Inno4scale: Innovative Algorithms for Applications on European Exascale Supercomputers

EuroHPC Project 101118139 **https://www.inno4scale.eu/**

Call for Proposals for Inno4scale Innovation Studies

Identifier: Inno4scale-2023

Call title: 2023 Call for Inno4scale Innovation Studies

Project full name: Innovative Algorithms for Applications on European Exascale Supercomputers

Acronym: Inno4scale

Grant agreement number: 101118139

Deadline: 28th September 2023, at 17:00 Brussels local time

Expected duration of participation: 12 months, with expected commencement not later than 1st February, 2024

The indicative total funding budget is € 4 million.

Maximum funding request per proposal: € 200,000 (covering all participants)

Funding constraints: The maximum level of effort to be supported for a proposed innovation study is 24 person months (in total). Only organisations with head offices based in an EU Member State or in associated countries that are members of the EuroHPC Joint Undertaking are eligible to receive funding. Natural persons (individuals) are not eligible to receive funding.

Submission language: English

Internet address for full open call information https://www.inno4scale.eu/calls

Proposal submission: https://www.inno4scale.eu/calls/submission

E-mail: **inno4scale_call@bsc.es**

Funded by the European Union

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Introduction

Inno4scale is funded by the EuroHPC Joint Undertaking (EuroHPC JU) within the section of its work programme covered by the call HORIZON-EUROPE-JU-2022-ALG-02, topic HORIZON-EUROPE-JU-2022-ALG-02-01, "New algorithms for applications on European exascale supercomputers". The general conditions relating to the aforementioned call can be summarised as follows:

> The availability of new European hardware and supercomputer architectures for exascale and post-exascale computers require the radical redesign, reimplementation and even reinvention of algorithms to exploit the massively parallel and heterogeneous processing capabilities. Ground breaking performance gains which allow the solution of computational problems currently considered intractable require the conversion of innovative concepts to novel algorithms and their efficient and reliable implementation. In order to boost the performance of HPC applications to a qualitatively new level on current and future European supercomputers, new approaches must be identified and validated with prototypical implementations.

The Inno4scale project will support the EuroHPC JU in achieving the efficient use of its supercomputing resources through the development of novel algorithms for applications on those resources. It will do this by funding a set of focused innovation studies that will realise proof-of-concept demonstrators of fundamentally new and innovative algorithms with a clearly identified potential impact through integration and use in important applications.

This call for proposals targets highest quality research and development studies leading to proof-of-concept demonstrators exhibiting enhanced performance relevant for important applications executed on exascale systems. The call addresses researchers that have identified novel concepts for computational solutions of important numerical problems in scientific applications and use cases which rely on exascale supercomputers. The central goal is the conversion of mathematical concepts for algorithms, for example by a fundamentally new decomposition of a numerical problem for the efficient use of hierarchical memory to exploit heterogeneous and massively parallel computing capabilities of upcoming exascale supercomputer architectures, into proof-of-concept implementations to explore and assess potential performance gains for common HPC applications.

Proposals and proposed new algorithms will be assessed on the basis of their potential to reduce resource consumption of typical use cases executed on the European supercomputer infrastructure across applications and application domains, which must be clearly demonstrated by applicants. Innovation study activities for the successful proposals are expected to commence at TRL 0-1 and achieve TRL 3-4 by the end of the 12-month study period[1]. Activities encompassing porting, reimplementation, incremental improvement, or parallelization of an existing algorithmic implementation will not be considered within the scope of this call. Proposals addressing algorithms using emerging technologies such as quantum computers will only be considered to be within the scope of the call if linked to HPC, for example, by exploiting hybrid quantum-classical exascale architectures.

[1] TRL definitions are included at the end of this document

Expectations for the innovation studies and for proposals

The proposed innovation studies are expected to:

1. **Demonstrate scientific excellence on the identified and proposed novel, forward-looking and potentially disruptive approaches to the solution of complex mathematical, numerical or data processing problems on current and future European exascale supercomputers.**
2. **Present proofs-of-concepts and solutions, which:**
    - **Clearly demonstrate great potential to solve currently non-tractable computational challenges in the context of use of the European flagship HPC systems;**
    - **Clearly demonstrate significantly superior performance compared to existing solutions and exploiting the specific capabilities of Exascale supercomputers by recovering compute or improving substantially time-to-solution and energy-to-solution for important use cases, possibly across scientific domains;**
    - **Demonstrate the potential to be integrated into important applications, addressing relevant use cases with a broad user base.**
3. **Involve a balanced and appropriate consortium which:**
    - **Includes all necessary parties required for the effective and efficient execution of the proposed study;**
    - **Involves at most 3 organisations, each of which is assigned at least 6 person months of effort**
4. **Define the HPC computing resources they need and budget for them. Successful proposals will be encouraged and assisted to obtain access to exascale technology for their development purposes, notably through the Benchmark and Development Access calls for the EuroHPC JU systems, in order to test and implement their algorithm concepts and/or novel solutions. (Inno4scale will <u>not</u> be in a position to provide computing resources).**
5. **Deliver, as part of their final reporting, a report suitable for broad communication to non-technical experts (incl. stakeholders and the general public).**

Taking into consideration the first 2 points above, proposals should:

- Explain the concept and design of a fundamentally new and innovative algorithm.
- Present a sound theoretical concept, substantiated by, for example, peer-reviewed publications, with a credible and convincing plan to achieve a first proof-of-concept implementation.
- Describe clearly the state of the art (baseline) of the concept and implementation which should be in line with the scope of the call regarding the TRL (as stated in the introduction above).

- Provide a list of applications frequently used on HPC systems with typical use cases which could substantially benefit from the proposed solution including an estimate of the reduction of time-to-solution for the use cases.

Proposals that do not meet the expectations listed under the 3rd item (concerning a balanced and appropriate consortium) should clearly justify the construction of the proposed consortium in terms of effectiveness of the workplan and quality of the expected results. Furthermore, proposals should demonstrate the feasibility of the innovation study work plan, in terms of quality and efficiency, and present a clear and sound financial management of the study.

Submission Details

Submission deadline:
All submissions must be made by 17:00 Brussels local time on September 28th 2023.

Electronic submission: Proposal submission is exclusively in electronic form using the proposal submission tool accessible via the Inno4scale web-site:
https://www.inno4scale.eu/calls/submission

The central component of proposal submission is the completion of administrative information within the online submission system (which will include information about all proposal participants) and the uploading of a PDF-document (whose individual size must not exceed 5.0 MB) compliant with the instructions on proposal structure given below.

Proposal format and structure:
Proposals must be submitted in English.

The main section of the proposal – "Part B" the PDF-document to be uploaded to the submission system - must not exceed 10 pages in length (including any appendices, but excluding the cover page). The text should be no smaller than 11 point Arial font. **Proposals submitted with a Part B whose length (excluding the cover page) exceeds the 10-page limit will be rejected without further evaluation.**

ALL PROPOSERS MUST TAKE CAREFUL NOTE OF THE ABOVE RULES.

The structure of Part B of the proposal (and indicative length per section) should be as follows:

1. Summary (1 page)
2. State of the art (1 page)
3. Concept and design of the innovative algorithm (1 page)
4. Expected impact and exploitation by existing applications (2 pages)
5. Baseline performance and means of verification of the improvements (1 page)
6. Description of the work plan (2 pages)
7. Quality of the consortium as a whole and of the individual proposers (1 page)
8. Justification of costs and resources (1 page)

A management structure will be imposed on the successful proposals. That is, the proposal will not need to contain a description of how the management of the experiment in the framework of the overall Inno4scale project will be achieved, but should include tasks for the technical management of the experiment activities.

A proposal exemplar for Part B can be found at
https://www.inno4scale.eu/calls/submission.

It is a requirement that this exemplar be followed and in particular that the proposal budget be provided using the embedded Excel spread-sheet.

Indicative budget

Inno4scale will make use of the Financial Support for Third Parties method[2] to enable the inclusion of new study partners. The indicative total funding budget for the call is
€ 4 million

The funding of Third Parties will follow the same principles as used for beneficiaries of Inno4scale, which receive European Commission funding within the R&D&I programme of the EuroHPC Joint Undertaking. In particular, Third Parties will receive 100% funding of incurred eligible costs[3].

The funding for an individual innovation study may not exceed € 200,000 (covering all participants). The maximum level of effort to be supported for a proposed innovation study is 24 person months (in total). Proposers should consider their actual needs and the evaluation will take into account the appropriateness of the requested resources.

Only organisations with head offices based in an EU Member State or in associated countries that are members of the EuroHPC Joint Undertaking are eligible to receive funding.

Natural persons (individuals) are not eligible to receive funding.

Proposals to Inno4scale Call-2023 that do not adhere to the abovementioned funding restrictions **will be rejected without further evaluation.**

Inno4scale reserves the right to make the appropriate and necessary effort and budget cuts in the case that erroneous budget data is included in accepted proposals.

[2] Integration of new Third Parties will conform with the Horizon Europe/EuroHPC JU grant agreements
[3] The details of funding rules that will be applied can be found in the annotated model grant agreement for the Horizon Europe programme:
https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/aga_en.pdf

Evaluation Criteria

The criteria for evaluation will comprise:

1. **Impact:** based on the expected performance improvement and target applications.
2. **Excellence:** soundness of concept, innovation and quality of the proposers.
3. **Implementation:** quality of the workplan and justified deployment of resources.

Each criterion will carry a score ranging from 0 to 5, and with a minimum threshold of 3 for each of them and the overall threshold for the sum of all criteria is 10. All criteria are equally weighted. However, in case of a tie in the overall score ranking, proposals are ranked based on the individual criteria scoring applying the following priority: Impact, Excellence, Implementation.

Adherence to the proposal format and structure described previously – and notably to the prescribed page limit – will allow the independent external evaluators to evaluate the proposal against all of the above-mentioned evaluation criteria. As explained earlier in this document, failure to adhere to the funding restrictions and to the proposal format instructions will lead to immediate rejection of the proposal. Each proposal will be evaluated by two independent expert evaluators. The proposers will be provided with the results of the evaluation in the form of an evaluation summary report comprising the consolidated findings of the independent expert evaluators and a decision from the project on the result of the selection procedure. That decision is final and the project will not enter into discussions concerning the evaluation results, and no appeals process will be provided.

Financial information for innovation study consortia selected for funding:

Consortia concluding an agreement for funding of an innovation study with the Inno4scale project coordinator, the Barcelona Supercomputer Centre (BSC), will receive, on commencement of the innovation study, an initial payment (pre-financing) totalling 50% of the budgeted, indicative funding for the study. Thereafter, quarterly monitoring of technical progress and use of financial resources will be the basis of interim payments up to a maximum of 85% of the total budgeted, indicative funding for the study. The remaining 15% will be paid following acceptance of the final reports as part of the final project review by the EuroHPC JU and BSC's approval of the final cost reports from the study consortium.

Technology readiness levels (TRL)

The following definitions apply:

TRL 1 basic principles observed

TRL 2 technology concept formulated

TRL 3 experimental proof of concept

TRL 4 technology validated in lab

TRL 5 technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 6 technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 7 system prototype demonstration in operational environment

TRL 8 system complete and qualified

TRL 9 actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)