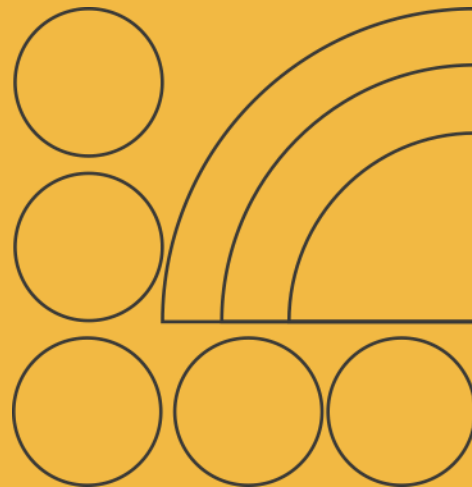




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Exascale ambition towards D2.4: status and next steps

Team EARTH
CINECA



WP2 Tasks



WP2 tasks					
Task	Name	Lead partner	Start month	End month	Percentage at M38 (%)
2.1	Code audits	HLRS	3(27)	15(36)	100%
2.2	Increasing the performance portability of flagship codes for different accelerators	CIN	1	48	79%
2.3	Optimisation for Exascale	CIN	6	48	76%
2.4	Continuous Performance Efficiency Monitoring	BSC	18	48	66%



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



Exascale ambition: Definition and Goals

Adapting ChEESE-2P codes for (pre-)exascale systems

Defined in technical reports, deliverables and linked to WP2 tasks/activities (but not only)

ChEESE-2P **Flagship Codes**:

- Each defines its own ambition (D2.2, D6.1,...)
- Linked to **Simulation Cases** (SCs)

Execution Types:

- **Capability**
- **Capacity**



Capability vs Capacity: Two Paths to Exascale

Capability Execution:

- Focus on a **single large** simulation
- Maximize performance (strong scaling)

Capacity Execution:

- Focus on **many** simulations (**ensembles**/workflows)
- Limited scalability for each member
- **Maximize throughput/workflows scaling** (WP4)

These represent two different ways to achieve Exascale ambition



Role of WP2 in the Exascale ambition

WP2 Tasks:

- T2.1 → performance assessment (POP metrics)
- T2.2 → (performance) portability across different hardware
- T2.3 → Code restructuring
- T2.4 → performance assessment at scale (TALP monitoring)

Other relevant topics (not covered by WP2):

- Resource allocation (WP1)
- Energy efficiency (WP3)
- Alignment to EPI (WP3)
- ...



Exascale ambition update: B1 / B2 Structuring

Code categorization based on **distance** from specific Exascale ambition (WP2 final response to R2 recommendation from reviewers)

A new classification of codes is introduced into two distinct groups, based on their proximity to Exascale ambition and the level of commitment from the respective code owners. (**N.B.: every code is relevant to the WP2 objectives!**)

B1 – “Near the target” Codes

Codes that:

- Are already close to their Exascale ambition **or** show clear potential to reach it
- Have a **formal commitment** from code owners to achieve Exascale ambition



Exascale ambition update: B1 / B2 Structuring

B2 – Other Codes

Codes that:

- Have a lower level of maturity with respect to Exascale ambition or
- Do not have a formal commitment from code owners to achieve their proper Exascale ambition

Implications

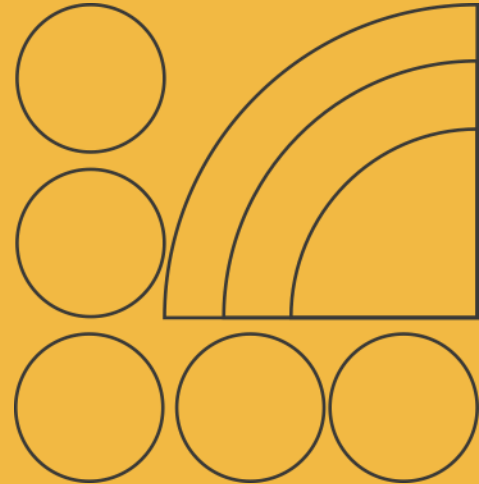
- Deliverable **D2.4** will explicitly reflect the B1 vs B2 distinction
- WP2 activities until the end of the project will be **prioritized** according to this classification (though **all codes** are important).





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Drafting the Exascale ambition: current status



Exascale ambition update: B1 / B2 Structuring

Code	Performance Analysis	Performance Portability	Code Restructuring	Alignment to Exascale ambition
SeisSol				B1
SPECFEM3D				B1
ExaHyPE				B1
Tandem				B2
xSHELLS				B2
HySEA				B1
FALL3D				B1
OpenPDAC				B2
LaMEM				B2
pTatin3D				B2
ELMER/ICE				B1

Exascale ambition update: B1 Remaining effort

Code	Performance Analysis	Performance Portability	Code Restructuring
SeisSol			
SPECFEM3D			
ExaHyPE			
HySEA			
FALL3D			
ELMER/ICE			



Exascale ambition update: Other partners

Remaining effort

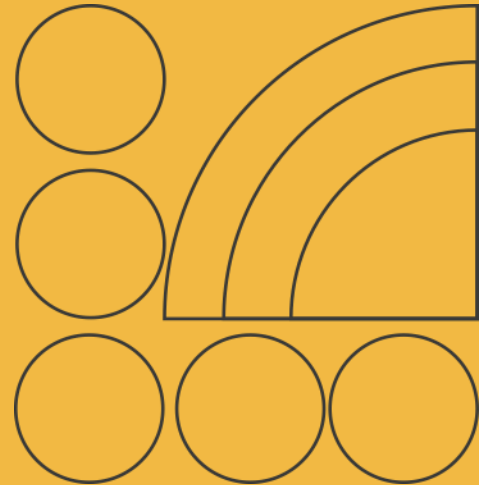
Team	Remaining effort	Performance Analysis	Performance Portability	Code Restructuring
BSC				
CINECA				
Eviden				
HLRS				





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Drafting the Exascale ambition path forward: Cross-cutting and Vertical Tasks



Cross-cutting Tasks (CINECA Proposal)

These tasks are derived from
common technical needs

Primary focus is on providing
concrete support to B1 codes

Extension to B2 codes will be
considered based on **impact vs effort**

Task	Codes	WP2 task	Priority	Partners
Performance monitoring at scale	SeisSol, xSHELLS, HySEA, FALL3D, ELMER/ICE	T2.4	High	BSC, CINECA
Deepening PETSc GPU performance	Tandem, LaMEM, pTatin3D	T2.3	High	CINECA



Cross-cutting Tasks (CINECA Proposal)

- Main objectives:
 - Investigation on the TALP side
 - Scalability testing (production versions) and resolution of any issues (porting). It will require EuroHPC budget.
- A reasonable goal: to extract lessons learned for D2.4 and metrics for new code releases
- BSC should coordinate this part together with HLRS and CINECA (as WP2 lead)

Task	Codes	WP2 task	Priority	Partners
Performance monitoring at scale	SeisSol, xSHELLS, HySEA, FALL3D, ELMER/ICE	T2.4	High	BSC, CINECA
Deepening PETSc GPU performance	Tandem, LaMEM, pTatin3D	T2.3	High	CINECA



Cross-cutting Tasks (CINECA Proposal)

Main objectives:

investigation on the PETSc side
potential engagement of
expertise on the library
(particularly regarding GPU
support)

Benchmarking campaign (use of
demonstrators)

Minimum goal to extract lessons
learned for D2.4

CINECA proposes to coordinate this
task

Task	Codes	WP2 task	Priority	Partners
Performance monitoring at scale	SeisSol, xSHELLS, HySEA, FALL3D, ELMER/ICE	T2.4	High	BSC, CINECA
Deepening PETSc GPU performance	Tandem, LaMEM, pTatin3D	T2.3	High	CINECA



Vertical Tasks (CINECA Proposal)

Vertical tasks address **code-specific needs** that cannot be generalized across multiple applications.

Task	Codes	WP2 task	Priority	Partners
Performance portability campaign using SPECfem-Waves	SPECfem3D	T2.2	Medium	CINECA
Avoiding GPU-CPU memory transfers in full-app by changing memory layout to SoA	ExaHyPE	T2.3	High	
Overlapping of communication and computation	ExaHyPE	T2.3	High	
Performance portability studies with different GPU backends on new hardware	ExaHyPE	T2.2	Medium	CINECA
Tuning I/O performances	ELMER/ICE	T2.3	Medium	
Clang/clang version tailored to AMD hardware	ELMER/ICE	T2.3	Medium	
Performance portability campaign using new hw	ELMER/ICE	T2.2	Medium	CINECA



Next steps (tentative)

- Agree on Cross-cutting and Vertical tasks (**ALL**)
- Monitoring advancement (**CINECA**)
- Start drafting D2.4 (**CINECA/task leaders**)
- ...





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Questions/Comments?

