



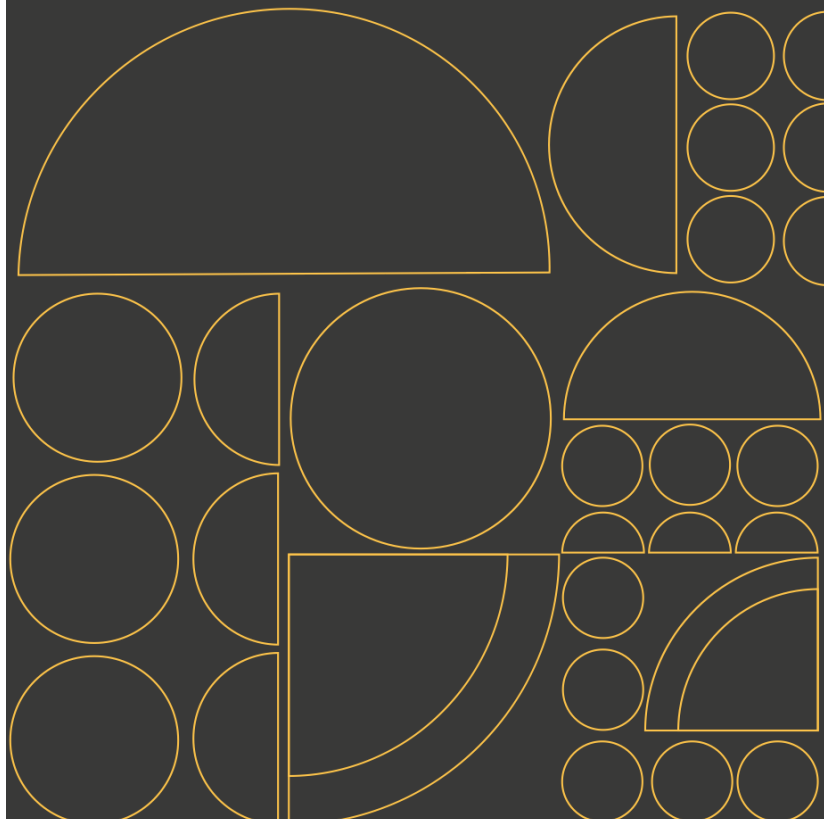
ChEESE

WP2 telco,
February 2023

Piero Lanucara
CINECA



Project funded by EuroHPC under the grant agreement No 101093038.



Objectives

- | | |
|---|--|
| 1 | Address technical challenges (potentially at exascale) in the 11 flagship codes |
| 2 | Exploit actual accelerators , in particular those targeting EuroHPC pre-exascale machines |
| 3 | Audit the codes and improve single node, multi-node, and I/O performances at scale. |
| 4 | Continuously monitor the code performance efficiency during the project |



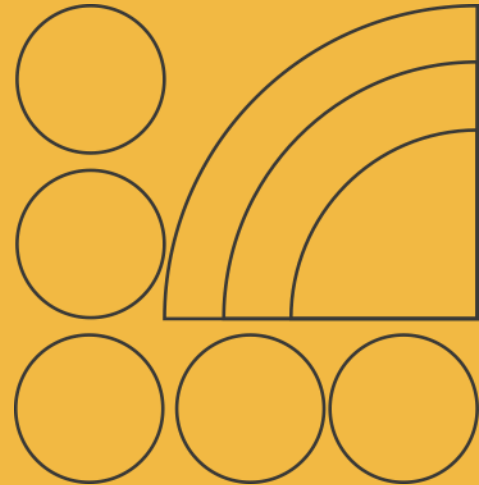
Tasks and task leaders

Task	Task name									Start	End	Lead	
Task 2.1	Code audits (Jose Gracia, HLRS)									3 (27)	15 (36)	HLRS	
Task 2.2	Increasing the performance portability of flagship codes for different accelerators (Giorgio Amati, Luca Ferraro CINECA)									1	48	CIN	
Task 2.3	Optimisation for exascale (Piero Lanucara, CINECA)									6	48	CIN	
Task 2.4	Continuous Performance Efficiency Monitoring (Marta Garcia, BSC)									18	48	BSC	
Effort (PMs)													
CIN	CSIC	BSC	INGV	HLRS	TUM	LMU	UMA	CNRS	IPGP	BULL	CSC	UM	SU
67	12	18	18	18	22	14	12	28	1	14	8	8	7

Deliverables

D	Deliverable name	Lead	Type	Level	M	Date
2.1	First code audit report	HLRS	R	PU	12	Dec 2023
2.2	First report on improving code performance at exascale	CIN	R	PU	24	Dec 2024
2.3	Second code audit report	HLRS	R	PU	30	Jun 2025
2.4	Final report on improving code performance at exascale and Best Practice Guide	CIN	R	PU	48	Dec 2026

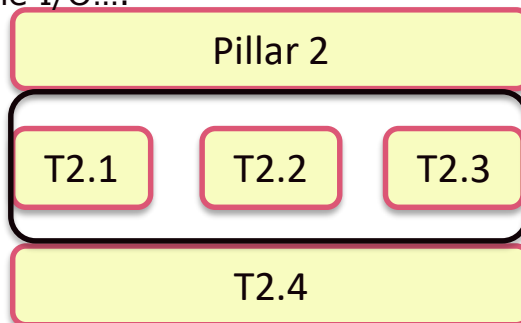
Highlights



Preparation strategy (Pillar 2)

The transversal WP2 will deal with the technical challenges (including porting, optimization, audit and performance monitoring) devoted to the preparation of the flagship codes to Exascale. Those challenges will consider node heterogeneity and different levels of parallelism on complex hardware architectures and will require a development and optimization methodology to guarantee a full utilization of the HPC resources available. Three tasks (T2.1 and two developments Tasks):

- ❑ T2.1 Code audits
- ❑ T2.2 “accelerator arena”, with a clear focus on EuroHPC hardware (Lumi, Leonardo, MN5) and associated GPUs (AMD, NVIDIA but also Intel GPUs...)
- ❑ T2.3 “generic” audit-driven development and tuning activities addressing known or unexpected code issues, starting from the single-node level and passing through the multi-node scaling, the I/O....



Adequacy of flagship codes to
EuroHPC heterogeneous
hardware



Monitoring performances: TALP in ChEESE-2P

01

A tool for codes

Integrate TALP with the different codes.

To allow a continuous performance monitoring.

Can also be integrated with CI/CD platforms

02

Extending TALP

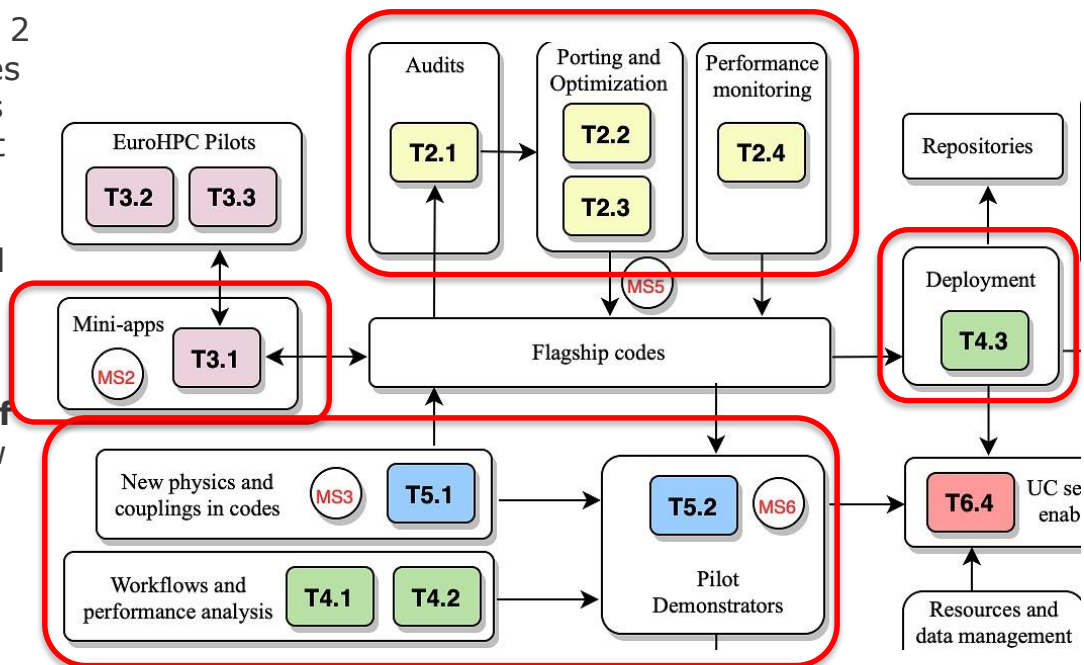
Extend TALP to address the needs of ChEESE-2P codes:

- ... to collect PAPI HWC counters
- ... with OpenMP hybrid metrics
- ... with GPU metrics

The complete “Big Picture” and WP2 external dependencies

WP2 will take care of Pillar 2 (adequacy of flagship codes to EuroHPC heterogeneous hardware) and will interact with:

- ❑ **Task T3.1 of WP3** for Mini-apps extraction and preparation
- ❑ **Task T4.3 of WP4** for deployment
- ❑ **Tasks T5.1 and T5.2 of WP5** for addressing new development in flagship codes and Pilot Demonstrators



WP2 will contribute to the fulfillment of milestone MS5 at month 36

Milestone No.	Milestone Name	Lead beneficiary	Means of verification	Due date (month)
MS5	Exascale code preparation	CINECA	Improvements in the flagship codes performance metrics after the second code audit round (D2.3)	36

ChEESE WP2 and ChEESE-2P WP2: what is similar and what is different?

- ❑ **S:** most of the WP2 structure and methodology. WP2 leader and some of the task leaders.
- ❑ **S:** most of the flagship codes and code owners.

No.	Code	Initial Level	Area	Lead
1	SeisSol	1	Computational seismology Tsunami modeling	LMU
2	SPECFEM3D	1	Computational seismology	CNRS
3	ExaHyPE	2	Computational seismology Tsunami modeling	TUM
4	Tandem	2	Computational seismology	LMU
5	xSHELLS	1	Magnetohydrodynamics	CNRS
6	HySEA	2	Tsunami modeling	UMA
7	FALL3D	2	Volcanology	CSIC
8	OpenPDAC	2	Volcanology	INGV
9	LaMEM	1	Geodynamics	UM
10	pTatin3D	1	Geodynamics	SU
11	ELMER/ICE	2	Glacier hazards	CSC



ChEESE and ChEESE-2P WP2: what is similar and what is different?

- ❑ **D:** a new task (T2.4). Emphasis on performance portability (T2.2). New accelerators (AMD, ...)
- ❑ **D:** novel features moved to WP5. Co-design moved to WP3.
- ❑ **D:** new flagship codes and code owners

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