EuroHPC
Joint Undertaking

EuroHPC JU CONSOLIDATED ANNUAL ACTIVITY REPORT 2022

ANNEX TO GB DECISION NO 12/2023

CONSOLIDATED

ANNUAL ACTIVITY REPORT

2022

In accordance with Article 19 of Council Regulation (EU) 2021/1173 of 13 July 2021 and with Article 23 of the Financial Rules of the EuroHPC JU.

The Consolidated Annual Activity Report will be made publicly available after its approval by the Governing Board.

TABLE OF CONTENTS

FACTSHEET

Name of the JU	European High Performance Computing Joint Undertaking
Objectives	Council Regulation (EU) No 2021/1173 of 13 July 2021: The Joint Undertaking shall have the following overall objectives: (a) to contribute to the implementation of Regulation (EU) 2021/695 and in particular Article 3 thereof, to deliver scientific, economic, environmental, technological and societal impact from the Union's investments in research and innovation, so as to strengthen the scientific and technological bases of the Union, deliver on the Union strategic priorities and contribute to the realisation of Union objectives and policies, and to contribute to tackling global challenges, including the Sustainable Development Goals by following the principles of the United Nations Agenda 2030 and the Paris Agreement adopted under the United Nations Framework Convention on Climate Change (b) to develop close cooperation and ensure coordination with other European Partnerships, including through joint calls, as well as to seek synergies with relevant activities and programmes at Union, national, and regional level, in particular with those supporting the deployment of innovative solutions, education and regional development, where relevant; (c) to develop, deploy, extend and maintain in the Union an integrated, demand-oriented and user-driven hyper-connected world-class supercomputing and data infrastructure; (d) to federate the hyper-connected supercomputing and data infrastructure and interconnect it with the European data spaces and cloud ecosystem for providing computing and data services to a wide range of public and private users in Europe; (e) to promote scientific excellence and support the uptake and systematic use of research and innovation results generated in the Union; (f) to further develop and support a highly competitive and innovative supercomputing and data ecosystem broadly distributed in Europe contributing to the scientific and digital leadership of the Union, capable of autonomously producing computing technologies and architectures and their integration on leading computing systems, and advanced applications optimised for these systems; (g) to widen the use of supercomputing services and the development of key skills that European science and industry need
Legal Basis	Article 187 of the Treaty on the Functioning of the European Union and Council Regulation (EU) 2021/1173 of 13 July 2021 on establishing the European High Performance Computing Joint Undertaking and repealing Regulation (EU) 2018/1488

Executive Director	Anders Dam Jensen
Governing Board	Chair on 31 December 2022: Dr Herbert Zeisel, elected in October 2021. Members: one representative of the EU and each Participating States. See Annex 4
Other bodies	The Industrial and Scientific Advisory Board consists of the Research and Innovation Advisory Group (RIAG) and the Infrastructure Advisory Group (INFRAG)
Staff number	24 full time employees including the Executive Director as of 31 December 2022. Recruitments ongoing to fill the posts provided in the Regulation.
Total Budget 2022 [1]	Commitment appropriations: €1.374.456.640,65 Payment appropriations: € 629.887.243,91
Budget implementation / execution	Commitment appropriations: total consumption: amount (in € and percentage spent on total) Title 1: Staff– €4.699.801,29 – 52,9 % consumed Title 2: Administrative – €3.516.922,89 – 34,5% consumed Title 3: Operational – €1.366.239.916,47 – 79,3% consumed Payment appropriations: amount (in € and percentage spent on total) Title 1: Staff– €4.802.209,95 – 46,8% consumed Title 2: Administrative – €3.383.328,01 – 23% consumed Title 3: Operational – 621.701.705,90 – 24,3% consumed
Grants	In 2022, 13 grants signed for a total value of 141,741,201€
HPC Infrastructure	The following systems are operational in 2022: • Vega, hosted by IZUM in Maribor, Slovenia • MeluXina, hosted by LuxProvide in Bissen, Luxembourg • Discoverer, hosted by consortium Petascale Supercomputer Bulgaria in Sofia, Bulgaria • Karolina, hosted by IT4Innovations in Ostrava, Czech Republic

[1] Total budget includes operational budget (used for funding selected projects) & administrative (used for funding Programme Office activities)

	• LUMI, hosted be CSC in Kajaani, Finland The following systems are underway: • Leonardo, hosted by CINECA in Bologna, Italy (available through for pre-production through an early access programme, expected to be fully operational in 2023) • Deucalion, that will be installed by MACC in Guimaraes, Portugal • MareNostrum 5, to be hosted by Barcelona Supercomputing Center in Spain In 2022, the EuroHPC Governing Board approved the selection of Hosting Entities for 5 new systems: JUPITER, the first EuroHPC exascale system, to be hosted at the Jülich Supercomputing Centre, Germany A further four sites have also been selected to host mid-range supercomputers with petascale or pre-exascale capabilities in Greece, Hungary, Ireland and Poland.
Quantum Computing **Infrastructure**	In 2022, the Governing Board selected six hosting sites to host and operations the EuroHPC Computers: Czechia, Germany, Spain, France, Italy, and Poland. The Governing Board also approved funding to allow for Discoverer and Leonardo to be upgraded in 2024.
RIAG **Strategic Research & Innovation Agenda**	EuroHPC_RIAG_Strategic_Agenda_2019_0.pdf (europa.eu) (as required under Regulation 2018/1488.[2])
INFRAG **Multiannual Strategic Agenda**	Multiannual Strategic Agenda (europa.eu) (First version adopted in October 2021 and under review as of December 2022.)
MASP **Multiannual Strategic Plan**	Decision 24_2021_MASP 2021-2027.docx (europa.eu) The MASP was developed during 2021 and adopted by the Governing Board in September 2021. An updated MASP will be approved in 2023.

[2] Council Regulation (EU) 2018/ 1488 establishing the European High Performance Computing Joint Undertaking (europa.eu)

Call implementation	Number of calls launched in 2022: 3 Number of proposals submitted: 22 Number of eligible proposals: 19 Number of proposals granted: 13 Number of global project portfolio as of end of 2022 (since the setting up; signed grant only; for evolution overview): 40 There were also three Calls for Expression of Interest (COI) to select hosting entities for: • A Second Exascale HPC • A number of Mid-Range HPCs • A number of Quantum Computers Furthermore, 5 calls were adopted in the Work Programme 2022 in December 2022 and formally launched in 2023.
Participation, including SMEs	Total number of beneficiaries in funded projects: 417[3] of which: 10% of SMEs 8% of private for profit/large companies

[3] Number of beneficiaries involved in R&I projects allocated under both Regulation 2018/1488 and new Regulation 2021/1173.

FOREWORD

2022 was the year the world finally started to reopen after the lockdowns due to the Covid-19 pandemic. The EuroHPC Joint Undertaking was amongst the first to invite the European HPC community to, once again, meet face to face at the EuroHPC Summit in Paris in March 2022, organised with the help of PRACE, the Partnership for Advanced Computing in Europe. This event was only the first of many European HPC events in 2022 and reminded us all what we had been missing. It helped establish the mission of the EuroHPC JU with its old and new stakeholders, and enabled the European HPC community to back come together.

In May 2022, we saw concrete evidence that the EuroHPC JU was delivering on the mission and the strategy set out by the European Commission and Participating States in 2018, when the LUMI supercomputer was ranked as number three in the world on the TOP500 list and number one in Europe. This achievement was soon followed up with the ranking of the Leonardo supercomputer, as number four in the world, and number two in Europe, in November 2022. Never before in the history of the TOP500 list, has Europe had two supercomputers in its top 5.

The LUMI and Leonardo supercomputers joined the family of EuroHPC systems available to researchers and industry across Europe. This family already had four operational petascale systems. A total of 874.667.077 core hours was awarded to users in Europe on the operational systems in 2022. To allocate time on these machines, the EuroHPC JU has been helped by PRACE. In June 2022, the Governing Board decided that this critical function was better handled from within the Joint Undertaking and with the support and experience of PRACE, the Joint Undertaking started building up its own peer-review capability. The Joint Undertaking will continue to work with external experts to assess projects and ensure that world class scientific excellence research is undertaken on EuroHPC systems.

2022 was also the first year for the JU to implement the new 2021 founding Regulation. Due to the delay in adopting the new Regulation, and consequently the Work Programme 2022, the JU was not able to start the implementation of the new regulation until December 2021, including growing the team. 2022 was therefore a year where the JU prioritised recruitment and the team grew from 10 staff members to 23 staff in post and 4 interim agents, with another three due to start in early 2023. This was only possible with the help and excellent collaboration

with the staff organisation of the Commission who provided the required Staff Committee representation on the many recruitment panels that were organised.

The implementation of the new Regulation also included a new and exciting area of responsibility for EuroHPC JU, namely the development of quantum infrastructure for Europe. Over the years to come, the Joint Undertaking will invest in quantum computers across Europe and make them available to European researchers just like the JU is now doing for supercomputers. The first six sites to host EuroHPC quantum computers were selected in June 2022 and the procurements will be launched in 2023.

The new Regulation also meant further investments in EuroHPC supercomputers. In June 2022, EuroHPC JU therefore selected further sites to host EuroHPC mid-range supercomputers, as well as the first site to host a EuroHPC exascale supercomputer. The JU also selected the new generation of HPC Centres of Excellence for the development of exascale HPC Applications, the national Competence Centres who will attract users to the HPC ecosystem and launched the European HPC Masters Programme.

Finally, 2022 marked the end of the court case brought against EuroHPC Joint Undertaking by Lenovo Global Technology Belgium BV. The European Court cleared the JU of any wrongdoing and confirmed that EuroHPC procurements, which include the EU added value concept, are inline the EU procurement rules. As a result, Lenovo was ordered to pay the JU's legal costs.

To conclude, 2022 was another very busy year for the Joint Undertaking and its small staff. It was a year focused on our external stakeholders, making EuroHPC's world leading supercomputers available and accessible to European science, and building the organisation ready for new challenges. Behind the scenes, the EuroHPC finance team of the Joint Undertaking, managed to ensure that all activities were conducted in accordance with EU rules and regulations resulting in a clean audit opinion. All of these achievements were only possible due the hard work of each and every EuroHPC staff member and the great teamwork within the Joint Undertaking, as well as the huge support of the European Commission, the EuroHPC Governing Board, the Research and Innovation Advisory Board, and the Infrastructure Advisory Board and other key stakeholders such as the European Cout of Auditors and of course the HPC Community.

Anders Dam Jensen

Executive Director, EuroHPC JU

EXECUTIVE SUMMARY

2022 marked a significant milestone for the European high-performance computing (HPC) community. For the first time, two of the five fastest and most powerful supercomputers in the world were European machines, procured by the EuroHPC JU.

In 2022, the JU's first two pre-exascale supercomputers were inaugurated. LUMI, in Finland in June and Leonardo, in Italy in November. In November 2022, the TOP 500 list, a biannual ranking of the 500 most powerful supercomputer in the world, was released and placed LUMI and Leonardo in third and fourth place respectively. This ranking confirmed Europe's growing presence on the global supercomputing stage and its place among the world leaders in HPC.

In its second full year of autonomy, the EuroHPC JU continued to grow and further cement its ability to deliver on its mission to lead the way in European Supercomputing.

OPERATIONAL ACHIEVEMENTS

In 2022, five supercomputers were operational: LUMI , Vega, MeluXina , Karolina, and Discoverer. Leonardo was inaugurated and was made available through an early access programme. While LUMI and Leonardo achieved top rankings, all operational EuroHPC supercomputers were ranked among the top 140 systems on the TOP 500 list of the world most powerful supercomputers in the world.

All EuroHPC systems were also ranked on the Green 500 list, which ranks the 500 most powerful supercomputers by order energy efficiency. LUMI is ranked in top ten greenest supercomputers in the world.

All operational EuroHPC systems are ranked among the world's most powerful &energy efficient supercomputers and are accessible to users located across Europe.

The EuroHPC JU continued to expand its fleet of supercomputers:

The effects of the COVID-19 pandemic, having caused significant disruption throughout 2020 and 2021, had affected the progress of procurement of Leonardo, MareNostrum5 and Deucalion. Nevertheless, the installation of Leonardo began and was able to be completed in 2022, with its inauguration taking place on 24 November 2022 and full acceptance expected for 2023.

The vendor for MareNostrom5 was selected and the installation of the machine began in Spain, at the Barcelona Supercomputing Centre. MareNostrum5 will be inaugurated in 2023.

With regards to Deucalion, the system to be hosted in Portugal, the Portuguese Government identified a data centre and the system is due to be installed in 2023.

Under the framework of the "new" Regulation 2021/1173, the EuroHPC JU Governing board selected hosting entities for five new EuroHPC supercomputers. This selection included hosting sites for four mid-range (petascale) systems in Greece, Hungary, Ireland and Poland, as well as the hosting entity for EuroHPC's first high-end (exascale) supercomputer.

Named JUPITER, this new exascale system will be hosted at the Jülich Supercomputing Centre in Germany. With its ability to perform over a billion billion calculations per second, JUPITER's procurement represents a significant technological milestone for Europe and will have a major impact on European research and scientific excellence. The hosting agreement for JUPITER was signed in December 2022 and installation is due to start in 2023.

At the end of 2022, the JU launched a call of expression of interest to identify a hosting entity for a second exascale supercomputer as well as for further mid-range systems.

The Governing Board also approved the selection of hosting entities for six quantum computers, to be procured in 2024. The six hosting entities for the first European quantum computers will be located in Czechia, France, Italy, Germany, Poland and Spain.

Following the launch of a research and innovation (R&I) call for Centres of Excellence (CoEs) for HPC applications, ten projects were selected with a purpose support the transition to exascale computing by developing and scaling up existing computing codes for exascale performance. In doing so, they will ensure that future exascale EuroHPC systems are accessible to European researchers and industries. The ten CoEs will kick off in early 2023.

The EuroHPC JU also funded two projects to further deploy the European network of national HPC competence centres (NCCs). The competence centres coordinate HPC expertise at national level and enable access to European HPC opportunities for research and scientific users, public administration, and industry, in particular SMEs, delivering solutions for a wide variety of users across Europe. These two flagship projects, EuroCC and CASTIEL will set up and run a network of NCCs in HPC collaboration and cooperation between these centres. The next phase of these two projects is due to begin at the start of 2023.

A Training and Education Call (EUMaster4HPC) was awarded to a consortium led by the University of Luxembourg to launch a pan-European Masters programme in HPC, in coordination with seven European universities. The project was launched on 1 January 2022. Since the preparation of the Grant Agreement with the Consortium of the Universities could not be concluded before this latest possible start date, the Authorising Officer in accordance with Article 193 of the Financial Regulation exceptionally authorised a retroactive start date of the project of 1 January 2022 to allow the Consortium to declare costs from this date and launch the action. Applications opened in February 2022. In September 2022, the first intake of 20 EUMaster4HPC students from across the EU started their first classes in the two year course.

The JU also launched a call on HPC software algorithms to develop novel algorithms to exploit the full potential of the upcoming European exascale supercomputers.

In 2022, the JU continued to manage its portfolio of ongoing R&I projects in different disciplines including development of new HPC technologies and novel applications covering areas such as health, climate modelling and engineering as well as training and skills in HPC.

The EuroHPC Governing Board decided to upgrade the Discoverer and Leonardo supercomputers.

In 2022, the JU organised a number of calls in order to provide European scientists and SMEs with access to the computing resources of the EuroHPC JU for large-scale European projects that have important needs in terms of compute time, data storage, and support resources. In 2022, 50 scientific projects were submitted in the fields of Biochemistry, Bioinformatics, Life Sciences, Physiology and Medicine, Chemical Sciences and Materials, Solid State Physics, Computational Physics: Universe Sciences, Fundamental Constituents of Matter and Engineering, Mathematics and Computer Sciences. By end 2022, these projects were allocated 874.667.077 core hours on the HPC systems, meaning all operational systems were fully allocated.

ADMINISTRATIVE UPDATE

In June 2022, Serbia became a new Participating State of the JU. The Governing Board met regularly, with six meetings taking place throughout 2022, both in hybrid and virtual meetings.

From an HR perspective, the EuroHPC JU continued to grow and establish itself, with 10 staff members being recruited over the course of 2022. By the end of the year, it had 23 staff in post and 4 interim agents supporting the work of the JU. Further staff members are scheduled to start work at the JU in early 2023, and several ongoing recruitment processes are underway.

The EuroHPC JU Governing Board agreed that EuroHPC JU could, where necessary, engage in Back Office Agreements (BOA) agreements with its sister JUs. Following the DG Budget's Decision to stop providing Accountancy Services, EuroHPC JU agreed to join the BOA Accountancy Services which is being provided by EU-RAIL JU.

Following the concerns raised by the European Court of Auditors (ECA), the Commission provided legal and financial guidance to all JU on employer contributions to staff pensions. It is estimated that EuroHPC JU will pay ca. EUR 5.7 million over the lifetime of the JU. Funds will come from EU contributions to the administrative budget of the JU.

In 2021, Lenovo Global Technology Belgium BV launched a complaint to the European Court of Justice about EuroHPC JU procurement for Leonardo, and requested an annulment of the procurement procedure for the Leonardo supercomputer to be installed in Italy. In 2022, the case was finalised following the European Court of Justice's ruling in favour of the EuroHPC JU. On 29 June 2022, the parties attended the hearing before the General Court to receive judgment, and subsequently by Judgment of 19 October 2022, the General Court dismissed the action brought by Lenovo and ordered Lenovo to bear its own costs and to pay those

incurred by EuroHPC. The Court confirmed that the JU had followed the correct procedures and confirmed the principle of ‘EU added value’ criteria should be part of the procurement evaluations. The Court therefore asked that Lenovo pays all the costs incurred in the case.

1. IMPLEMENTATION OF THE ANNUAL WORK PROGRAMME 2022

1.1. KEY OBJECTIVES 2022, ASSOCIATED RISKS AND CORRECTIVE MEASURES

The EuroHPC JU's key objectives for the year 2022 were established in the Annual work plan approved by the Governing Board[4]. The work plan was regularly amended to encompass the changes and requirement agreed by the Governing Board. All calls are synergy calls and can be linked with ERDF and with RRF funds.

Key Objectives of Pillars

In 2022, the following objectives were established at operational level for the Infrastructure Pillar:

- Launch of a procurement procedure for the acquisition and operation of the first EuroHPC high-end (exascale) supercomputer,
- Launch of a call for expression of interest for the acquisition and operation of the second EuroHPC high-end supercomputer,
- Launch of procurement procedure for acquisition of a number of midrange supercomputers,
- Launch of a call for expression of interest for the acquisition and operation for mid-range supercomputer,
- launch the procurement for the acquisition and operation of the quantum computers
- Launch of a Call for expression of interest for the hosting and operation of European quantum computers integrated in EuroHPC supercomputers,
- Launch a call for Expression of Interest in April 2022 for Hosting Entities who wish to upgrade EuroHPC supercomputers,
- Launch Call for Expression of Interest for the selection of EuroHPC supercomputers to be upgraded.

The objectives defined in the strand of the Connected and Federated Supercomputer Pillar were:

- Launch of a call for the establishment and four-year operation of a distributed European-wide high-performance computing application support service,

[4] Decision of the Governing Board of the EuroHPC Joint Undertaking No 41/2022 Amending the Joint Undertaking's Work Plan and Budget for the year 2022 (Work Programme and Budget Amendment no. 5)

- Deployment and operation of a platform for federating resources (including High Performance Computing, quantum computing and data resources) providing Union-wide, cloud-based secure services for a wide range of public and private users across Europe,
- Funding of a study for hyper-connectivity for HPC resources.

The objective related to the Technology (Research & Innovation) Pillar was:

- The set-up of a Framework Partnership Agreement (FPA) for developing a large-scale European initiative for High Performance Computing (HPC) ecosystem based on RISC-V.

The EuroHPC JU will work towards putting in place a stable and structured long term partnership between the JU and industry, research organisations and the institutions in High Performance Computing who commit themselves to establishing, coordinating and implementing a strategic and ambitious R&I initiative contributing to the development of innovative HPC hardware and software technology based on the open RISC-V ecosystem, followed by an ambitious action for building and deploying the exascale and post-exascale supercomputers based on this technology.

For the International Cooperation Pillar, the defined objective was:

- Launch a call to develop a collaboration in HPC with Japan which seeks to implements of the High Performance Computing R&I aspects of Japan-EU Digital Partnership.

Concerning the Applications and Widening Usage Pillars, the objectives were:

- Launch of a call on Centres of Excellence for HPC applications, preparing applications in the exascale era,
- Launch of a call for Centres of Excellence for supporting supercomputing applications for Science and Innovation,
- Launch of a call for new algorithms for applications on European exascale supercomputers,
- Launch a call for the creation of National Competence Centres (NCCs) for High Performance Computing
- Launch a call for the creation of Networking and coordination of national HPC Competence Centres and Centres of Excellence (CoEs) ,
- Development of EuroHPC Training Platform,
- Increase the EuroHPC support to the International HPC Summer School,
- Call to develop EuroHPC traineeships in Hosting Entities, Centres of Excellence and Competence centres SMEs and Industry,
- Procurement for a 2022 a study on user requirements with regards to commercial access of supercomputers.

A risk assessment exercise was carried on at entity level and risks were identified for the mentioned objectives. Specific corrective measures were implemented, including some

amendments that were introduced to the work plan and regularly adopted by the Governing Board.

The main associated risks in 2022 were:

- Rising energy costs due to the Ukraine war and impact on costs of running the HPC systems. This only impacted the Karolina system and in line with the Hosting Entity agreement signed between EuroHPC JU and the local Czech Hosting Entity, the costs incurred by the increase of price of electricity was taken on by the Hosting Entity and the Czech government.
- Ongoing global supply issues in the field of micro-electronics that impacted the delivery of certain key HPC components needed for the LUMI and Leonardo systems
- The delivery of these ambitious objectives with only a very limited team of human resources/FTEs.

1.2. RESEARCH & INNOVATION ACTIVITIES

Calls for proposals launched in 2022:

Under Regulation 2021/1173, R&I activities in 2022 focused on four calls:

- Call **HORIZON-JTI-EuroHPC-2021-COE-01-01** covered High Performance Computing applications for exascale and post-exascale systems. In 2022, grant agreements were signed with several consortia to develop Exascale Lighthouse applications including weather forecast and climate change, material science, natural hazards, digital twin of the human body.
- Call **DIGITAL-EUROHPC-JU-2022-NCC-01** focused specifically on helping small and medium-sized enterprises (SMEs) to gain better access to HPC resources, thereby increasing their innovation capabilities. This will include developing tools, services, and training programmes that are tailored to the specific needs of SMEs. Following the evaluation of the proposals, the awarded projects signed agreements in 2022.
- Call **HORIZON-EUROHPC-JU-2022-ALG-02-01** was launched to create new and innovative algorithms that can take full advantage of the powerful capabilities of the upcoming European exascale supercomputers. The JU evaluated submissions for the Call and awarded the winning project in late 2022.
- Call **DIGITAL-2022-CEI-QC-01** was launched with the purpose to choose organizations that will host and operate quantum computers purchased by the EuroHPC JU. As part of this initiative, the EuroHPC JU is planning to acquire quantum computers, which are advanced computing systems that use the principles of quantum mechanics to perform calculations much faster than classical computers. Based on the proposals received, the Governing Board approved the winning hosting entities in late 2022.

The following table shows funding rates according to the types of organisation receiving EuroHPC funding. Each grant agreement specifies the grant reimbursement rate of:

- the eligible costs of the beneficiaries that are non-profit making legal entities
- the eligible costs of the beneficiaries and the affiliated entities (such as SMEs) that are profit making legal entities

CALL	NON-PROFIT	FOR-PROFIT
H2020-JTI-EuroHPC-2019-1		
EuroHPC-01-2019 (RIA)	50%	50%

EuroHPC-02-2019 (IA)	50%	35%
EuroHPC-03-2019 (IA)	50%	35%
H2020-JTI-EuroHPC-2019-2		
EuroHPC-04-2019		
CSA	100%	100%
RIA	50%	50%
EuroHPC-05-2019 (RIA)	100%	100%
H2020-JTI-EuroHPC-2020-01		
EuroHPC-2020-01-a (RIA)	50%	50%
EuroHPC-2020-01-b (RIA)	50%	50%
H2020-JTI-EuroHPC-2020-02 (SGA)	50%	50%
H2020-JTI-EuroHPC-2020-03 (CSA)	100%	100%
HORIZON-EUROHPC-JU-2021-COE-01		
HORIZON-EUROHPC-JU-2021-COE-01-01 (RIA)	50%	50%
HORIZON-EUROHPC-JU-2021-COE-01 (RIA)	50%	50%
DIGITAL-EUROHPC-JU-2022-NCC-01		
DIGITAL-EUROHPC-JU-2022-NCC-01-01 (SIMPLE)	50%	50%

DIGITAL-EUROHPC-JU-2022-NCC-01-02 (CSA)	100%	100%
HORIZON-EUROHPC-JU-2021-ALG-02		
HORIZON-EUROHPC-JU-2021-ALG-02-01 (RIA)	100%	100%

Table 1 Funding rates for all calls managed in 2022

Summary and state of play of calls

Call HORIZON-EUROHPC-JU-2021-COE-01 (Centres of Excellence for HPC applications)

This call for research proposals aimed to develop and adapt HPC applications for the exascale and post-exascale era. This funding opportunity is geared towards supporting research and innovation actions that will enable the transition of existing applications to the next level of computing capabilities. The primary objective of this call was to collaborate with HPC users and relevant stakeholders in the transition towards exascale computing. The ultimate goal is to support the development of advanced HPC applications that will enhance the capabilities of European researchers and industries, enabling them to solve inherently complex problems that were previously impossible to tackle.

Applications were invited for two topics:

- Topic 1 "*EuroHPC-2021-COE-01-01"* called for the clear identification of exascale lighthouse applications. The proposals had to convincingly demonstrate their exascale capabilities, as well as the necessity for such applications. Proposals should also be able to articulate clearly the scientific grand challenge(s) addressed by their applications and why exascale performance is necessary. Targeted applications should be relevant for HPC user communities as well as for future EuroHPC JU systems to be acquired. Proposals should be inherently committed to co-design activities ensuring future HPC architectures are well suited for demanding applications and users.
- Topic 2 "*EuroHPC-2021-COE-01-02"* called for CoEs that are user-driven and inherently committed to co-design activities ensuring future HPC architectures to be well suited for upcoming demanding applications and users, both from academia and industry. The anticipated CoEs should combine existing resources around Europe, exploiting available competences, and ensuring multidisciplinary (combining application domain and HPC system, software and algorithm expertise) and synergies with national/regional programmes. These CoEs should further enlarge and expand their capabilities across Europe, particularly by including user communities from EU

countries that are currently developing and advancing their HPC infrastructure and ecosystem.

The call was published with an indicative EUROHPC JU contribution of EUR 45 million on 6 January 2022 and closed on 6 April 2022. In total, grant agreements for 10 projects were signed by the JU.

Call DIGITAL-EUROHPC-JU-2022-NCC-01 (National Competence Centres for High Performance Computing)

National Competence Centres (NCCs) are institutions playing a crucial role in High-Performance Computing in their respective countries. They serve as central hubs that coordinate and connect different national initiatives related to HPC. They help promoting and facilitating access to European HPC competencies and provide opportunities for stakeholders in different industrial sectors and domains. One of the primary objectives of NCCs is providing support Small and Medium-sized Enterprises (SMEs), but also offering assistance to other local institutions such as public sectors, larger industries, and academic institutions. As a result, the EuroHPC Joint Undertaking promoted interest in HPC towards new user groups from private to public sectors and thus in widening of HPC skills across Europe.

Applications were invited for two topics:

- The objective of topic 1 "*DIGITAL-EUROHPC-JU-2022-NCC-01-01"* was the support existing NCCs, but also the creation of one NCC in each EuroHPC JU Participating States. The NCCs will provide HPC services to industry (in particular to SMEs), academia and public administrations, delivering tailored/modular solutions for a wide variety of users, with the aim to ease and foster the transition towards a wider uptake of HPC in Europe. NCCs will be a focal point of HPC in the respective country, liaising with national initiatives in the area of HPC, facilitating access of national stakeholders to European HPC competences and opportunities in different industrial sectors and domains. Local SMEs will play a central role in each NCC's activities. While academic institutions and stakeholders may be addressed to a limited extent, most of the resources of each NCC will be dedicated to support local SMEs, industry and public services.
- The objective of topic 2 "*DIGITAL-EUROHPC-JU-2022-NCC-01-02"* was to maximise the existing European HPC knowledge and expertise. The provided tasks and services will constitute a single focal point at the European level, which will be responsible for the coordination of the National Competence Centres (NCCs) for HPC and the European Centres of Excellence for HPC Applications (CoEs). The exchange of best practices between both initiatives will facilitate sharing of applications, knowledge and information, networking and training across NCCs and CoEs.

The call was published on 5 April 2022 and closed on 28 June 2022. A budget of up to 43 million was foreseen for the grant(s). In total, grant agreements for two projects were signed by the JU.

Call HORIZON-EUROHPC-JU-2022-ALG-02-01 (New algorithms for applications on European exascale supercomputers)

The purpose of this call was to encourage the development of new algorithms that can take full advantage of the upcoming European exascale supercomputers. Exascale supercomputers are capable of performing a billion billion (10^{18}) floating point operations per second revolutionizing scientific research and engineering by enabling faster and more accurate simulations and data analysis. To take full advantage of these powerful machines, new algorithms that are specifically designed to maximise their capabilities are needed. Therefore, the objective of this call was to incentivise the creation of innovative algorithms that can fully leverage the performance and capabilities of the upcoming European exascale supercomputers. This would enable researchers and engineers to address more complex and challenging problems, as well as to accelerate the pace of scientific discovery and innovation. The call as published on 5 April 2022 and was closed on 27 October 2022. A budget of up to EUR 5 million was allocated to the programme.

Call DIGITAL-2022-CEI-QC-01 (Call for expression of interest for the hosting and operation of European quantum computers integrated in HPC supercomputer)

The EuroHPC Joint Undertaking invited supercomputing centres to apply as hosts for quantum computers. The Joint Undertaking will procure and own these quantum computers, and by making them available to European users, helping to address the growing demand for quantum computing resources and services in both industry and academia. By providing a quantum computing infrastructure, the EuroHPC Joint Undertaking will support the development of a wide range of applications with industrial, scientific, and societal relevance for Europe. This action is expected to have significant benefits for the development of advanced technologies, research in various fields, and the overall competitiveness of European industry. The supercomputing centres selected to host the quantum computers will operate them on behalf of the EuroHPC Joint Undertaking. The integration of quantum computers into existing supercomputers also offers several advantages, such as the ability to leverage existing infrastructure and expertise, and the potential to increase the overall computing power available to users. The call was published on 31 March 2022 and closed on 30 June 2022. The JU will co-fund up to 50% of the total cost of the quantum computer procurement with an estimated total contribution of between EUR 8 – 10 million per quantum computer. In total, the JU selected six sites across the European Union to host and operate the first EuroHPC quantum computers.

Evaluation procedures and outcomes

The evaluation of proposals for calls under Horizon and Digital programme followed a set of rules and procedures. The evaluation criteria were based on three standard criteria, namely excellence, impact, and implementation.

The evaluation process involved external experts who were selected based on their skills, experience, and knowledge in the areas of the call. The experts carried out an initial individual evaluation, followed by a consensus group, and concluded with a panel review. Each admissible and eligible proposal was evaluated by at least three external experts to ensure a high level of quality. To ensure a well-balanced composition, the selection of external experts considered factors such as skills, experience, knowledge, geographical diversity, gender, and affiliation with organizations in the private and public sector.

Project Call ID	No of successful Proposals	Average TTI	Average TTS	Average TTG	Average TTP
H2020-JTI-EuroHPC-2019-2	3	117	143	260	80
H2020-JTI-EuroHPC-2019-3	1	37	27	64	90
H2020-JTI-EuroHPC-2019-1	20	182	154	345.8	72.95
H2020-JTI-EuroHPC-2020-1	2	132	311	443	
H2020-JTI-EuroHPC-2020-2	1	181	303	484	
H2020-JTI-EuroHPC-2020-03	1	112	208	320	
DIGITAL-EUROHPC-JU-2022-NCC-01	2	63	112	175	
HORIZON-EUROHPC-JU-2021-COE-01	10	127	124	250.7	
HORIZON-EUROHPC-JU-2022-ALG-02	1	82			
DIGITAL-2022-CEI-QC-01	6				
Total Average	47	148	153	307.8	74.5

Table 2 Number of submitted eligible proposals, average Time-to-Inform (TTI), Time-to-Sign (TTS), Time-to-Grant (TTG) and Time-to-Pay (TTP)

Participation and awarded grants

The calls for proposals received applications from a diverse range of European countries, and the successful consortia comprised beneficiaries from 34 countries. While the participation of SMEs (Small and Medium Enterprises) and LEs (Large Enterprises) is relatively lower than that of public institutions (Other), the evaluation process was conducted in an unbiased manner, ensuring a fair representation of different types of participating entities in successful proposals.

"Participations" refers to all applicants from eligible proposals (where one applicant can be counted multiple times if they are involved in multiple proposals) and "applicants" refers to distinct applicants from eligible proposals.

ENTITY	PARTICIPATIONS	APPLICANTS	SUCCESSFUL BENEFICIARIES
SME	11%	17%	13%
LE	10%	13%	10%
Other	79%	70%	77%

Table 3 Participations and unique beneficiaries in all and successful (funded) proposals by type of entity. The category Other refers mostly to public bodies.

In 2022, 417 legal entities participated as beneficiaries in the R&I ongoing projects. More than the average of the participating entities (61%) applied as a partner in only one proposal, while only a few beneficiaries participated in more than 10 proposals (2%). However, one beneficiary stood out with exceptionally high participation in 23 proposals and was a partner in 56% of all submitted proposals. The distribution of requested EU grants among the participants also reflects the high participation frequency of a few entities while 670 beneficiaries requested a total EU grant for all participations up to EUR 1 million.

Participations	No of Beneficiaries
1	257
2	68
3	41
4	17
5	8
6	5
7	5
8	1
9	1
10	5
11	1
12	3
15	1
18	1
21	1
22	1
23	1

Grant Requested (M Euro)	Applications
0-1	670
1-2	46
2-3	8
3-4	5
4-5	1
7-8	1
8-9	2
9-11	1

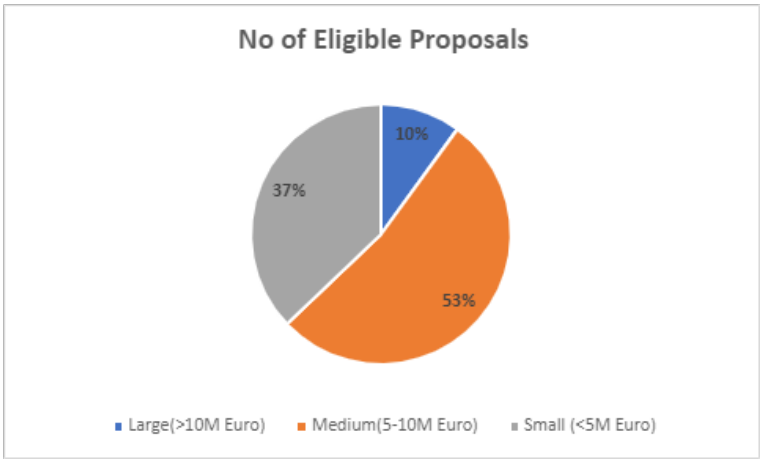


Figure 1 Number of all eligible proposals

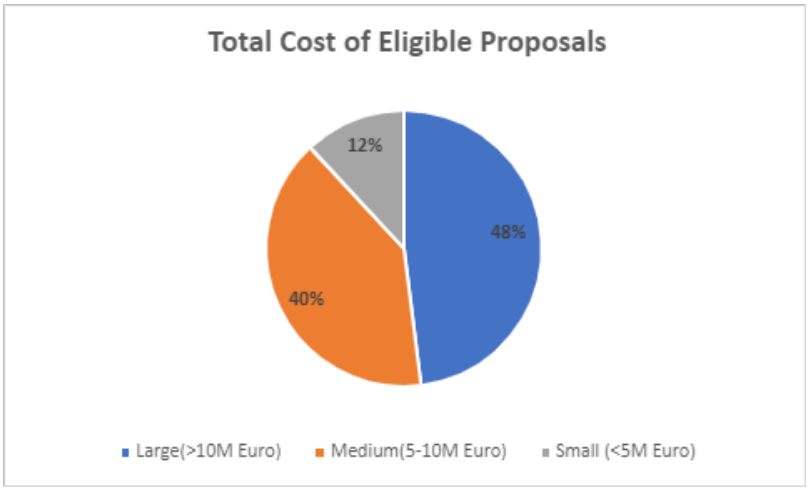


Figure 2 Distribution of total cost for all eligible proposals

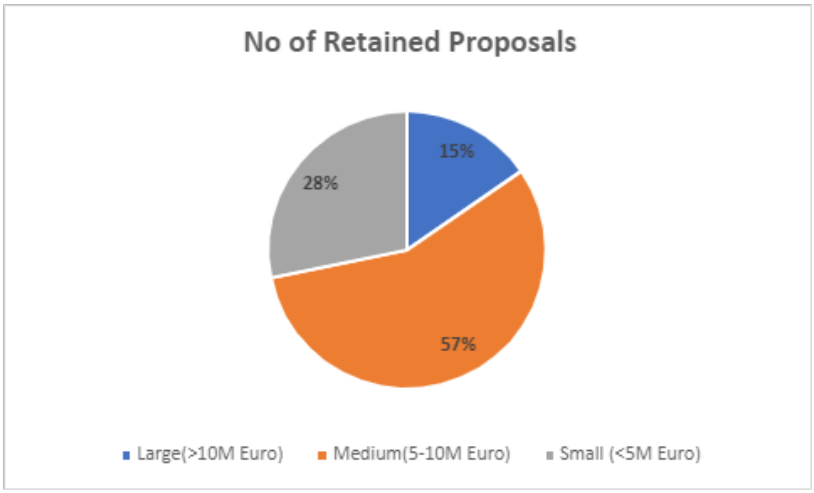


Figure 3 Number of all retained proposals

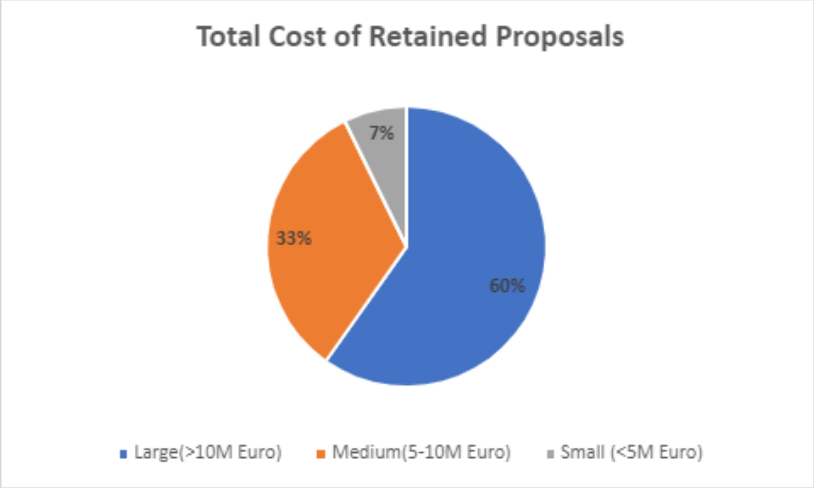


Figure 4 Distribution of total cost for all retained proposals

CALL	SUCCESSFUL PROPOSALS	TOTAL COST (TOTAL)	REQUESTED EU FUNDING (TOTAL)	REQUESTED EU FUNDING (SME)	REQUESTED EU FUNDING (LE)
EuroHPC-04-2019	2	79,158,094	29,936,560		1,240,625
EuroHPC-05-2019	1	9,998,475	9,998,475	585,437	
EuroHPC-01-2019	10	69,808,666	31,893,020	3,192,774	5,307,925

EuroHPC-02-2019	5	32,224,916	13,990,464	1,353,565	1,766,551
EuroHPC-03-2019	5	23,397,221	10,056,380	1,817,544	1463073
EuroHPC-2020-01-a	2	74,196,428	35,379,995	4,428,523	15979980
EuroHPC-2020-03	1	7,492,705	6,999,999		23750
DIGITAL-EUROHPC-JU-2022-NCC-01-01	1	84,802,512	42,401,074	2,872,304	3198932
DIGITAL-EUROHPC-JU-2022-NCC-01-02	1	2,999,611	2,999,611	406,279	
HORIZON-EUROHPC-JU-2021-COE-01-01	4	32,433,765	16,109,286	1,269,757	384562
HORIZON-EUROHPC-JU-2021-COE-01-02	6	37,656,582	18,798,363	1,467,625	1736280
HORIZON-EUROHPC-JU-2022-ALG-02-01	1	4,999,999	4,999,999	202,000	
GRAND TOTAL	39	459,168,978	223,563,230	17,595,810	31,101,682

Table 6 No of retained proposals and corresponding financial information including breakdown in funds requested by SMEs and LEs. All monetary values are in EUR.

COUNTRY	BENEFICIARIES	SME	LE
AT	12	6	1
BE	8	1	
BG	4		1
CH	6	2	
CY	3	1	
CZ	3		
DE	44	13	4
DK	8		
EE	4		
EL	11	4	1
ES	26	6	1
FI	2		
FR	38	7	12
HR	9		
HU	3		

IE	2		
IS	2		
IT	46	8	8
LT	4		
LU	4		1
LV	2		
ME	2		
MK	3	2	
NL	7	1	1
NO	10		2
PL	6		
PT	9		
RO	1		
RS	2		

SE	7		
SI	10	1	
SK	2		
TR	5		
UK	5		2
TOTAL	310	52	34

Table 7 Beneficiaries, SMEs and LEs participating in all awarded grants

COUNTRY	TOTAL COST (TOTAL)	REQUESTED EU FUNDING (TOTAL)	REQUESTED EU FUNDING (SME)	REQUESTED EU FUNDING (LE)
AT	9,523,537	4,055,416	1,619,335	52,040
BE	8,402,127	4,436,345	1,177,635	
BG	4,503,072	2,158,880		
CH	10,003,546	4,964,348	313,468	
CY	4,634,055	2,323,277	210,625	

CZ	7,929,458	4,015,276		
DE	87,892,373	48,430,143	5,031,146	524,977
DK	6,903,108	2,859,366		
EE	4,997,799	2,288,899		
EL	20,394,453	9,329,382	1,054,031	2,009,263
ES	46,541,367	25,255,955	2,346,118	180,625
FI	5,066,621	2,533,310		
FR	74,084,548	35,374,616	2,020,540	20,764,280
HR	4,696,501	2,062,576		
HU	4,468,016	2,097,039		
IE	4,355,207	2,183,853		
IS	2,822,228	1,411,114		
IT	54,593,528	22,887,423	3,002,006	4,495,816
LT	1,832,698	916,349		
LU	10,757,134	5,434,513		543,025
LV	2,800,000	1,200,000		
ME	1,000,000	500,000		
MK	2,470,667	912,935		

NL	6,525,589	3,209,044	192,500	1,866,739
NO	9,312,078	4,656,039		143,039
PL	9,141,177	3,713,529		
PT	6,217,907	2,268,453		
RO	4,097,200	2,048,600		
SE	17,324,426	8,692,832		
SI	9,742,752	4,161,236	628,402	
SK	3,198,415	1,599,207		
TR	4,324,735	1,680,273		
UK	8,612,642	3,902,988		521,875
TOTAL	**459,168,978**	**223,563,230**	**17,595,810**	**31,101,682**

Table 8 Breakdown of awarded grants by country as indicated by the participants since 2020. The figures are based on original data submitted with the proposals and may differ in the final grant agreement. All monetary values are in EUR.

Portfolio analysis

In 2022, a variety of activities have been undertaken, covering a broad spectrum of topics. These activities include the development of new technologies, the creation of novel applications, and the provision of training and skill-building initiatives. In addition to these general R&I efforts, specific actions have been launched to address the needs of European small and medium-sized enterprises. These efforts are intended to support these businesses as they seek to grow and expand, and to help them compete effectively in the global marketplace. A more detailed breakdown of the individual R&I projects, including information on agreements that have been signed, is provided in the table below.

CALL	PROPOSAL	OBJECTIVE	COORDINATOR NATIONALITY	GRANT AGREEMENT SIGNED
H2020-JTI-EuroHPC-2019-1	ACROSS	High-Performance Computing, Big Data and Artificial Intelligence convergent platform, workflows and applications to aeronautics, climate and weather, and energy domains	IT	2020
H2020-JTI-EuroHPC-2019-1	ADMIRE	To create an active I/O stack that dynamically adjusts computation and storage requirements through intelligent global coordination, malleability of computation and I/O, and the scheduling of storage resources along all levels of the storage hierarchy	ES	2020
H2020-JTI-EuroHPC-2019-1	DComEX	Novel scalable library of AI-enhanced algorithms for the solution of large scale sparse linear system, application to cancer immunotherapy and composite materials	EL	2020
H2020-JTI-EuroHPC-2019-1	DEEP-SEA	To deliver a programming environment for future European exascale systems, adapting all levels of the software stack	DE	2020
H2020-JTI-EuroHPC-2019-1	eFlows4HPC	Workflows as a service for High-Performance Data Analytics, Machine Learning and High-Performance Computing, simulations for manufacturing (digital twins) and natural phenomena	ES	2021

H2020-JTI-EuroHPC-2019-1	eProcessor	Development of an open source out-of-order RISC-V processor, related intellectual property building blocks and software	ES	2020
H2020-JTI-EuroHPC-2019-1	exaFOAM	improvement of the OpenFOAM software for computational fluid dynamics across the entire process chain (pre-processing, simulation, I/O, postprocessing)	FR	2021
H2020-JTI-EuroHPC-2019-1	HEROES	Implementation of a software solution for HPC-platform selection, adapted to simulation tasks of scientific and industrial users, and its application using marketplace concepts	FR	2020
H2020-JTI-EuroHPC-2019-1	IO-SEA	Develop a data management and storage platform for exascale computing, based on hierarchical storage management and on-demand provisioning of storage services	FR	2021
H2020-JTI-EuroHPC-2019-1	LIGATE	Implement a computer-aided drug design solution for automated drug discovery	IT	2020
H2020-JTI-EuroHPC-2019-1	MAELSTROM	Develop a software environment to combine machine learning with established simulation techniques for weather and climate modelling	UK[5]	2020

[5] Maelstrom is coordinated by ECMWF (European Centre for Medium-Range Weather Forecasts) which has its headquarters in in Reading, UK.

H2020-JTI-EuroHPC-2019-1	MICROCARD	Develop a production-ready simulation platform for cardiac electrophysiology for models with micrometer resolution	FR	2021
H2020-JTI-EuroHPC-2019-1	NextSim	development of a numerical flow solver, adapted to new HPC architectures, for computational fluid dynamics applications in the aeronautical industry	ES	2021
H2020-JTI-EuroHPC-2019-1	OPTIMA	Optimise selected industrial applications and open-source libraries for HPC systems including field programmable gate arrays	EL	2021
H2020-JTI-EuroHPC-2019-1	RED-SEA	Develop the next generation of European exascale interconnects for modular supercomputer architectures	FR	2020
H2020-JTI-EuroHPC-2019-1	REGALE	Improve resource management at HPC centres by integrating and optimising components covering the entire process cycle	EL	2021
H2020-JTI-EuroHPC-2019-1	SCALABLE	Transfer of leading technology from public-domain research software to an industrial simulation software for computational fluid dynamics	FR	2021
H2020-JTI-EuroHPC-2019-1	SPARCITY	Maximising the performance and energy efficiency of sparse computations on emerging HPC systems	TR	2020

H2020-JTI-EuroHPC-2019-1	TEXTAROSSA	Advance innovative power and thermal management solutions, develop novel intellectual property for reconfigurable accelerators in heterogeneous HPC multi-node platforms	IT	2020
H2020-JTI-EuroHPC-2019-1	TIME-X	Advance parallel-in-time integration from an academic methodology into a widely available technology adapted to current and future exascale HPC Architectures	BE	2020
H2020-JTI-EuroHPC-2019-2	CASTIEL	Combine the National Competence Centres for HPC created in the EuroCC project into a pan-European network	DE	2020
H2020-JTI-EuroHPC-2019-2	EUROCC	Create national competence centres for HPC to elevate the participating countries to a common high level in the fields of HPC, high-performance data analytics and artificial intelligence	DE	2020
H2020-JTI-EuroHPC-2019-2	FF4EuroHPC	Promote innovation using high-performance computing in small and medium-sized enterprises across Europe	DE	2020
H2020-JTI-EuroHPC-2020-01	EUPEX	Design, build, and validate the first prototype HPC system gathering European technology from different R&I activities including the European Processor Initiative and the Modular Supercomputing Architecture	FR	2020
H2020-JTI-EuroHPC-2020-01	HPCQS	Develop the programming platform and deploy a twin pilot system for a quantum simulator with 100+ qubits in each system, offer hybrid HPC/quantum simulator resources to users and application developers	DE	2021

H2020-JTI-EuroHPC-2020-01	The European PILOT	Demonstrate RISC-V based accelerators coupled to any general purpose processor and deliver a full software stack including middleware, runtimes, compilers, and tools for the emerging RISC-V ecosystem	ES	2021
H2020-JTI-EuroHPC-2020-02	EPI SGA2	Develop a European microprocessor and accelerator for HPC and beyond, second implementation phase of the European Processor Initiative within the Framework Partnership Agreement (FPA) in European low-power microprocessor technologies	FR	2022
H2020-JTI-EuroHPC-2020-03	EUMaster4HPC	Pilot for a pan-European MSc Programme on HPC	LU	2022
HORIZON-EUROHPC-JU-2021-COE-01	BioExcel-3	Centre of Excellence: Life science, especially biomolecular research, drug development, and molecular dynamics	SE	2022
HORIZON-EUROHPC-JU-2021-COE-01	CEEC	Centre of Excellence: engineering, aeronautic, and atmospheric engineering topics e.g., simulation of airplane wings, static mixers, offshore wind turbine foundations, merchant ship hulls	SE	2022
HORIZON-EUROHPC-JU-2021-COE-01	ChEESE-2P	Centre of Excellence: earth science with a focus on earthquakes, , tsunamis, magnetohydrodynamics, physical volcanology, geodynamics, and glacier hazards	ES	2022

HORIZON-EUROHPC-JU-2021-COE-01	ESiWACE3	Centre of Excellence: efficient and scalable simulations for earth system modeling, weather, and climate prediction	ES	2022
HORIZON-EUROHPC-JU-2021-COE-01	EXCELLERAT P2	Centre of Excellence: engineering use cases, manufacturing, energy, and mobility, e.g., aircraft, rotors, emissions, aero-dynamics, and aero-acoustics	DE	2022
HORIZON-EUROHPC-JU-2021-COE-01	HIDALGO2	Centre of Excellence: simulations of air quality in urban agglomerations, energy efficiency of buildings, renewable energy sources, wildfires, and meteo-hydrological forecasting	PL	2022
HORIZON-EUROHPC-JU-2021-COE-01	MaX	Centre of Excellence: quantum simulations of materials that contributes to information technology, green energy, health, supporting experimentation at large-scale, and manufacturing	IT	2022
HORIZON-EUROHPC-JU-2021-COE-01	MultiXscale	Centre of Excellence: software development for use cases on helicopter design, battery applications for the sustainable energy transition, ultrasound for non-invasive diagnostics, and biomedical applications.	SI	2022

HORIZON-EUROHPC-JU-2021-COE-01	Plasma-PEPSC	Centre of Excellence: plasma science, focusing on magnetic confinement fusion, industrial plasmas, medical applications, basic plasma experiments, plasma accelerators, laser-plasma interactions, space and astrophysics.	SE	2022
HORIZON-EUROHPC-JU-2021-COE-01	SPACE	Centre of Excellence: astrophysics and cosmology with the help of numerical simulations.	IT	2022
DIGITAL-EUROHPC-JU-2022-NCC-01	CASTIEL 2	Coordination and Support Actin for the National Competence Centres and Centres of Excellence	DE	2022
DIGITAL-EUROHPC-JU-2022-NCC-01	EuroCC 2	Establish a network of National Competence Centres	DE	2022
HORIZON-EUROHPC-JU-2022-ALG-02	Inno4Scale	Promote the efficient use of European HPC systems by identifying and funding the most promising novel algorithms for applications	ES	

Experts

Overall 70 experts from 19 different European countries, including Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Greece, Spain, Finland, France, Croatia, Ireland, Italy, Lithuania, Latvia, Poland, Romania, Sweden, Slovenia, contributed to the evaluations and project reviews. A total number of 25 proposals were submitted to four calls and a greater female than male presence was detected (64% to 36%). On average, each expert evaluator assessed almost three proposals, indicating a robust and thorough evaluation process.

CALL	AVERAGE NO. OF PROPOSALS PER EVALUATOR	NO. OF FEMALE EXPERTS	NO. OF MALE EXPERTS
HORIZON-JTI-EuroHPC-2021-COE-01	5.0	10	5
DIGITAL-EUROHPC-JU-2022-NCC-01	2.0	1	2
HORIZON-EUROHPC-JU-2022-ALG-02	1.0	2	2
DIGITAL-2022-CEI-QC-01	3.0	5	1

1.3. HPC INFRASTRUCTURE ACTIVITIES

Calls for tenders and procurements of supercomputers

The EuroHPC JU did not launch any new procurements of supercomputers in 2022. However, it did oversee and finalise the procurement of the MareNostrum5 system (launched in 2021) to be located at the Barcelona Supercomputer Centre in Spain. The system will be operational in 2023.

The JU's first two pre-exascale supercomputers were inaugurated: LUMI in Finland in June 2022 and Leonardo in Italy in November 2022. In November 2022, LUMI was ranked the third fastest and Leonardo was ranked fourth fastest supercomputers in the world, making them the fastest supercomputers in Europe.

LUMI's inauguration on 14 June 2022 at the CSC Supercomputing Centre in Kajaani.

Leonardo's inauguration on 24th November 2022 at Bologna Technopolis

In 2022, the following EuroHPC supercomputers were operational: LUMI in Finland, Vega in Slovenia, MeluXina, Karolina in Czech Republic, and Discoverer in Bulgaria and all made the TOP500 list[6] of the world most powerful supercomputers in the world. All operational EuroHPC systems ranked among the world's most powerful & energy efficient supercomputers and are accessible to users located in Europe.

Following further delays due to the COVID-19 pandemic and uncertainties regarding the location of the hosting Data Centre, the installation of DEUCALION was postponed until 2023.

In June 2022, the Governing Board selected hosting sites for four new petascale supercomputers to be located at GRNET in Greece, KIFU in Hungary, NUI Galway in Ireland and Cyfronet in Poland. The additional midrange supercomputers will have a sustained performance of 15 to 60 petaflops. At the same time, a hosting site was also selected for the first EuroHPC exascale supercomputer, JUPITER, to be located at Julich Supercomputing Centre in Germany.

By the end of 2022 hosting agreements were signed with Julich Supercomputing Centre and GRNET, and preparations for the system procurements were initiated. The agreements for the rest of the selected Hosting Entities are ongoing.

At the end of 2022, the JU launched a call of expression of interest to identify a hosting entity for a second exascale supercomputer as well as further mid-range systems.

[6] The November 2022 edition of the TOP500 list.

The EuroHPC JU's regulation provides for the procurement of supercomputers with exascale and post-exascale capabilities ("high-end" supercomputers), as shown in the below timeline the second exascale system is expected to come in 2025. Plans for the procurement of post-exascale systems will be forthcoming from 2024 onwards.

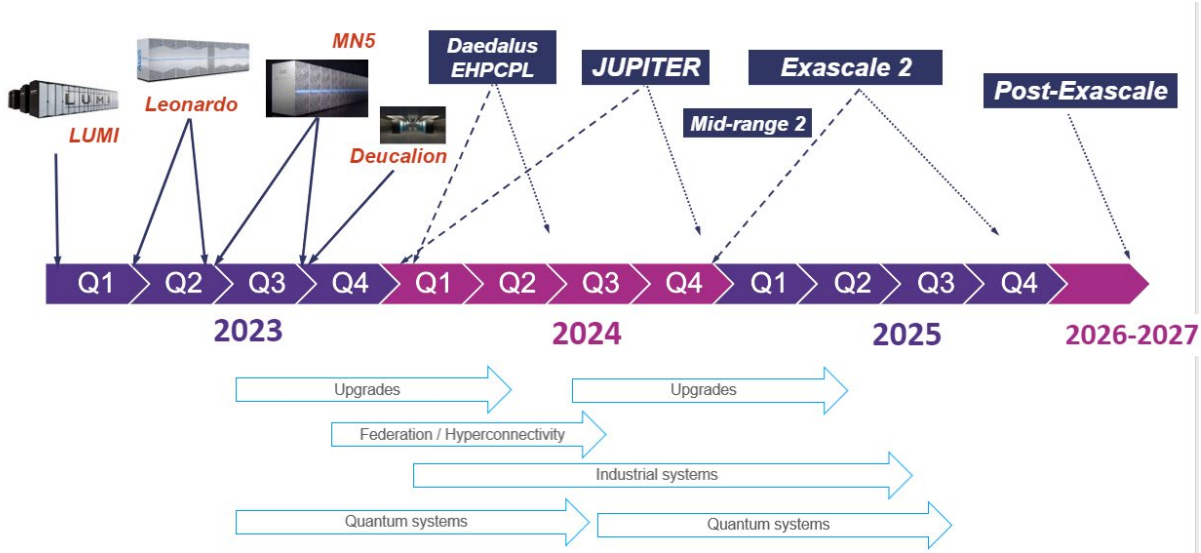


Table 1 EuroHPC JU Infrastructure Timeline until 2027

Global view on EuroHPC systems/ global standing of EuroHPC systems

As of November 2022, two EuroHPC supercomputers were ranked in the top four of the TOP500 list of most powerful supercomputers. LUMI is the fastest supercomputer in Europe and third fastest in the world, with a High Performance Linpack (HPL) performance of 309,10 petaflops per second while Leonardo's 174,70 petaflops per second put the system in second place in Europe and fourth place globally.

All available EuroHPC systems were ranked in the May and November editions of the TOP500 list of the most powerful supercomputers in the world. While LUMI and Leonardo topped the table with their high placements, all EuroHPC systems appeared in the top 140 most powerful supercomputers in the world.

In the table below we list the ranking and performance in Petaflops of all ranked EuroHPC supercomputer, as of the latest editions of the TOP500 and Green500 lists.

System name	Linpack Performance (PFlops)	Top500 ranking (November 2022)	Top500 first ranking	Green500 ranking
LUMI	309,10	3	3	7
LEONARDO	174,70	4	4	14
MeluXina Accelerator Module	10,52	52	36	22
Karolina GPU	6,75	85	71	20
LUMI – C	6,30	91	76	82
DISCOVERER	4,59	123	91	223
VEGA CPU	3,82	140	106	272
VEGA GPU	3,10	196	134	273
Karolina CPU	2,84	226	149	77
MeluXina Cluster Module	2,29	340	230	22

Below are the technical specifications of the procured petascale and precursor to exascale supercomputers.

Vega, Karolina, MeluXina and Discoverer, were fully operational at the end of 2021. The LUMI supercomputer installation was completed in 2022 with the addition of the LUMI-G partition (the GPU-based part of the supercomputer). The installation of Leonardo was also completed and the HPL test was run on the system in Autumn 2022. The system will become operational in 2023.

LUMI

LUMI is a Cray EX supercomputer supplied by Hewlett Packard Enterprise (HPE) and located in Finland. The first phase of the system installation has been completed with the delivery of the CPU only partition, LUMI-C. The installation of the GPU partition, called LUMI-G, is currently ongoing and expected to go operational in Q3 2022. Once installed LUMI will be the most powerful system in Europe, and one of the most powerful in the world, able to deliver ~400 PFlops of sustained aggregated performance.

Sustained performance:	375 petaflops (commited)
Peak performance:	552 petaflops
Compute partitions:	GPU partition (LUMI-G), x86 CPU-partition (LUMI-C), data analytics partition (LUMI-D), container cloud partition (LUMI-K)
Central Processing Unit (CPU):	LUMI-C partition: 3rd generation AMD EPYC™ CPUs 64-core, LUMI-G partition: AMD Trento 64-core
Graphics Processing Unit (GPU):	LUMI-G partition will incorporate 10,240 AMD MI250X GPUs
Storage capacity:	LUMI's storage system will consist of three components. First, there will be a 7-petabyte partition of ultra-fast flash storage, combined with a more traditional 80-petabyte capacity storage, based on the Lustre parallel filesystem, as well as a data management service, based on Ceph and being 30 petabytes in volume. In total, LUMI will have a storage of 117 petabytes and a maximum I/O bandwidth of 2 terabytes per second
Applications:	AI, especially deep learning, and traditional large scale simulations combined with massive scale data analytics in solving one research problem
Other details:	LUMI takes over 150m2 of space, which is about the size of a tennis court. The weight of the system is nearly 150

	000 kilograms (150 metric tons). LUMI will use renewable electricity and its waste heat will account for about 20 percent of the district heating in Kajaani and will reduce the entire city's carbon footprint. Overall the LUMI project aligns the Digital and Green Deal policies of the EC relying on 100% renewable carbon neutral energy.

LEONARDO

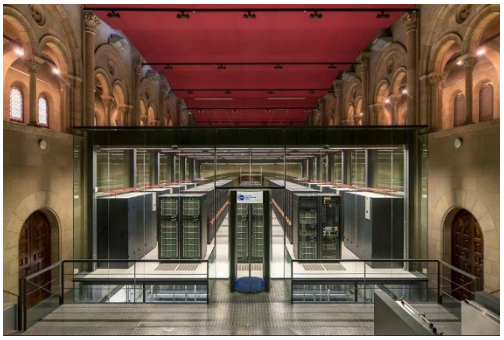
Leonardo is supplied by ATOS, based on a BullSequana XH2000 supercomputer and located in Italy. Once operational, Leonardo will be one of the fastest Artificial Intelligence (AI) Supercomputers in the world, delivering 10 exaflops of FP16 AI performance.

Sustained performance:	**249.4 petaflops (commited)**
Peak performance:	322.6 petaflops
Compute partitions:	Booster, hybrid CPU-GPU module delivering 240 PFlops, Data-Centric, delivering 9 Pflops and featuring DDR5 Memory and local NVM for data analysis
Central Processing Unit (CPU):	Intel Ice-Lake (Booster partition), Intel Sapphire Rapids (Data-centric partition)
Graphics Processing Unit (GPU):	NVIDIA Ampere architecture-based GPUs, delivering 10 exaflops of FP16 Tensor Flow AI performance
Storage capacity :	Leonardo is equipped with over 100 petabytes of state-of-the-art storage capacity and 5PB of High Performance storage
Applications:	The system targets: modular computing, scalable computing applications, data-analysis computing applications, visualization applications and interactive computing applications, urgent and cloud computing

Other details:	Leonardo is hosted in the premises of the Tecnopolo di Bologna. The area devoted to the EuroHPC Leonardo system includes 890 sqm of data hall, 350 sqm of data storage, electrical and cooling and ventilation systems, offices and ancillary spaces. The Governing Board approved funding to allow for Leonardo to be upgraded in 2024.

MARENOSTRUM 5

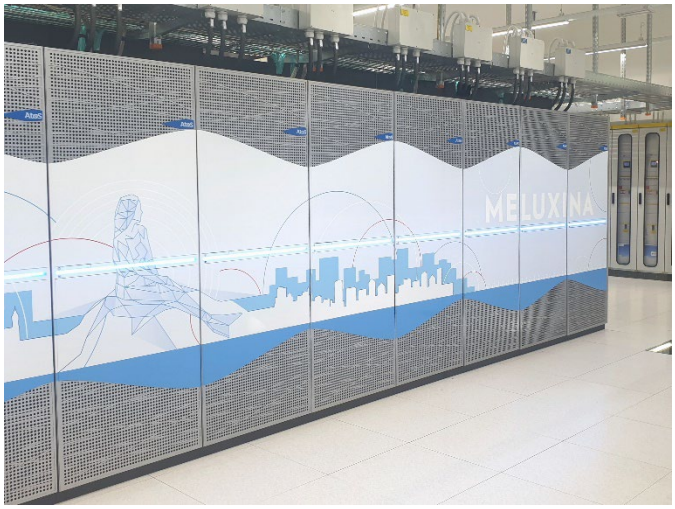
MareNostrum 5 is a pre-exascale EuroHPC supercomputer to be located in Barcelona, Spain. The system is supplied by Bull SAS combining Bull Sequana XH3000 and Lenovo ThinkSystem architectures. MareNostrum 5 is hosted by Barcelona Supercomputing Center (BSC).



Sustained performance:	**205 Petaflops**
Peak performance:	314 Petaflops
Compute partitions:	GPP (General purpose partition), ACC (Accelerated partition), NGT GPP (Next Generation Technology General Purpose partition and NGT ACC (Next Generation Technology General Purpose partition). Additional smaller partitions for pre- and post-processing.
Central Processing Unit (CPU):	The GPP, ACC partitions both rely on Intel Sapphire Rapids CPUs. NGT ACC is based on Intel Emerald Rapids and the NGT GPP is based on NVIDIA Grace.
Graphics Processing Unit (GPU):	The ACC partition is based on NVIDIA Hopper whereas the NGT ACC partition is built on Intel Rialto Bridge.

Storage capacity :	MareNostrum storage provides 248PB net capacity based on SSD/Flash and hard disks, and an aggregated performance of 1.2TB/s on writes and 1.6TB/s on reads. Long-term archive storage solution based on tapes will provide 402PB additional capacity. Spectrum Scale and Archive will be used as parallel filesystem and tiering solution respectively.
Applications:	MareNostrum5 is a highly versatile system thanks to its heterogeneous configuration, with a special focus on medical applications, drug discovery as well as digital twins (earth and human body), energy, etc. Its large general-purpose partition provides an environment well suited for most current applications that solve scientific/industrial problems. In addition, the accelerated partition provides an excellent environment for large scale simulations, AI and deep learning.
Other details:	MareNostrum 5 is located in BSC's new facilities, next to the Chapel which is hosting previous systems. The datacentre has a total power capacity of 20MW, and cooling capacity of 17MW, with a PUE below 1,08.

MELUXINA



MeluXina is an Atos BullSequana XH2000 supercomputer, installed in Luxembourg. The system implements a modular architecture, offering multiple partitions incorporating different technologies to satisfy most of the processing requirements of scientific and industrial HPC applications. MeluXina is the most powerful of the EuroHPC petascale supercomputers with an aggregated performance of 12.81 petaflops. When announced in June 2021, it was listed in #36 of Top500 and #4 in Green500 making it the most energy efficient system in the EU.

Sustained performance:	**12.8 Petaflops**
Peak performance:	Expected 15+ petaflops HPL and ~500 petaflops AI (Accelerator - GPU Module), 3+ petaflops HPL (Cluster Module)
Compute partitions:	Cluster, Accelerator - GPU, Accelerator - FPGA, Large Memory
Central Processing Unit (CPU):	AMD EPYC Rome
Graphics Processing Unit (GPU):	NVIDIA Ampere A100 GPUs
Storage capacity:	20 petabytes main storage with an all-flash scratch tier at 400GB/s, and a 5 petabytes tape library expandable to 100 petabytes
Applications:	Traditional Computational, AI and Big Data/HPDA workloads
Other details:	Modular Supercomputer Architecture with a Cloud Module for complex use cases and persistent services, an aggregated 476TB RAM, Infiniband HDR interconnect in Dragonfly+ topology, high speed links to the GÉANT network and Public Internet

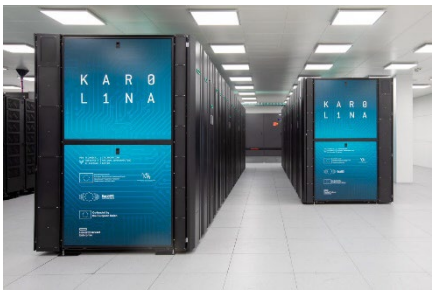
VEGA

Vega, was the first supercomputer to become operational. It is an Atos BullSequana XH2000 supercomputer, located in Slovenia. It comprises mainly of two partitions: the first offering CPU only processing and the second providing GPU capabilities. Vega CPU was listed in #106 and Vega GPU in #134, in the June 2021 edition of Top500 list.

Sustained performance:	**6,9 petaflops**
Peak performance:	10,1 petaflops

Compute partitions:	CPU partition: 960 nodes, 256GB memory/node, 20% double memory, HDR100 & GPU partition: 60 nodes, HDR200
Central Processing Unit (CPU):	122.800 cores, 1920 CPUs, AMD Epyc 7H12
Graphics Processing Unit (GPU):	240 Nvidia A100 GPUs
Storage capacity:	High-performance NVMe Lustre (1PB), large-capacity Ceph (23PB)
Applications:	Traditional Computational, AI, Big Data/HPDA, Large-scale data processing
Other details:	Wide bandwidth for data transfers to other national and international computing centres (up to 500 Gbit/s). Data processing throughput 400GB/s from high-performance storage and 200Gb/s from large capacity storage

KAROLINA



Karolina is built by Hewlett Packard Enterprise (HPE) and based on an HPE Apollo 2000Gen10 Plus and a HPE Apollo 6500 partition.

Sustained performance:	**9,59 petaflops**
Peak performance:	15.2 petaflops
Compute partitions:	The supercomputer consists of 6 main parts: • a universal part for standard numerical simulations, which will consist of approximately 720 computer servers with a theoretical peak performance of 3.8 PFlop/s, • an accelerated part with 72 servers and each of them being equipped with 8 GPU accelerators providing a performance of 11 PFlop/s for

	standard HPC simulations and up to 150 PFlop/s for artificial intelligence computations, • a part designated for large dataset processing that will provide a shared memory of as high as 24 TB, and a performance of 74 TFlop/s, • 36 servers with a performance of 131 TFlop/s will be dedicated for providing cloud services, • a high-speed network to connect all parts as well as individual servers at a speed of up to 200 Gb/s, • data storages that will provide space for more than 1 PB of user data and will also include high-speed data storage with a speed of 1 TB/s for simulations as well as computations in the fields of advanced data analysis and artificial intelligence.
Central Processing Unit (CPU):	More than 100,000 CPU cores and 250 TB of RAM
Graphics Processing Unit (GPU):	More than 3.8 million CUDA cores / 240,000 tensor cores of NVIDIA A100 Tensor Core GPU accelerators with a total of 22.4 TB of superfast HBM2 memory
Storage capacity:	More than 1 petabyte of user data with high-speed data storage with a speed of 1 TB/s
Applications:	Traditional Computational , AI, Big Data

DISCOVERER

Discoverer is a BullSequana XH2000 supercomputer, located in Sofia, Bulgaria. It comprises of a single CPU-based partition offering 4.5 Petaflops of sustained performance. Compared to the rest of the EuroHPC petascale systems, it offers the largest and most powerful CPU-only partition and is an excellent platform for traditional computational applications that do not benefit from GPU accelerators.

Sustained performance:	**4,52 petaflops**
Peak performance:	6 petaflops
Compute partitions:	One partition providing 1128 nodes
Central Processing Unit (CPU):	AMD EPYC “Rome” 7H12 64core
Graphics Processing Unit (GPU):	No
Storage capacity:	2 petabytes
Applications:	Traditional Computational
Other details:	Topology - Dragonfly+ with 200Gbps (IB HDR) bandwidth per link The Governing Board approved funding to allow for Discoverer to be upgraded in 2024

DEUCALION

Deucalion supercomputer is supplied by Fujitsu and will be located in Portugal. It combines a Fujitsu PRIMEHPC (ARM partition) and Atos Bull Sequana (x86 partitions). The PRIMEHPC partition is based on the similar architecture like Fugaku in Japan, which is currently the most powerful supercomputer in the world.

Sustained performance:	**7,22 petaflops (committed)**
Peak performance:	10 petaflops
Compute partitions:	ARM Partition: 1632 nodes, 3.8 PFLops ; x86 Partition: 500 nodes, 1,62 PFLops ; Accelerated: 33 nodes, 1,72 PFLops
Central Processing Unit (CPU):	A64FX (ARM partition), AMD EPYC (x86 partitions)
Graphics Processing Unit (GPU):	NVidia Ampere
Storage capacity:	430 TB High-speed NVMe partition, 10.6 PB high-speed based Parallel File System partition.

Applications:	Traditional Computational, AI, Big Data
Other details:	Deucalion will be installed at the Portuguese Foundation for Science and Technology (FCT) Minho Advanced Computing Centre (MACC), in close collaboration with the municipality of Guimarães, in the North of Portugal, as part of a fully sustainable computing infrastructure aiming at promoting new advancements in the digital and green transitions

1.4. ACCESS TO EUROHPC SUPERCOMPUTERS

Calls for access to EuroHPC systems

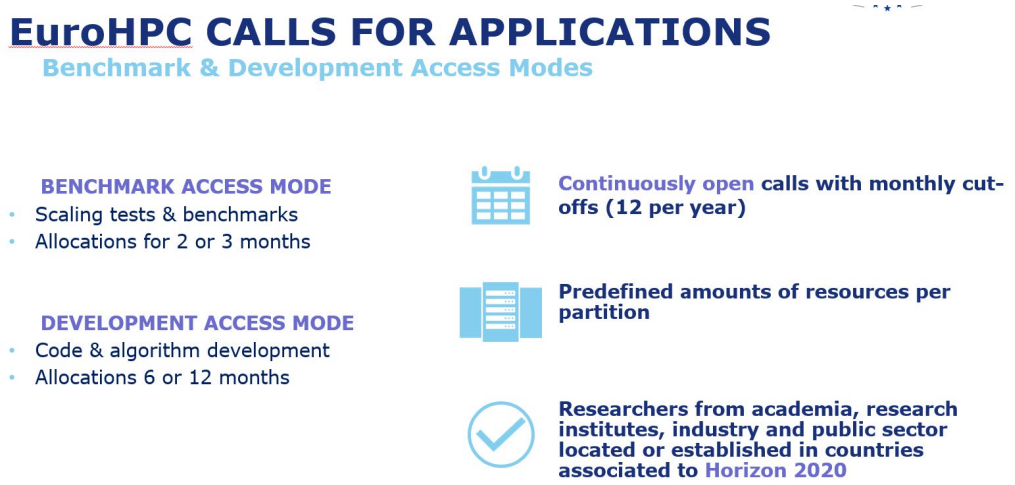
Since 2021, EuroHPC has been providing scientists, SMEs and industry located in Europe with access to operational HPC Systems. As defined in the EuroHPC JU Access Policy,[7] the type of access available are as follows:

Benchmark mode:

The Benchmark access mode is meant for users to collect performance data on a target system in order to document the technical feasibility of their applications to be submitted to other access modes.

Development Access mode:

The Development access mode is meant for projects focusing on code and algorithm development and developing a science portal or other infrastructure software components.



Regular Access mode:

This access mode, open to all fields of science, will call for applications with a case to enable progress of science in the domains covered. These applications are expected to be able to justify the need for large allocations in terms of compute time, data storage and support resources because they are significantly contributing to the progress in their domain.

[7] The EuroHPC Joint Undertaking's Access Policy.

EuroHPC CALLS FOR APPLICATIONS

Regular Access Mode

- Intended to serve research domains or communities that require large-scale HPC resources
- 6 research domains
- Allocations on EuroHPC JU **petascale** systems
- Allocations for 12 months with a **continuation** possibility of additional 12 months

Continuously open call with 3 cut-off dates per year

Predefined minimum resources requests and overall resources offer per cut-off

Researchers from academia, research institutes, industry and public sector located or established in countries associated to Horizon 2020

Next cut-off – 3 March 2023

Extreme Scale Access mode:

This access mode calls for applications with high-impact, high-gain innovative research and is open to all fields of science and industry justifying the need for and the capacity to use extremely large allocations in terms of compute time, data storage and support resources.

EuroHPC CALLS FOR APPLICATIONS

Extreme Scale Access Mode

- Intended for extremely large allocations in EuroHPC JU **(pre) exascale** systems;
- Applications with high-impact, high-gain innovative research;
- Allocations for **12 months** with a **continuation** possibility of additional 12 months
- In exceptional cases possibility of **24 months** initial allocation

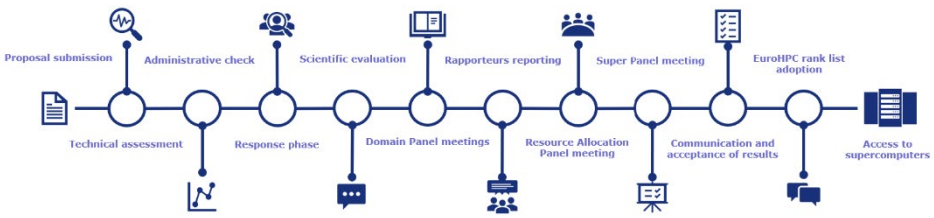
Continuously open call with 2 cut-off dates per year

Predefined minimum resources requests and overall resources offer per cut-off

Researchers from academia, research institutes, industry and public sector located or established in countries associated to Horizon 2020

Next cut-off – 28 April 2023

Access to EuroHPC system is undertaken based on a peer review process which is managed by the Joint Undertaking.



Regular Access and Extreme Scale Access – State of Play

In 2022, access was available to all operational HPC systems.

The Regular Access call first opened in 2021 and as of December 2022, four cut-off dates for applications had passed.

Throughout 2022, demand on the EuroHPC systems' computing time has increased and following the outcome of the November 2022 cut-off, capacity for Regular Access is almost completely full, with Vega CPU, Vega GPU, Karolina GPU, Discoverer CPU and LUMI-C being fully allocated.

	VC	VG	MC	MG	KC	KG	DC	LC
Total to allocate	85.1	3.8	65.5	11.1	60.0	6.3	114.0	318.5
Additional offer	10.1	2.3	-	-	-	0.3	10.0	12.5
Min allocations	10.0	0.5	100.0	2.0	10.0	1.0	10.0	20.0
Allocated	85.0	3.8	60.0	10.5	50.3	6.3	114.0	318.5
Scientific Access Track	85.0	3.8	60.0	6.5	50.3	6.3	59.0	248.4
Industry Access Track	0,0	0,0	0,0	3.9	0,0	0,0	55.0	70.1
Public Sector Access Track	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
still available	0.1	-	5.5	0.6	9.7	-	-	-
still available	0%	0%	8%	6%	16%	0%	0%	0%

Table 2: Allocation of computing time under the Regular Access call

Across all cut-offs, over 1.5 billion core hours of computing time have been allocated under the EuroHPC Regular Access calls, to 79 research projects from five different research domains and from 21 European countries.

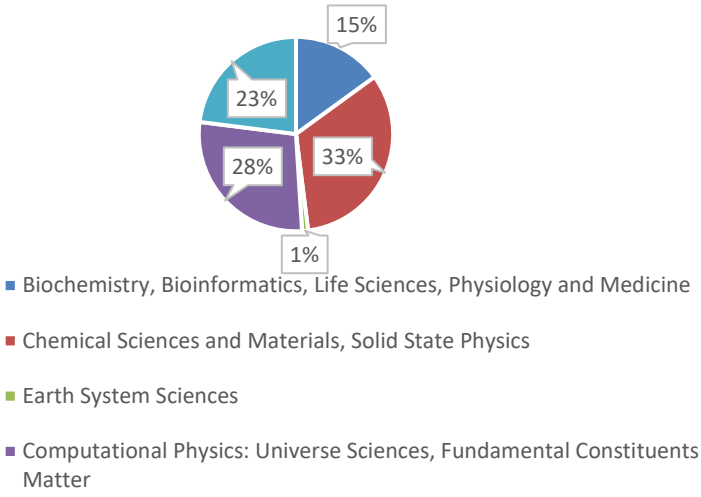


Table 3 Research domains distribution across all cut-offs via the Regular Access call

EUROHPC SYSTEM	CORE HOURS AWARDED
VEGA	383,379,687
KAROLINA	140,900,667
DISCOVERER	151,310,720
MELUXINA	121,207,896
LUMI (CPU only)	765,204,976
TOTAL	1,562,003,946

Table 4 Core hours awarded per system across all cut-offs via the Regular Access Call

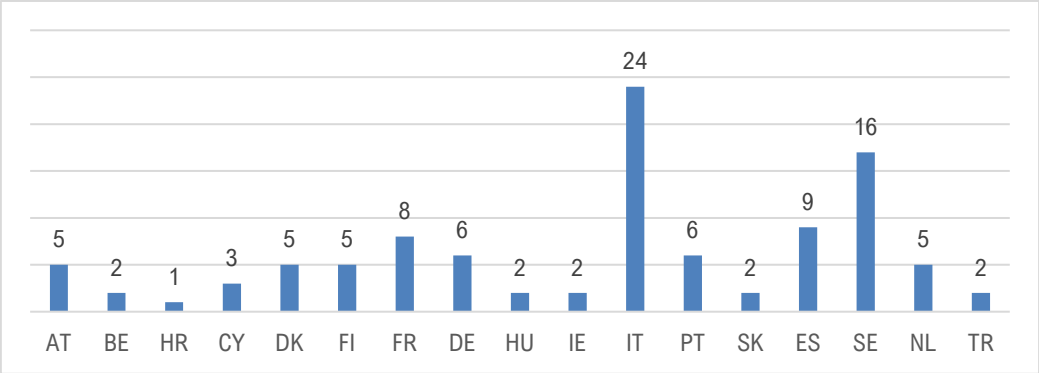
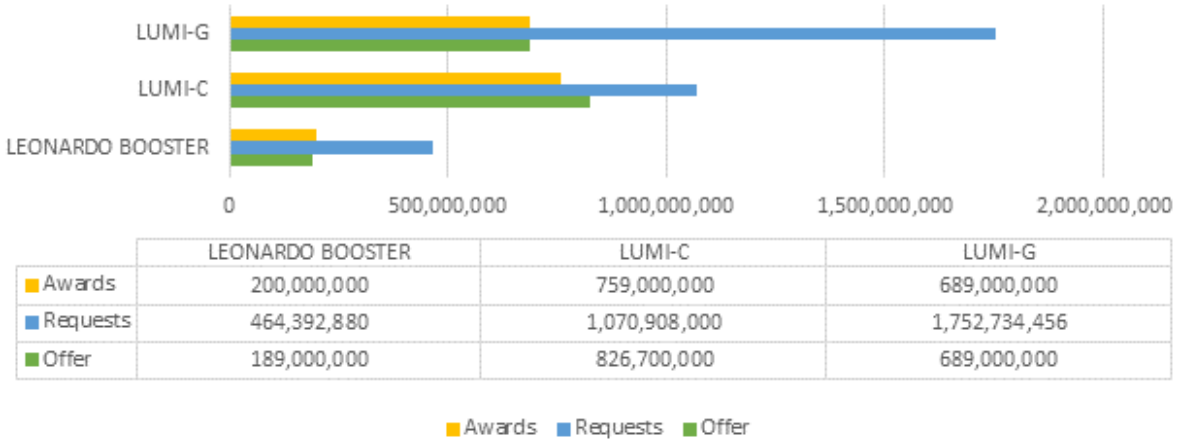


Table 5 Awarded projects per country across all cut-offs via the Regular Access Call

The Extreme Scale access call opened in 2022 and the first cut-off date closed in December 2022. At the end of 2022, the applications submitted are under evaluation. 40 proposals were submitted across five research domains.

40 proposals were submitted, of which 36 were administratively accepted and 25 proposals awarded.

The requests for computing time on Leonardo Booster, LUMI-C and LUMI-G exceed available capacity.



	LEONARDO BOOSTER	LUMI-C	LUMI-G
Awards	200,000,000	759,000,000	689,000,000
Requests	464,392,880	1,070,908,000	1,752,734,456
Offer	189,000,000	826,700,000	689,000,000

Table 6 System offers, requests and awards (core hours) via the Extreme Scale Access Call

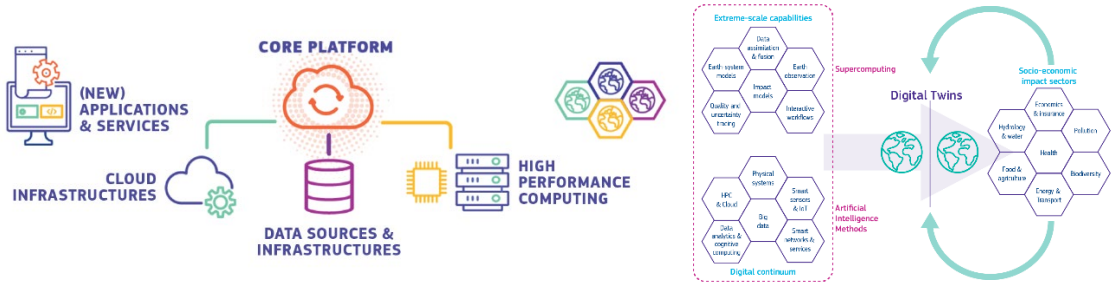
Special Access and Destination Earth

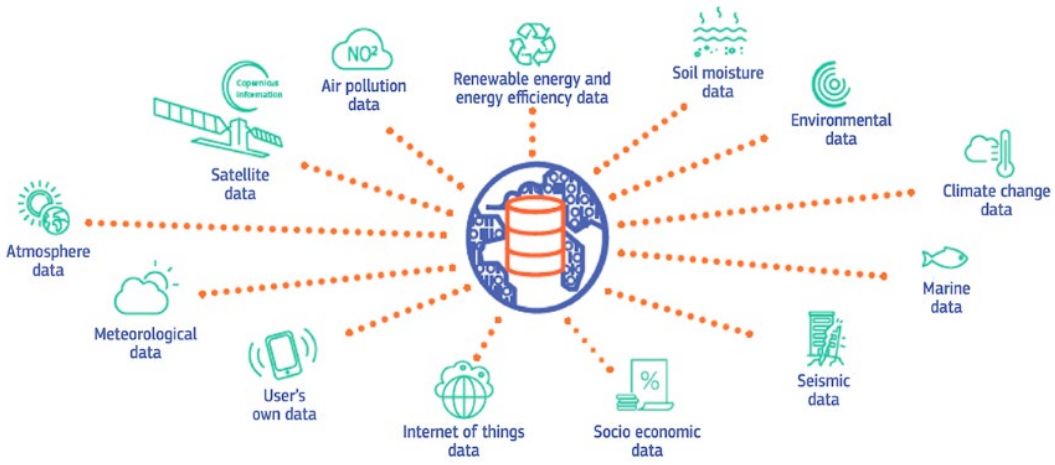
EuroHPC JU can grant special access free of charge to strategic European Union initiatives considered to be essential for the public good, or in emergency and crisis management situations.

In 2022, the Destination Earth project, also known as DestinE, became the first such initiative to be granted Special Access. The targeted EuroHPC supercomputers are Lumi, Leonardo, MareNostrum5 and MeluXina.

The project aims to develop a highly accurate digital model of the complex Earth system – a digital twin (DT) – to monitor, simulate and predict environmental change and human impact to support more sustainable developments and support corresponding European policies supporting the European Green Deal.

Users will have cloud–based access to Destination Earth models, algorithms, applications and natural and socioeconomic data to exploit and test their own models. The DestinE initiative has been divided into three major components: the Data Lake, the Core Service Platform and the Digital Twin Engine supporting the first two digital twins of the Earth system. The overall system and its components will be user-friendly and flexible to adapt to a wide spectrum of user needs and scenarios.





Source: Destination Earth

User requirements study

In 2022, the JU launched a call for expression of interest to procure a data driven analysis of High Performance Computing services uptake by academic/SME/industrial and commercial end-users in European Participating States who are members of the EuroHPC JU. With this study, EuroHPC JU seeks to understand what specific technical, legal, financial and commercial considerations shape academic/industrial/commercial end-user requirements and how these requirements influence the business decisions of HPC users (academic, industrial and/or SMEs) to access high-performance computing solutions and services.

The results of this study will be available in 2023.

1.5. OTHER OPERATIONAL ACTIVITIES

Legal Proceedings

In Case T717/20, Lenovo Global Technology Belgium BV ("Lenovo"), sought annulment of the decision Ares(2020)5103538 of EuroHPC of 29 September 2020 rejecting the tender submitted by the applicant concerning the third lot in call for tenders SMART 2019/1084 relating to the acquisition, delivery, installation and maintenance of the Leonardo Supercomputer for the hosting entity Cineca (Italy) and awarding the contract to another tenderer.

During 2022, the case was finalised following the release of the judgment of the European General Court. On 29 June 2022, the parties attended the hearing before the General Court to receive judgment, and subsequently by Judgment of 19 October 2022, the General Court

dismissed the action brough by Lenovo and ordered Lenovo to bear its own costs and to pay those incurred by EuroHPC.

Hyperconnectivity

One of the key goals of the EuroHPC JU is to establish a world-leading hyper-connected, federated and secure high-performance computing, quantum computing service and data infrastructure ecosystem in Europe. As a first step to make this a reality and in line with the Annual Work Plan 2022, the JU launched a procurement for a "Study on hyper-connectivity of HPC resources".

The purpose of the study is to provide an analysis of the stakeholders needs, to define the specifications of the HPC connectivity requirements in Europe, and to provide options and a roadmap to foster the implementation of a federated, secure, and hyper-connected European HPC and data infrastructure.

A maximum budget of EUR 900,000.00 has been allocated for the study which will be delivered in 2023. The results of the study will be presented to the Governing Board.

Japan-EU call

The purpose of this call is to enhance international collaboration in high-performance computing with Japan by supporting the implementation of the Japan-EU Digital Partnership in the priority domains of the HPC collaboration identified in the Partnership.

The call was prepared in 2022 and was published at the start of 2023.

1.6. PROGRESS AGAINST KPIS

Progress against JU-specific KPIs

Identification of Key Performance Indicators (KPIs) linked to Horizon Europe and Digital Europe Programme by the Joint Undertaking and the Commission are ongoing.

The following two KPIs below are however in line with the Decisions taken by the Governing Board and EuroHPC JU's Regulation and are being tracked by the JU.

- In 2022, the JU met the KPI[8] 'Number of EuroHPC systems installed in the EU ranking among the top 10 in the world' in 2022 by having two supercomputers in the TOP500. As indicated in the other parts of this Report, they are the LUMI Supercomputer (#3) and the LEONARDO Supercomputer (#4) which both rank in the top 5 fastest supercomputers in the world.

- The JU is working to meet the following target which is that 'the Union has, by 2025, its first computer with quantum acceleration, paving the way for the Union to be at the cutting edge of quantum capabilities by 2030. [9] [10] In 2022, the JU has identified six hosting entities to accommodate six quantum computers which will be procured in 2023/2024.

For other KPIs, please review Annex 7 which sets out Horizon 2020 KPIs which are common to all JUs.

8 Strategic plan 2020-2024 – DG Communications Networks, Content and Technology - Ares (2020) 4565545 02/09/2020

9 Communication on 2030 Digital Compass: the European way for the Digital Decade: COM (2021) 118 final

10 Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030

2. SUPPORT TO OPERATIONS

2.1. COMMUNICATION ACTIVITIES

Throughout 2022, communication activities continued to raise the profile of the EuroHPC Joint Undertaking. With restrictions and lockdowns loosening following the Covid-19 pandemic, in-person activities became possible once again.

Events

On site events in 2022 provided key communication opportunities for the EuroHPC JU. The first of these events took place in March 2022, with the EuroHPC Summit Week 2022 in Paris. The EuroHPC Joint Undertaking was part of the Organisation and Programme Committee for the event, and was responsible for a number of sessions throughout the week to showcase its programme and priorities.

In May of 2022, the JU attended the ISC (International SuperComputing) conference in Hamburg for the first time. Teaming up with flagship projects EuroCC, Castiel and FF4EuroHPC, as well as the hosting entity for Meluxina, LuxProvide, the JU had a small booth in the exhibition area of the event. This was an opportunity to exchange with both a European and an international audience, and the collaboration with EuroHPC stakeholders was deemed a success.

The May 2022 edition of the TOP500 list was published during the event and LUMI's excellent ranking at third place on the list generated much interest and publicity.

The EuroHPC JU also organised some key events of its own this year, with LUMI and Leonardo being inaugurated. Both events were key communication opportunities, particularly alongside the Top 5 rankings received by both machines ahead of their inaugurations. Mr. Petri Honkonen, Finland's Minister for Science and Culture and Mr. Mika Lintilä, Finland's Minister for Economic Affairs, attended the inauguration of LUMI. Sergio Mattarella, President of the Italian Republic and Anna Maria Bernini, Italian Minister of University and Research participated in the inauguration ceremony for Leonard and the event was also attended by Roberto Viola, Director General for Communication Networks, Content and Technology, European Commission (CNECT).

The inaugurations were covered by local, national and European press, helping to grow awareness of the EuroHPC's work and infrastructure among the public.

Publications

In 2022, the EuroHPC JU published a Projects Info Pack, in collaboration with CORDIS and the EU's Publication Office. The informational brochure is the first of its kind, and the concept was

developed by the Publications Office to communicate on projects which are ongoing and may not have results to publish yet.

The Projects Info Pack compiled articles on nine of the JU's projects, laying out in digestible terms how their work will improve citizens' quality of life, advance science, boost the innovation potential of European enterprises and their role in supporting European digital sovereignty.[11]

The brochure became a key communication tool for the JU, both as a handout and a starting point to engage with both the general public and members of the HPC community. The visuals created for the brochure were re-used across all the EuroHPC communication outlets, from the website to presentations to social media.

The publication of a second edition, featuring a new selection of projects, is planned for 2023.

EuroHPC JU Website

With the help of the Directorate-General for Informatics of the European Commission (DIGIT), the JU migrated the EuroHPC website[12] to the Europa Web Publishing Platform (EWPP), the European Commission's corporate solution for publishing content online.

The EuroHPC website was regularly updated and formed a key tool in the JU's communication activities, as the main place for publishing press releases, information on calls, vacancies and other EuroHPC opportunities. All Governing Board decisions, work plans, and Annual Activity Reports as well as any relevant updates to the composition of the Governing Board are published on the website. Detailed information on all the existing EuroHPC systems can also be found on the website.

Regular press releases are published to the EuroHPC website to share information on the JU's activities and achievements, in particular new calls or initiative, announcements on new supercomputers or update on the procurement of machines, and events, such as inaugurations and conferences.[13]

Press releases on new project launches provided opportunities to coordinate with projects and their communication teams directly. Successful coordination was undertaken in 2022 with the European Processor Initiative (EPI), The European PILOT (EUPILOT) and the European Pilot for Exascale (EUPEX), EUMaster4HPC, EuroCC and Castiel.

Social Media

The JU has continued to use social media consistently to engage with its online community. Both Twitter and LinkedIn accounts have been active and both followings have grown in the last year. At the end of 2021, both accounts had surpassed 2000 followers, however consistent and meaningful engagement and regular posting has led to increased followings on both

[11] Introducing the EuroHPC Projects Info Pack, available in 10 languages (europa.eu)

[12] The EuroHPC Joint Undertaking website.

[13] The EuroHPC page for press releases.

platforms. Through these channels, the communication team of the JU promotes its press releases, calls, announcements and participation in events.

The engagement on LinkedIn was especially high, with the EuroHPC page achieving nearly 4000 followers at the end of 2022.

Taking advantage of the buzz around events such as the EuroHPC Summit week and inaugurations, and announcements such as the publication of TOP500 lists and posting live and topical updates has been key for growing the reach of the EuroHPC social channels.

EuroHPC News Digest

Following its elaboration in September 2021, the EuroHPC JU News Digest is sent out at the end of every month, rounding up the JU's own press releases and updates as well as a selection of news articles from European and international press, either specifically related to EuroHPC supercomputers, initiatives or projects, or more broadly covering relevant issues in HPC.

The digest is sent to all EuroHPC staff and governing board members, EuroHPC project coordinators, relevant journalists and partners. At the end of 2022, 223 people receive the monthly digest and members of the HPC community can contact the JU via email to be added to the mailing list. Due to the positive reception of the Digest and the interest in subscribing to the newsletter, the communication team is exploring the possibility of adding an option to subscribe to the digest via the EuroHPC website.

Communication Policy

In 2022 the EuroHPC JU developed its Communication Policy in a document presented to the EuroHPC Governing Board in June 2022. This document defines the priorities and key action points for the JU's communication efforts and will ensure a more strategic approach to communication activities.

2.2. LEGAL AND FINANCIAL FRAMEWORK

The legal framework refers to:

- Council Regulation (EU) 2021/1173 of 13 July 2021
- The Horizon 2020 Regulation (EU) 1291/2013 and its Rules for Participation:
- Regulation (EU) 2021/695 of The European Parliament and of The Council of 28 April 2021 establishing Horizon Europe;
- The CEF Regulation (EU) 1290/2013;
- Regulation (EU) 2021/1153 of the European Parliament and of the Council of 7 July 2021 establishing the Connecting Europe Facility;
- The Digital Europe Programme 2021-2027, established by Regulation (EU) 2021/694 of the European Parliament and of the Council of 29 April 2021;
- The Financial Rules adopted by the EuroHPC Governing Board on 20 February 2020 and re-adopted by the Governing Board on 30th September 2021

The financial framework is set by the Commission Decision C(2019)5357 and its annexes.

2.3. BUDGETARY AND FINANCIAL MANAGEMENT

The Financial Rules establishes that the Accounting Officer shall be independent in the performance of his or her duties, enforcing an effective separation of duties between this position and that of Authorising Officer. In 2020, the EuroHPC JU agreed with the Commission to nominate the Commission Accounting Officer as Accounting Officer for the EuroHPC JU and this was continued in 2021.

The budget of the EuroHPC JU is divided into 3 titles as follows:

- Title 1: Staff Expenditure
- Title 2: Other Administrative Expenditure
- Title 3: Operational Expenditure Procurement and Contracts

Budget and budget implementation

The EuroHPC JU budget revenue according to the final voted budget for 2022 is EUR 474.8 million. The cashed amount in 2022 includes the cashed amount from 2021 (LEONARDO was launched in 2021 but cashed in 2022) was EUR 531.2 million.

- The contributions received from PT (Deucalion), CSC (Finland) and CINECA (Italy) Hosting Entities (HEs) include the financial contributions made by the EuroHPC JU Participating States. This contribution amounts to EUR 123 million for the petascale, pre-exascale and high-end / exascale supercomputers. Recovery of these financial contributions is done through the Hosting Entities which, for these procurements, act on behalf of the Participating States. One Recovery Order was launched in 2021 but the amount was only cashed in 2022 (Leonardo: EUR 55.3 million).
- The EU contribution from the 3 funding programmes (DEP, HE and CEF2) and legacy (H2020 and CEF1) amounts to EUR 407.1 million for 2022.
- Due to a contractual penalty (late delivery of MeluXina Supercomputer Luxembourg), an additional amount of EUR 1 million is included in the revenue. Therefore the total revenue amounts to EUR 531.2 million.
- Julich Supercomputing Centre also contributed EUR 63.250 million in 2022 as part of a contribution for the procurement of JUPITER exascale system.

The table below shows in detail the contributions cashed in 2022 from the EU and Participating States.

Contributions from EU and Participating States 2022	
EU H2020 ADMIN	1.740.965,29 €
EU H2020 Operational	67.228.103,12 €
EU CEF	43.818,00 €
EU HE ADMIN	1.258.944,30 €
EU HE Operational	95.504.766,73 €
EU DEP ADMIN	2.210.135,08 €
EU DEP Operational	209.149.572,98 €
EU CEF2 Operational	30.000.000,00 €
Total ADMIN	5.210.044,67 €
Total Operational	401.926.260,83 €
Total EU	**407.136.305,50 €**
PS Leonardo cashed 2022	55.337.170,67 €
PS Deucalion	2.266.637,50 €
PS Lumi CZ NFA	1.250.000,00 €
PS Lumi CSC FI	933.617,03 €
PS Jupiter	63.250.000,00 €
Total PS	**123.037.425,20 €**
Other Income	**1.025.541,00 €**
Total Revenue	**531.199.271,70 €**

Table 7 Cashed contributions from EU and Participating States 2022

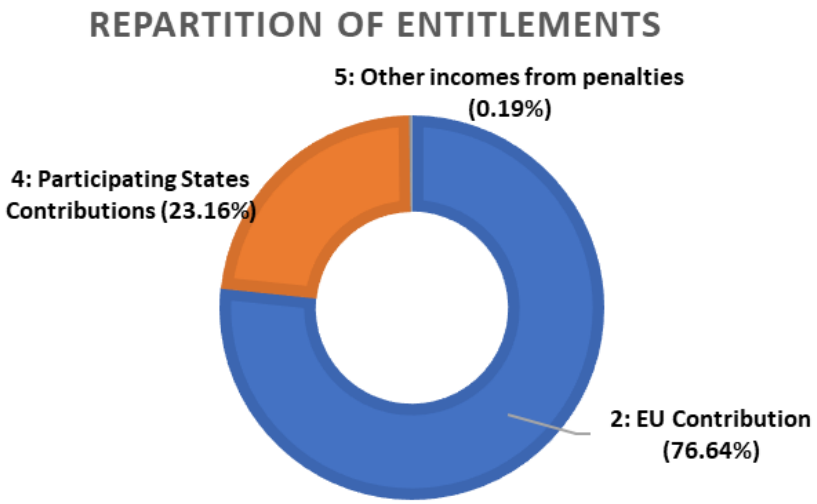


Table 8 Repartition of entitlements

Expenditure under Title 1 and 2:

The EuroHPC JU did not use all commitment and payment appropriations reserved on administrative lines. The JU has given priority to spending the C2 (reactivated credits) first.

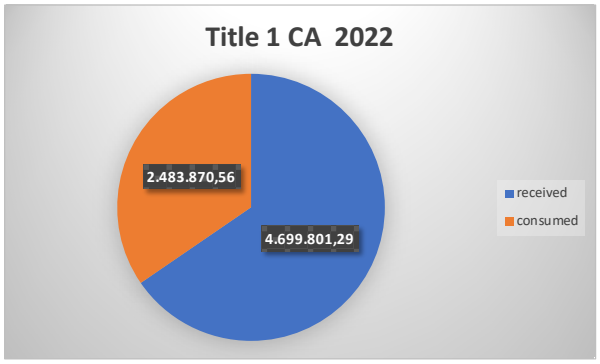
The JU has paid the EC PMO for the employee pension contribution for 2022 an amount of 107.275,72 EUR.

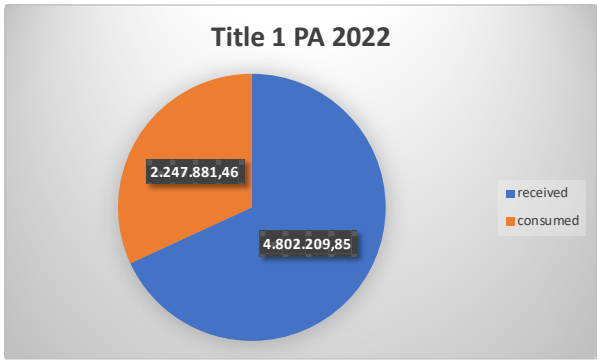
Budget implementation under title 1 and 2 (Administrative Expenses C1 and C2 appropriations) is as follows:

	CA Appropriations 2022	CA consumed 2022	CA available 2022	PA Appropriations 2022	PA consumed 2022	PA available 2022
Title 1	4.699.801,29	2.483.870,56	2.215.930,73	4.802.209,85	2.247.881,46	2.554.328,39
%		**52,9%**			**46,8%**	
Title 2	3.516.922,89	1.211.760,64	2.305.162,25	3.383.328,16	764.634,12	2.618.694,04
%		**34,5%**			**23%**	
Total Administrative Expenditure	8.216.724,18	3.695.631,20	4.521.092,98	8.185.538,01	3.012.515,58	5.173.022,43
		45,0%			**36,8%**	

Situation of Commitment and Payment Appropriations Title 1

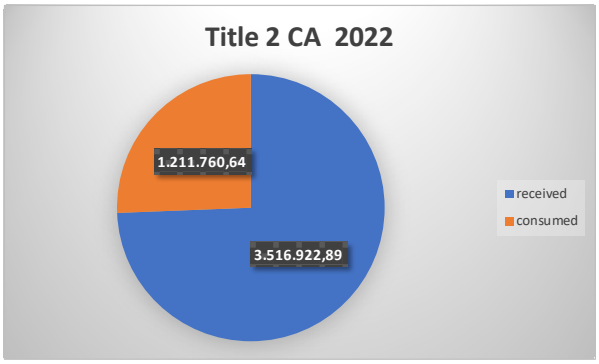
	CA 2022		PA 2022
received	4.699.801,29	received	4.802.209,85
consumed	2.483.870,56	consumed	2.247.881,46
	52,9%		46,8%

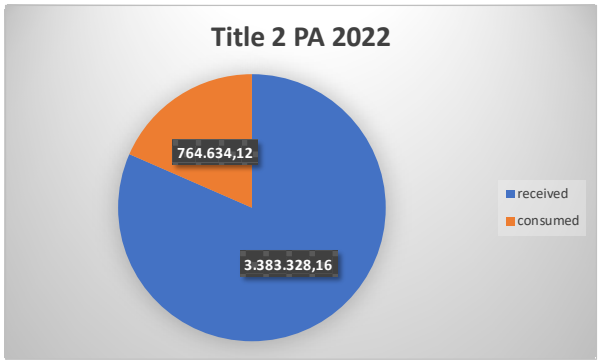




Situation of Commitment and Payment Appropriations Title 2

	Title 2 CA 2022		Title 2 PA 2022
received	3.516.922,89	received	3.383.328,16
consumed	1.211.760,64	consumed	764.634,12
	34,5%		22,6%





In line with the Joint Undertaking N+3 rule, unused appropriations will be carried over to 2023. The tables above show the C1 and C2 appropriations.

Expenditure under Title 3:

Due to the relatively late adoption of the regulation 2021/1173 (August 2021) and consequently the late approval of the Work Programme 2021 in December 2021, EuroHPC JU was not able to launch all calls foreseen for 2021 and those had to be launched and implemented during 2022 in addition to the calls foreseen under Work Programme 2022.

As a result the expected pre-financing payments will be delayed to 2023.

Also the CEF appropriations which were foreseen for the Hyperconnectivity were postponed due to the need for a study to inform the exact requirements for this complex call.

Due to the delays in completing the supercomputers, the interim payments for the OPEX grants signed for the pre-exascale supercomputers (LUMI, Leonardo and MARENOSTRUM 5) will also be delayed. The hosting entities have already incurred costs for the site preparation, staff and operating costs but can only claim those costs once the supercomputers are accepted and operational to produce access time for the end-users. These payments will also only take place in 2023 and thereafter.

With regards to 2021/1173 Regulation HPC systems, the hosting entities for the high-end / exascale supercomputer, the Quantum Computers and Midrange Computers were selected in 2022, but the procurement pre-financing payments and OPEX grants related to the selected hosting entities will only be finalised in 2023.

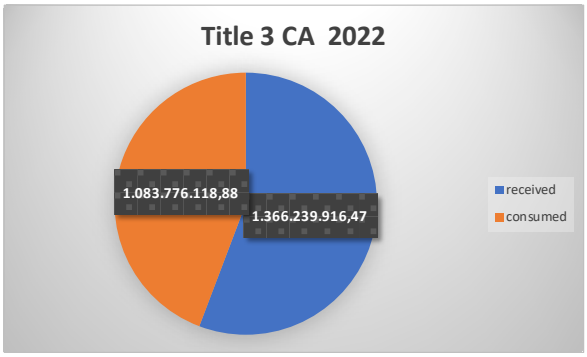
At the end of 2022, the JU received some requests for interim payments for the R&I Grants. The JU will only proceed with the payment procedure once the expert technical evaluation is finalised, at the beginning of 2023.

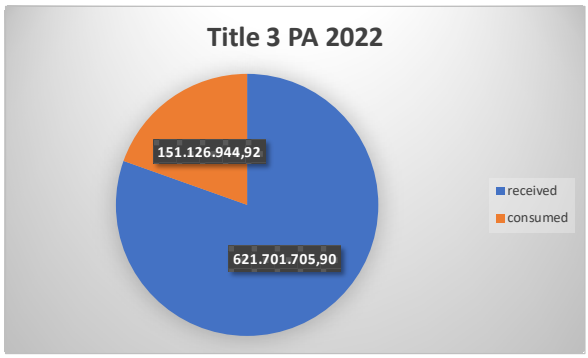
The RISC-V Call, the High Level Support Call, the two training and skills call and the international cooperation with Japan call under the Work Programme 2022 were launched in December 2022 and at the beginning of 2023, therefore the pre-financing payments will be done in 2023.

Budget implementation under title 3 (Grants and Infrastructure C1 and C2 appropriations) is as follows:

Situation of Commitment and Payment Appropriations Title 3 - Operational

	Title 3 CA 2022		Title 3 PA 2022
received	1.366.239.916,47	received	621.701.705,90
consumed	1.083.776.118,88	consumed	151.126.944,92
	79,3%		24,3%





Summary of the voted budget of the year

The JU Work plan and Budget 2022 was voted in December 2021. This budget set up the work programme for the first year under the new EuroHPC Regulation which was adopted in 2021 and included a full staff establishment plan. Almost all calls were launched in 2022. The last amendment of the Work Programme took place in December 2022, which meant that four calls were only launched in early 2023.

2.4. FINANCIAL AND IN-KIND CONTRIBUTIONS FROM MEMBERS OTHER THAN THE UNION

The Participating States reported on their contributions for the operational activities in 2022.

The two Private Members, ETP4HPC and DAIRO (BDVA) reported the in-kind contributions related to indirect actions in implementation under the Horizon 2020 programme.

The new Private Member, QuIC that joined the EuroHPC in December 2021 will report mainly on the operational activities funded by the new programmes (Horizon Europe and DEP).

In 2022, there are signed 12 grant agreements under the new programmes, the Horizon Europe and DEP with the starting date of the implementation as for 1st of January 2023. Then the Private Members will be able to report the in-kind contributions under these programmes starting from the next financial year.

The tables below represent the total financial and IKOP contributions reported by Participating States and Private Members for the financial year 2022.

FY2022	In-kind contributions in operating costs Pre-ExaScale	Acquistion Infrastructure Pre-ExaScale	Acquisition Infrastrusture Petascale	Indirect Actions R&I (PSs Financial Contributions)
Amount	25,005,655.36 €	59,770,503.67 €	3,104,594.79 €	12,504,839.97 €

FY2022	In-kind contributions in o operating costs of the EuroHPC supercomputers owned by the Joint Undertaking	Acquistion Infrastructure High-end EuroHPC Supercomputers or Quantum Machines	Acquisition Infrastrusture jointly of the Mid-range EuroHPC supercomputer	Indirect Actions R&I (PSs Financial Contributions)
Amount	- €	63,250,000.00 €	- €	2,050,176.50 €
Grand Total	**25,005,655.36 €**	**123,020,503.67 €**	**3,104,594.79 €**	**14,555,016.47 €**

FY2022	In-kind contributions by the Private Members
DAIRO	2,871,386.36 €
ETP4HPC	3,922,091.20 €
QuiC	- €
Grand Total	**6,793,477.55 €**

Participating States & Private Member contributions	FY 2022 Amounts in Euro
Financial Contributions (Acquisition Petascale + Indirect Actions)	17,659,611.26 €
Total IKOP (PS and private	31,799,132.91 €
Total to report in the annual	**31,799,132.91 €**
Total to report in the AAR 2022	**49,458,744.17 €**

2.5. ADMINISTRATIVE PROCUREMENT AND CONTRACTS

The majority of the EuroHPC JU's contractual commitments in 2022 were concluded on the basis of existing multiannual framework contracts (FWCs). In terms of volume, the FWCs used most were in the field of IT and audit services. When these contracts were not available to EuroHPC JU or they had expired, it was necessary to launch specific tender procedures, most of them for low-value contracts. All procedures were administered in compliance with the EuroHPC JU Financial Rules to ensure fair competition amongst economic operators, and the most sound and efficient use of EuroHPC JU funds.

In addition, throughout 2022, EuroHPC JU used Service Level Agreements (SLAs) in force with the European Commission. Several other contracts were concluded for less than EUR 15,000 each, while the following Table shows contracts concluded in 2022 for single amounts higher than EUR 15,000:

Contractor Official Name	Description	Procedure Type/ Legal Basis Desc	Date	Contract Amount (EUR)
INSIGHT DIRECT USA, INC.	Media monitoring services provided by Meltwater	Open Procedure (Art. 104(1) (a) FR)	14.01.2022	15.597,00
CROWELL & MORING LLP	Supply of data protection services: EU data protection online central register and data protection gap analysis services	Negotiated procedure low value contract (Annex 1 – 14.3)	09.03.2022	30.000,00
INSIGHT DIRECT USA, INC.	Microsoft 365 licenses renewal (ILA 2022)	Open Procedure (Art. 104(1) (a) FR)	24.05.2022	30.371,22
NTT BELGIUM	Additional networking equipment for EuroHPC JU new offices	Open procedure (FR 164 (1)(a))	12.09.2022	43.505,79
PROMETEUS **PROFESSOR MEUER TECHNOLOGIEBERATUNG UND SERVICES GMBH**	Booking EuroHPC JU exhibition space at ISC 2023- 21-25 May 2023- Hamburg/ Germany	Negotiated procedure low value contract (Annex 1 – 14.3)	19.10.2022	59.600,00
ARENDT & MEDERNACH SA	ARENDT & MEDERNACH –	Simplified procedure – Legal services as in Annex 1 – 38.6. (Annex 1 – 38.1 (d))	20.12.2022	79.200,00
ERNST & YOUNG **REVISEURS D'ENTRPRISES**	Audit services for annual accounts for 2022 and 2023	Open procedure (FR 164 (1)(a))	19.12.2022	52.920,00
VIDELIO-IEC	Procurement of AV&C Equipment and Services for the organisation of the EuroHPC Summit 2023	Open procedure (FR 164 (1)(a))	29.11.2022	299.999,97

2.6. IT AND LOGISTICS

Due to the expansion of the EuroHPC JU team and the addition of 9 new staff members, the EuroHPC JU arranged with the Luxembourg authorities to expand their office space in the Drosbach building in Luxembourg to accommodate the growing team.

The JU is set to move into the additional offices in 2023.

The JU also had exploratory discussions with the other JUs on a back-office arrangement (BOA) for ICT (mentioned in 2.7.2 this CAAR) , wherein all services not specific to a JU should be managed through the BOA.

EuroHPC JU is cooperating with other Jus and monitoring the implementation of this BOA which will happen in 2023.

2.7. HUMAN RESOURCES

HR Management

RECRUITMENT

With the entry into force of the new Regulation establishing EuroHPC JU (2021/1173 of 13 July 2021), the main focus of the Human Resources in 2022 was on the recruitment and integration of the newcomers in the team, as well as enhancing team cohesion within new re-organised JU. In view of the future growth, the organization needed a solid structure, in order to ensure both the efficiency and effectiveness of its operations.

Seventeen selection procedures were finalised in 2022 of which:

- 11 selection procedures were launched in 2022
- 6 procedures launched in December 2021 were finalised in 2022.

As a result, at the end of 2022 the JU staff almost doubled in size (from 15 staff members on 31/12/2021 to 23 staff members on 31/12/2022, with additional contracts signed and start date beginning of 2023).

2 staff members left the JU in 2022 (<10% of turnover).

All Temporary Agent selection procedures were published externally.

Vacancies were actively promoted on the EuroHPC JU's website and additional multiplier websites (e.g. EPSO, EU Agencies Network etc.), as well as on social media.

The HR cell, with support of the Communication team, produced a video promoting job opportunities in EuroHPC JU, which was disseminated via social media and via the multipliers.

IMPLEMENTING RULES

In 2022 EuroHPC JU adopted the Commission decision on Working Time and Hybrid Working. As the JU demonstrated the ability to deliver under the constraints of the COVID pandemic, flexible arrangements in terms of the working time and telework were introduced (see more information below).

The Joint Undertaking has also adopted the implementing rules reinforcing staff conduct, such as the general implementing provisions on the conduct of administrative inquiries and disciplinary proceedings and rules on the prevention and management of conflicts of interest of the staff members of the EuroHPC Joint Undertaking (see below the full list of staff implementing rules adopted in 2022).

The JU adopted all implementing rules (including the ones indicated above) within the deadline imposed by Article 110(2) of the Staff Regulations.

LEARNING AND DEVELOPMENT

In 2022 effort was made to strengthen the existing and develop new competencies among the JU staff. The list of mandatory and recommended training was defined for different function groups of staff across the organisation.

All staff was requested to follow e.g. the ethics and anti-fraud training.

Staff members dedicated on average 34 hours to training in 2022.

NEWCOMERS' ONBOARDING

Onboarding processes, including the newcomers welcome pack, mentoring system and introductory meetings etc. were put in place, in order to smoothly integrate the newcomers within their respective teams.

HR TOOLS AND PROCESSES

The implementation of the HR tools, policies and procedures continued.

Cross-sector interaction and knowledge sharing between colleagues was encouraged.

HR processes were strengthened and new tools were deployed, streamlining some of the HR processes e.g. the management of the probation period.

STAFF COMMITTEE

The elections of the Staff Committee were organised and finalised, with the Staff Committee being established and operational before the end of 2022.

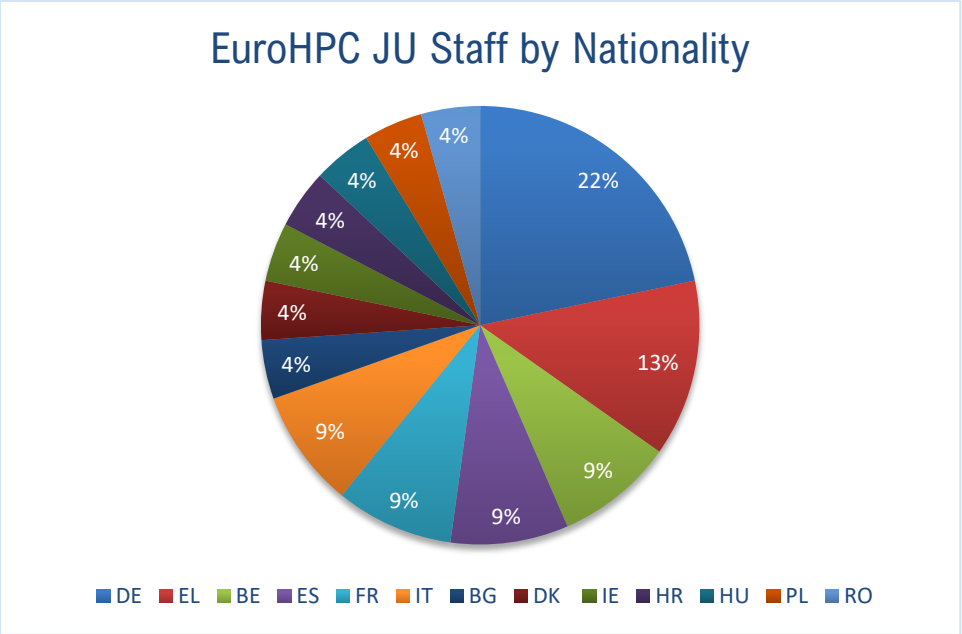
DIVERSITY AND INCLUSION

EuroHPC JU values and encourages diversity and inclusion across the JU.

Geographical diversity

In December 2022 JU staff represented 13 different nationalities. Germans are the larger population in EuroHPC JU (5 staff members), followed by Greek (3 staff members), followed

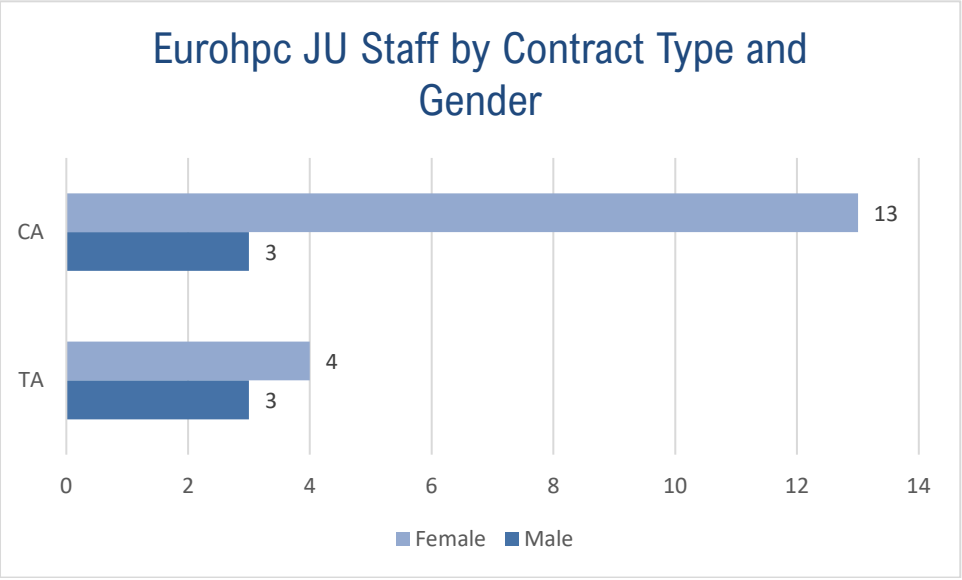
by Belgian, French, Italian and Spanish (2 staff members of each nationality) and one staff member each from Ireland, Croatia, Denmark, Hungary, Poland and Romania.



Staff situation as of 31/12/2022

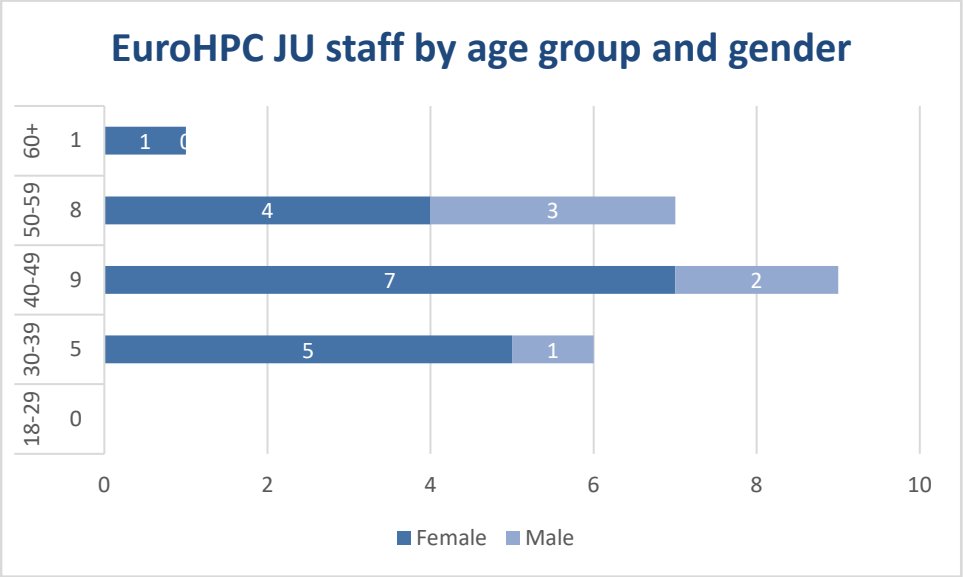
Gender and age balance

JU staff population is more balanced in terms of gender in the Temporary Agent category (4 female /3 male staff). In the population of Contract Agents, females are more numerous than males (13 female staff / 3 male staff).



Staff situation as of 31/12/2022

EuroHPC JU is also very diversified in terms of age. Staff represent all age groups above 30 years old. In the future EuroHPC JU intends also to attract young professionals group.



Staff situation as of 31/12/2022

EuroHPC JU is currently establishing its middle management layer of the organisation – the statistics will follow.

HEALTH AND WELLBEING

Following the outbreak of COVID-19 pandemic, the JU introduced more flexible arrangements in terms of the working time and telework, in line with the implementing rules on Working Time and Hybrid Working, adopted by the JU in 2022. The implementing rules also aim at promoting a modern, digital and flexible working environment, contributing to staff's health and wellbeing, as well as enhancing the efficiency and improving work-life balance.

The JU, together with the network of Joint Undertakings, further strengthened the network of Confidential Counsellors by launching a call for volunteers, selecting and training new Confidential Counsellors able to support all JU staff in the context of the anti-harassment policy.

The JU continued organising virtual coffee meetings for all staff, as well as in-premises social gatherings, e.g. on the occasion of two year's anniversary of the JU's autonomy or Christmas.

SIR implemented in 2022	
Title of the SIR	**Reference and date of the GB decision (if relevant)**
Working Time and Hybrid Working	N/A – adoption by analogy following the 9 months' period
Rules on the prevention and management of conflicts of interest of the staff members of the EuroHPC Joint Undertaking	DECISION OF THE GOVERNING BOARD OF THE EuroHPC JOINT UNDERTAKING No 16/2022
Decision laying down general implementing provisions on the conduct of administrative inquiries and disciplinary proceedings	DECISION OF THE GOVERNING BOARD OF THE EuroHPC JOINT UNDERTAKING No 5/2022
Decision laying down general implementing provisions regarding the payment of the education allowance provided for in Article 15 of Annex X to the Staff Regulations to staff members for the duration of temporary assignments to the seat of the institution or any other place of employment in the Union	DECISION OF THE GOVERNING BOARD OF THE EuroHPC JOINT UNDERTAKING No 15/2022

Efficiency gains and synergies

In 2022, EuroHPC Joint Undertaking (JU) was in its 2nd full year of operation since its autonomy in September 2020. In 2022, EuroHPC JU implemented most activities as set out in the Work Programmes. Two areas where EuroHPC JU worked with the other Jus were the implementation of the Back Office Arrangement and the Employer Pensions Contributions issue.

Back Office Arrangement (BOA)

EuroHPC JU continued to grow and establish itself. Relations with other Jus have been excellent.

The Single Basic Act (SBA) of the Joint Undertakings[14] establishes that the Jus covered by the SBA shall achieve synergies via the establishment of a back-office arrangements, operating in some identified areas. The SBA also underlines that these synergies should be implemented

[14] Article 13, Council Regulation (EU) No 2021/2085, of 19 November 2021

where screening of resources has proved to be efficient and cost effective, while respecting the autonomy and the responsibility of each Authorising officer.

As EuroHPC JU is not a part of the Single Basic Act regulation, it may decide to participate to BOA activities on case-by-case basis.

The EuroHPC JU Governing Board confirmed that EuroHPC JU could, if appropriate,[15] engage in Back-Office Arrangement (BOA agreements) with its sister Jus. As a result, in 2022, the JU entered into a Back-Office Arrangement (BOA) with EU-RAIL JU on accountancy services. EuroHPC JU is also cooperating in the BOAs on ICT, HR and Procurement.

In order to obtain an independent view on the possible synergies among the Jus and the impact in terms of efficiencies, the Jus – including EuroHPC JU – contracted an external consultant to perform a study on the Common back-office arrangements. The study was finalised in July 2022 and its specific objectives were to:

- Identify **areas, or sub-functions of areas**, for being operated under Back Office Arrangements, including necessary elements of cost efficiency, risks and opportunities

- Support the Jus to **assess the viability** (including the screening of resources) of these areas

The study identified 21 potential synergies opportunities among the Jus were identified for all services covered by Article 13 of the SBA. It concluded that the estimated efficiency gains in terms of FTE savings were modest for most synergies, but there were potential benefits in terms of harmonisation of current practices, standardisation of procedures, establishment of critical mass for effective negotiation, coordination and cost savings

Those synergy opportunities were clustered into three main groups:

- **Quick wins** (14) – Synergies that scale-up the existing collaboration among the Jus, as a result, these should be potentially implemented in a first wave.

- **Long-term solutions** (5) – These synergies require further reflection on the structuring and planning of their setup and an accurate assessment of the potential benefits, cost-efficiency and risks;

- **Low priority opportunities** (2) – Synergies which were identified as less feasible/desirable by the Joint Undertakings due to their limitations in terms practical applicability and value.

- The largely preferred model for the BO Arrangement among Jus is a setup with one JU taking the lead dealing in coordinating tasks with one backup JU, organising the work among staff of several Jus and having a clear scope and decision making power. Example: Back office arrangement for the provision of accounting services (following DG BUDG decision to terminate the contract with the Jus)

[15] As EuroHPC JU is not a part of the Single Basic Act regulation, it may decide to participate to BOA activities on case-by-case basis.

- For some synergies a more flexible option was chosen, with collaboration involving only some Jus, while remaining open for the others to join at a later stage.

The preparation work led to the establishment of coordinated plans, prioritising those aspects of the BOA that had the objective to bring most value in the short term and could be adapted to EuroHPC JU's situation. For EuroHPC JU, these included, (i) the accounting function (ii) IT deployment (iii) joint procurement opportunities and (vi) HR support. This approach was endorsed[16] EuroHPC JU's Governing Board.

In detail the BOA arrangement that were put in place in 2022 were:

BOA Accounting

The JUs took over the Accounting services that until 2022 were provided by DG BUDG. In this BOA EU Rail is the lead JU, and to take into board these service the support of 3 additional Contractual Agents and an external Accounting Services provider was decided. Accounting officer's services will be provided by 3 JU's: CA JU , SESAR JU and EU-Rail

Organisation :

- The Executive Director of the Lead JU is responsible for the organization, oversight and coordination of the accounting services to the other Jus on the basis of an annexe of the BOA SLA.
- The Head of Administration and Finance or another officer with the necessary grade, skills and competencies of the Lead JU shall act as Accounting Coordinator of the BOA Accounting Officers.
- The Accounting Officer(s) of the JU Accounting Providers delivers the service to one or more JU Accounting Beneficiary and is responsible for the accounts she/he signs off, while counting on the support and coordination with the lead JU.

As a result, in December 2022, the JU entered into a Back-Office Arrangement (BOA) with EU-RAIL JU on accountancy services.

BOA Human Resources

For what concerns the HR domain, the study recommended to explore synergies by coordinating the management of SYSPER, possibly obtaining a single contract for all Jus, perform joint recruitments, harmonise job profiles and procedures.

These synergies will allow to obtain a better harmonisation among the Jus, exploiting best practices, achieving efficiency gains and economy of scale. In particular the areas where this BOA will act are: recruitment, legal framework and IT landscape in the HR domain.

[16] See minutes of EuroHPC JU 29th Governing Board meeting of 25 November 2022

Following the screening of HR resources in each JU, the study also points out no more than marginal FTE gains would be achieved in this area due to the very limited HR dotation of the Jus.

EuroHPC JU is cooperating with other Jus and monitoring the implementation of this BOA which will happen in 2023.

BOA ICT

The ICT area covers a list of ~50 services (service catalogue) structured in 6 service groups:

1. Inter-JU IT Governance,
2. Management of shared ICT infrastructure,
3. Management of ICT tools, services and contracts,
4. Workplace services provision,
5. Security and compliance management,
6. ICT activities specific per JU.

The underlying concept is that, out of the ICT service catalogue, everything that is non-specific to a JU should be managed through the ICT BOA. Therefore, ICT developments and other activities specific to each JU will be under the responsibility of each ED and will not be part of the ICT BOA, that in any case will have to ensure the integrity of the overall ICT architecture.

EuroHPC JU is cooperating with other JUs and monitoring the implementation of this BOA which will happen in 2023.

BOA Procurement

This BOA arrangement has been established with the objective of centralising administrative procurement capability and process to maximise open tenders for award of inter-Jus Framework contracts (FWCs) and middle value negotiated procedures.

The focus is on the critical joint administrative procurement such as ICT, building management/corporate services and common support services that will be identified and agreed via joint Public Procurement Planning (PPP).

EuroHPC JU is cooperating with other Jus and monitoring the implementation of this BOA which will happen in 2023.

Employer Pension Contributions

Following the concerns raised by the ECA, the Commission provided legal and financial guidance to all Jus on employer contributions to staff pensions. It is estimated that EuroHPC JU will pay ca. EUR 5.7 million over the life-time of the JU. Funds will come from EU contributions to the administrative budget of the JU.

3. GOVERNANCE

3.1. MAJOR DEVELOPMENTS

The year is considered normal with no major developments.

3.2. GOVERNING BOARD

At the end of 2022, the EuroHPC JU has 33 Participating States, following the Governing Board decision to accept Serbia as a new member in June 2022.

The Governing Board met six times in 2022, at the occasion of the 25th, 26th, 27th, 28th, 29th and 30th meetings. Meetings took place online, in Luxembourg and in Kajaani Finland (inauguration of the LUMI system) and Bologna (Inauguration of the Leonardo system) Major decisions taken by the Governing Board included the selection of hosting entities for new EuroHPC supercomputers,[17] in particular the first high-end (exascale) system to be hosted by Julich Supercomputing Centre in Germany[18] and the selection of hosting entities for six quantum computers to be integrated in existing supercomputers across Europe.[19]

3.3. EXECUTIVE DIRECTOR

In 2022, Anders Dam Jensen, Executive Director of the EuroHPC Joint Undertaking, continued to lead the Joint Undertaking.

3.4. INDUSTRIAL AND SCIENTIFIC ADVISORY BOARD FOR EUROHPC

In March 2022, the Governing Board agreed the membership of the two Working Group that make up the Industrial and Scientific Advisory Board.[20] The two groups are the Research and

[17] Decision No 18/2022 On the selection of the Hosting Entities for the Mid-Range Supercomputers

[18] Decision No 19/2022 On the selection of the Hosting Entities for a High-End Supercomputer

[19] Decision No 27/2022 On the selection of the Hosting Entities for the European quantum computers integrated in HPC supercomputers

[20] Annexes 5 and 6 RIAG and INFRAG Membership Lists

Innovation Advisory Group (RIAG) and the Infrastructure Advisory Group (INFRAG) met once physically in Luxembourg and the rest of the year virtually. In 2022, their main task was to produce expertise to populate the revision of the Multi-Annual Strategic Programme which will be adopted by the Governing Board in 2023.

During their first in-person meeting in Luxembourg on the 4th and 5th of May 2022, RIAG and INFRAG elected their chairs.[21]

RIAG

The RIAG members elected Jean-Philippe Nominé as their chair for the next two years. Jean-Philippe Nominé is HPC Strategic Collaborations Manager at the French Alternative Energies and Atomic Energy Commission (CEA). He is also a member of the ETP4HPC Association Steering Board and ETP4HPC Vice Chair for Research. The RIAG members also elected Thomas Lippert, is director of the Jülich Supercomputing Centre, as vice-chair.

The tasks of the RIAG are the following:

- Drawing up and regularly updating the draft multiannual strategic research and innovation agenda of the EuroHPC JU. This draft agenda identifies research and innovation priorities to support the development of an integrated HPC, quantum computing and data ecosystem in the European Union (EU).
- Providing advice on potential international cooperation activities in research and innovation.
- Issuing recommendations to promote training and education priorities for addressing key competences and the skills gap in HPC and quantum computing technologies and applications, in particular for industry.
- Organising public consultations open to all public and private stakeholders having an interest in the fields of HPC and quantum computing to inform them and collect feedback.

INFRAG

Sinead Ryan was elected chair of INFRAG in May 2022. She is a professor of Theoretical High Energy Physics at Trinity College Dublin. The INFRAG members also elected Claus Axel Muller as their vice-chair. Claus Axel Müller is managing director at the Gauss Centre for Supercomputing.

The tasks of the INFRAG are the following:

- Providing advice to the Governing Board of the EuroHPC JU for the acquisition and operation of the supercomputers, drawing up and regularly updating the draft

[21] EuroHPC Press Release "New EuroHPC JU advisory groups have elected leadership"

multiannual strategic agenda in relation to such acquisition but also capability building and widening activities.

- Issuing recommendations on the federation and interconnection of the EuroHPC infrastructure, taking into account, inter alia, the integration with national HPC or quantum computing infrastructures, and the architecture of the hyper-connected and federated infrastructure.
- Advising on the capability building, including the national HPC Competence Centres and widening and training activities for end-users, as well as opportunities for promoting the take-up and use of European technology solutions notably by the national HPC Competence Centres.
- Organising public consultations open to all public and private stakeholders having an interest in the field of HPC, including quantum computing, to inform them, and collect feedback.

Above: The RIAG Members at their first in-person meeting in Luxembourg on 4th May 2022.

Below: The INFRAG Members at their first in-person meeting in Luxembourg on 5th May 2022.

4. FINANCIAL MANAGEMENT AND INTERNAL CONTROL

4.1. CONTROL RESULTS

Legality and regularity of the financial transactions

The legality and regularity of financial transactions was ensured by the application of the manual of financial procedure, stating the roles, responsibilities and processes for the financial transactions (financial circuits)[22]. Ex-ante controls were regularly performed, a limited number of ex-post controls were performed by the Common Audit Service (CAS) of DG RTD.

Audits performed by CAS are not finalised nevertheless, the preliminary audit reports (PARs) have been published and allow for a provisional calculation of the Representative error rate for 2022 of 2.23%. The residual error rate for the year was calculated by CAS and is based on indirect coverage of 60.12% (direct coverage will be available at the delivery of final audit reports) and has a value of 1.85%. The residual error rate remains below the materiality of 2%, a reservation in the assurance declaration of the Executive Director for the year 2022 is not considered necessary.

A specific monitoring system was set up to ensure the smooth and reliable processing of transactions as well as accountability of staff involved. Initiating and verification phases are recorded in Ares and an e-signature workflow is applied.

The annual assessment of the Internal control system did not identify weaknesses related the financial transactions.

Fraud prevention, detection, and correction

The Governing Board adopted the EuroHPC Anti-Fraud Strategy in 2021[23], deciding to apply the Common Anti-Fraud Strategy in the Research Family approach.

The 2022 annual Risk assessment included the identification and assessment of fraud risks. The assessment did not identify fraud risks and no risks were identified thereafter.

Assets and information, reliability of reporting

The safeguard of information and reliability of reporting was ensured by regular controls performed at every level of EuroHPC JU. Controls are extensively supported by the use of IT

[22] Decision No 4/2020 Regarding the Approval of the Manual of Financial Procedures of the EuroHPC JU

[23] Decision No 07/2021 Adopting the EuroHPC JU Anti-Fraud Strategy

tools such as: ABAC for financial and accounting activities, Compass, Sygma, Simba for projects management, Ares for document management, Sysper and RCAM/JSIS for HR matters. Controls are in place and effectively functioning for all operational and horizontal activities, in compliance with regulations and procedures. There were no breaches of sensitive information in 2022. IT assets and security matters had been promptly managed by EuroHPC JU's IT sector, the IT BCP is in place.

Reliability of reporting was assured by the Accounting officer and the external auditors. The latest validation of the accounting systems was conducted in May 2022 and was related to the financial year 2021. The evaluation has not identified any internal control weakness which would have a material impact on the accuracy, completeness and timeliness of the information required to draft the annual accounts and produce reliable reporting. The ECA expressed its opinion on the reliability of accounts for the financial year 2021 and stated that the accounts of the EuroHPC JU present fairly, in all material respects, the financial position of the EuroHPC JU, the results of its operations, its cash flows, and the changes in net assets for the year, in compliance with its Financial Regulation. Accounting officer and ECA assurance on the reliability of accounts for the financial year 2022 are not yet available.

The IC system annual assessment did not disclose significant weaknesses on safeguard of assets and information nor on the reliability of reporting. Some improvements are needed and concerns the formalisation of an overall control strategy and the set-up of some registers to record adverse events.

4.2. EFFICIENCY OF CONTROLS ("TIME TO")

The recent establishment of EuroHPC JU and the limited number of launched projects do not allow for significant 'Time to' indicators nor for time evolution analysis. Furthermore, giving the nature of objectives and projects, timelines vary significantly, invalidating the meaning of an average result.

Nonetheless, indicators had been monitored and reported for each project. The following table shows the reported 'Time to' indicators results per project and year of call deadline.

Year of Call Deadline	Project Call Id	Average TTI	Average TTS	Average TTG	Average TTP
2019	H2020-JTI-EuroHPC-2019-2	117	143	260	80
2019	H2020-JTI-EuroHPC-2019-3	37	27	64	90
2020	H2020-JTI-EuroHPC-2019-1	182	154	346	73

2020	H2020-JTI-EuroHPC-2020-1	132	311	443	
2020	H2020-JTI-EuroHPC-2020-2	181	303	484	
2021	H2020-JTI-EuroHPC-2020-03	112	208	320	
2022	DIGITAL-EUROHPC-JU-2022-NCC-01	63	112	175	
2022	HORIZON-EUROHPC-JU-2021-COE-01	127	124	251	
2022	HORIZON-EUROHPC-JU-2022-ALG-02	82			

For H2020 projects, average values for TTI, TTG and TTP indicators are disclosed in Annex 7: "Scoreboard of Horizon 2020 H2020 Legacy KPIs".

4.3. ECONOMY OF CONTROLS

EuroHPC JU is finalising the setup of its Internal Control system (ICS) and carried out its first annual assessment for the year 2022. The cost of controls process will be established and implemented in 2023.

4.4. CONCLUSION ON THE COST-EFFECTIVENESS OF CONTROLS

The analysis on cost-effectiveness of controls was not performed in 2022. It will follow the evaluation of cost of controls that will be implemented in 2023.

4.5. AUDIT OBSERVATIONS AND RECOMMENDATIONS

Internal Audit

The DG Internal Audit Service (IAS) ran the first an in-depth risk assessment in April 2021 and, based on its results, drafted the 2022-2024 Strategic internal audit Plan. The shortlist of audit topics included an audit on HR management.

In 2022, the IAS carried out the limited review on HR management in EuroHPC JU. The Final report was delivered at the end of October. The following recommendations were issued:

Rec.	Severity	Title
1	Very important	Staffing plan: from design to implementation

2	Important	Finalisation of the setup of the HR and ethics functions
3	Important	Improve internal communication and the documentation of recruitments

An action plan was agreed to tackle the recommendations. Its implementation is ongoing, actions will be finalised in Q1 to Q4 of 2023.

Audit of the European Court of Auditors

The ECA statement of assurance is provided annually to the European Parliament and the Council. The latest available statement is related to the financial year 2021. The ECA expressed its opinion on the reliability of accounts for the financial year 2021[24] and stated that the accounts of the EuroHPC JU present fairly, in all material respects, the financial position of the EuroHPC JU, the results of its operations, its cash flows, and the changes in net assets for the year, in compliance with its Financial Regulation.

The following observations were pointed out in the report[25]:

Observation	Title and description	Actions and results as for 31/12/2022
On legality and regularity of transactions	**JU's employer contributions to the EU pension scheme**: EuroHPC had not yet paid such contributions	Contributions calculated by the Commission PMO and paid
On budgetary management	**Implementation of the Horizon 2020 and Connecting Europe Facility (CEF) budget**: - the risk that the JU will not achieve the other members' contribution targets under the new founding Regulation is significantly increased - low implementation rate for commitments and payments	- actions to achieve the others member's contribution targets are ongoing - implementation rates increased - appropriations from previous year were used before new appropriations

[24] Annual Report on EU Joint Undertakings for the financial year 2021.

[25] The observations do not call the final opinion into question.

	- the JU did not consider sufficiently in the planning of budget 2021, the reallocation of unused payment appropriations from previous year and did not used reallocated budget appropriations from previous year before the new appropriations of the year	
On the management and control systems	**The JU's internal control framework**: the JU had not fully completed the development of a control and monitoring strategy nor a business continuity and IT security plan **The new centralised system to manage Participating States' financial contributions**: The lack of planning in the introduction of the CMFC system combined with the staff situation, and the lack of IT tools and support may negatively affect the implementation of the JU's programmes and the achievement of the other members' contributions	The control and monitoring strategy and the BCP will be completed by 2023, the IT BCP is in place
On other issues	**The JU's human resources situation**: - As the JU had only 15 staff members at the end of 2021, it may face considerable human resource challenges in managing these new recruitments, in addition to the new administrative and operational processes yet to be established - The absence of key staff could have adverse effects on the JU's business continuity and the achievement of its objectives, in particular, given the highly technical nature of infrastructure projects for supercomputers, and the requirement for highly qualified staff with very specific knowledge	Recruitment was intensified, including highly qualified staff

Regarding the observations disclosed in the previous year's reports, the EuroHPC JU had set up and implemented corrective actions. According to the latest report, among the five observations from previous years (2020 and earlier), one action is completed and four are ongoing.

The ECA has not performed audits on specific topics since the establishment of EuroHPC JU. The ECA has conducted audits on a sample of four beneficiaries from the H2020 programme. Audits were launched in 2022, three had been finalised and one is ongoing. Among the three finalised audits, two did not disclose findings. For one audit, findings on the management of HR and staff contracts were found, EuroHPC defined and implemented actions to investigate, identify and mitigate risks.

Overall Conclusions

EuroHPC JU was established in 2018 and became autonomous in 2020. Its operational activities mostly began in late 2021. EuroHPC JU had pursued its operational objectives meanwhile building up its organisational structure at pace with very limited human resources. Nonetheless, no critical issues were identified by internal and external auditors.

The IAS finalised its first limited review at the end of 2022. An action plan had been agreed and will be implemented in 2023.

The ECA published the Annual report on the EU Joint Undertakings for each financial year since 2018. Actions to tackle observations were selected and had been implemented or are ongoing.

In 2022, the Common Audit Service of DG RTD began the audit of a sample of six beneficiaries from the H2020 programme. For the time being, audits are not yet finalised.

Overall, the internal auditors did not identify any weaknesses that have a critical or material impact on the achievement of EuroHPC objectives. The ECA disclosed findings with material impact for one audit, actions were decided and implemented to recover undue payments and mitigate risks. Audits performed by the CAS, although not finalised yet, disclosed results that allows for provisional calculation of the representative and the residual error rates. Both rates are aligned with the R&I family rates, the residual error rate is within the materiality threshold of 2%.

4.6. ASSESSMENT OF THE EFFECTIVENESS OF INTERNAL CONTROL SYSTEMS

EuroHPC JU's Internal Control Framework (ICF) grounds on the Committee of Sponsoring Organisations (COSO)[26] Internal Control Integrated Framework and is aligned with the Internal Control Framework (ICF) of the European Commission (EC)[27].

[26] https://www.coso.org/SitePages/Home.aspx

[27] EC, Revision of the Internal Control Framework, C(2017)2327

The Internal control system was set up and applied methodology consisted of the assessment of all principles and components as disclosed in the EuroHPC ICF, adopted by the Governing Board with the decision No. 13/2020[28]. The assessment of the presence and functioning of each principle was carried out taking into account strengths and deficiencies as identified from ongoing and specific controls. Results were aggregated for assessment at component level. The assessment of the Internal Control System as a whole was carried out considering results from principles and components.

The Internal Control System Self-assessment report was drafted and approved by the Executive Director[29]. The calculation methodology applied for the assessment of principles, components and overall ICS is explained in Annex 1 of the report. Results are summarised in paragraph 4.4 of the present CAAR. An action plan will be drafted and implemented to tackle identified deficiencies.

Continuous monitoring

The EuroHPC JU established and regularly implemented several internal controls to ensure horizontal and operational activities are performed efficiently and effectively, in compliance with regulation and aligned with planned objectives. Regular controls are performed at any level of EuroHPC JU.

Controls are embedded with activities, manual controls are extensively supported by the use of IT tools such as: ABAC, Compass, Sygma, Simba, Ares, Sysper and RCAM/JSIS for HR matters. The overall control system is in place and well-functioning but is not yet formalised, although guidelines to IT tools and Programmes (HE, DEP, CEF) are fully applied to ensure the adequate recording and reliability of data. The efficient use of mentioned tools reduced the risk of missed controls to acceptable very low level.

Eight exception and non-compliance events were reported, and mitigation actions have been developed in all cases.

Risk assessment and management

The EuroHPC JU performed a risk assessment exercise for the identification and assessment of risks. The exercise was only partially carried out due to the lack of an internal control officer (The post was subsequently filled in 2023). An action plan to mitigate identified risks and related follow up was not yet implemented. Nevertheless, actions were decided and implemented. Overall, risk management in EuroHPC is partially present and functioning, major improvements are needed to establish a formalised process, implement and integrate it with the performance management cycle.

[28] Re-adopted with Decision No 17/2021 after COUNCIL REGULATION (EU) 2021/1173 of 13 July 2021 on establishing the European High Performance Computing Joint Undertaking and repealing Regulation (EU) 2018/1488

[29] Executive Director Decision No 05/2023 Approving the Internal Control System Self-Assessment Report 2022

Prevention of Conflict of Interest

EuroHPC JU staff and members of the Governing Board (GB) and Advisory bodies (INFRAG, RIAG) shall submit a declaration of interests disclosing any interests that can conflict with the EuroHPC's legitimate interests.

The declarations of staff are collected, reviewed, filed and monitored by the HR Sector at the recruitment and whenever necessary.

GB members shall sign the declarations of confidentiality, interests and conflicts of interest upon their appointment and update it whenever a change occurs. Advisory Bodies members shall sign the declarations of confidentiality, interests and conflicts of interest upon their appointment and prior the attendance of meetings. Participants to the meetings (GB substitutes, observers, experts, experts included in reserve lists of advisory bodies) shall sign the declarations before attendance. If before or during a meeting any attendee, whose participation in the work of the EuroHPC JU leads or may lead to a conflict of interest with regard to a particular agenda item, he/she shall without delay inform the Chair who shall without delay and before any discussion is initiated, decide on any specific measure in this respect, in consultation with the Executive Director.

Rules on Conflict of interest for the members of the GB were revised in 2022, with Decision No. 24/2022.[30] INFRAG rules on conflict of interest are disclosed in the Article 12 of the Decision 01/2022[31]. RIAG rules on conflict of interest are disclosed in the Article 12 of the Decision 01/2022[32]. The secretariat of the GB manages the declarations according to established rules. Templates are in place and used for declarations.

Prevention of conflict of interest is efficiently and effectively managed. Any Infringement was identified in 2022.

4.7. CONCLUSION ON THE ASSURANCE

The results of the continuous and specific monitoring activities did not deploy critical deficiencies with an impact on the presence and functioning of the IC principles. Major improvements are needed for six principles and minor improvements are necessary for another four principles. At component level, four components require substantial improvements.

[30] Decision of the Governing Board of the EuroHPC Joint Undertaking No 24/2022 – Approving the Amendment of the Governing Board Rules of Procedure

[31] Decision of the Infrastructure Advisory Group of the EuroHPC Joint Undertaking N° 01/2022 – Adopting its Rules of Procedure

[32] Decision of the Research And Innovation Advisory Group of the EuroHPC Joint Undertaking N° 01/2022 - Adopting its Rules of Procedure

Most relevant weaknesses arise from the lack of formal procedures and guidelines. The risk management was partially implemented.

The overall assessment concluded that principles and components are present and functioning, major improvements are needed.

4.8. STATEMENT OF ASSURANCE

Assessment of the Consolidated Annual Activity Report by the Governing Board

BACKGROUND

The Executive Director submits the draft Consolidated Annual Activity Report (CAAR) 2022 to the Governing Board for assessment and approval. The Governing Board approves the CAAR together with the annual accounts. Once approved by the GB, the CAAR is made publicly available. No later than 1 July 2023, the CAAR together with its assessment will be sent by the Executive Director to the European Court of Auditors and to the European Commission.

The members of the Governing Board of the EuroHPC Joint Undertaking took note of the Annual Activity Reports 2021 and 2022. The presented document is the third Annual Activity Report of the EuroHPC JU since its autonomy in September 2020. The highlights of the report have been presented during the Governing Board meeting held 14-15 June 2023.

The EuroHPC Joint Undertaking was established on 28 September 2018 by Council Eegulation No 2018/1488, published in the Official Journal of the EU on 8 October 2018 and entered into force on 28 October 2018. Following the adoption of the new Council Regulation 2021/1173 in July 2021, the JU's objectives were updated and now reads as follows:

- to contribute to the implementation of Regulation (EU) 2021/695 and in particular Article 3 thereof, to deliver scientific, economic, environmental, technological and societal impact from the Union's investments in research and innovation, so as to strengthen the scientific and technological bases of the Union, deliver on the Union strategic priorities and contribute to the implementation of Union objectives and policies, and to contribute to tackling global challenges, including the Sustainable Development Goals by following the principles of the United Nations Agenda 2030 and the Paris Agreement adopted under the United Nations Framework Convention on Climate Change;

- to develop close cooperation and ensure coordination with other European Partnerships, including through joint calls, as well as to seek synergies with relevant activities and programmes at Union, national, and regional level, in particular with those

supporting the deployment of innovative solutions, education and regional development, where relevant;

- to develop, deploy, extend and maintain in the Union an integrated, demand-oriented and user-driven hyper-connected world-class supercomputing and data infrastructure;
- to federate the hyper-connected supercomputing and data infrastructure and interconnect it with the European data spaces and cloud ecosystem for providing computing and data services to a wide range of public and private users in Europe;
- to promote scientific excellence and support the uptake and systematic use of research and innovation results generated in the Union;
- to further develop and support a highly competitive and innovative supercomputing and data ecosystem broadly distributed in Europe contributing to the scientific and digital leadership of the Union, capable of autonomously producing computing technologies and architectures and their integration on leading computing systems, and advanced applications optimized for these systems.

WORK OF THE GOVERNING BOARD AND ADVISORY COMMITTEES

In consequence of the new mission given by the new Council Regulation, the new Governing Board was composed and a new chair, Dr Herbert Zeisel, was elected in October 2021. In 2021, the composition of RIAG and INFRAG was rearranged due to the updated mission and their main work in 2022 was to recommend an updated Multi-Annual Strategic Plan for the Governing Board to decide upon in 2023 . Six Governing Board meetings were held throughout 2022. One new Participating State applied to join EuroHPC JU in 2022, Serbia was accepted at the Governing Board meeting in 14-15 June 2022.

2022 saw the expansion of the JU's team to 23 staff members with additional staff planned to join in early 2023.

The JU received its European Court of Auditors (ECA) feedback on its budget and accounting 2021. For the most part this feedback was positive, with some places to grow and implement changes. The EuroHPC JU's European Parliamentary discharge in respect of the implementation of the JU's budget for 2021 was granted and adopted by the European Parliament in May 2023.

In 2022, the EuroHPC JU and the Governing Board could, for its first time under the MFF 2021-2027, operate completely without Covid restrictions. This enabled a smoother path for the EuroHPC JU to meet the milestones defined by the Governing Board and to fulfil its strategic mission. The Board is of the opinion that the Annual Activity Report sets out the relevant highlights of the execution of the 2022 activities defined for the Joint Undertaking from both an operational and administrative point of view. The report will be sent to the European Parliament,

Council of Ministers, Commission and Court of Auditors. It will form the basis of the discussion with the European Parliament in the preparation of the Budgetary Discharge in 2024.

HIGHLIGHTS OF THE EUROHPC JU MAIN ACHIEVEMENTS IN 2022

The Board is pleased to note the acquisition and successful implementation of supercomputers – petascale and pre-exascale machines – as well as the start of procuring Europe's first exascale machine. This will ensure the set-up of a world-class HPC ecosystem in Europe that addresses relevant and important socio-economic challenges. During 2022 two pre-exascale supercomputers were inaugurated and made fully available to the users, LUMI in Finland and Leonardo in Italy. Both LUMI and Leonardo are rated among the top 5 supercomputers globally. The third pre-exascale supercomputer MareNostrum 5 in Spain will follow in 2023 and hopefully Jupiter, Europe's first exascale supe computer located in in Germany soon after that. In addition, EuroHPC provided access to four peta-scale supercomputers in 2022, with more planned for 2023.

The EuroHPC supercomputers catered for users from academia as well as from the private- and public sectors. Also, the EuroHPC GB decided to give dedicated access to supercomputing resources to the EU-funded Destination Earth project with the aim to understand the future development of the Earth's climate as well as address mitigation and adaptation strategies.

During 2022, the EuroHPC JU launched training and support actions with the aim to both support current users of HPC in all sectors as well as foster the next generation of HPC users. By supporting and coordinating training and support actions across Europe, EuroHPC aims to build European critical mass in all aspects of HPC as well as utilise competence in all Participating States.

In 2022, the EuroHPC JU also took steps to support Europe's competitiveness computing hardware technology and applications. Notably though by the Governing Board decision to host and acquire of six quantum computers linked to existing HPC centers, devising a strategy for developing European hardware technology in classical HPC (in particular RISC-V) and approving ten proposals for HPC Centers of Excellence (CoEs) for developing applications and supporting users in domains such as drug discovery, climate modelling and fluid mechanics. The CoEs are both a continuation of previously EuroHPC funded collaboration initiatives and newly established collaborations.

The dialogues with PRACE and GEANT as specified in the EuroHPC regulations continued during 2022. However, the EuroHPC JU, with support from the Governing Board decided to in-source the evaluation of applications for access to the EuroHPC supercomputers. This transition will be completed in 2023. Also the discussions how to align the hardware development with the Key Digital Technologies (KDT) JU continued during 2022.

CONCLUSIONS BY THE GOVERNING BOARD

The Governing Board is pleased about the excellent dissemination of the JU's activities and notes that no critical risks have been identified regarding the JU's main business processes and internal controls and is pleased to note the further development and strengthening of the risk management approach, in particular enhancing the systematic monitoring of technical and financial risks in the projects.

The main risks associated with the financial autonomy of the EuroHPC JU have been appropriately addressed and overcome.

The Governing Board takes note that the JU has fulfilled its monitoring tasks through the implementation and usage of dedicated key performance indicators (KPIs) for the achievement of strategic objectives.

Declaration of assurance

I, the undersigned, Anders Dam Jensen

Executive Director of the EuroHPC Joint Undertaking

In my capacity as authorising officer by delegation

Declare that the information contained in this report gives a true and fair view.

State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on my own judgement and on the information at my disposal, such as the results of the self-assessment, ex-post controls, the work of the internal audit capability, the observations of the Internal Audit Service and the lessons learnt from the reports of the Court of Auditors for years prior to the year of this declaration.

Confirm that I am not aware of anything not reported here which could harm the interests of the Joint Undertaking.

However the following reservations should be noted:

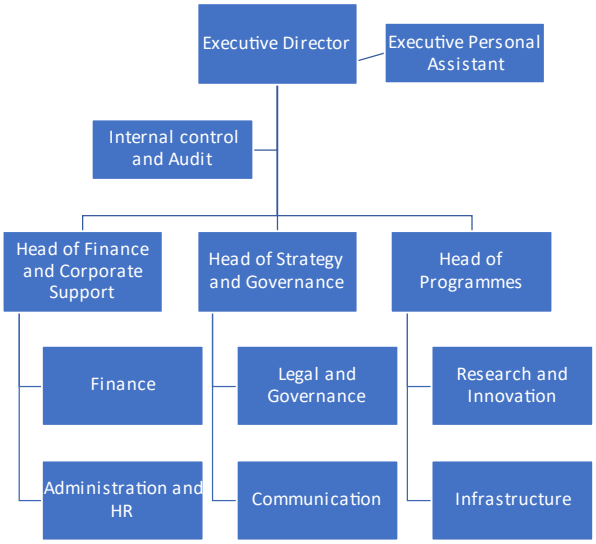
- *The design of HR strategy, plans and management shall be finalised and implemented;*
- *The Risk Management process shall be formalised and fully implemented;*
- *The Control activities strategy shall be formalised;*
- *The communication strategy and plans shall be finalised;*
- *The ICS strategy shall be finalised and fully implemented.*

Luxembourg, 21 June 2023

Anders Dam Jensen

ANNEXES

1. ORGANISATIONAL CHART



2. ESTABLISHMENT PLAN AND ADDITIONAL INFORMATION ON HR MANAGEMENT

Function group and grade	YEAR N-1				YEAR N			
	Authorised		Actually filled as of 31/12		Authorised		Actually filled as of 31/12	
	Permanent posts	Temporary posts	Permanent posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts
AD 16								
AD 15								
AD 14	1	1		1		1		1
AD 13								
AD 12						1		
AD 11								
AD 10		1		1		2		1
AD 9						1		0
AD 8		2		2		13		2
AD 7						2		3
AD 6						1		
AD 5								
TOTAL AD	**4**		**4**		**21**		**7**	
AST 11								
AST10								
AST 9								
AST 8								
AST 7								
AST 6								

AST 5							
AST 4					1		
AST 3							
AST 2							
AST 1							
TOTAL AST	**0**		**0**	**1**			
AST/SC 6							
AST/SC 5							
AST/SC 4							
AST/SC 3							
AST/SC 2							
AST/SC 1							
TOTAL AST/SC	**0**			**1**		**0**	
TOTAL AD+AST+ AST/SC		**4**			**22**		**7**
GRAND TOTAL	**4**			**22**		**7**	

Contract Agents	**Authorised**	**Actually filled as of 31/12/2022**
Function Group IV	9	6
Function Group III	13	9
Function Group II	3	1
Function Group I	0	0
TOTAL	25	16

Seconded National Experts	Authorised	Actually filled as of 31/12/2022
	0	0
TOTAL	0	0

3. LIST OF EUROHPC PARTICIPATING STATES
(AS OF 31 DECEMBER 2022)

Austria

Belgium

Bulgaria

Croatia

Cyprus

Czech Republic

Denmark

Estonia

Finland

France

Germany

Greece

Hungary

Iceland

Ireland

Italy

Latvia

Lithuania

Luxembourg

Malta

North Macedonia

Norway

Poland

Portugal

Romania

Serbia

Slovak Republic

Slovenia

Spain

Sweden

The Netherlands

Turkey

4. LIST OF EUROHPC GOVERNING BOARD MEMBERS
(AS OF 31 DECEMBER 2022)

CHAIR: HERBERT ZEISEL
VICE-CHAIR: THOMAS SKORDAS

COUNTRY	REPRESENTATIVE
Austria	Stefan Hanslik
Belgium	Geert Van Grootel
Bulgaria	Ivan Dimov
Croatia	Ana Butkovic
Cyprus	Evgenios Epaminondou
Czech Republic	Vít Vondrák
Denmark	René Michelsen
Estonia	Toivo Räim
Finland	Erja Heikkinen
France	Laurent Crouzet
Germany	Stefan Mengel
Greece	Nectarios Koziris
Hungary	István Erényi
Iceland	Morris Riedel
Ireland	Peter Healy
Italy	Paola Inverardi
Latvia	Sarmite Mickevica
Lithuania	Tadas Juknevicius
Luxembourg	Mario Grotz
Malta	Antonella Gatt
North Macedonia	Boro Jakimovski

Norway	Ulrike Jaekel
Poland	Mariusz Sterzel
Portugal	Paulo Quaresma
Romania	Monica Alexandru
Serbia	Bojan Jakovljevič
Slovak Republic	Lukáš Demovič
Slovenia	Karolina Schlegel
Spain	Joaquin Serrano Agejas
Sweden	Magnus Friberg
The Netherlands	Marjan van Meerloo, Jelle Stronks
Turkey	Memhmet Mirat Satoglu

5. LIST OF RIAG MEMBERS

Jean-Philippe Nominé (Chair)	French Alternative Energies and Atomic Energy Commission (CEA)
Thomas Lippert (Vice-Chair)	Jülich Supercomputing Centre (JSC)
Mateusz Tykierko	Wroclaw Centre for Networking and Supercomputing
Martin Danek	DAITEQ s.r.o.
Are Magnus Bruaset	SIMULA Research Lab
Barbara Krašovec	SLING (Slovenian National Supercomputing Network)
Mateo Valero	Barcelona Supercomputing Center (BSC)
Axel Auweter	MEGWARE, Computer Vertrieb und Service GmbH
Daniele Cesarini	CINECA (Interuniversity Consortium for Automatic Computing in North Eastern Italy)
María S. Perez-Hernandez	Universidad Politécnica de Madrid (UPM)
Jeanette Nilsson	Research Institutes of Sweden AB (RISE)
Benno Broer	PASQAL

6. LIST OF INFRAG MEMBERS

Sinéad M. Ryan (Chair)	**Trinity College Dublin**
Claus Axel Müller (Vice-Chair)	Gauss Center for Supercomputing (GCS)
Branislav Jansík	IT4 Innovations National Supercomputing Center
Sanzio Bassini	CINECA (Interuniversity Consortium for Automatic Computing in North Eastern Italy)
Minna Palmroth	University of Helsinki
Stephane Requena	Grand équipement national de calcul intensif (GENCI)
Gunnar Bøe	Uninett Sigma2
Erwin Laure	Max Planck Computing and Data Facility (MPCDF)
Pedro Almeida Alberto	University of Coimbra
Norbert Meyer	Poznan Supercomputing and Networking Center (PSNC)
Nuria López	Institut Català d'Investigació Química (ICIQ)
Peter Hans Michielse	SURF BV

7. SCOREBOARD OF HORIZON 2020 H2020 LEGACY KPIS

LEGACY HORIZON 2020 KEY PERFORMANCE INDICATORS[12] COMMON TO ALL JUS

		Key Performance Indicator	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Baseline at the Start of Horizon 2020 (latest available)	Target at the End of Horizon 2020	EuroHPC JU
EVALUATION	NA	Time to inform (TTI) all applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number and % of information letters sent to applicants within target Average TTI (calendar days) Maximum TTI (calendar days)	Joint Undertaking	FP7 latest know results?	153 calendar days	**55% within target** **Average** **148 days** **Max. TTI: 182 days**
	NA	Redress after evaluations	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring	Number of redresses requested	Joint Undertaking	FP7 latest know results?		**1**

			a high scientific level peer reviewed process					
GRANTS	NA	Time to grant (TTG) measured (average) from call deadline to signature of grants	To minimise the duration of the granting process aiming at ensuring a prompt implementation of the Grant Agreements through a simple and transparent grant preparation process	Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	Joint Undertaking	n.a. [new approach under Horizon 2020]	TTG < 243 days (as %of GAs signed)	**2% within target** **Average** **307** **Max. TTG: 345 days**
	NA	Time to sign (TTS) grant agreements from the date of informing successful applicants (information letters)		Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	Joint Undertaking	n.a. [new approach under Horizon 2020]	TTS 92 calendar days	**2% within target** **Average** **153** **Max. TTS: 311 days**
PAYMENTS	NA	Time to pay (TTP) (% made on time) -pre-financing - interim payment -final payment	To optimise the payments circuits, both operational and administrative, including payments to experts	Average number of days for Grants pre-financing, interim payments and final payments; Average number of days for administrative payments;	Joint Undertaking	FP7 latest know results?	-pre-financing (30 days) - interim payment (90 days)	**100% within target**

				Number of experts appointed			-final payment ((90days)	**Average 74.5** **Max. TTP:** **90 days**
HR	NA	Vacancy rate (%)		% of post filled in, composition of the JU staff [13]	Joint Undertaking	n.a. [new approach under Horizon 2020]		**0%**
JU EFFICIENCY	NA	Budget implementation/execution: 1. % CA to total budget 2. % PA to total budget	Realistic yearly budget proposal, possibility to monitor and report on its execution, both in commitment (CA) and payments (PA), in line with sound financial management principle	% of CA and PA	Joint Undertaking		100% in CA and PA	**Nothing to report at this stage**
	NA	Administrative Budget: Number and % of total of late payments	Realistic yearly budget proposal, possibility to monitor and report on its execution in line with sound financial management principle	Number of delayed payments % of delayed payments (of the total)	Joint Undertaking			**The JU did not have any late payments in 2022**

8. MATERIALITY CRITERIA

The 'materiality' concept provides the Authorising Officer with a basis for assessing the importance of the weaknesses/risks identified and thus whether those weaknesses should be subject to a formal reservation to his declaration.

When deciding whether something is material, both qualitative and quantitative terms have been considered. In qualitative terms, when assessing the significance of any weakness, the following factors have been taken into account:

• The nature and scope of the weakness;

• The duration of the weakness;

• The existence of compensatory measures (mitigating controls which reduce the impact of the weakness);

• The existence of effective corrective actions to correct the weaknesses (action plans and financial corrections) which have had a measurable impact.

In quantitative terms, in order to make a judgement on the significance of a weakness, the potential maximum (financial) impact is quantified. Whereas the EuroHPC JU control strategy is of a multiannual nature (i.e. the effectiveness of the JU's control strategy can only be assessed at the end of the programme, when the strategy has been fully implemented and errors detected have been corrected), the Executive Director is required to sign a declaration of assurance for each financial year. In order to determine whether to qualify his declaration of assurance with a reservation, the effectiveness of the JU's control system must be assessed, not only for the year of reference, but more importantly, with a multiannual perspective.

The control objective for EuroHPC JU is set out in the Commission proposal for the Council Regulation on the EuroHPC Joint Undertaking. The objective is to ensure that the 'residual error rate' - i.e. the level of errors which remain undetected and uncorrected - on an annual basis, can range between two and five per cent, with the ultimate aim of achieving a residual level of error as close as possible to two per cent at the closure of the multiannual programme. Progress towards this objective is to be (re)assessed annually, in view of the results of the implementation of the ex-post audit strategy.

As long as the residual error rate is not (yet) close to two per cent at the end of a reporting year within the programme life cycle, the Authorising Officer may also take into account other management information at his disposal to identify the overall impact of the situation and determine whether or not it leads to a reservation.

If an adequate calculation of the residual error rate is not possible, for reasons not involving control deficiencies, the consequences are to be assessed quantitatively by estimating the likely exposure for the reporting year. The relative impact on the declaration of assurance would then be considered by analysing the available information on qualitative grounds and

considering evidence from other sources and areas (e.g. information available on error rates in more experienced organisations with similar risk profiles).

Assessment of the effectiveness of controls

The starting point to determine the effectiveness of the controls in place is the cumulative level of error expressed as the percentage of errors in favour of the EC budget, detected by ex-post audits, measured with respect to the amounts accepted after ex-ante controls.

However, to take into account the impact of the ex-post controls, this error level is adjusted by subtracting:

- Errors detected and corrected as a result of the implementation of audit conclusions.
- Errors corrected as a result of the extension of audit results to non-audited contracts with the same beneficiary.

This results in a residual error rate, which is calculated as follows:

$$\mathrm{Re}\,sER\% = \frac{(\mathrm{Re}\,pER\% * (P - A)) - (\mathrm{Re}\,pERsys\% * E)}{P}$$

where:

ResER% residual error rate, expressed as a percentage.

RepER% representative error rate, or error rate detected in the common representative sample, expressed as a percentage. The RepER% is composed of complementary portions reflecting the proportion of negative systemic and non-systemic errors detected. This rate is the same for all implementing entities, without prejudice to possibly individual detected error rates.

RepERsys% portion of the RepER% representing negative systemic errors, (expressed as a percentage). The RepERsys% is the same for all entities and it is calculated from the same set of results as the RepER%

P total requested EC contribution (€) in the auditable population (i.e. all paid financial statements).

A total requested EC contribution (€) as approved by financial officers of all audited financial statements. This will be collected from audit results.

E total non-audited requested EC contribution (€) of all audited beneficiaries.

The Common Representative Sample (CRS) is the starting point for the calculation of the residual error rate. It is representative of the expenditure of each FP as a whole. Nevertheless,

the Director-General (or Director for the Executive Agencies) must also take into account other information when considering if the overall residual error rate is a sufficient basis on which to draw a conclusion on assurance (or make a reservation) for specific segment(s) of the Seventh Framework Programme (FP7)/Horizon 2020. This information may include the results of other ex-post audits, ex-ante controls, risk assessments, audit reports from external or internal auditors, etc. All this information may be used in assessing the overall impact of a weakness and considering whether to make a reservation or not.

If the CRS results are not used as the basis for calculating the residual error rate this must be clearly disclosed in the AAR, along with details of why and how the final judgement was made.

Should a calculation of the residual error rate based on a representative sample not be possible for a FP for reasons not involving control deficiencies,[33] the consequences are to be assessed quantitatively by making a best estimate of the likely exposure for the reporting year based on all available information. The relative impact on the Declaration of Assurance would then be considered by analysing the available information on qualitative grounds and considering evidence from other sources and areas. This should be clearly explained in the AAR.

[33] Such as, for instance, when the number of results from a statistically-representative sample collected at a given point in time is not sufficient to calculate a reliable error rate.

9. LIST OF ACRONYMS

AAR – Annual Activity Report

ABAC – Accrual Based Accounting

BOA – Back-Office Arrangement

CAAR – Consolidated Annual Activity Report

CoE – Centre of Excellence

COSO – Committee of Sponsoring Organisations

CSA – Coordination and Support Actions

DG CNECT – Directorate-General Communications Networks, Content and Technology

DG RTD – Directorate-General Research and Innovation

EC – European Commission ECA – European Court of Auditors

ED – Executive Director

EFTA – European Free Trade Association

ERDF – European Regional and Development Fund

EU – European Union

EuroHPC JU – European High Performance Computing Joint Undertaking

FPA – Framework Partnership Agreement

FR – Financial regulation

FTE – Full-time Equivalent

GB – Governing Board

HPC – High Performance Computer

ICF – Internal Control Framework

ICP – Internal Control Principles

INFRAG – Infrastructure Advisory Group

JTI – Joint Technology Initiatives

JU – Joint Undertaking

KPIs – Key Performance Indicators

MN5 – MareNostrum 5

NCC – National Competence Centre

RIA – Research and Innovation Actions

RIAG – Research and Innovation Advisory Group

RRF – European Recovery and Resilience Fund

SMEs – Small and Medium Enterprises

SRIA – Strategic Research and Innovation Agenda

TRL – Technology Readiness Level

TTG – Time to grant

TTI – Time to inform

TTP – Time to pay

WP – Work Programme