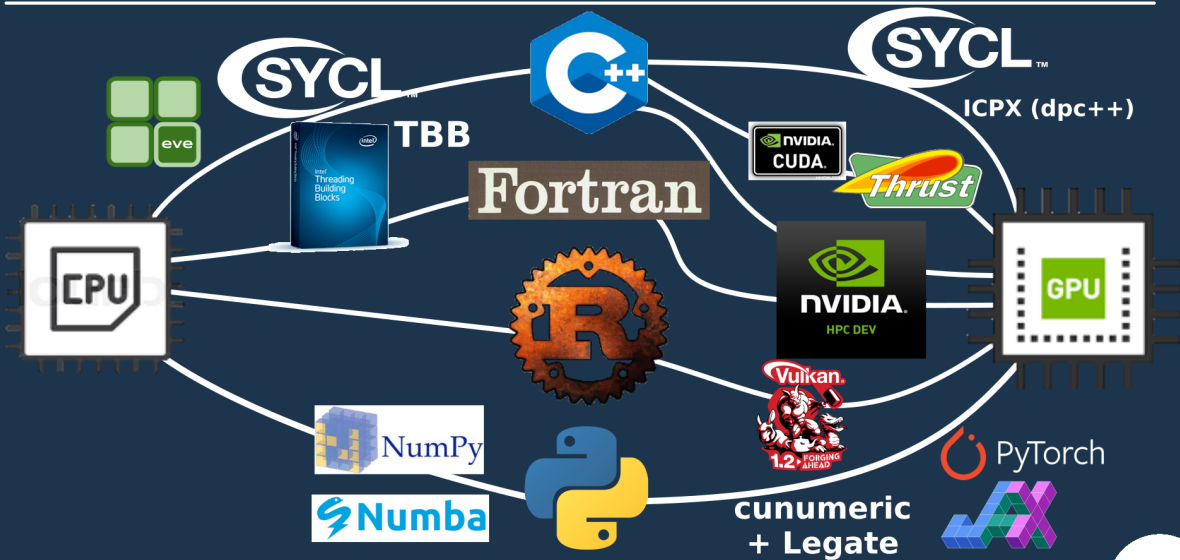








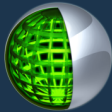




Performance tests

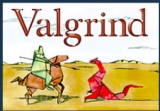


Perf

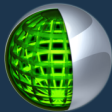


NSight

Performance tests



Perf



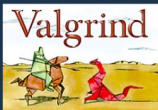
NSight

Memory Profiler

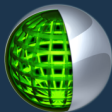
MATL

NUMA Prof

Performance tests



Perf



NSight

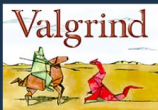
Compilers

Memory Profiler

MATL

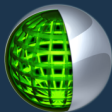
NUMA Prof

Performance tests



Perf

MATL



NSight

Compilers



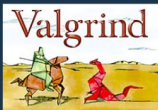
LLVM : CLang /
CLang ++ / FLang

Memory Profiler

MATL

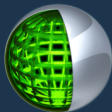
NUMA Prof

Performance tests



Perf

MATL



NSight

Compilers



LLVM : Clang /
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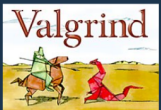
GNU : GCC / G++ /
GFortran

Memory Profiler

MATL

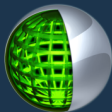
NUMA Prof

Performance tests



Perf

MARAO



NSight

Memory Profiler

MATL

NUMA Prof

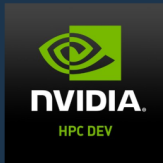
Compilers



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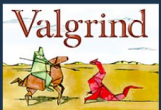
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nvc++ / nvfortran

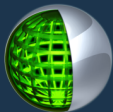
intel®
icpx / dpc++

Performance tests



Perf

MATLAB



NSight

Memory Profiler

MATLAB

NUMA Prof

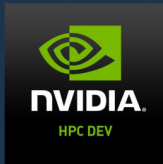
Compilers



LLVM : Clang /
Clang ++ / FLang



GNU : GCC / G++ /
GFortran



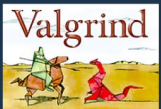
nvc++ / nvfortran

intel®
icpx / dpc++

Precision

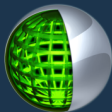


Performance tests



Perf

MATLAB



NSight

Memory Profiler

MATLAB

NUMA Prof

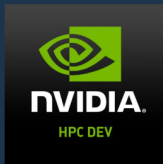
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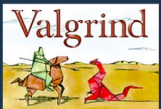
intel®

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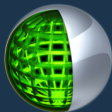


Performance tests



Perf

MATLAB



NSight

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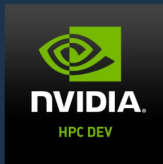
MATLAB

NUMA Prof

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nvc++ / nvfortran



GNU : GCC / G++ /
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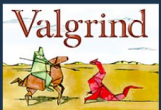
intel®

icpx / dpc++

Precision

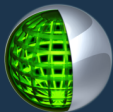


Performance tests



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MATLAB



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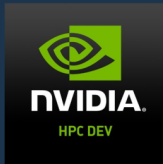
MATLAB

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LLVM : Clang /
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nvc++ / nvfortran



GNU : GCC / G++ /
GFortran

intel®

icpx / dpc++

Precision



git



Gitlab





- **Association**
- **Valorisation / Dissemination** of Knowledge :
Schools / Seminars / Interviews
- **Bridge** between **Academy** and **Industry**

France



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EuroCC (Catalog of HPC/HTC/HPDA formations)

France



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+33 Countries



EuroHPC

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+33 Countries



Annecy

LAPP

~ 40 people

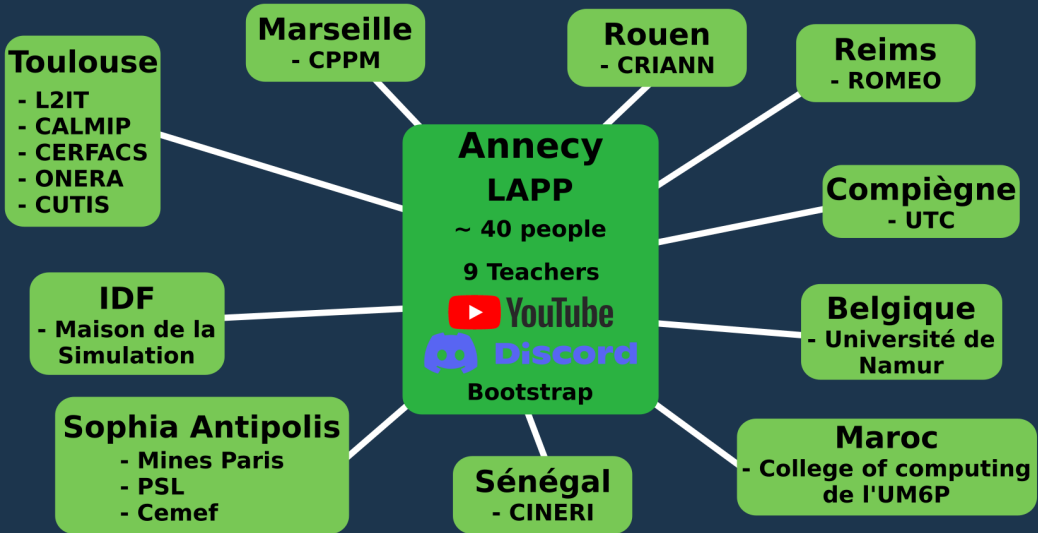
9 Teachers

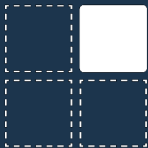
 **YouTube**

 **Discord**

Bootstrap

Multi-site diffusion

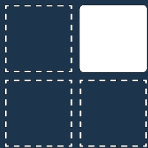




CODE RECKONS

Science to the CORE

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CODE RECKONS

Science to the CORE

Computing center access

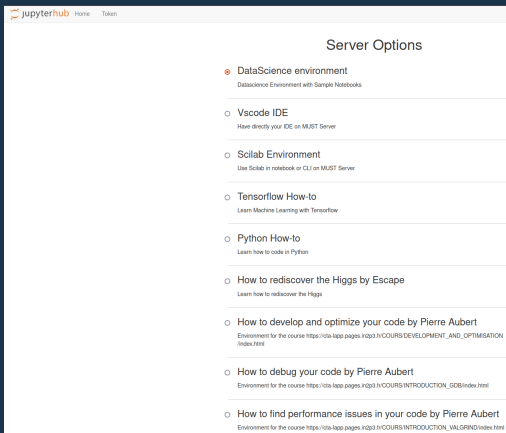
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Engineers helping at bootstrap day

| | K80 | P6000 | T4 | V100 | A100 | A100 80GB |
|------------------|--------------|-------|-------|-------|-------|-----------|
| TFlops (float) | 8.73 (boost) | 12.6 | 8.1 | 14 | 19.5 | 19.5 |
| Memory (GB) | 11.441 (24) | 24 | 15 | 16 | 40 | 80 |
| Nb Cuda Cores | 2496 (4992) | 3840 | 2560 | 5120 | 6912 | 2688 |
| Clock rate (GHz) | 0.824 | 1.645 | 1.590 | 1.380 | 1.410 | 1.410 |
| Generation | 3.7 | 6.1 | 7.5 | 7.0 | 8.0 | 8.0 |



<https://jupyter.must-dc.cloud/hub/>



The screenshot shows the JupyterHub interface with the following content:

- Server Options**
- DataScience environment**
DataScience Environment with Sample Notebooks
- Vscode IDE**
Have directly your IDE on MUST Server
- Scilab Environment**
Use Scilab in notebook or CLI on MUST Server
- Tensorflow How-to**
Learn Machine Learning with Tensorflow
- Python How-to**
Learn how to code in Python
- How to rediscover the Higgs by Escape**
Learn how to rediscover the Higgs
- How to develop and optimize your code by Pierre Aubert**
Environment for the course https://cta-lapp.pages.in2p3.fr/COURS/DEVELOPMENT_AND_OPTIMISATION/index.html
- How to debug your code by Pierre Aubert**
Environment for the course https://cta-lapp.pages.in2p3.fr/COURS/INTRODUCTION_GDB/index.html
- How to find performance issues in your code by Pierre Aubert**
Environment for the course https://cta-lapp.pages.in2p3.fr/COURS/INTRODUCTION_VALGRIND/index.html



`condor_submit job.submit`

https://cta-lapp.pages.in2p3.fr/COURS/INTRODUCTION_MUST/

`https://indico.in2p3.fr/event/30939/timetable/#all.detailed`

`https://cta-lapp.pages.in2p3.fr/COURS/GRAY_SCOTT_LECTURE_DEMO/`

`https://jupyter.must-dc.cloud/hub/`

`https://cta-lapp.pages.in2p3.fr/COURS/INTRODUCTION_MUST/`