

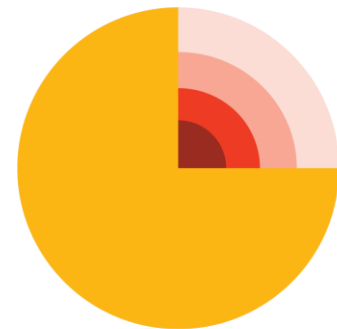


WP3 progress and next steps

Co-design with European HPC vendors and technologies

5th PSB Meeting
2024-06-05

Erwan Raffin on behalf of WP3 partners



ChEESA



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Agenda

- Very brief recall of the work package outlines
- WP3 status update
- Early results on mini-XSHELLS and mini-SPECFEM3D
- Outlook of the EUPEX Early Access Programme
- Q&A



01

Work Package outlines



WP3: Objectives & Tasks

1	Extract to mini-apps the most relevant parts of applications according to targeted prototype architecture
2	Leverage European HPC technologies through the SE Community applications
3	Foster co-design with HPC vendors and technology and associated ecosystem (EuroHPC Pilots)

Task	Task name	Start	End	Lead
Task 3.1	Preparation of mini-apps	6	18	CIN
Task 3.2	OpenSequana prototypes (EUPEX)	12	42	BA
Task 3.3	RISC-V prototypes, the European Processor Initiative (EPI) and EUPILOT	19	42	BSC

WP3: Deliverables

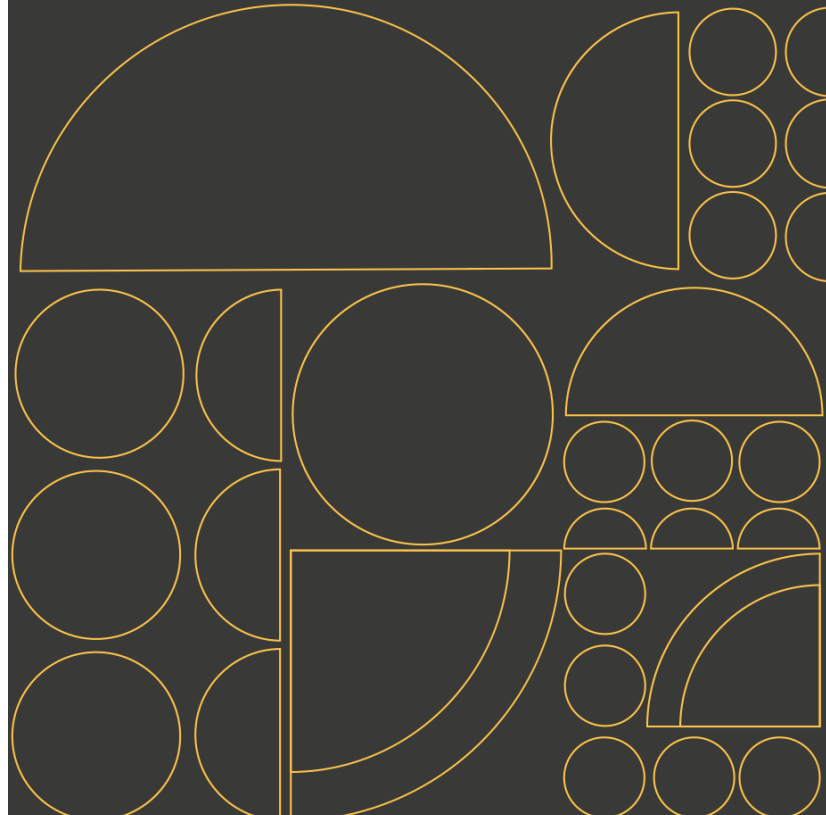
D	Deliverable name	Lead	Type	Level	M	Date
3.1	~~Selected set of mini-apps and its requirements~~	CIN	R	PU	12	Dec 2023
3.2	SE Community applications on European HPC technologies	BA	R	PU	42	Jun 2026



02

WP3

update



Latest activity in WP3 since the 1st review meeting

- Recall: all the mini-apps have been released and documented
- Testing mini-apps on x86 & GPU before porting it to prototypes to ensure a good starting point for co-design activities in T3.2 and T3.3
 - Mini-SHELLS done
 - Mini-SPECFEM3D almost done
 - FALL3D ongoing
 - More to come
- Mini-FALL3D
 - Enhancing mini app portability to run it on AMD devices
 - Tested (and discarded) Fortran StdPar option to accelerate the mini app
 - Porting new GPU multi vendor version
 - Next: Compare results with same full app version
- Mini-SPECFEM3D
 - Validation of results ongoing



Next steps

- One Stop Shop for the ChEESE-2P mini-apps
- Keep alignment between WP2 and WP3 activities
- Increase effort on co-design for EUPLEX (T3.2)
- Start activity on co-design for RISC-V prototypes, the European Processor Initiative (EPI) and EUPILLOT (T3.3)



03

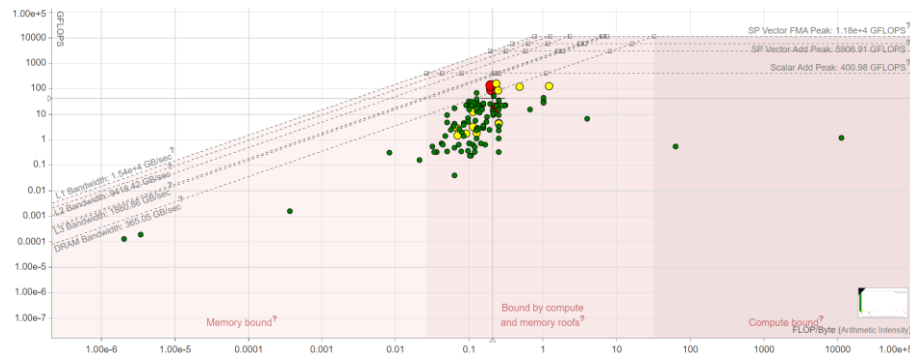
Early results on
mini-XSHELLS and
mini-SPECFEM3D



Mini-XSHELLS

- Mini-app profile (xsbig_hyb2) on Intel Ice Lake 8358 (2x32 c)
 - 50 % Frequency
 - 50 % Memory bandwidth
- Vectorization (xsbig_hyb2)
 - 91 % : 256 bit (AVX2)
 - 7 % : 512 bit (AVX-512)
- On going work and next steps
 - Porting on aarch64 SIMD on Ampere Altra Q8030 Neoverse N1 architecture (Armv8.2-a+simd)
 - Porting on other ARM systems

bin	mpi	omp	GCC+OMPI		ICC+IMP	
			sum time	exec time	sum time3	exec time3
xsbig_hyb	32	2	133,43	150,99	139,71	161,98
xsbig_hyb	16	4	131,63	157,43	137,87	152,46
xsbig_hyb	8	8	130,62	144,84	138,79	155,24
xsbig_hyb	4	16	130,19	144,84	137,85	153,00
xsbig_hyb	2	32	132,96	145,15	131,01	144,41
xsbig_hyb2	32	2	121,63	138,80	125,50	137,35
xsbig_hyb2	16	4	121,38	138,74	124,95	138,57
xsbig_hyb2	8	8	365,69	379,92	368,23	387,25
xsbig_hyb2	4	16	230,17	246,46	215,73	231,47
xsbig_hyb2	2	32	612,02	633,42	437,78	465,26
xsbig_mpi	64	1	132,33	147,29	139,39	166,45



Mini-specfem3D CPU

- Test run on AMD Milan 7763 (1 socket with 64c)
- Some mini-apps are not vectorized

Mini app	Execution time	Compute bound	Memory bound	Vectorized
acoustic_iso_mpi	48 s	19%	81%	Yes
elastic_aniso_mpi	259 s	77%	23%	No
elastic_iso_mpi	140s	49%	51%	No
elastic_iso_att_mpi	275 s	49%	51%	No
elastic_iso_vecto_mpi	103 s	14%	86%	Yes

Mini-specfem3D CPU

- Vectorization optimization:
 - Add !\$OMP SIMD directive before the calculation loop
- Test run on AMD Milan 7763 (1 socket with 64c):

Mini app	Execution time	Speedup	Compute bound	Memory bound	Vectorized
acoustic_iso_mpi	48 s	-	7%	93%	Yes
elastic_aniso_mpi	166 s	1,6	61%	39%	Yes
elastic_iso_mpi	116 s	1,2	40%	60%	Yes
elastic_iso_att_mpi	240 s	1,1	37%	63%	Yes
elastic_iso_vecto_mpi	102 s	-	6%	94%	Yes

- To take advantage of the SVE it is important to have vectorized mini-apps



Mini-specfem3D GPU

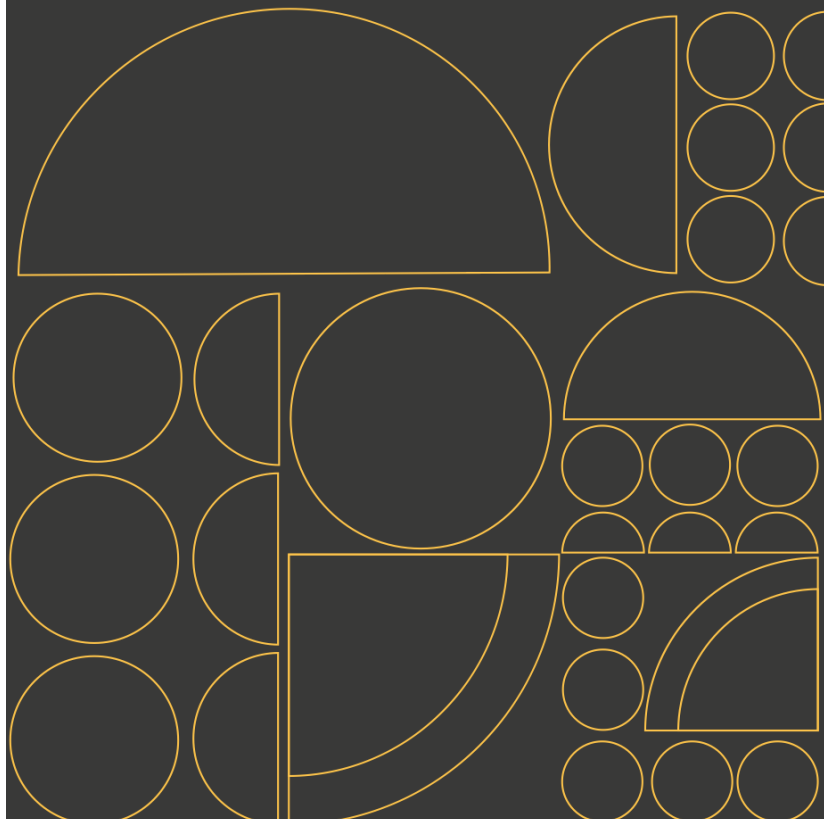
- Test run (mono-core, mono-GPU):

Mini application version	Execution time	% of time in the CPU setup function	% of time in GPU parts	time in kernels	time in data transfers
acoustic_iso_cuda_mpi	68.385 s	79.7%	10%	5 s	0.3 s
elastic_aniso_cuda_mpi	89.504 s	63.2%	19.7%	13.875 s	1.250 s
elastic_iso_att_cuda_mpi	104.243 s	58.4%	27.9%	24 s	1.5 s
elastic_aniso_cuda_mpi	73.891 s	73.7%	15.2%	9.345 s	0.187 s



04

EUPEX Early Access Programme



EUPEX Early Access Programme

- Presentation of the EAP during WP3 meeting
- What you get
 - A contact point for access to the Alpha system and for each software included in the EAP.
 - A "Getting started" user guide of the EUPEX environment.
 - A programme of webinars on the components of the EUPEX SW stack.
 - User Support (for the A64FX platform and the tools of the EUPEX software stack)
- What you give
 - Provide feedback on their user-experience.
 - Acknowledge the EUPEX EAP in any publication or presentation using results obtained with the support of the EUPEX EAP:
- Now surveying interest from ChEESE-2P partners on phase 1, survey [here](#)
- Full EAP presentation available [here](#)
- Next step: sign the EAP framework agreement if relevant

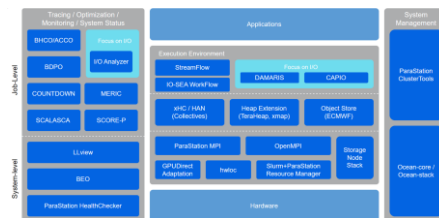


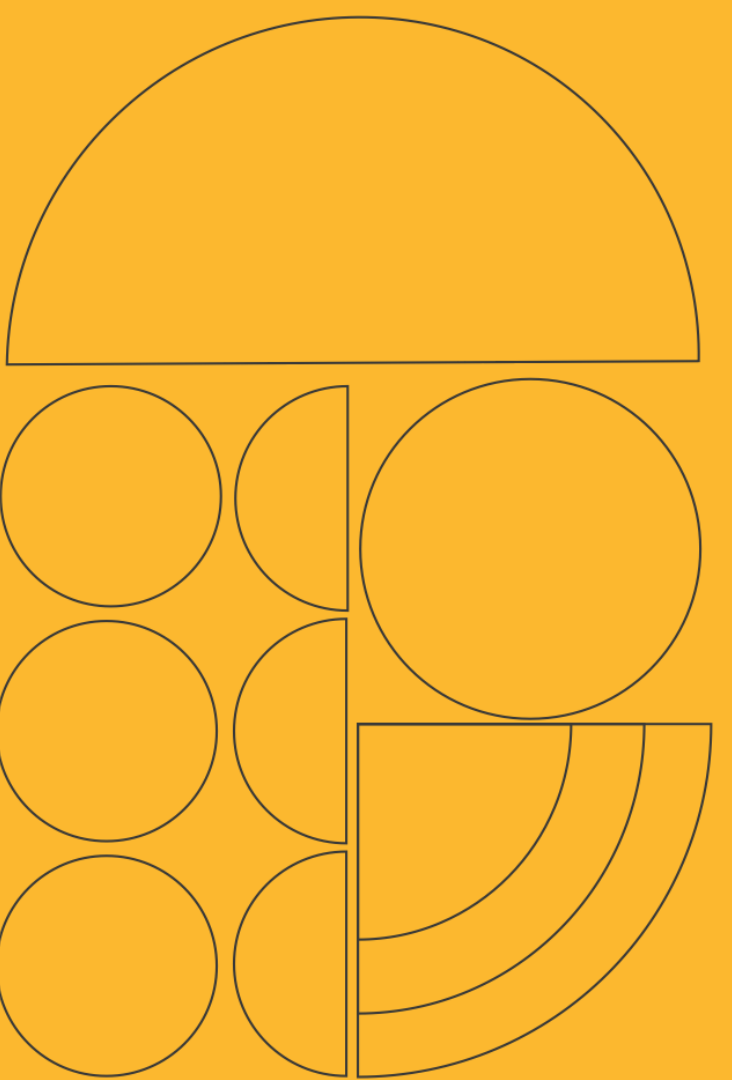
EUPEX Early Access Programme (EAP)

- EUPEX will open its target Pilot system to organisations interested
- As Pilot system is only planned for Summer 2025
 - Phase 1: Access to main Alpha system (CEA Irene A64FX partition)
 - Includes access to planned EUPEX software stack
 - Phase 2: Access to Pilot system once ready

➤ <https://eupeu.eu/early-access-program/>

➤ EUPEX EUPEX Presentation





Thank you



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