ACP.2030 Advanced Computing Portugal 2030

Progress Report 2019-2020

November 2020

FCT Fundação para a Ciência e a Tecnologia

Computação Científica Nacional FCCN

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1. EXECUTIVE SUMMARY

This document presents the progress promoted by the Advanced Computing Portugal 2030 Strategy (ACP.2030) since its debut in 2019 at the main science annual gathering [ ] that took place in Lisbon. One of the first actions of ACP.2030 was the revive of the National Network for Advanced Computing (RNCA), an organisation led by FCT that brings together all 4 Portuguese advanced computing centres with the objective of aligning under a single strategy the main public funded computational resources and services.

RNCA was created by a resolution of the council of ministers on March 8th of 2018, as a computing network to be developed under the National Digital Skills Initiative, Portugal INCoDe.2030.

RNCA relies on resources distributed over the national operational centres, and will soon, also, on the new Spanish supercomputer MareNostrum 5, through a 5% participation of Portugal in the project.

FCT, as the coordinator entity of RNCA, has launched the first national open call to the entire scientific and innovation community for usage of RNCA's advanced computing resources. The call is in its final stage, having reached a demand that is 2.9 times higher than the initial capacity inscribed in the call notice.

FCT is participating in the EuroCC projet in order to develop the HPC competence centres described in ACP.2030.

RNCA will integrate in 2021 a large HPC machine, named Deucalion to be installed in the Minho Advanced Computing Centre (MACC) in the North of Portugal, through an ongoing EuroHPC effort to increase Europe's HPC capacity. Beyond Deucalion, still on the same EuroHPC effort, RNCA will also integrate 5% of the new Spanish supercomputer, Mare Nostrum 5.

ACP.2030 international collaboration efforts are being pursued by the Institute for Systems and Computer Engineering, Technology and Science (INESC-TEC) in Porto and the Laboratory for Advanced Computing (Laboratório de Computação Avançada - LCA) at University of Coimbra, as partners of RISC2, a project funded by EuroHPC to create a network for supporting the coordination of High-Performance Computing research between Europe and Latin America. RNCA, through Coimbra University, is a member of PRACE - Partnership for Advanced Computing in Europe.

RNCA, through FCT, is represented at EuroHPC Joint Undertaking Governing Board. RNCA has a strategic role in the implementation of ACP.2030 in the years to come. However, it is a recent effort coordinated by FCT that is still consolidating many of its essential operational processes, such as publishing its internal regulation on the Republic Official Journals, nominating RNCA official members and enabling supporting functions as human resources and information systems.

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2. RNCA SUPERCOMPUTERS IN 2019-2020: BOB, NAVIGATOR, OBLIVION, CIRRUS

Since 2019, RNCA integrates 4 HPC clusters, hosted by 4 geographically distributed operational centres. Bob, Navigator and Oblivion are currently operating as HPC clusters while INCD offers a wider range of services that comprise HPC, HTC and Cloud Computing. A rich and diverse supercomputing ecosystem is being developed in Portugal, where dozens of new and existing users make the most of these powerful machines. In the next sections, a brief description of each cluster is made, accompanied by recent usage data. The following figure shows the map of mainland Portugal and the location of each of these 4 operational centres:

• **MACC:** Minho Advanced Computing Centre
• **LCA-UC:** Laboratório de Computação Avançada da Universidade de Coimbra
• **HPC.UE:** High Performance Computing da Universidade de Évora
• **INCD:** Infraestrutura Nacional de Computação Distribuída

Figure 1. RNCA operational centers in 2020-2021.

2.1. BOB

Bob is a supercomputer with 800 compute nodes and 12.800 cores installed in a state-of-the-art datacentre facility located in Riba de Ave.

Each node of Bob has: two Intel 8-core "Sandy Bridge" generation Xeon processors at 2.7Ghz with 32GB of RAM and a shared storage with 1,5 PB. Nodes are integrated with a Mellanox FDR 56 Gb/s InfiniBand network.

Bob is part of the former Stampede 1 supercomputer of Texas Advanced Computing Center (TACC).

Main features of Supercomputer Bob are:
- 1 PFlops of peak performance (with accelerators)
- Installed in MACC, Riba d'Ave in March 2019. Operational since July 2019.
  - 800 compute-nodes each with 2x Intel Xeon Sandy Bridge 2.7GHz (16-cores), 32GB RAM. Infiniband FDR (56Gbit/s)
  - Xeon-Phi
- Total of 12 800 CPU cores and 1,5 PB storage
- LUSTRE filesystem
- GPU Nvidia T4 currently being tested

Further details at **https://macc.fccn.pt/**

Figure 2. Bob at MACC

2.1.1 USAGE DATA FROM BOB

The following figure shows total monthly used core.hours (darker blue bars) and accumulated core.hours (lighter blue bars) from July 2019 until September 2020. In December 2019 LUSTRE filesystem was updated and the cluster needed a partial shutdown.
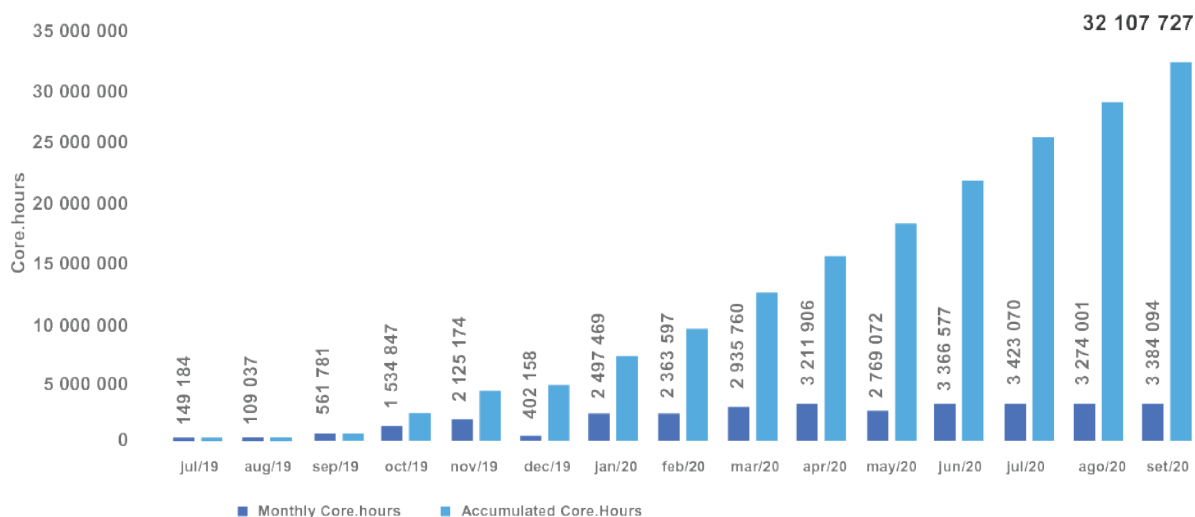
Figure 3. Monthly and accumulated usage from July 2019 until August 2020.

The following pie chart shows the percentage of core.hours used in projects of several scientific users, according to user enquiries and their affiliation. Data time span: July 2019 - September 2020.
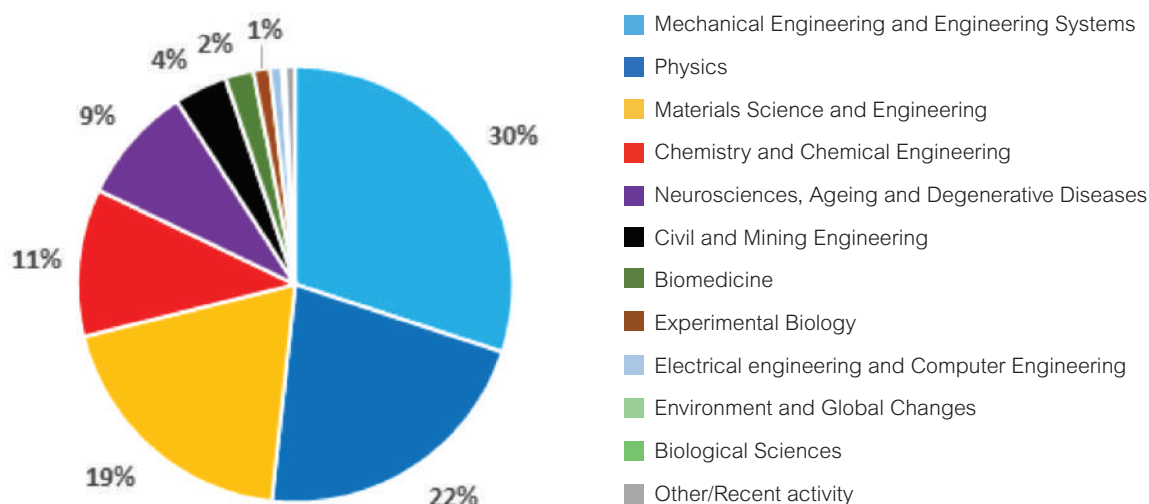
Figure 4. Scientific areas and % of used core.hours between July 2019 and September 2020

2.2. NAVIGATOR

The Laboratory for Advanced Computing at University of Coimbra was founded to provide high performance computing resources & services to enable computationally intensive research within the University. Nowadays it also supports Portuguese researchers from all over Portugal. Currently LCA hosts and operates the HPC cluster Navigator/Navigator+ (3936 + 1280 CPU cores). With a long experience and deep understanding of HPC academic needs, LCA has been steadily growing. It is a PRACE member and is set to become a host system in 2020-2021 in PRACE-6IP through the DECI program. Besides PRACE, LCA is also a RISC partner. RISC is a Network for Supporting the Coordination of Supercomputing Research between Europe and Latin America.
Since 2007 LCA has published over 200 Publications and Scientific Papers in world renowned journals (see more details here **https://www.uc.pt/lca/publications**).

LCA also provides consulting and documentation and its team has been keen on developing Courses, Workshops and Presentations, thus promoting the training and skills development in new and existing user communities. LCA is also part of the FCT infrastructures roadmap.

Main features of Supercomputer Navigator are:

- 3rd generation, successor of Milipeia and Centaurus
- Installed in LCA-UC, Coimbra since 2015.
- Recent upgrade to Navigator+ in 2020.
  - Navigator: 164 compute-nodes each with 2x Intel E5-2697v2 2.7GHz (12-cores), 96GB RAM. Infiniband FDR (56 Gbit/s)
  - Navigator+: 32 compute-nodes each with 2x Intel Xeon Gold 6148 2.4 GHz (20-cores), 96-384GB RAM. Infiniband EDR (100 Gbit/s)

- Total of 3936 + 1280 cores and 200 TB + 1,27 PB storage
- LUSTRE filesystem
- Includes some GPU Nvidia v100

Figure 5. Navigator at LCA-UC
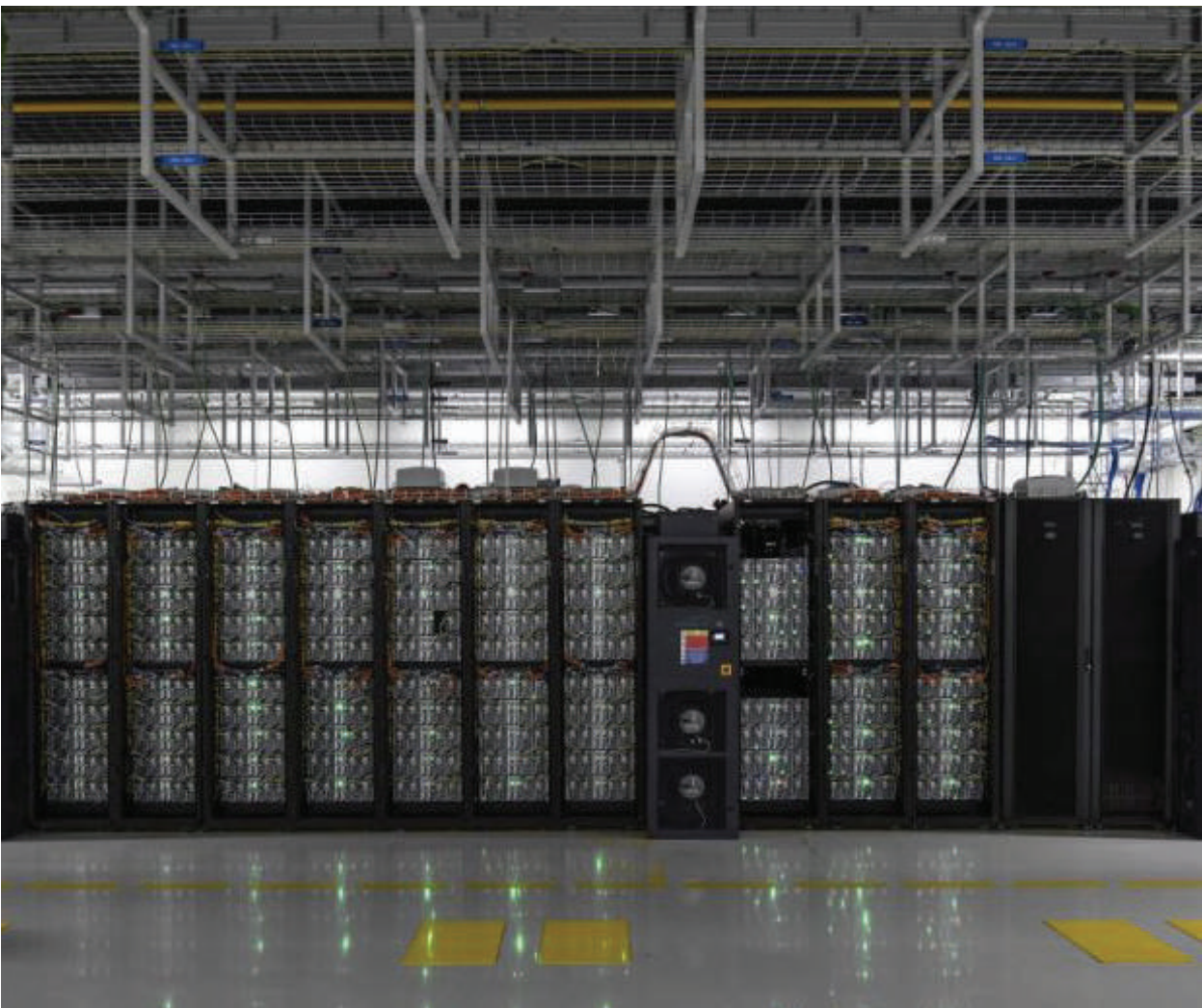
2.2.1 USAGE DATA FROM NAVIGATOR

The following figure shows total monthly used core.hours (blue bars) and accumulated core.hours (orange bars) from July 2019 to April 2020.
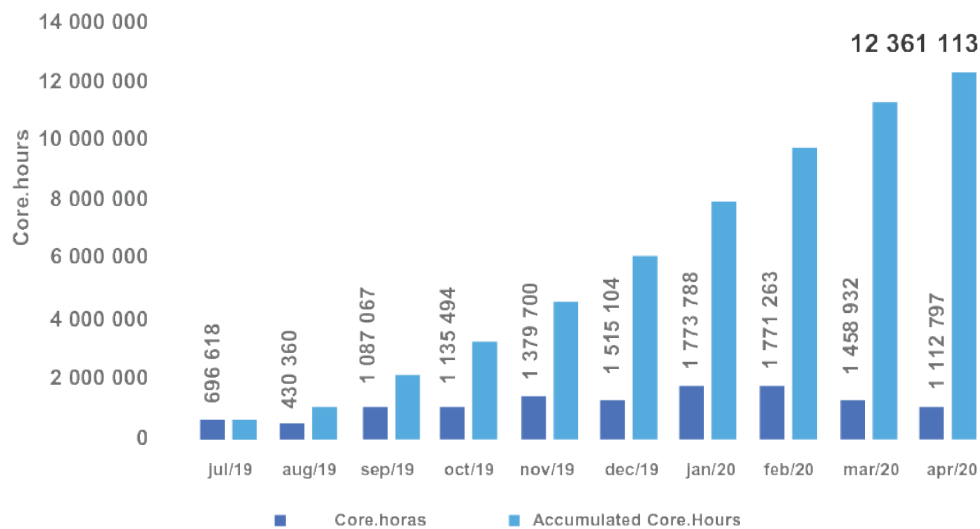Further details are available at **https://www.uc.pt/lca**

Figure 6. Navigator usage in 2019-2020

2.3 OBLIVION

The Oblivion supercomputer, acquired for the ENGAGE SKA research infrastructure – "Enabling Green E-science for the SKA Research Infrastructure" - is a machine capable of processing 239 billion operations per second, thus making it the best performance / energy ratio machine in Portugal.

The Oblivion Supercomputer was acquired by U. Évora, a Portuguese University, within the scope of the ENGAGE SKA research infrastructure, to support the processing of massive volumes of data (of the order of Petabytes, equivalent to millions of Gigabytes), resulting from the various research and innovation activities developed in Portugal and within the scope of the design, prototyping and operation of the Square Kilometer Array (SKA) radio telescope and its forthcoming precursors. It's reserved for these activities 50% of Oblivion's CPU time, with the remaining 50% used by the scientific community and companies within the scope of the National Network for Advanced Computing, coordinated by FCT.

With a global funding of around 4 million Euros, awarded by the Foundation for Science and Technology (FCT) through the COMPETE 2020 Program, ENGAGE SKA intends to respond to SKA's challenges, in line with one of the main axes of the Portugal INCoDe.2030 program (National Digital Competence Initiative e.2030): supercomputing.

Figure 7. Oblivion at HPC-UE

Main features of Supercomputer Oblivion are:
• Newest supercomputer in RNCA with 239 TFlops peak performance
• Installed in HPC-UE, Évora since 2020. Pilot phase started in June 2020.
    • 68 compute-nodes each with 2x Intel Gold 6154 3.0 GHz (36-cores), 96GB RAM. Infiniband EDR (100 Gbit/s)
• Total of 2492 cores and 576 TB storage
• BeeGFS filesystem

Further details available at **https://www.oblivion.uevora.pt/**

Usage data from Oblivion:
• Recent machine - No usage data available yet.

2.3 CIRRUS AND STRATUS (INCD)

INCD – National Distributed Computing Infrastructure is a digital research infrastructure which transverses all the knowledge areas. Its mission is to ensure access for scientific and academic communities operating in Portugal to high-capacity and high performance computational and storage resources. The INCD encompasses an integrated system that provides its services from multiple locations, connected to each other by the latest generation network infrastructure.

The INCD is designed specially to provide services in the field of scientific computing, supporting researchers and their participation in national and international projects, and is the result of the evolution of a computing infrastructure established in 2008 as part of the National Grid Initiative.

The INCD is integrated with international counterpart infrastructures, with which it shares resources and allows Portuguese researchers to use computational resources, both nationally and internationally.

In this context, the INCD is part of the European Grid Infrastructure (EGI), the Iberian infrastructure IBERGRID, and the Worldwide LHC Computing Grid (WLCG).
INCD provides several types of advanced computing services, as small scale HPC, HTC and virtualization. INCD is also part of the FCT infrastructures roadmap.

Figure 8. Cirrus-A at INCD

Main features of Supercomputer Cirrus are:
• Several HPC and Cloud clusters installed in Lisbon, Coimbra, Minho.
    • Cirrus-A includes several compute-nodes each with 2 microprocessors AMD EPYC 7501 2.6 GHz (64-cores), 500GB RAM. Infiniband FDR (56 Gbit/s)
• LUSTRE filesystem
• GPU Nvidia T4

Further details available at **https://www.incd.pt/**

2.3.1 USAGE DATA FROM HPC, HTC AND CLOUD COMPUTING AT INCD

The following bar graph shows total monthly used core.hours in Cirrus A and B (HPC+HTC in blue) plus Stratus (Cloud computing in grey) from January 2019 until June 2020.
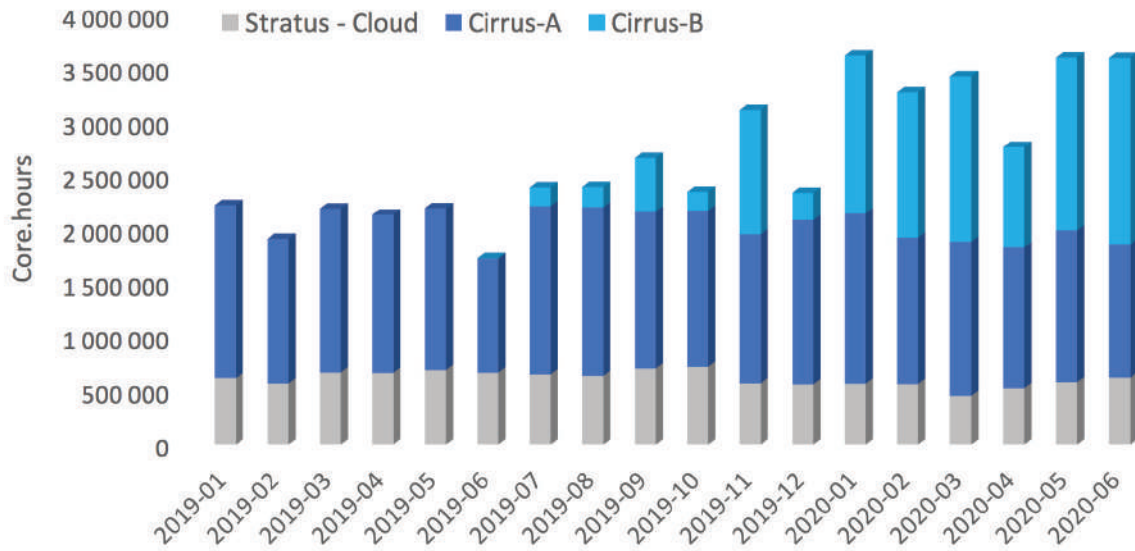
Figure 9. INCD usage in 2019-2020

3. RNCA REGULATIONS

The National Network for Advanced Computing (RNCA) has an internal regulation that went through a public consultation period at FCT's website in February 2020. It is available at [ ] in Portuguese language, under the title Proposta de Regulamento Interno para a Rede Nacional de Computação Avançada (RNCA). That document was later approved by FCT, establishing terms of reference for the regular operation of RNCA, such as a management model, rules for the access committee composition, functions and procedures, as well as other important features of RNCA. It is currently in the process of being officialised by publication in the Republic Official Journals.

RNCA was first declared in a resolution of the council of ministers on March 8th of 2018 as a computing network to be developed under the National Digital Skills Initiative, Portugal INCoDe.2030.

RNCA was later included by ministerial dispatch in the National Roadmap for Research Infrastructures of Strategic Interest, in April 2019. RNCA opens public calls for usage of its computing resources, following FCT rules of engagement with national user communities. FCT has thus produced, discussed, approved and published in the Republic Official Journals, a regulation for Advanced Computing projects and related documents. It was published in September 2020 and a public call is ongoing and described in the following section.

4. FIRST FCT CALL ON ADVANCED COMPUTING PROJECTS IN 2020

For the first time in decades FCT has opened in 2020 a call to provide computational resources that allow candidates to access HPC, HTC and Cloud computing. This call, dubbed *FCT/CPCA/2020/01*, had a total of 133 applications submitted on the 1st round of applications between August 14th and September 14th, 2020.

About 27 M Core.hours were made available on Bob, Navigator, Oblivion and Cirrus to be used over a maximum time span of 6 months. More than 80 M Core.hours were requested on this 1st round, showing the high demand of the Portuguese research community for this type of resources. RNCA Access Committee and FCT are expected to have a final ranking by November 2020 (preliminary results shown in the next table). In a procedure similar to that of PRACE and RES *(Red Española de Supercomputación)*, the call was divided in 2 types of access – preparatory (A1) and project (A2). Over two thirds (71%) of all applications selected A2 type of access and 77% referred having previous experience with HPC, with candidates already showing some level of proficiency. Good quality proposals were received in a wide range of subjects, from particle physics to SARS-CoV-2 studies. 80% of applications registered a previously approved scientific or innovation project that could support the use of computational resources. 15% of female candidates have applied, a percentage that RNCA will actively work to increase in the following CPCA editions. As a first experience, these results are very promising and show how Portuguese scientists are willing to use HPC

to improve their research. More and better machines are needed to have more people, more companies and more institutions making a wider use of advanced computing in Portugal. Future calls are expected to come soon, in the first semester of 2021.

More information available at **https://www.fct.pt/apoios/Computacao/index.phtml.pt**

The following boxes detail the requirements and limitations of the 2 types of proposals admitted to the first call on Advanced Computing Projects. Combination of the two types were also eligible.

> **A1 – Preparatory Access:**
> • Software performance tests
> • Scalability tests
> • Benchmarking and/or re-factoring
> • Short term projects
> Limits: 50 000 core.hours or vCPU_core.hours. Duration up to 2 months

> **A2 – Project Access:**
> • Larger projects
> Limits: 3.000.000 core.hours or vCPU.hours. Duration up to 6 months

The following snapshot figures act as key performance indicators of this call, still in its technical evaluation: (a) percentage of applications that required A1 and/or A2 type of access; (b) representation of men and women in the total number of candidates; (c) percentage of submissions that referred a scientific or innovation funded project by a competent entity; (d) percentage of applicants that showed previous experience in HPC; (e) bar chart with distribution of applications over the 4 scientific domains (FCT classification).

a)

29%

71%

■ A1 ■ A2

b)

M/F representation

85%   15%

c)

Scientific or Innovation Funded Project

80%

d)

Previous experience in HPC

77%

Legend:
- Exact Sciences and Engineering
- Life and Health Sciences
- Natural and Environmental Sciences
- Social Sciences and the Humanities
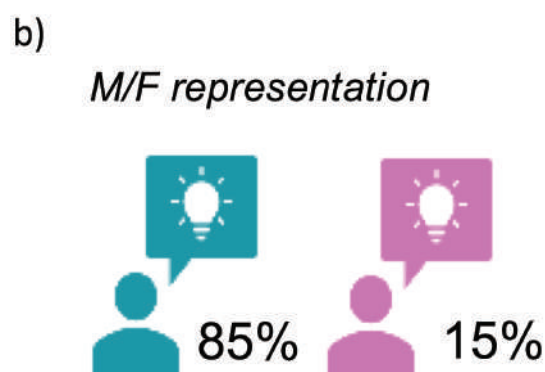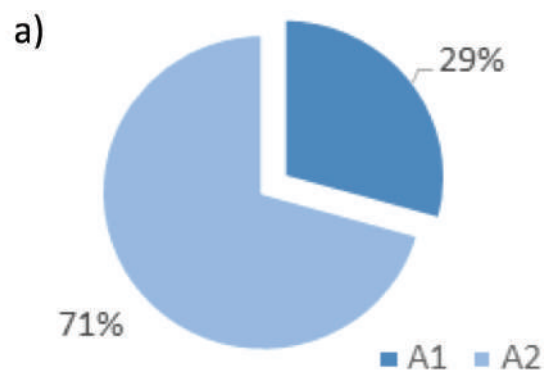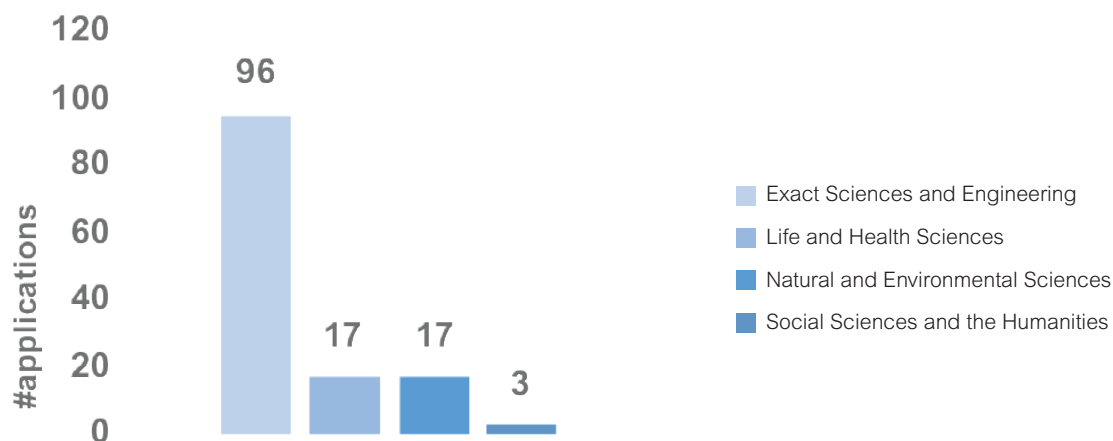
This call is being financially supported by FCT, through RNCA's operational centres that provide computing services to national communities. FCT subsidizes operational centres for the call.

Operational centres	Platform	Computational Model	Core.hours CPU/ vCPU	#projects A1 and A2	#projects A0 and A00
Minho Advanced Computing Centre	Bob	HPC	20 427 660 ^{CPU}	25	30
Laboratório de Computação Avançada da U. Coimbra	Navigator	HPC	4 636 368 ^{CPU}	9	8
High Performance Computing da U. Évora	Oblivion	HPC	4 177 600^{CPU}	10	7
Infraestrutura Nacional de Computação Distribuída	Cirrus-A	HPC/HTC	4 116 856^{CPU}	15	14
	Stratus	CLOUD	1 885 880^{vCPU}	8	3
		TOTAL	35 244 364	129	

Table 1 - Preliminary results of the 1st call on Advanced Computing Projects – by platform

5. FCT CALL - AI 4 COVID / DSAIPA

DataScience and Artificial Intelligence for Public Administration (DSAIPA) calls have been launched since 2018. In April 2020, FCT announced a 3rd of such calls, this time with a specific objective of tackling the Covid-19 pandemic - AI 4 COVID. This was the first research projects funding call in which FCT offered applicants the possibility of requesting RNCA resources and have an extra evaluation score by submitting a data management plan. 11 out of 39 applications requested RNCA resources. Scientific evaluation results are expected to come out in October 2020. More information available at **https://www.fct.pt/apoios/ projectos/concursos/datascience/index.phtml.pt**

The following graph shows the number of computational resources requests submitted to this call, on each of the available HPC clusters. As 3 applications requested more than 1 platform (Eg: HPC and Stratus-Cloud), the sum of all bars is over 11.

The following pie chart shows the amount of requested core.hours in this call, for each of the available HPC clusters. Each application could ask a maximum of 50.000€ equivalent on computational resources, considering the rate of 0,01€/core.hour.

Figure 11. Total core.hours requested on RNCA HPC platforms on DSAIPA 2020 call, before evaluation of proposals

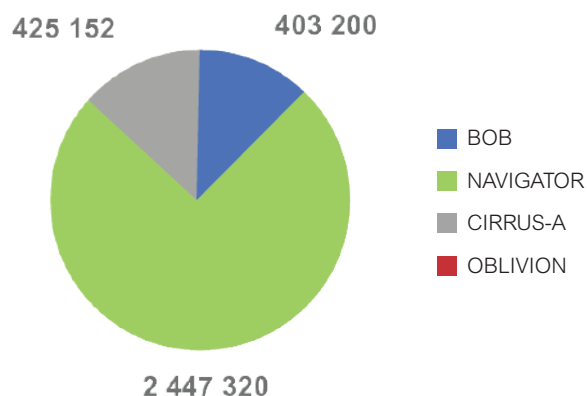The following table entails the 6 out of 12 final approved projects that requested computational resources in AI 4 COVID call. Chosen platforms and RNCA vouchers are shown below for each project:

Figure 10. Number of total applications that requested RNCA computational resources.

Reference	Title	Platform	RNCA Voucher
DSAIPA/AI/0083/2020	THOR - Computer Assisted Thoracic Assessment using POCUS	Cirrus-A	17 879,67 €
DSAIPA/AI/0088/2020	PandIA - Gestão de situações de confinamento com base em informação municipal e social PandIA - Management of Pandemic Social Isolation Based on City and Social Intelligence	Navigator + Stratus-Cloud	4 480,20 €
DSAIPA/AI/0094/2020	Artificial Intelligence and Data Science Supporting Tool for the Detection, Diagnosis and Prognosis of the COVID-19 Disease	Navigator	21 146,64 €
DSAIPA/AI/0111/2020	Artificial Intelligence and Data Science Supporting Tool for the Detection, Diagnosis and Prognosis of the COVID-19 Disease	Navigator	7 528,56 €
DSAIPA/AI/0122/2020	AI-based mobile applications for public health response	Bob+Navigator	2 251,56 €
DSAIPA/DS/0118/2020	Cutting-Edge Virus-Host Interactome Discovery: A Multi-Omics AI Driven Approach	Navigator	13 857,26€

Tabela 2 – 6 AI 4 COVID approved projects with RNCA vouchers (last update: nov 2020)

After technical validation from the operational centers, the sum of all 6 projects listed above totalizes 66 775,40€, an amount funded by FCT to support the operation of the selected platforms. Costs of CPU core.hour, GPU.hour and TB.month of storage were taken into account for each proposal. Average amount per proposal would be 8 346,92€ (min: 2251,56€; max: 21 146,64€). All together, these 6 health related projects have a total of 2.151.772 CPU core.hours allocated in 4 different platforms, making use of HPC and/or Cloud computing.

6. NATIONAL ADVANCED COMPETENCE CENTRES

National advanced competence centres provide Advanced Computing support to research groups and industry, with specialization in different scientific and application areas. To this extent they work has entry gates to the 4 HPC centres, having high storage capacity to prepare and retrieve data from HPC centres through ultrahigh bandwidth connections.

Competence centres hold expertise in analysing data results from computational processes, leveraging on state-of-art visualisation software and hardware. They work in close proximity to industry, including SME's, and researchers working in HE Institutions, Research Centres, CoLabs, AIR Centre, PT.Space, among other institutions.

National advanced competence centres will receive a major boost from the European project EuroCC, described next. Beyond EuroCC other initiatives are under way to promote the activity of this proximity centres.

6.1   EUROCC PROJECT

The EuroCC - National Competence Centres in the framework of EuroHPC - activity will bring together the necessary expertise to set up a network of National Competence Centres in HPC across Europe in 34 participating, member and associated states, to provide a broad service portfolio tailored to the respective national needs of industry, academia and public administrations. All of this to support and increase strongly the national strengths of High Performance Computing (HPC) competences as well as High Performance Data Analytics (HPDA) and Artificial Intelligence (AI) capabilities and to close existing gaps to increase usability of these technologies in the different states and thus provide a European excellence baseline.

The project is led by FCT, participant number 21 in the following list of EuroCC participants - total of 34 NCCs:

N.	Proposer name	Country	Total Cost	%	Grant Requested	%
P1	UNIVERSITAET STUTTGART	wDE	2,357,475	4.01%	1,128,737.5	4.04%
2	Gauss Centre for Supercomputing (GCS) e.V	DE	1,242,187,5	2.20%	621,093.75	2,22%
3	INSTITUTE OF INFORMATION AND COMMUNICATION TECHOLOGIES	BG	995,000	1,77%	497,500	1,78%
4	NIVERSITAT WIEN	AT	1,969,645	3,50%	984,822.5	3,52%
5	SVEUCILISTE U ZAGREBU SVEUCILIN RACUNSKI CENTAR	HR	799,917.5	1,42%	399,958.75	1,43%
6	THE CYPRUS INSTITUTE	CY	1,999,550	3,55%	999,775	3,58%
7	VYSOKA SKOLA BANSKA- TECHNICKA UNIVERZITA OSTRAVA	CZ	1,997,750	3,55%	998,875	3,57%
8	DANMARKS TEKNISKE UNIVERSITET	DK	2,030,625	3,60%	1,000,000	3,58%
9	TARTU ULIKOOL	EE	2,000,000	3,55%	1,000,000	3,58%
10	CSC.TIETEEN TIETOTEKNIIKAN KESKUS OY NATIONAL INFRASTRUCTURES FOR RESEARCH AND TECHNOL-OGY	FI	1,993,098.75	3,54%	996,549.38	3,57%
11	NATION INFRASTRUCTURES FOR RESEARCH AND TECHNNOLOGY	EL	1,800,000	3,19%	900,000	3,22%
12	KORMANYZATI INFORMATIKAI FEJLESZTES| UGY-NOKSEG	HU	2,309,875	4,10%	1,000,000	3,58%
13	NATIONAL UNIVERSITY OF IRELAND GALWAY	IE	1,999,520	3,55%	999,760	3,58
14	CINECA CONSORZIO INTERUNIVERSITARIO	IT	1,982,500	3,52%	991,250	3,55%
15	VILNIAUS UNIVERSITETAS	LT	285,000	0,51%	142,500	0,51%
16	RIGAS TEHNISKA UNIVERSITATE	LV	1,000,000	1,77%	500,000	1,79%
17	UNINETT SIGMA2AS	NO	800,525	1,42%	400,262.5	1,43%
18	NORCE NORWEGIAN RESEARCH CENTRE AS	NO	495,990	0,88%	247,995	0,89%
19	SINTEF AS	NO	700,250	1,24%	350,125	1,25%
20	AKADEMIA GORNICZO- HUTNICZA IM.STANISLAWA STASZICA W KRAKOWIE	PL	2,000,000	3,55%	999,760	3,56%
21	FUNDACAO PARA A CIENCIA E A TECNOLOGIA	PT	2,000,000.5	3,55%	1,000,000	3,58%
22	INSTITUTUL NATIONAL DE CERCETARE-DEZVOL TARE IN INFORMATICA ICI BUCURESTIRA	RO	2,000,000	3,55%	1,000,000	3,58%
23	AKADEMSKA RAZISKOVALNA MREZA SLOVENIJE	SI	2,069,350	3,71%	1,000,000	3,58%
24	BARCELONA SUPERCOMPUTING CENTER- CENTRO NACIONAL DE SUPERCOMPUTACION	ES	1,873,562.5	3,33%	936,781.25	3,35%
25	UPPSALA UNIVERSITET	SE	1,997,092.5	3,54%	998,546.25	3,35%
26	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	CH	1,999,625	3,55%	999,812.5	3,58%
27	TURKIYE BILMSEL VE TEKNOLOJIK ARASTIRMA KURUMU	TR	2,025,375	3,59%	1,000,000	3,58%
28	THE UNIVERSITY OF EDINBURCH	UK	1,991,715	3,59%	995,857.5	3,56%
29	TERATEC	FR	2,000,000	3,54%	1,00,000	3,58%
30	SURFSAR BV	NL	661,250	1,21%	340,625	1,22%
31	CENTRE DE RECHERCHE EN AERONAUTIQUE ASBL-CENAERO	BE	2,000,000	3,55%	1,000,000	3,58%
32	LUXINNOVATION GIE	LU	2,001,250	3,55%	1,000,000	3,58%
33	CENTRUM SPOLOCNYCH CINNOSTI SLOVENSKEJ AKADEMIE VIED	SK	1,198,200	2,13%	599,100	2,14%
34	Se. CYRL AND METHODIUS UNIVERSITY IN SKOPJE	MK	1,825,490	3,24%	912,745	3,27%
Total			56,341,819.2		27,942,671.8	

Figure 12. List of EuroCC participants

FCT work package was structured to tackle the main needs of HPC in Portugal, encompassing the following tasks:

- Management.
- Training and skills development;
- Technology transfer / business development;
- Collaboration with industry;
- Mapping of HPC / Big data / AI Technical competences;
- Facilitation of access to scientific and technical expertise and knowledge pools; and
- Awareness creation and collaboration.

The tasks of the National Competence Centres include mapping existing HPC, HPDA and AI competences, HPC training and the identification of HPC, HPDA and AI experts, as well as the coordination of services such as business development, application support, technology transfer, training and education, and access to expertise. Researchers from academia and industry both benefit from this competence concentration, and more efficient research ultimately benefits the state and national governments and society as a whole.

The National Competence Centres will act as the first points of contact for HPC, HPDA and AI in their respective countries. The NCCs will bundle information and provide experts, offer access to expertise and HPC training and education. The overall objective of EuroCC is to create a European base of excellence in HPC by filling existing gaps and comes with a clear vision: offering a broad portfolio of services in all HPC, HPDA, and AI-related areas, tailored to the needs of industry, science, and public administrations.

FCT is the national coordinator and will carry other supporting tasks. All participants except FCT will provide two lines of services: (1) proximity regional support for advanced computing usage, including local guidance and consulting, basic usage training, service dissemination and facilitating access to testbeds wherever they are available; and (2) specialized consultancy and training, considering each participant's skill set and user community's needs. Besides these services each partner will fulfil EuroHPC's roles within the project.

In Portugal, the Euro-CC project will be composed of linked third parties that will contribute to the development of the tasks presented:

Work number Package	19		Lead Beneficiary:			FCT			
Work package title	Competence Centre Portugal								
Participant No	21	TP	TP	TP	TP	TP	TP			
Participant Short Name	FCT	UCoimbra	LIP	UMinho	UPorto	ULisboa	UÉvora			Total
Person- Months	43	72	65	96	72	72	48			468
Start Month	1						End Month		24	

Figure 14. summary description of EuroCC WP19 - Portugal

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Linked third parties are mainly Portuguese large universities, except LIP that is the national Laboratory of Instrumentation and Experimental Particle.

Portuguese HPC centres have been in the past decades distributed on the organizations that most need them, namely universities and other organizations of the science and technology national systems, and, alongside with the physical resources, so have been the expertise necessary to exploit those resources.

Being a distributed competence centre, it will be a challenge to coordinate the effort effectively and efficiently from 6 different partners. To address this circumstance, FCT, the coordinating organization, will reinforce its staff and put in place close communication loops with the participating organizations.

Envisaged Status of the Competence Centre after the two years: There will be a national competence centre on advanced computing in Portugal, leveraging and expanding current expertise on these subjects, which will significantly increase the usage of advanced computing in Portugal, for the scientific, technological and innovation/industry systems. The competence centre will provide and transfer know how to users in order for them to use advanced computing resources, national and international. It will be geographically distributed and coordinated by a national consortium leader. Each consortium member will have an assigned geographic area to cover for support and training responsibilities, and, additionally, will have one or more areas of specialization, such as specific HPC application support, or project management duties. Portugal intends to leverage the current cooperation it has with international centres as BSC   Barcelona Supercomputing Centre – and TACC   Texas Advanced Computing Centre – to bootstrap its competence centre, with such components as tutorials, teaching materials, tools, methodologies, procedures and consultancy services. Within 2 years, the competence centre, through its promotional and supporting activities, will tripe industry advanced computing use

cases. At the end of the project, there will be an increase in HPC usage from areas of knowledge not traditionally associated with HPC usage, thus a more widespread usage of competences by areas of knowledge. The competence centre will also leverage more quickly emerging computing techniques applied to HPC, such as deep learning, AI, or virtual environments with near real time access to HPC resources. User communities will be more informed on best practices on such domains as data management, life cycle and security issues.

7. ADDITIONAL COMPETENCE AND VISUALIZATION CENTRES

Seven new competence and visualization centres are planned to join RNCA in 2021-22:

• Algarve University - visualization equipment was purchased by FTC and installed in August 2020. It is starting operations, the Advanced Computing Visualization Centre of the University of Algarve, which will collaborate in the processing of data produced by the operational centers of the National Advanced Computing Network (RNCA).

• Porto University – A technical project was developed in 2019 to install visualization and multimedia equipment. The purchase and setup of this equipment had to be postponed. Until the end of 2020 the final agreement will be finalized. It is expected that this centre will become operation in the first hall of 2021.

• Técnico - Lisboa University – A technical project was developed in 2019 to install visualization and multimedia equipment. The purchase and setup of this equipment had to be postponed. Until the end of 2020 the final agreement will be finalized. It is expected that this centre will become operation in the first hall of 2021.NONAGON in Azores - Aspires to be an international reference in the development of human, technological, business and social capital, sustained on knowledge, technology and innovation, with special regard to skills and entrepreneurial dynamics, being the first Science and Technology Park of the Autonomous Region of the Azores, located in the city of Lagoa, São Miguel Island. NONAGON is starting an engagement process to join RNCA.

• Aveiro University, Universidade da Beira Interior (UBI) and Universidade de Trás-os-Montes e Alto Douro (UTAD) are also planned to become future RNCA competence centres, thus making the national network wider and with better connections to more people and entities.

8. RISC2 PROJECT - HPC RESEARCH COORDINATION BETWEEN EUROPE AND LATIN AMERICA

High-Performance Computing (HPC), used to be promoted mainly by the big science and defense communities. However, with the recent advent of AI and IoT, wider use of HPC is bringing new benefits to areas such as industry, healthcare and the economy. All regions now see intense investments in HPC as an essential in order to compete globally. In this context, coordination and capacity sharing between allied regions is crucial.

The RISC2 project will gather eight keys European HPC actors, and the main HPC actors from Brazil, Mexico, Argentina, Colombia, Uruguay, Costa Rica and Chile, to encourage stronger cooperation between their research and industrial communities on HPC applications and infrastructure deployment. The work plan is well organized into five work packages and will be advised by an external Board made up of distinguished experts from Latin America and Europe.

RISC2 will promote exchange of best practice through meetings, workshops and training, organized to coincide with major HPC events in Europe (like ISC and EuroHPCSW) and in Latin America (like CARLA and ISUM). RISC2 will build on the already strong relationships of the consortium partners; on the results of the previous RISC project, and on the use of platforms like the Ella link Subsea Cable **https://ella.link/.**

The main project deliverable will be a cooperation roadmap aimed at policymakers, the scientific community and industry, identifying key

application areas, HPC infrastructure and policy requirements, and exploring ways for the activities established during the project to last beyond its lifetime. RISC2's activities and results will be disseminated widely through dedicated project communication tools and will take advantage of existing platforms such as Campus Iberoamerica. The training carried out in the project will help capacitate Latin American HPC, and the structured interaction between researchers and policymakers in both regions will reinforce links and help define a coordinated policy and a clear roadmap for the future.

Noted are participants number 7 and 8 in the follow list of project members.

N	Proposer Name	Country	Total Cost	%	Grant Requested	%
1	BARCELONA SUPERCOM-PUTING CENTER-CEN-TRO NACIONAL DE SUPERCOMPUTACION	ES	192,125	38,42%	192,125	38.43%
2	CENTRO DE INVESTIGA-TIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNLOGICAS- CIEMAT	ES	10,083.75	2,02%	10,083.75	2,02%
3	FORSCHUNGSZENTRUM JULICH GMBH	DE	179,310	35.87%	179.310	35.87%
4	INSTITUT NACIONAL DE RECHERCHE ENINFOR-MATIQUE ET AUTOMA-TIQUE	FR	22,846.25	4,57%	22,828.25	4,57%
5	BULL SAS	FR	14,141.25	2,83%	14,141.25	2,83%
6	CINECA CONSORZIO INTERUNIVERSITARIO	IT	11.250	2,25%	11,250	2,25%
7	UNIVERSIDADE DE CO-IMBRA	PT	12,656.25	2,53%	12,658.25	2,53%
8	INESC TEC- INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTA-DORES, TECNOLOGIA E CIENCIA	PT	26,250	5,25%	26,250	5,25%
9	FACULTAD DE CIENCIAS EXACTAS Y NATURALES DE LA UNIVERSIDAD DE BUENOS AIRES	AR	6,250	1,25%	6,250	1,25%
10	UNIVERSIDAD INDUSTRI-AL DE SANTANDER	CO	6,250	1,25%	6,250	1,25%
11	UNIVERSIDAD DE LA REPUBLICA	UY	6,250	1,25%	6,250	1,25%
12	LABORATORIO NATION-AL DE COMPUTAÇÃO CIENTíFICA	BR	0	0,00%	0	0,00%
13	CENTRO DE INVESTI-GACION Y DE ESTU-DOS AVANZADOS DEL INSTITUTO POLITECNICO NACIONAL	MX	0	0,00%	0	0,00%
14	UNIVERSIDAD DE CHILE	CL	6,250	1,25%	6,250	1,25%
15	ESTUDOS TECNOLOGI-COS COPPETEC	BR	0	0,00%	0	0,00%
16	FUNDACION CENTRO DE ALTA TECNOLOGIA	CR	6,250	1,25%	6,250	1,25%
Total			499,912.5		499,912.5	

Figure 15 – List of participants on RISC2 project

9. BIGHPC PROJECT – THE MANAGEMENT FRAMEWORK FOR CONSOLIDATED BIG DATA AND HPC

The BigHPC project, developed by INESC TEC's and UMinho's High Assurance Software Laboratory (HASLab) aims to create an integrated platform that favours the efficient and low-cost management of advanced computing centres, particularly concerning parallel and Big Data applications.

"The results of this project will help improving the competitiveness of HPC centres and companies that own data centres, through a more efficient computational resources management that will reduce financial costs and improve the performance of the advanced computing services provided. Consequently, it will be possible to better the experience of users who resort to said services, so they can obtain results from their data analysis more quickly. For instance, these benefits will be crucial to accelerate scientific discoveries in different fields i.e. healthcare (genomics, virology, etc.) and the environment (prevention of natural disasters). Moreover, the outcomes will help improving the analysis and decision-making competences of

companies that use HPC services to support these and other industrial processes, thus improving the competitiveness of the national industry", said João Paulo, researcher at HASLab.

Wavecom leads the BigHPC project, in partnership with INESC TEC, the Laboratory of Instrumentation and Experimental Particle Physics (LIP), the MACC, the University of Texas at Austin (UT Austin) and the TACC. According to the estimates, the project will last until March 2023. The total project budget is close to 2M€.

More info: bighpc.wavecom.pt , **https://utaustinportugal.org/projects/bighpc/**

Source: BIP INESCTEC Magazine and UTAustinPortugal

10. DEUCALION PROJECT

A new supercomputer called "Deucalion", co-financed by European funds as part of the EuroHPC Joint Undertaking, is going to be acquired and installed at the Minho Advanced Computing Centre in Portugal, with operations to begin by 2021.

The following pictures are evocative of the European process that led to the Deucalion project, which starter from the Portuguese + Spain original Deucalion proposal to EuroHPC Joint Undertaking (picture on the left), signing event of the grant agreement that took place in November 2019, in Strasbourg (picture in the middle), with all countries involved in EuroHPC's calls.

Deucalion will be making a fundamental contribution to the development of both European and Portuguese HPC capabilities across various disciplines and at different levels. It will support and foster research and innovation into the co-design of HPC systems, from their implementation all the way to their optimisation and exploitation. Furthermore, it will build capacity in the management and operation of HPC systems. Finally, it will foster the creation, expansion and consolidation of computational engineering and innovation teams and centres on European and national high-priority scientific domains requiring either large-scale digital simulations or very large-scale data management and processing.

Deucalion is expected to enter the TOP 100 GREEN500 international ranking, due to its advanced design that incorporates traditional microprocessor technology with low power and high-performance microprocessors, based in ARM and also GPUs.

Due to problems with the original datacentre envisioned to house Deucalion, that were communicated officially to EuroHPC, a new data centre was found and FCT is currently working to develop the site to house Deucalion.

Figure 16 – About Deucalion

11. MARENOSTRUM 5 PROJECT

The following picture is evocative of the Spanish led project "Mare Nostrum 5", in which Portugal participates along with other countries. Mare Nostrum 5 proposal was submitted to EuroHPC only a few days early than the Deucalion proposal.

Figure 17 – Infographic about MareNostrum 5

Barcelona Supercomputing Center, BSC, will host a new supercomputer, MareNostrum 5, with 200 Petaflops. BSC will be one of three European centres to house pre-exascale supercomputers promoted and co-funded by the European Commission (EC). Portugal has a 5% contribution in the project, that will correspond to the same percentage of capacity available in Mare Nostrum 5 to Portuguese user communities under FCT access rules. Besides this immediate counterpart on machine access time, there is a firm will on both countries to cooperate on matters related to advanced computing, that was translated to a sectoral Memorandum of Understanding signed in the XXX Portuguese-Spanish Summit, that created the Iberian Advanced Computer Network (RICA).

12. OTHER FUNDING INSTRUMENTS

From 2016 to 2020, FCT has funded Advanced Computing research through other funding instruments, namely Scientific Employment Stimulus contracts and Research Infrastructures development grants.

A total 72 Scientific Employment Stimulus contracts were awarded, totalling 12,7 M€ and a total 30 Research Infrastructures were funded, totalling 56,3M€.

13. REPRESENTATION IN ADVANCED COMPUTING EUROPEAN PROGRAMS AND PARTNERSHIPS

13.1 PRACE

PRACE (Partnership for Advanced Computing in Europe) is a European supercomputing infrastructure which is an international not-for-profit association under Belgian law, with its seat in Brussels, founded in 2010.

PRACE has 26 members and two observers and it is governed by the PRACE Council in which each member has a seat **(see http://www.prace-ri.eu/).**

Figure 18 - PRACE member as 31/12/2019. Source: PRACE annual report 2019

Portugal has been participating in the PRACE activities since the beginning and was a founding member of the PRACE association. It is represented by the University of Coimbra with a mandate endorsed by FCT and has, as third parties, IST and Universidade de Évora. For the current PRACE-6IP project, Universidade do Porto and Universidade do Minho will also join as third parties.

Although at this time it is not yet clear what will be the extension of PRACE's role in the EuroHPC era, for sure most of its activities will continue in some form. Therefore Portugal has to participate in PRACE so that it can develop the full spectrum of activities connected to HPC, namely, among others, CPU time allocation, training, testing and scaling application software, user support at increasing levels, explore new technologies in software and hardware. Since the main European HPC players are in PRACE, the access to their knowledge and competences allows also to further develop all aspects of HPC services and competences in Portugal.

PRACE is already looking into the developments of the emerging field of High Performance Data Analytics, the new workflows for Artificial Intelligence and Machine Learning. Other very

important aspects are the collaborations with large experimental facilities, which generate massive amount of data that must be processed. Since Portugal is participating in some of these experiments, the participation in PRACE is again an added value.

Finally, the involvement of Portugal in PRACE, since more than 10 years, has accumulated a capital of experience that could and should be used and developed for a successful implementation of increasingly more sophisticated and diverse HPC services in our country, including data services.

13.2 PRACE AWARDED ADVANCED COMPUTING PROJECTS

Over the years dozens of Portuguese participants have been awarded with PRACE projects with over 600 M core.hours being used between 2010 and 2019.

In 2020, the project TOOLING4G |Minimize the airflow generated noise on automotive HVAC systems", was the first Portuguese project approved in the program SHAPE of PRACE (Partnership for Advanced Computing in Europe). In **https://www.uc.pt/lca/news_source/news_calls/project_SHAPE**
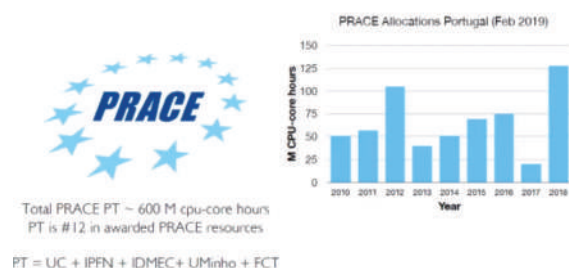

Figure 20. Infographic on PRACE Portuguese participation (2019, Luís O. Silva, ACP. 2030)

13.3 EUROHPC

The EuroHPC JU was established by Council Regulation (EU) 2018/1488 in 2018. 32 European countries are currently taking part in the initiative and pooling their resources with the EU and private partners to enable the EU to become a world leader in supercomputing.

The mission of the EuroHPC JU is to develop, deploy, extend and maintain an integrated world-class supercomputing and data infrastructure in the European Union (EU) and to develop and support a highly competitive and innovative HPC ecosystem.

The EuroHPC JU aims at equipping the EU by early 2021 with an infrastructure of petascale (capable of at least 1015 calculations per second) and precursor to exascale supercomputers (capable of at least 1017calculations per second), and developing the necessary technologies and applications for reaching full exascale capabilities around 2022 / 2023.

The Portuguese Member at the Governing Board is João Nuno Ferreira, from FCT.

13.4 EUROHPC AWARDED ADVANCED COMPUTING PROJECTS

Among the 38 received proposals in response to the call "Towards Extreme Scale Technologies and Applications" (H2020-JTI-EuroHPC-2019-1) launched in July 2019, 19 proposals have been selected. With a total budget of EUR 55 million, provided by the EU and complemented with additional funds by the EuroHPC Participating States, the proposals will support research and innovation activities that will help Europe to become globally competitive in the field of supercomputing.

Portugal is present in 2 successful projects: ExaFOAM and SPARCITY.
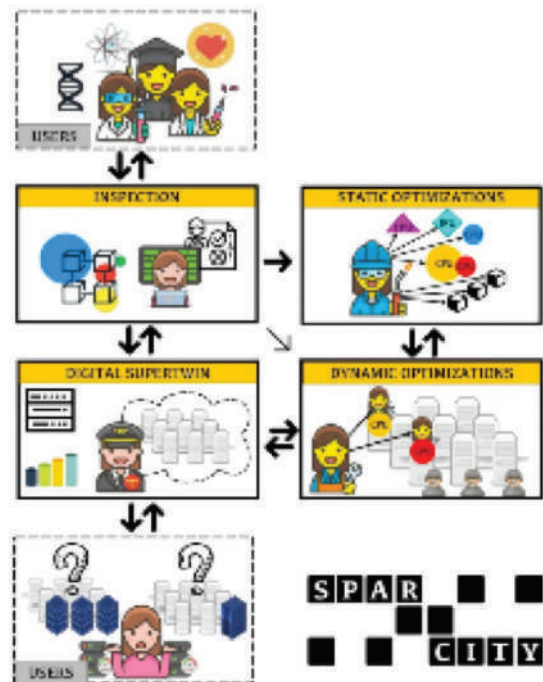
Source: https://ec.europa.eu/

Funding from	Call	Reference	Name	Institution
EuroHP-C+FCT (50%:50%)	H2020-JTI-Eu-roHPC-2019-1	956416	ExaFOAM	U. MINHO
EuroHP-C+FCT (50%:50%)	H2020-JTI-Eu-roHPC-2019-1	956213	SPARCITY	INESC ID

Table 3 – Portuguese awarded projects at EuroHPC calls

Figure 21 – About SPARCITY project (Credits: INESC ID)

More information here **https://www.fct.pt/jti/ eurohpc/index.phtml.pt**
and also here **https://www.inesc-id.pt/inesc-id- most-recent-h2020-achievement-sparcity/**

Under Horizon2020 programme, before the EuroHPC JU was operational, there was a call for the 1st phase of development of the future European processor. Técnico, from Lisbon University, is a member of the EUROPEAN PROCESSOR INITIATIVE (EPI) and became beneficiary in the awarded grant (cordis.europa. eu/project/id/826647). The 2nd phase call is now open, through EuroHPC and it's expected the continuation of the national participation in the major development effort.
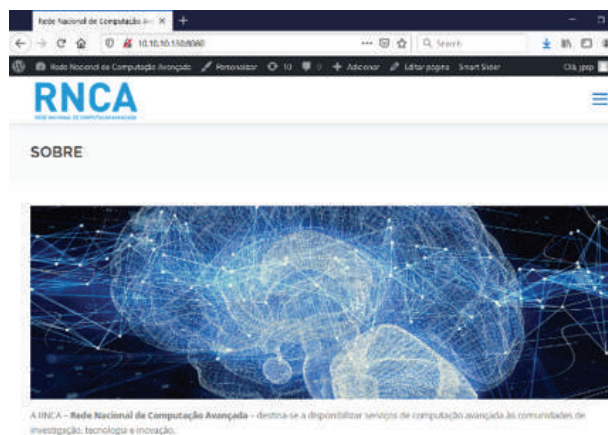

Figure 22 – Snapshot of the new RNCA website, soon to be active

14. RNCA COORDINATION AND OTHER ACTIVITIES

RNCA efforts are being coordinated by FCT. For that effect a team is being consolidated from an existing FCT organization unit, that has hired two full time employees, both women, one in 2019 and other in 2020.

In 2020 RNCA's internal regulation is to be published in the Republic Official Journals, and, after that, FCT should nominate positions there in inscribed, such as access committee members and a RNCA general coordinator.
The following picture presents a dedicated website that is being developed for RNCA, expected to go online until the end of the current year.

It was developed an online system for RNCA's operational centres to deposit statistics related to community runs on its platforms. A related database was developed from which FCT extracts indicators about RNCA usage levels, available at https://www.fccn.pt/computacao/rnca/ . In 2020 further processes will be developed to receive reports on the execution phase of the first FCT Call on Advanced Computing Projects in 2020.

Preparations for a second FCT call on Advanced Computing Projects should start in 2021, reviewing call rules in light of knowledge gathered on the first call, organizing evaluation panels and prepare a new, more supportive, information system.

FCT's financial supported the 1st national call for advanced computing. For a 2nd national call, new financial support is to be procured in 2021.

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