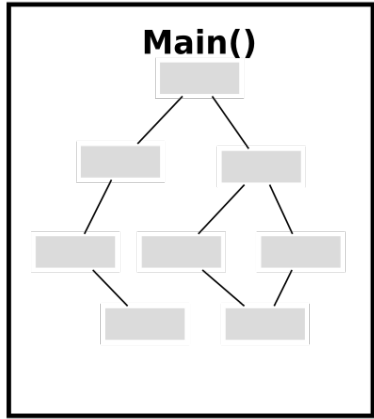


Energy scope

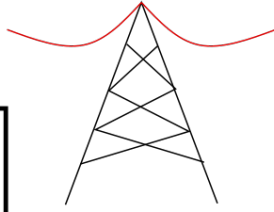
**a tool to measure
the energy profile of HPC&AI applications**

Why energy_scope? -> Project roadmap -> UX

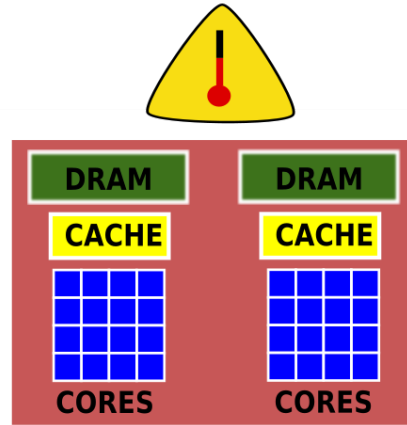
SOFTWARE



INTERNET



SERVER



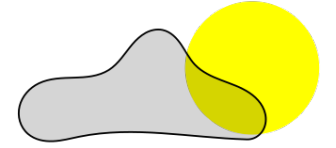
SERVER CABINET



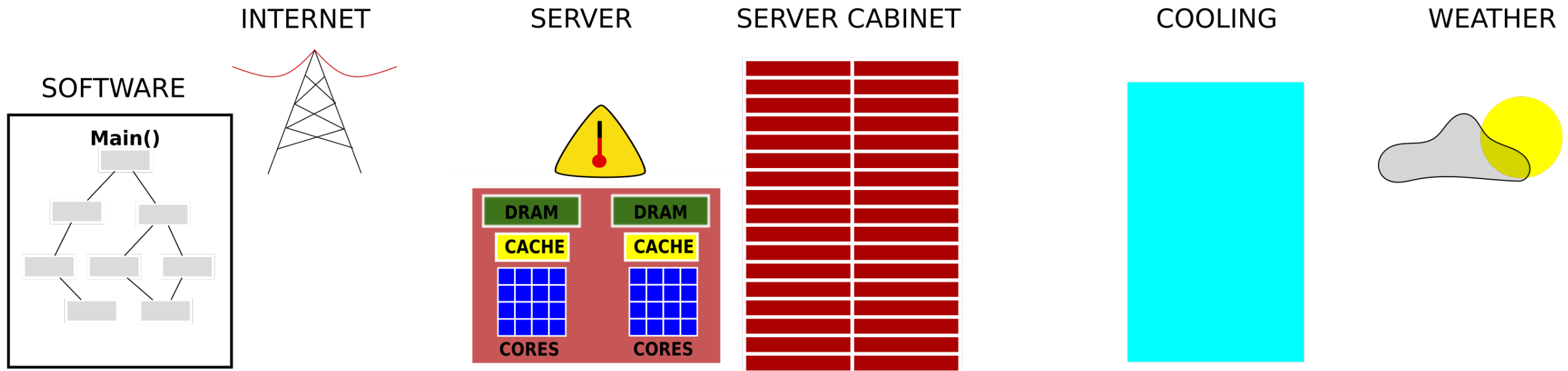
COOLING



WEATHER



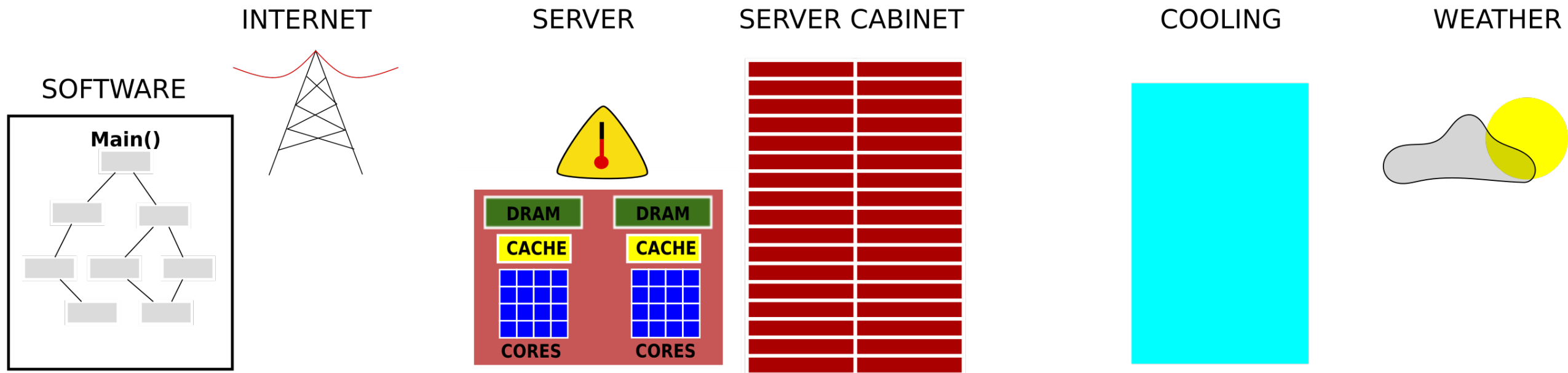
Electricity bill



Electricity bill

Intel SPEED SHIFT HOT CORRIDOR FREE COOLING

TEMPERATURE WASTE HEAT RECOVERY



Electricity bill



Intel SPEED SHIFT

HOT CORRIDOR

FREE COOLING

TEMPERATURE

WASTE HEAT RECOVERY

A solution to optimize the criteria *energy*

PHASE 1

Measure
Understand
Explore

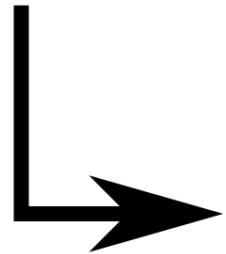
PHASE 2

Share
Optimise

2021

2022

2023



Proof Of Concept : energy_scope

real-time energy acquisition + visualization

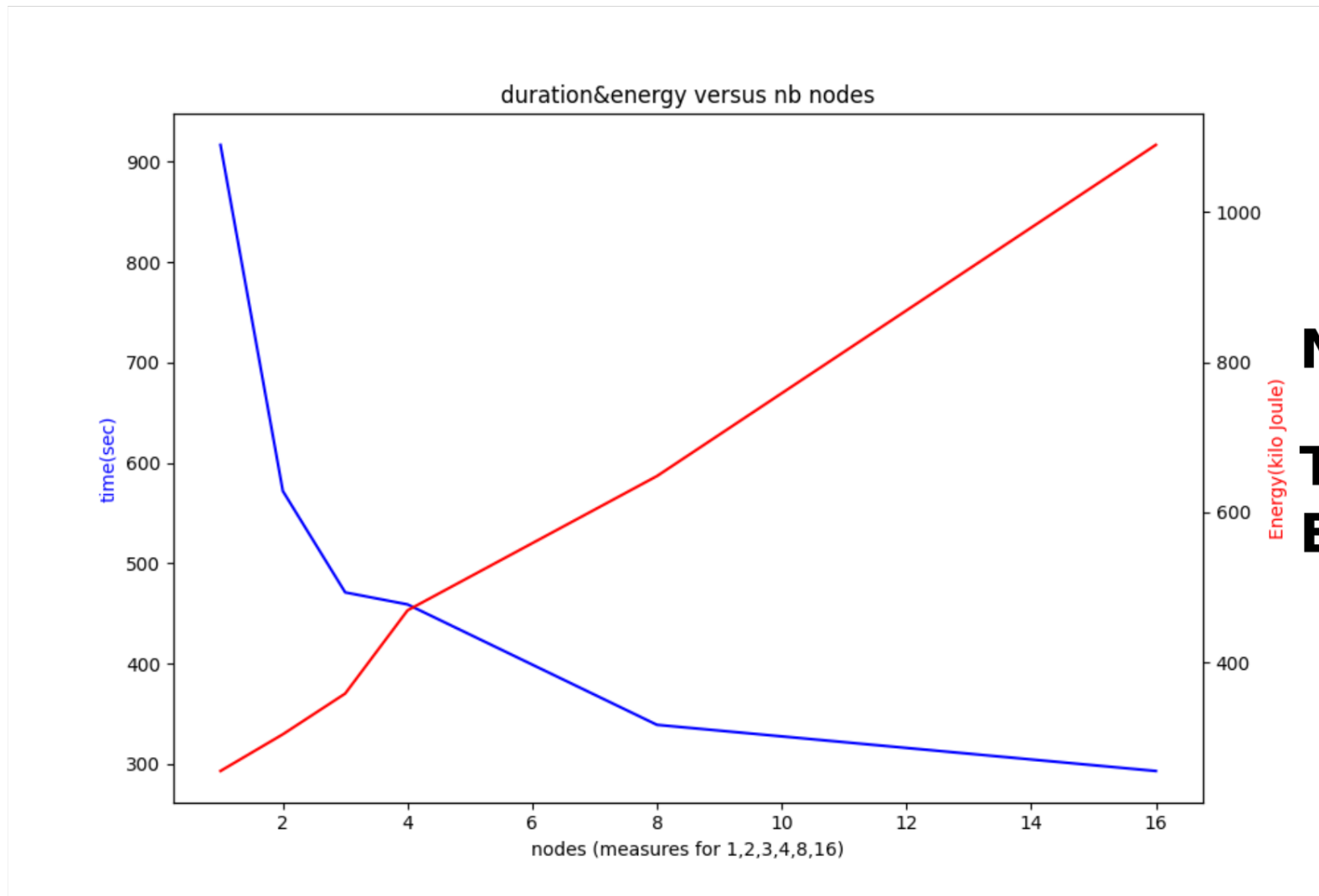
Measure

Allocated: Nodes: 50 CPU:100 Cores:1800
Duration: 30484 sec -> over 8 hours
Total Joules: 1161892938 -> over 32 kWh

Allocated : Nodes:2 CPU:4 Cores:48, GPU:7
Duration : 508 sec
Total Joules: 293114

Allocated: Nodes:2 CPU:4 Cores:72
Duration: 314 sec -> around 5 minutes
Total Joules: 163079 -> around 45 Wh

Speed up with energy



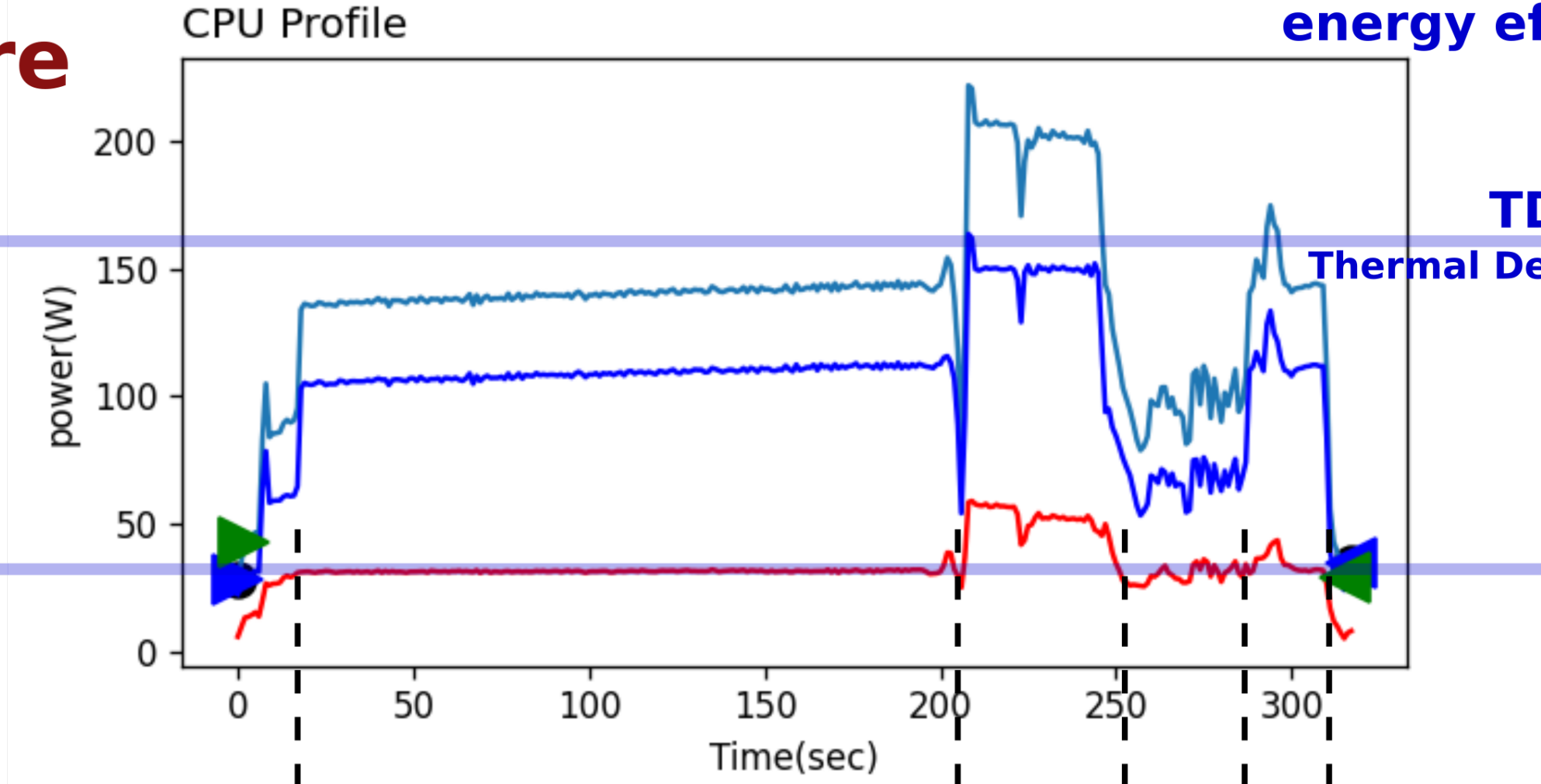
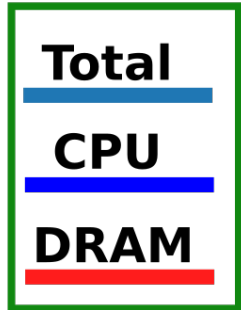
Nodes: 8 -> 16

Time: 350 -> 300 sec => -14%

Energy: 600 -> 900 kJ => +50%

<https://cerfacs.fr/wp-content/uploads/2021/08/GLOBE-WN-Maisonnave-21-88.pdf>

Explore



To retrieve the energy efficiency

TDP

Thermal Design Power

Min

To retrieve the application's phases

DATA LOAD

MATRIX MERGE JOIN

Compare

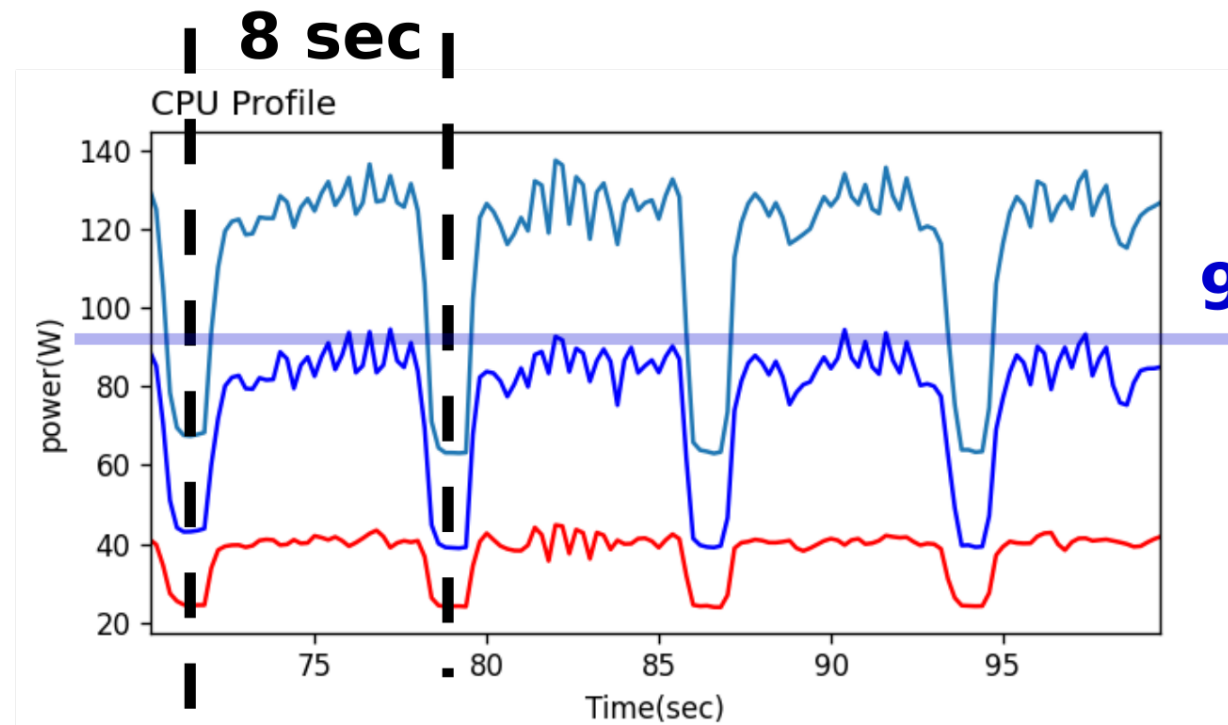
Without AVX-512

Total

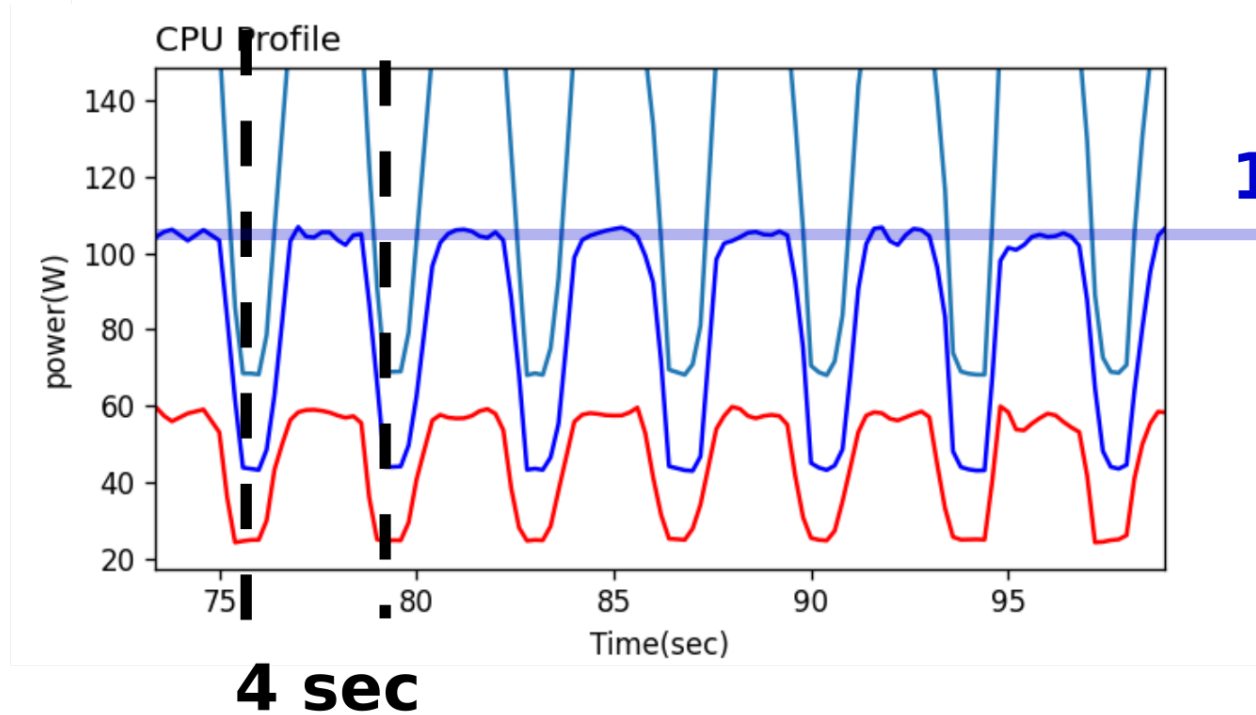
CPU

DRAM

With AVX-512



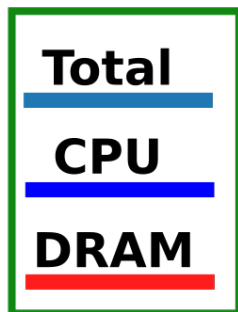
Time(sec): 8 4
Power(W): 90 105
Energy(J): 720 420



Time divide by 2
Energy 42% more efficient

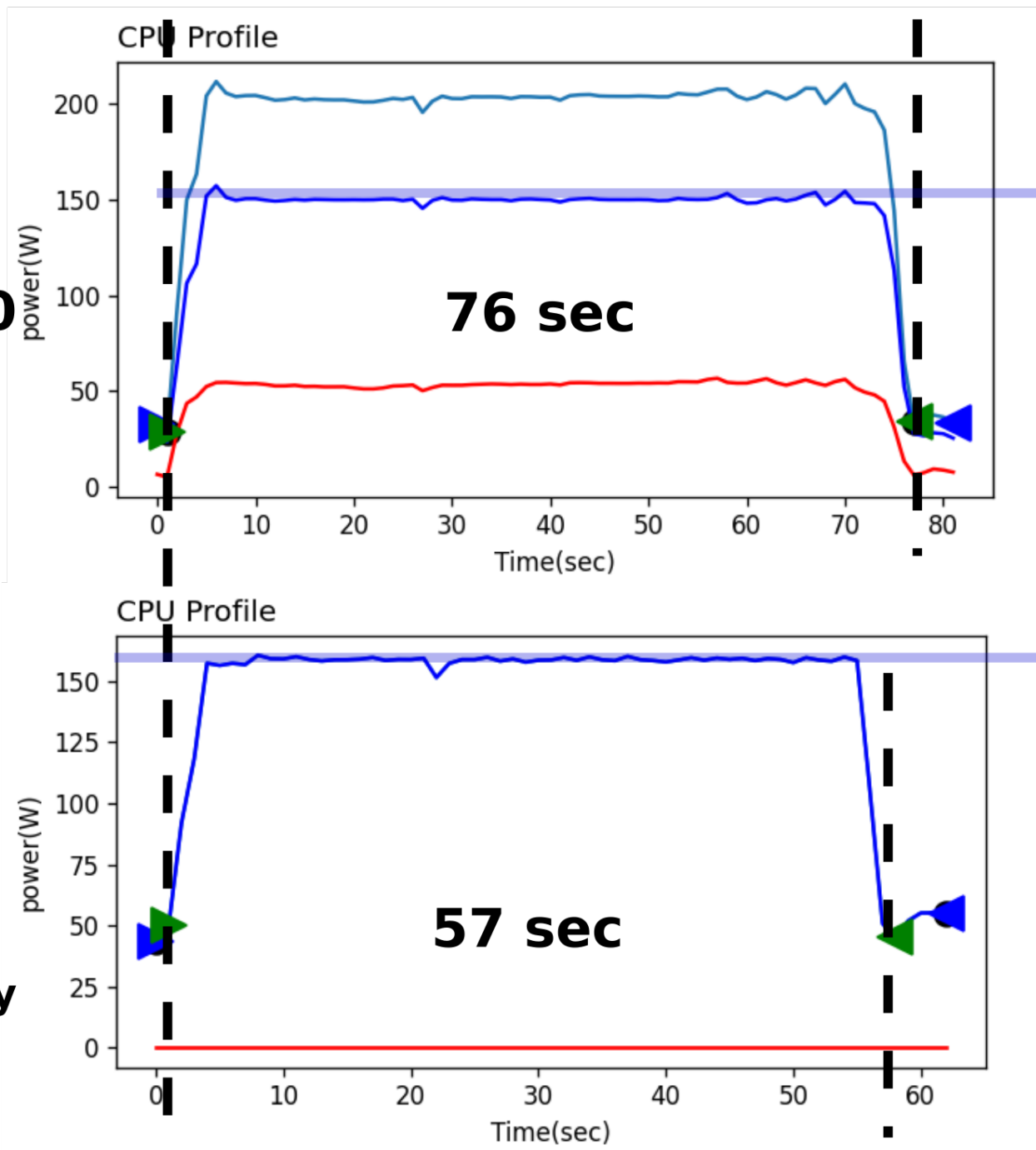
Compare

**Intel
Xeon(R)Gold6240**



**AMD
EPYC745232**

**General Matrix Multiply
(GEMM)**



150 W

Intel 11400 J

160 W

AMD 9120 J

**Energy AMD
20% more efficient
than Intel**

Thanks

https://sed-bso.gitlabpages.inria.fr/datacenter/energy_scope.html

energy_scope@inria.fr