



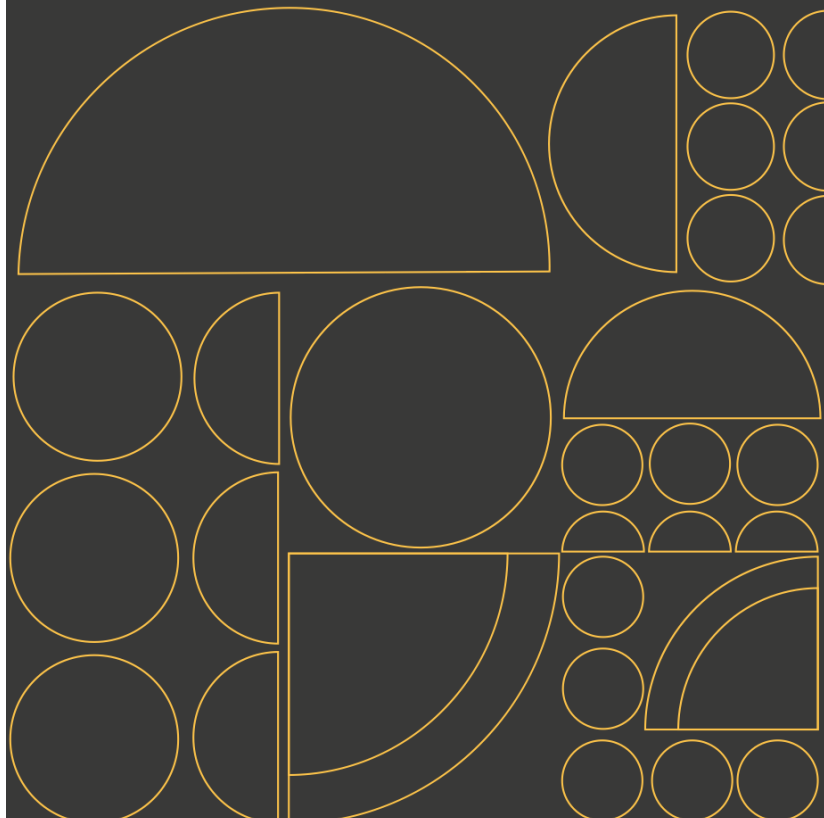
ChEESE

Work Package 2: Exascale technical challenges in flagship codes

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CINECA



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WP2: Tasks

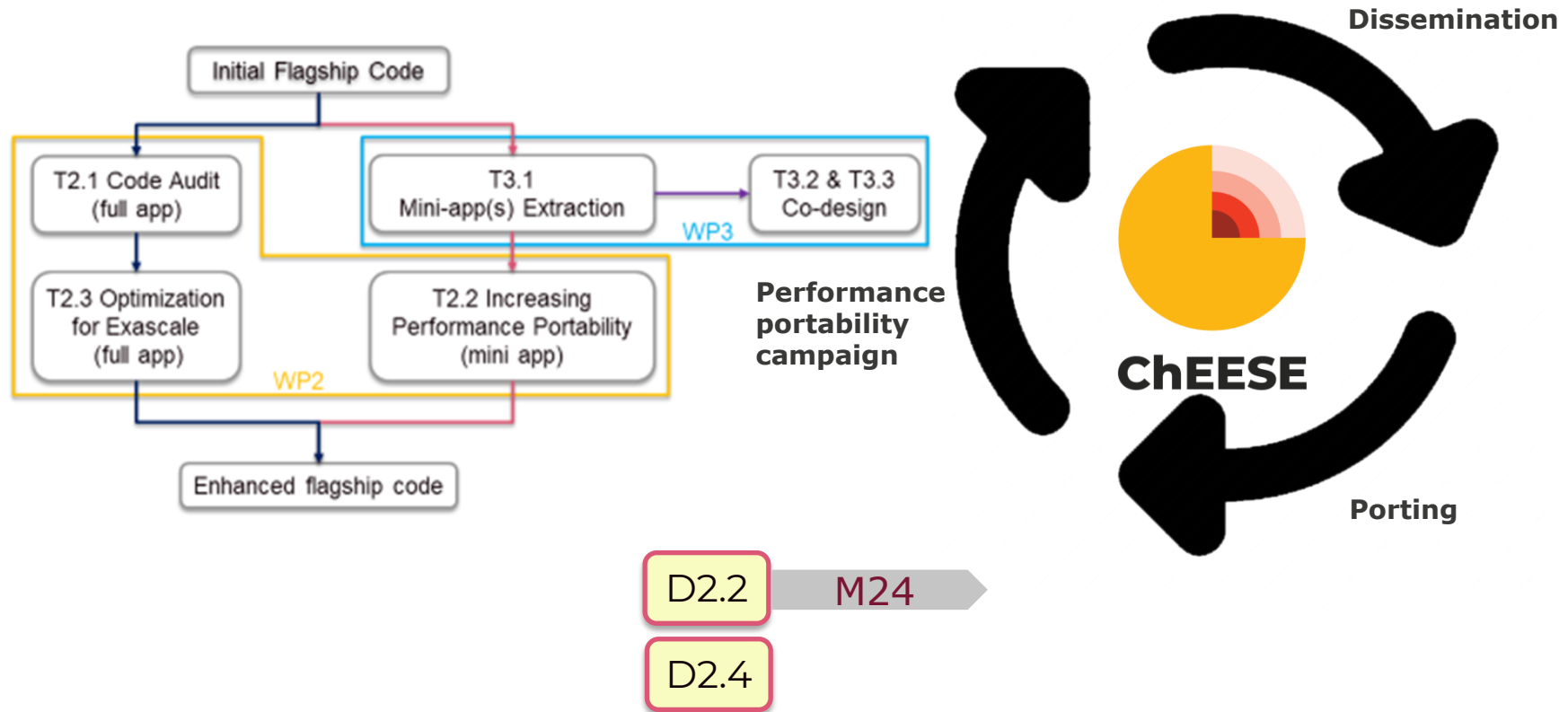
Task	Name	Lead partner	Start month	End month
2.1	Code audits	HLRS	3(27)	15(36)
2.2	Increasing the performance portability of flagship codes for different accelerators	CIN	1	48
2.3	Optimisation for Exascale	CIN	6	48
2.4	Continuous Performance Efficiency Monitoring	BSC	18	48

WP2: Deliverables

D	Deliverable name	Short description	Lead	Type	Level	M
2.1	First code audit report	First code audit round results and the recommendations arising from the analysis	HLRS	R	PU	12
2.2	First report on improving code performance at exascale	Report on porting, optimization and tuning for the selected applications on the available hardware	CIN	R	PU	24
2.3	Second code audit report	Update of D2.1 and further recommendations arising from the analysis	HLRS	R	PU	30
2.4	Final report on improving code performance at exascale and Best Practice Guide	Technical report describing the achieved scalability level and related performances obtained for the selected applications on the available hardware including a final Best Practice guide	CIN	R	PU	48



T2.2 Increasing the performance portability of flagship codes for different accelerators: the methodology



T2.3 Optimisation for Exascale

Duration: M6-M48

This task guarantee technical support to each flagship code to enhance its performance and scalability.

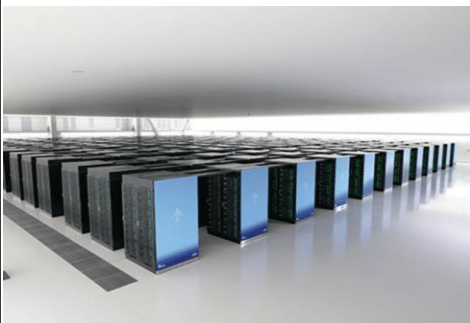
First set of observations and recommendations from the code audits at M12

D2.1

This task address primarily the following features (not an exhaustive list):

- ❑ **single heterogeneous node performance**
- ❑ **multi-node performance**
- ❑ **algorithmic improvements**
- ❑ **resilience and fault tolerance**
- ❑ **I/O performance**

Exascale features



Adequacy of flagship codes to EuroHPC heterogeneous hardware



D2.2

M24

D2.4

T2.4 Continuous Performance Efficiency Monitoring

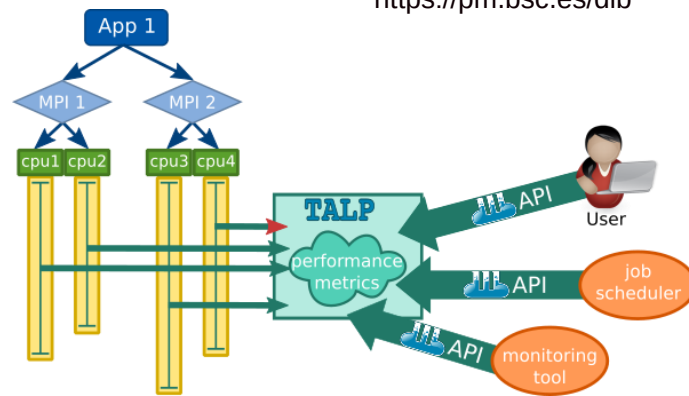
- Provide lightweight, straightforward, and easy-to-use mechanism to measure the parallel efficiency of flagship codes at Exascale.
- Based on TALP, a DLB tool that gathers POP metrics at runtime, without tracing.

TALP:

- Library that collects MPI parallel efficiency metrics at runtime, transparently to the application.
- Lightweight for production use.
- Offers an API to collect MPI parallel efficiency metrics at runtime
- At finalization, reports the MPI parallel metrics



<https://pm.bsc.es/dlb>



Progress Update: how it's started (M12)

Flagship code	Porting	Performance portability campaign	Code audit driven optimization	Workplan driven optimization
SeisSol				
SPECFEM3D				
ExaHyPE				
Tandem				
xSHELLS				
HySEA				
FALL3D				
OpenPDAC				
LaMEM				
pTatin3D				
ELMER/ICE				



Progress Update: how it's going (NOW)

Flagship code	Porting	Performance portability campaign	Code audit driven optimization	Workplan driven optimization
SeisSol		ON-GOING		NOT AVAILABLE
SPECFEM3D	✓	ON-GOING	NOT AVAILABLE	
ExaHyPE	ON-GOING	NOT AVAILABLE	ON-GOING	ON-GOING
Tandem	ON-GOING	ON-GOING	NOT AVAILABLE	
xSHELLS		ON-GOING	NOT AVAILABLE	ON-GOING
HySEA	✓	ON-GOING	ON-GOING	
FALL3D		✓	NOT AVAILABLE	ON-GOING
OpenPDAC			NOT AVAILABLE	ON-GOING
LaMEM	ON-GOING	NOT AVAILABLE	ON-GOING	ON-GOING
pTatin3D		ON-GOING	NOT AVAILABLE	
ELMER/ICE	ON-GOING	ON-GOING		



Progress Update: T2.2 summary (see CODES I and II for details)

Porting

- ❑ Everything is proceeding fine (overall) even if the task is challenging and full of technical obstacles
- ❑ Dramatically increased the ChEESE-2P codes' ecosystem (codes+mini-apps in different GPU flavours)
- ❑ Low level (HIP), cross-platform languages (SYCL, OpenMP) and specific libraries targeted to different GPUs among the others

Performance portability campaign

- ❑ This task is proceeding smoothly
- ❑ Most of the work is on-going, as Ppc is composed of several steps and it's hard to finalize each step.
- ❑ Almost all codes produced some numbers but still lack PP metrics computation (very often)
- ❑ FALL3D almost finalized the complete Ppc.

**Discussion #1: Porting and Performance portability campaign
please, join the WP2 and WP3 Parallel Sessions**



Progress Update: T2.3 summary (see CODES I and II for more details)

Code audit driven optimization

- ❑ This task is experimenting some delay (overall)
- ❑ Anyway, some code did the homework (ExaHyPE, HySEA among the others). FALL3D will come soon
- ❑ It's worthwhile to note that some of the planned activities are crucial to solve bottleneck arising in large production runs (e.g. SPECFEM3D as an example)

Workplan driven optimization

- ❑ Not surprisingly, this task is proceeding fine (this is usually the "container" of already planned activities not related to code audit outcomes)
- ❑ Some "new" activity rised up even if not planned (again SPECFEM3D as an example)
- ❑ Improving strong and weak scalability using different architectures. Varying PETSc options to tune performance, among the others

**Discussion #2: Code audit and Workplan driven optimization
please, join the WP2 and WP3 Parallel Sessions**



Progress update: T2.4 summary

- Support for MPI metrics: Stable
 - Available in DLB 3.4.1
- Support for PAPI counters: Stable
 - Available in DLB 3.4.1
- Support for OpenMP metrics: Next release (Q4-2024)
 - In testing and evaluation phase
 - Available for brave developers under request
- Support for GPU metrics: In development
- Integration with git solutions: Next release (Q4-2024)
 - In testing and evaluation phase

Please, contact the T2.4 team to use any of the above with your codes

**Discussion #3: Continuous Performance Efficiency Monitoring
please, join the WP2 and WP3 Parallel Sessions**



What's next?

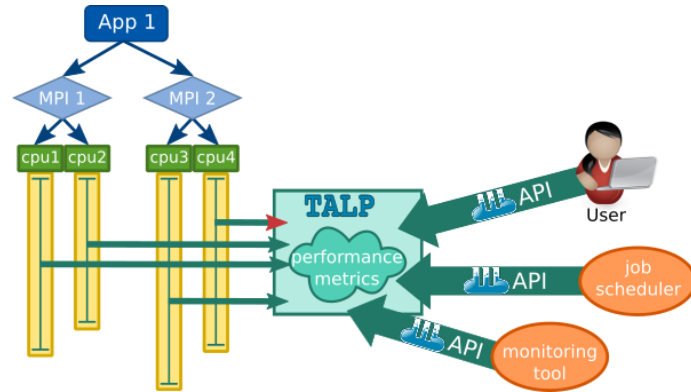
Finalize everything is on-going or still not available within the end of 2024 (D2.2)

Flagship code	Porting	Performance portability campaign	Code audit driven optimization	Workplan driven optimization
SeisSol		ON-GOING		NOT AVAILABLE
SPECFEM3D	✓	ON-GOING	NOT AVAILABLE	
ExaHyPE	ON-GOING	NOT AVAILABLE	ON-GOING	ON-GOING
Tandem	ON-GOING	ON-GOING	NOT AVAILABLE	
xSHELLS		ON-GOING	NOT AVAILABLE	ON-GOING
HySEA	✓	ON-GOING	ON-GOING	
FALL3D		✓	NOT AVAILABLE	ON-GOING
OpenPDAC			NOT AVAILABLE	ON-GOING
LaMEM	ON-GOING	NOT AVAILABLE	ON-GOING	ON-GOING
pTatin3D		ON-GOING	NOT AVAILABLE	
ELMER/ICE	ON-GOING	ON-GOING		



What's next?

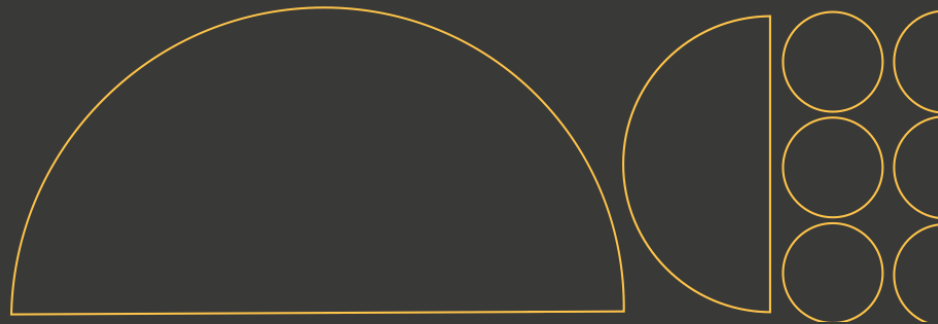
Start integrating T2.4 tools and techniques into the WP2 codes' ecosystem and methodology



HOW to
Do It?



Thank you!



@cheese-coe



<http://cheese2.eu>



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@cheese_coe@techhub.social

