CALL NOTICE FOR ADVANCED COMPUTING PROJECTS

IN ALL SCIENTIFIC DOMAINS

3rd edition

Ref.: FCT/CPCA/2022/01

According to the Regulations for Advanced Computing Projects, published under No. 10/2022 in *Diário da República* (Official Portuguese Law Gazette), the allocation of computing resources of the National Network for Advanced Computing (RNCA) is carried out following a competitive tendering procedure whose terms are published on the page of the Foundation for Science and Technology, I. P. (FCT).

This Call notice, henceforth designated as AAC, was drawn up under the terms of the provisions of article 12 of the Regulations for Advanced Computing Projects.

1   Objectives and priorities

The consolidation and strengthening of the National Scientific and Technological System (SCTN) are priorities of the science and technology policy made in Portugal. These priorities aim to contribute to the national and international competitiveness of science and technology, and its contribution to innovation and knowledge transfer, as well as to contribute to the achievement of global aspirations set out in the United Nations Sustainable Development Goals (ODSs). In this context, it is particularly important to promote and strengthen the skills of scientific and technological institutions through their participation in advanced computing projects.

It is with these objectives that FCT opens this Call for Advanced Computing Projects (CPCA) to technologically support advanced computing projects in all scientific domains.

FCT manages the National Network for Advanced Computing (RNCA) seeking to aggregate national advanced computing resources, promoting cooperation between the various centres involved and developing national and international partnerships with other entities.

RNCA was integrated in the National Roadmap of Research Infrastructures of Strategic Interest by Order No. 4157/2019, from the Minister of Science, Technology and Higher Education.

Keywords: RNCA, CPCA, Advanced Computing, High Performance Computing, HPC - High Performance Computing, SCC - Scientific Cloud Computing, VRE – *Virtual Research Environment.*

2   Type of beneficiaries

The individuals or institutions mentioned in Article 3 of the Regulations for Advanced Computing Projects may apply for the allocation of computing resources, individually or in co-promotion.

3 Computational models and types of access

3.1 Computational models

This call aims at allocating computational resources to Projects in all scientific and innovation domains, with reference to international technology standards. The following computational models are available to applicants:

- **High Performance Computing (HPC)**
- **Scientific Cloud Computing (SCC) or Virtual Research Environment (VRE)**

3.1.1 High Performance Computing (HPC)

For the purposes of this call, each HPC architecture is made up of the following elements:

a) A set of compute nodes operating jointly and temporarily dedicated to a single application, which together can execute at least 40 x 10^12 [1] strongly dependent floating-point operations each second, executed on generic, non-specialised microprocessors [2].

b) A file system accessible from each compute node at a shared rate of at least 40 Gbps [3] with multiple concurrent access streams [4] in each compute node.

Compute nodes are typically managed by a batch system like Slurm or similar. HPC systems are generally accessed by SSH for one or more input nodes, from which you can submit jobs to the batch system.

3.1.2 Scientific Cloud Computing (SCC) or Virtual Research Environment (VRE)

Both SCC and VRE models are carried out through a computational architecture of virtual servers:

3.1.2.1 Scientific Cloud Computing (SCC)

In the context of this notice, each *SCC*[5] architecture is integrated by the following elements:

a) A set of computing nodes shared by several users and applications, made available in a self-service system with maximum quotas for the use of physical resources, through a virtualisation software layer in cloud computing IaaS [6].

b) The virtual servers (VM - Virtual Machines) provided will access the virtual disk through local devices, or by mounting a remote file system.

The creation of VMs can be done through a web dashboard, command-line tools or using APIs. The service is based on Openstack. SCC is best indicated for scientific data processing in cloud computing environment. This model allows the instantiation of fully user-defined VMs, both in the Linux operating system, as well as in the configuration of hardware and software, providing great flexibility in the configuration and use of the means to perform computational tasks.

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[1] 40 Tera-FLOP

[2] Example of a class of specialised processors are GPU

[3] 1Gbps= 1 Giga bit per second

[4] *Parallel file system, like Lustre or BeeGFS*

[5] https://www.incd.pt/?p=servicos/cloud

[6] See cloud IaaS definition in: https://csrc.nist.gov/publications/detail/sp/800-145/final.

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3.1.2.2   Virtual Research Environment (VRE)

In the context of this notice, VREs are defined by the following elements:

a) Set of interoperable online tools that contribute to facilitate the management, storage, processing and visualization of research data between one or more groups or institutions.
b) Similar to SSC they require a set of compute nodes, memory capacity and data storage, and the possibility to create VMs – see points a) and b) of point 3.1.2.
c) VREs can make use of SSC resources, which can be supplemented by HPC for the performance of heavier processing tasks.

VREs are platforms for computing, processing and accessing data, typically available through portals or web interfaces based on cloud computing. They aim to facilitate research and collaboration between researchers from one or more organisations. Unlike SCC, this model aims to provide environments as services that will be available to researchers continuously during the execution of the project. VREs are optimized to provide access to databases, workflow systems, or for production, availability and sharing of data products.

3.2   Types of access

The present call includes the following access types:

- **A0 – Experimental Access**
- **A1 – Preparatory or Development Access**
- **A2 – Project or Regular Access**

Table 1. Summary of access typologies with duration and maximum limits per application.

	A0	A1	A2	
Computational model	HPC and/or SCC			SCC or VRE
Duration[a]	6 months		12 months	24 months
CPU core. hours [b]	50.000	100.000	3.000.000	-
vCPU.hours[b]			1.200.000	
GPU. hours[b]	730	2.190	8.760	
Quota[c]	**5%**	**15%**	**80%**	

(a) maximum duration, extendable for a further 6 months in duly justified and approved cases; (b) maximum limits of computational resources, or smaller, if the capacity punctually installed in the operational center does not allow the above mentioned ceilings. For projects that request SCC or VRE candidates should consider the maximum limit of 256 GB RAM (memory) and 5 TB storage per project;

3.2.1 A0 – Experimental Access

This type of access is recommended for scientific or innovation projects whose work team has no prior experience in advanced computing or who has no history of use in RNCA computing resources. It is intended for experimentation, testing and pilot access to platforms.

Applications for this type of access will be subject to administrative validation carried out by the FCT and technical validation by elements of the RNCA operational centers that administer the requested resources.

Requests to use visual features (e.g.: dedicated GPUs for this purpose) are also accepted in this type of access by teams with or without prior experience.

3.2.2 A1 – Preparatory or Development Access

This type of access is recommended for conducting software performance tests, code optimization, scalability testing, benchmarking, re-factoring and short-scale projects.

Applications for this type of access will be subject to administrative validation carried out by the FCT and evaluation of technical suitability by elements of the RNCA operational centers that administer the requested resources.

3.2.3 A2 – Project or Regular Access

This type of access is intended for the use of HPC, SCC or VRE resources and is recommended for scientific or innovation projects whose work team has prior experience in HPC or Cloud.

To assess the appropriate software scalability, the operational teams of the platforms may request A0 or A1 access before using A2 project resources.

Applications for this type of access will be subject to evaluation of technical suitability by elements of the RNCA operational centers that administer the requested resources and the evaluation of scientific merit by external evaluation panels invited by FCT.

4   Form of support

The support to be granted under this concursal procedure is exclusively the way of allocating time to use advanced computing resources, not providing funding of any kind or human resources to develop or support computer applications.

5 Computer resources global allocation

The allocation of computational resources of this call is described in table 2 and its notes, and the FCT can reinforce the available resources, if justifiable. The sum of the total available capacity is **36 million CPU core.horas or vCPU.hours and 105,000 GPU.hours**. The total financial value allocated to the competition is 400,000 euros, by applying the unit values indicated in Table 3 below.

Table 2. Summary of operational centres and their computer platforms available in this call. Detailed information on hardware and software can be found in the fact sheet of this call.

Operational center	Platform	Computational Model	System
MACC	Bob	HPC	360 compute nodes, each with two Intel X86 Xeon E5-2680 (8 cores each CPU) @2.7Ghz 2GB-RAM/core. 4 GPU type Tesla T4
LCA-UC	Navigator Navigator+		164 *compute nodes*, each with two Intel Xeon E5-2697v2 (12 cores each CPU) @2.7 GHz 32 *compute nodes*, each with two Intel Xeon Gold 6148 (20 cores each CPU) @2.4 GHz; 4-8 GB-RAM/core; 8 GPU type Tesla V100; 2 GPU Nvidia A40 for visualization
HPC-UE	Oblivion		88 *compute nodes*, each with two Intel Xeon Gold 6154 (18 cores each CPU) @3.0 Ghz; 5.33 GB-RAM/core
	Vision		16 GPU type Tesla A100
INCD	Cirrus-A		CPU type AMD EPYC 7501, each with 500GB-RAM e 64 cores; CPU type AMD Opteron 2356, each with 32 GB-RAM e 8 cores; amongst others (check technical sheet); 5 GB-RAM/core; 8 GPU type Tesla T4, V100, A100
	Stratus	SCC or VRE	vCPU in AMD EPYC 7501, each with 500GB-RAM and 64 cores

Notes: The computer appropriations per RNCA platform are detailed in the technical data sheet of the contest and correspond to the best projection that is possible to perform at the time of publication of the same.

Table 3. Unit values for the valuation purposes of each application [7]

	Description	Units	Unit cost (€)
HPC processing	Each CPU core	core.hour	0,0123
GPU processing	Each GPU card	GPUcard.hour	0,1800
Cloud processing	Each virtual-CPU	vCPU.hour	0,0123

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[7] Valores originalmente publicados no contexto do concurso FCT AI 4 COVID-19 em https://www.fct.pt/apoios/projectos/concursos/datascience/docs/Proposta_de_recursos_computacionais.xls

HPC storage	Each Tera Byte	TB.month	6,5000
Cloud storage	Each Tera Byte	TB.month	6,5000

5 Eligibility criteria for projects and beneficiaries

The conditions for eligibility of applications are those indicated in Article 6 of the Regulations for Advanced Computing Projects and those indicated in this AAC.

5.1 Advanced Computing Project

Applications are admitted individually or in co-promotion:

- to one or two computational models;
- to one or more platforms for the same project;
- in different access types (A0, A1, A2) - see limits in point 6.2.

Regarding applications from companies as beneficiaries, advanced computing projects should:

- occur in the context of pre-competitive research and innovation, where the goods or services which are the subject of that research or innovation do not yet have a commercial value.
- not exceed, for all applications of this type together, 50% of the total computational budget to be allocated in this call.

In the case of A2 applications:

- The eligibility of A2 access in the High-Performance Computing (HPC) model depends on the presentation of a scalability chart of the software to be used, using real or estimated data. It is also advisable to present information on previous experience, either through previous use of this model or through previous advanced computing projects (previous access A0, A1 and A2 or others, in the PRACE network for example).
- The eligibility of A2 access in the Scientific Cloud Computing model for commercial and/or profit-making organisations is limited to the availability of physical computing resources after such access has been granted to non-profit-making organisations.

5.2 Responsible Investigator (IR)

The IR of the project:

a) Should, at the moment of application update and make available **their CienciaVitae, associated to CiênciaID**, to FCT;
b) Is jointly responsible with the proposing institution(s), for the application, the project management, the achievement of the proposed objectives and the compliance with the rules underlying the allocation of resources.

6 Allocation of computer resources

As stipulated in article 9 of the Advanced Computing Projects Regulation, access to resources will be using computer resources from RNCA's operational centres. Access to resources will be provided for a limited period indicated in this notice, namely in points 3.2.1 and 3.2.2.

7 Evaluation criteria

Pursuant to Article 14 and 15 of the Regulation of Advanced Computing Projects, all applications received will be evaluated according to the criteria described in 8.1, 8.2 and 8.3, which are densified and detailed in the evaluation guide.

For A1 and A2 access types, and after gathering the evaluations results, the RNCA access committee (composed of elements of the FCT and the Operational Centers as defined by the Internal Regulation, published in DR under no. 1049/2020) will integrate and distribute the computational resources by the reserved quotas of resources. The full description of this process can be found in the evaluation script of this competition.

7.1 A0 – Experimental Access:

Applications will be submitted to simplified technical validation without grade assignment, based on the T1, T2 and T3 criteria described in 8.2. Applications will be handled in rounds and on a first-come, first-served basis until the defined quota is exhausted.

7.2 A1 – Preparatory or Development Access

Applications will be submitted to evaluation of technical suitability carried out by the technical teams operating the computer platforms, listed in table 5 of this AAC.

Evaluation criteria:

- • **T1: Technical adequacy to RNCA resources (25%);**
- • **T2: Reasonableness and planning of the use of the requested resources (50%);**
- • **T3: Work Plan (25%).**

Formula, weights and score:

General aspects of the evaluation process:

The evaluation of technical suitability shall be carried out in accordance with the defined evaluation criteria. The score is based on the quantitative scale from 0 to 10. For each batch of applications, an ordered list of applications will be generated. If two or more applications have the same final grade after applying the evaluation criteria, preference will be given to the oldest submission date and time.

7.3 A2 – Project or Regular Access

The applications will be submitted to evaluation of technical suitability carried out by the technical teams operating the computer platforms, listed in the table of point 5 of this AAC, and the evaluation of scientific merit by external evaluation panels invited by FCT, I.P.

Evaluation criteria:

- **T1: Technical adequacy to RNCA resources (10%);**
- **T2: Reasonableness and planning of the use of the requested resources (20%);**
- **T3: Work Plan (10%).**
- **S1: Scientific relevance that includes the proposed activity (20%);**
  - **S1.1 - Scientific merit (50%)**
  - **S1.2 - Innovative nature (50%)**
- **S2: Justification of computational activity to support the scientific project (20%);**
- **S3: Scientific merit and experience of the group and responsible researcher (15%);**
  - **S3.1 - Scientific merit of the responsible researcher (20%)**
  - **S3.2 - Scientific merit of the research group (20%)**
  - **S3.3 - Advanced Computing Experience (60%)**
- **S4: Dissemination and production of results (5%).**

Formula, weights and score:

General aspects of the evaluation process:

The evaluation of technical suitability (criteria T1 to T3 and any bonuses of these criteria) shall be carried out by the technical teams operating the computer platforms, listed in the table of point 5 of this AAC.

The scientific merit of the applications (criteria S1 to S4 and any bonuses of these criteria) will be evaluated by external evaluation panels, according to the scientific subarea of each application. Each application will be evaluated by 2 independent evaluators integrated into the relevant panel. For criteria S1 to S4 there are the following panels, each coordinated by an element that, as such, is designated by FCT:

- **P1 – Physics and Mathematics;**
- **P2 – Chemistry and Materials;**
- **P3 - Engineering and Technology;**
- **P4 – Life and Health Sciences;**
- **P5 – Earth and Environmental Sciences;**
- **P6 – Social and Economic Sciences.**

The score is based on the quantitative scale from 0 to 10. If two or more applications have the same value after applying the evaluation criteria, the highest ranked one with the highest score in the following criteria in the order of preference will be considered: S2 >>>T2 >>>S3.

Table 4. Summary of the evaluation process and criteria to be applied to applications received.

	A0	A1	A2
Evaluation of technical suitability	-		T1: Technical adequacy to RNCA resources[a] T2: Reasonableness and planning of the use of the requested resources[a] T3: Work Plan

			S1: Scientific relevance that includes the proposed activity [b]
Evaluation of scientific merit	-	-	S2: Justification of computational activity to support the scientific project [b]
			S3: Scientific merit and experience of the group and responsible researcher
			S4: Dissemination and production of results

aIn cases of proven execution above 50% of a previous project of the same IR with corresponding progress report delivery, T1 and T2 may be subsidized by 20%; bIn cases of justified and proven lack of experience where s3.3<5 points, the score of criteria S1 and S2, will be subsidized by 10%.

8 Submission of Applications

Applications are composed only of the electronic form referred to in paragraphs 9.1., 9.2. and 9.3, and its attachments. The maximum limit of applications by IR or co-IR is as follows:

- **Each IR and co-IR can submit a maximum of ONE application for typology A2;**
- **Each IR can submit a maximum of ONE application every 3 months for a0 or A1 typologies, always subject to the availability of resources.**

8.1 A0 – Experimental Access

Applications must be submitted in English from **25 October 2022 until 13:00 (GMT) on 31 May 2023**, at:

https://rnca.fccn.pt/concursos-id/

Every 6 to 8 weeks, the applications received so far will be aggregated in batches and subject to technical validation. Calendar of batch submission dates will be available at https://www.fct.pt/apoios/Computacao/index.phtml.pt

8.2 A1 – Preparatory or Development Access

Applications must be submitted in English from **25 October 2022 until 13:00 (GMT) on 31 May 2023**, at:

https://myfct.fct.pt/

>>>> Selecting "Call on Advanced Computing Project (3rd edition)- A1 Preparatory or Development Access"

Every 6 to 8 weeks, the A1 applications received so far will be aggregated into batches and are subject to technical adequacy assessment. Calendar of batch submission dates will be available at https://www.fct.pt/apoios/Computacao/index.phtml.pt

8.3 A2 – Project or Regular Access

Applications must be submitted in English from 25 October 2022 until 13:00 (GMT) on 6 December 2022, at:

https://myfct.fct.pt/

>>>> Selecting "Call on Advanced Computing Project (3rd edition)- A2 Project or Regular Access

8.4 Non-depletion of computational resources

Allocation on the platforms will be carried out until the respective quota limit is reached. If applications do not exhaust the available computational resources, FCT may set a new deadline for submission of applications for new batches of applications. This process can be repeated until all resources are assigned or the call is closed.

9 After approval of the applications

Each panel generates ordered lists of A1 and A2 applications according to the criteria and weightings defined above. Bringing together the evaluations of technical adequacies of the technical teams of the Operational Centers and scientific merit assessments of the panels, the RNCA Access Committee (composed of elements of the FCT and the Operational Centers as defined by the Internal Regulation, published in DR under no. 1049/2020) will integrate and distribute the computational resources by the reserved share of resources, following principle 20-40-40:

- 20% of the applications with the best score in each panel will have recommended access to 50-100% requested resources, according to the preference of the platform indicated in the application and availability of the same;
- 40% of the following applications will have recommended access to 50-75% requested resources;
- The remaining 40% applications will have recommended access to 5-25% of requested resources upon availability on the platform.

Each approved application will have a single associated reference, which will be known to the IR. The formalization of the allocation of computer resources will be made by signing a term of acceptance pursuant to Article 21 of the Regulation of Advanced Computing Projects.

9.1 9Use of resources allocated to the approved project

In accordance with Article 24 of the Regulation, beneficiaries should 1) ensure open access to publications, in particular by depositing them in one of the repositories of the RCAAP network; and 2) ensure open access to data, in compliance with the FCT Research Data Policy, in particular through the preparation and maintenance of the management plan and sharing of research data. FCT I.P. may advertise the project information, referred to as public.

All publications resulting from the use of the computer resources covered by this Regulation and any other results should include in the support section reference to FCT I.P., the platform used and the identifier assigned to the project.

The resources allocated should be used throughout the project, i.e., promoting the use of at least 1/3 of the computational resources up to half the project time. If the beneficiary does not start work by 2/3 of the deadline, he/she may see the assigned computer resources reduced or deleted.

In case of unforeseen events, such as breakdowns, works, maintenance of platforms or others, users may have to suspend their work with subsequent resumption, or be relocated on another platform of the network, in order to have the least impact on the realization of the project. It is the responsibility of the IR and co-IR to manage the generated data, as well as its backup.

10 Documents and further information

This document and other relevant documents and information, namely the Regulations for Advanced Computing Projects, are available at https://www.fct.pt/apoios/Computacao.

Additional information and clarifications, including on completing the application form, can be requested at the email address: rnca@fccn.pt "FCT/CPCA/2022/01".

It is recommended to read the tender documentation in advance, in particular:

- Advanced Computing Projects Regulations;
- Technical Sheet;
- Applications guide;
- Evaluation Guide
- CienciaVitae guide;
- Panels and scientific areas

11 Acronyms & definitions

- "AAC" = PT: Aviso para Apresentação de Candidaturas – ENG: Call Notice
- "core.hour" = Unit of processing time widely used in HPC. Number of CPU colours or vCPU times the time, in hours, that they are used for a given function.
- "HPC" = High Performance Computing
- "HPC-UE" = High Performance Computing - Universidade de Évora (Operational centre running the Oblivion and Vision platform)
- "INCD" = National Distributed Computing Infrastructure
- "IP" = Proposing Institution
- "IR" = Responsible Investigator
- "LCA-UC" = Advanced Computing Laboratory of the University of Coimbra
- "MACC" = Minho Advanced Computing Center
- "PRACE"= Partnership for Advanced Computing in Europe
- "SCC"= Scientific Cloud Computing
- "vCPU" = virtual CPU visible inside a VM. Typically corresponds to a CPU core of the VM host server.
- "vCPU.hora" = number of virtual CPUs times the time, in hours, that they are used for a given function.
- "VM" = *Machine*
- "VRE" = Virtual Research Environment