European High Performance Computing Joint Undertaking

GENERAL INVITATION TO TENDER

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Descriptive Document

Technical Part

Acquisition, delivery, installation, and services of the EuroHPC Federation Platform for the European High Performance Computing Joint Undertaking (EuroHPC JU)

V2.0

Table of Contents

Table of Figures

1. DESCRIPTION OF THE EUROHPC FEDERATION PLATFORM

The EuroHPC JU vision is to establish a world-leading federated and secure HPC and quantum service infrastructure ecosystem in the Union and ensure wide use of this infrastructure to many public and private users, to support the development of key skills for European science and industry.

EuroHPC JU aims to develop, deploy, maintain, and extend in the Union a world leading federated and secure supercomputing, quantum computing service and connection to the data infrastructure ecosystem such as federated data spaces and data lakes.

The infrastructure should be designed in highly flexible configurations tailored to a wide range of services, application and user needs and based on user requirements, following a co-design approach. One of the mandatory features of the platform should be its interoperability with European initiatives such as AI EU projects, digital twins (e.g., Destination Earth), SIMPL, EOSC platform, Gaia-X, ESFRI, European data spaces and data lakes. Associated federated data spaces will also be interconnected, for example through European digital identity eIDAS and/or the European Digital Identity Wallet (EUDI wallet), allowing each category of users to manage its own data flows to EuroHPC JU systems. The platform should ensure compatibility and ensure access to the available resources of existing European HPC federation solutions such as FENIX, PUHURI or LEXIS to the greatest extent possible.

A special attention should be given to industry friendly HPC federation services to stimulate the utilisation of the EuroHPC JU infrastructures by the private sector, especially SMEs.

The EuroHPC Federation Platform solution should rely on the future EuroHPC hyperconnectivity services and be compatible with existing GÉANT HPC connectivity services.

The first EuroHPC JU supercomputers came online and were made available to researchers in April 2021. Currently, there are eight EuroHPC supercomputers across Europe which are operational and available for use: these are: Leonardo in Italy, LUMI in Finland, MeluXina in Luxembourg, Karolina in Czech Republic, Vega in Slovenia, Discoverer in Bulgaria, Deucalion in Portugal and Marenostrum 5 in Spain. Two more exascale supercomputers, one in Germany and the other one in France are being procured. Additionally, a midrange system is being procured in Sweden. All three systems are expected to be fully operational latest by early 2026. Simultaneously, EuroHPC JU is procuring six quantum accelerators to be integrated to the current HPC systems and at least three of them are expected to be operation also by early 2026.

Each EuroHPC JU hosting entity of these supercomputers have diverse set up of tools used to manage the user Authentication and Authorisation Identity (AAI), resource allocations and resource management, as well as job scheduler and data transfer, there are varieties of software stack per system as well as different containerised solutions for workflows. To use any of these systems each user should learn different user environments on different systems. Moreover, many of these environments are not yet well adjusted to serve users with different experience levels of supercomputer usage. Thus, there is a clear and well-defined need of a highly flexible configurations of resource management, job scheduler and similar tools tailored to a wide range of services, application and user needs and based on user requirements, following a co-design approach. Additionally, it should remain open and flexible to accommodate eID managed by the EUDI wallet as well as My Access ID and similar. Where appropriate, the Federation platform should be compatible

with non-commercial federation initiatives such as FENIX, PUHURI, LEXIS and similar or should provide a proper justification if not.

During the initial phase the federated infrastructures solution should integrate all the current EuroHPC systems and be flexible enough to accommodate even the future EuroHPC HPC and quantum systems as well as interconnected to European initiatives such as AI EU projects, digital twins (e.g., Destination Earth), SIMPL, EOSC platform, Gaia-X, ESFRI, European data spaces and data lakes. This requirement is mandatory for the design and implementation of the federated infrastructure solution. It should also be ambitious enough to strive to integrate the whole European HPC and quantum ecosystem.

The figure below illustrates the overall vision of a world-leading federated and secure HPC and quantum service infrastructure ecosystem in the Union:

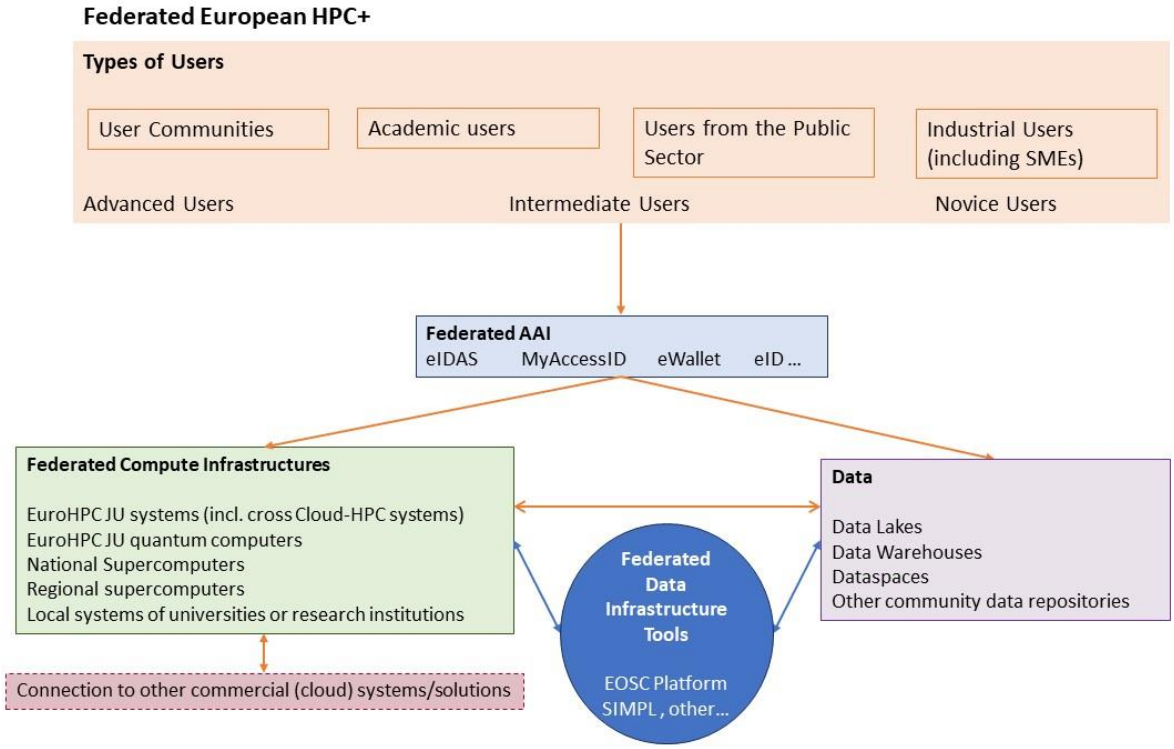

Figure 1: Overall vision of a world-leading federated and secure HPC, Quantum and Cloud service infrastructure ecosystem in the Union

1.1. Objectives of the EuroHPC Federation

The public procurement action is to build and deploy a fully operational enabling infrastructure federation solution for EuroHPC JU supercomputers, providing access to a rich portfolio and professional quality services in all relevant domains from access to pre-processing, computing, analysis, post-processing and storing. The procurement also covers operations, maintenance and

support of the federation solution and services for five years divided into a period of two (2) + three (3) years for implementation evaluation purposes.

The federation infrastructure, further referred as EuroHPC Federation Platform (EuroFP), should be robust, secure, scalable, flexible and user centric. It should constantly be improved and upgraded following user feedback and the state-of-the-art of the underlying core technologies. It should be open enough to be able to accommodate all EuroHPC JU supercomputers and quantum computers including the future industrial supercomputers. It intends to offer high quality of service management compliant with industrial standards. The proposed federation should also provide a superior user experience, usability, and ease of use for a very large number of users with the functionalities available 24/7.

It should offer seamless access to supercomputers, software, and services through customised user interfaces, allowing users to navigate with built-in guidance tools and analytics for (re)use and service composition. It should also be able to connect to the existing data federation solutions such as EOSC platform, SIMPL and similar, to enable seamless data transfer between supercomputers and quantum computers to data repositories, data lakes and data spaces. Additionally, EuroFP should be robust enough to seamlessly connect to local, regional as well as global (including commercial) cloud systems to satisfy both industrial and academic user needs.

The contractor(s) shall work closely with the EuroHPC JU current and future hosting entities and EuroHPC JU. Moreover, an official collaborative agreement and scheme should be set up with the EuroHPC JU hosting entities to ensure the integration of EuroFP at the centres as well as committed long-term support from them for the duration of five years.

The managed services, the infrastructure and solution procured will be owned by the Contracting Authority (i.e., the EuroHPC JU will be the platform owner), and it will be made available for its Member States and Associated Countries.

The high-level business objectives of the procurement are defined as follows:

- Fully operational, secure federated infrastructure solution offering high-quality staff and software professional services and superior user experience, usability, and ease-of-use for a high number of users with functionalities available 24/7.
- Provision of a rich set of innovative, modular, customisable, and composable services for a wide variety of users from research communities, industry and beyond.
- Connection to the existing data federation solutions to enable seamless data transfer between supercomputers and quantum computers to data repositories, data lakes and data spaces.
- Seamless connection to local, national, regional as well as global (including commercial) cloud systems to satisfy both industrial and academic user needs.
- Provision of collaborative agreements and scheme with the EuroHPC JU hosting entities to ensure the integration of EuroFP at the centres as well as committed long-term support from them for the duration of five years.

Specifically, EuroFP should include the following features and functions:

1. Authorisation, Authentication, and Identification (AAI) standards and services that ensure security and privacy, including MyAccessID and eIDs under EIDAS regulation (EUDI wallet).

2. Resource allocation interfaces for both users and administrators for seamless management of resources across systems, between different user groups and projects.
3. Enhanced and adjustable security compliance for satisfaction of different types of user groups such as industrial users or users of strategic projects for example related to national security of member states.
4. Advanced discoverability, service catalogue management, and orchestration services for all types of resources and metadata services for access to computing systems across EuroHPC systems.
5. Efficient workflow management and mechanisms that allow compute and data exchange between HPC, QC and cloud systems.
6. Smart scheduler of jobs across HPC systems and/with integrated quantum accelerators.
7. Connection to data federation platforms and enabling of data transfer and data share between these and the EuroHPC systems.
8. Federated and harmonised scientific software catalogue across systems
9. Harmonisation possibility of the system software stack across EuroHPC systems
10. Standardised Application Programming Interfaces (APIs).
11. Web-based user portal with a friendly graphical user interface and user experience.
12. User-friendly, responsive, and easy-to-use visualisation services.
13. User-friendly, responsive, and easy-to-use virtualisation services.
14. Thorough testing and reporting procedures.
15. Auditing and reporting processes and services.
16. Service quality management, monitoring, and accounting and performance management.
17. Helpdesk for service providers and users including advice on access, tools, applications, usage, licensing, and privacy issues.
18. Application of firm cybersecurity policies and measures for the hardening and regular assessment of systems regarding potential threats, infrastructure vulnerabilities, and overall attack surface as well as well-defined procedures for incident reporting and notification.
19. Support for an open metrics framework to assess federation uptake including usage, performance, value for money, and user satisfaction through the platform.
20. Feedback mechanism to allow users to comment on federation solution functionalities.
21. Extensive training portfolio of both users and system administrators.

The procurement should also support the provision of innovative, customisable, and composable applications and services to serve a wide variety of users, specifically including the following functions:

- Mechanism to link with the internal and external federated data lakes, data spaces and community data repositories including solutions like EOSC data platform, SIMPL and similar.
- Mechanism to link EuroHPC supercomputer and quantum computer to local, regional, national HPC infrastructures including quantum partitions and commercial cloud solutions.

1.2. Overview of the EuroHPC Federation Platform: Architecture, Components and Functionalities

This section gives an overview of the EuroHPC Federation platform concept and key functionalities and features:

1.2.1. The EuroHPC Federation concept

The overall architecture concept of the EuroFP is depicted in the high-level functional figure below:

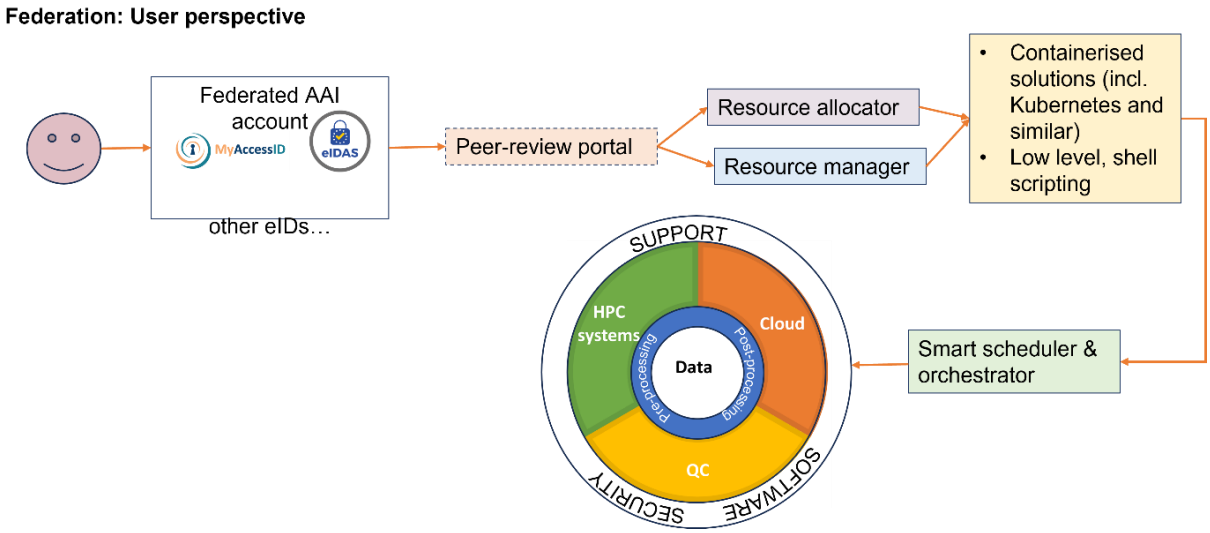

Figure 2: overall architecture concept of the EuroHPC Federation Platform.

Types of users

The EuroFP should be able to serve and accommodate users of HPC/QC/Cloud of all knowledge levels, from both academia and industry including Small and Medium Enterprises (SMEs).

Advanced, intermediate, and new users

It should satisfy the needs of advance users that are keen to adjust their software environment, libraries and would like to exploit the potential and capacity of HPC and quantum infrastructures in depth. It should also be user friendly and accommodating for intermediate users that would like to profit from all the advantages of the platform through for example containerised environments, by adjusting their workflows to use multiple different systems. Finally, the federation layer should be intuitive and self-explanatory for novice users providing sophisticated “click and run” interfaces for them.

Users from academia, industry, and the public sector

Another way of user categorisation that should be considered is the differentiation between academic, industrial and the public administration types of users.

While historically the academic usage of HPC have always prevailed, we can clearly notice that the uptake of HPC by industry, especially SMEs, is increasing exponentially. For the industrial users, HPC is only one small piece of the whole business portfolio. Many of the industrial users may use HPC

resources and then directly switch to a commercial cloud alternative for further parts of their solution. Moreover, time-to-solution, security of the environment and the software licencing issues are the most important aspects for industrial users. Thus, the proposed EuroFP solution should enable connection to outside system providers, should be fast and easy to use while simultaneously it should comply with required different levels of security. Security is also a critical point for the users from the public administration. For most of this type of users the data protection, fast, secure, and easy data transfer and data operability are the critical aspects to be able to use HPC.

Considering the current tremendous uptake of HPC by AI applications including machine learning methods, natural language processing applications, deep learning solutions, neural networks and more, EuroFP should exploit its whole potential in integration of environments like Kubernetes, JupiterLabs etc.

Technical staff and system administrators

Additionally, the proposed EuroHPC Federation Platform should consider the need of the systems' administrators and the overall technical staff at the EuroHPC hosting sites. The ecosystem should provide a homogeneous environment across multiple and different architectures to enable smooth, secure, fast, and efficient maintenance and support possibilities of these HPC and quantum systems by administrators.

1.2.2. EuroHPC Federation tool components and features

In this section we define 11 important components that should be part of EuroFP. While all these components should be implemented in the platform across all the EuroHPC JU systems as a final product, some of these components are of higher urgency than others. Below is the description of these 11 components and features that must be part of EuroFP while in the next section we detail on the implementation phases:

1. **Federated Authentication & Authorization Infrastructure (AAI)**

As of 2023 EuroHPC JU has eight HPC infrastructures available for users to utilize. The access to the systems is currently organised by the EuroHPC JU hosting entities through their own preferred AAI tools and procedures. These procedures defer from system to system and in some cases are not so straight forward for users. According to multiple user feedback the differences of AAI procedures of different systems create confusion and cause delays especially for users willing to shift from one HPC system to another.

Considering that in the future EuroHPC JU will be hosting many more systems as well as quantum computers and cloud solutions it is imperative for the EuroHPC JU hosting entities to adopt homogeneous AAI procedures and platform to serve the user needs, especially considering the industrial user-base of the systems.

The recent years the two federated AAI services, namely MyAccessID created by GÉANT, and EID services based on EIDAS regulation such as EUDI wallet have been widely used by educational institutions and businesses.

According to GÉANT, the MyAccessID Service enables users to securely access Connected Services and share electronic resources using federated identities from eduGAIN and trusted Identity Providers. Leveraging the ubiquitous presence of eduGAIN federated identities, the MyAccessID Service enables users to securely authenticate and identify themselves by using federated identities assigned by the organisation they are affiliated with. The MyAccessID Service caters also for users coming from the industry or citizen scientists who may not have access to an institutional account It does so by supporting external (non-eduGAIN) identity providers, such as social networks providing federated identities, community identity providers and other platforms that can provide federated users identities [1].

Similarly, the eIDAS Regulation established the framework to ensure that electronic interactions between businesses are safer, faster, and more efficient, no matter the European country they take place in. It is a European Regulation that created one single framework for electronic identification (eID) such as the EUDI wallet and trust services, making it more straightforward to deliver services across the European Union. eIDAS promoted interoperability across the 27 EU Member States, ensuring that countries mutually recognise each other's notified electronic identification schemes. It also ensures that the trust services provided by service providers who comply with the requirements in the Regulation can be accepted as evidence in legal proceedings [2].

Thus, a federated AAI that accommodates both MyAccessID and eIDs based on eIDAS regulation such as EUDI wallet should be the bases of the EuroFP solution across all EuroHPC HPCQ+ current and upcoming hosting entities.

Moreover, the access to EuroHPC JU systems is through periodic access calls for applications from potential users and assessment procedures. These calls and assessments are done on a dedicated peer-review platform. Thus, the creation of a trusted AAI user ID through EuroFP should already start from the moment the user would like to access the peer-review platform for application submission and later have the possibility to be coupled to the resource allocation and resource management components across EuroHPC systems.

2. Federated resource allocation, monitoring, and management

As was mentioned above, after the assessment of the user access applications on the peer-review platform, EuroHPC JU grants the successful users the access to one or several EuroHPC JU system with a dedicated budget of compute hours. Thus, the peer-review platform has already the information about the user/the user group, project, software, and libraries to be used, required memory and storage capacity for the project as well as the number of users the group consists of including their detailed profiles, the amount of allocated resources, duration of the project and the system(s) the project has been allocated to.

As a next step the federated resource allocation component of the EuroHPC federation platform should be able to subtract this information and manage the resource allocation across one or multiple systems accordingly.

From the user point of view the federated resource allocation component should give the possibility to the principal investigator (PI) of the successful project to manage these resource budget across the project group members, hosting entities of HPC and quantum resources as well as based on the project

implementation stages. It should be flexible enough to allow addition or subtraction of the project member as well as allow a possible shift of the budget proportions between resources after an a-priori agreement with the hosting entities. If the project has been allocated to multiple systems, the federated resource allocation component should allow smooth shifts of the allocated budget between these systems if desired by PI.

The federated resource monitoring and management component should allow users to monitor their usage of the allocated budget on and across systems in detail both per user and per submitted job as well as capable of producing usage summaries of the whole project for the PI. Additionally, it should have control and reminder features to ensure adequate use of the allocated budget during the whole duration of the project. It should be coupled to the workload manager to subtract even further details such as optimal use of the resources, energy usage and carbon footprint.

From the system administration point of view, this federated allocation, monitoring and management component should allow administrators to control the progress or the project, identify possible misbehaviour of the users as well as implement adequate penalties to foster correct and optimal use of the resources.

3. Sophisticated user interfaces for both advance users (possibility of terminal use and access software stack) and novice ones

As was described in the section above, EuroFP should serve users with various levels of HPC knowledge and experience. While advanced users appreciate the low-level access and wider privileges, the intermediate and novice ones need sophisticated graphical user-friendly interfaces to be able to use the HPC and quantum systems. Moreover, one of the main triggers for many SMEs to conduct their research of commercial systems is due to the “easy to use” interfaces to pug in their workflows and execute. Another important aspect is that use of HPC for AI is fastest growing tendency of the current era, especially by users from non-traditional “HPC-friendly” industrial sectors and scientific disciplines.

EuroFP should have a user-friendly graphical interface as well as give the terminal access possibilities to satisfy all types of users. Furthermore, it should be possible to access and use this platform from any mobile device. It should also enable access to not only login nodes but also interactive and compute nodes if needed at any point in time and from any device. The interface should allow to visually manage the workflows and run containerised solutions for any type of applications. It should also allow to monitor the job progress, allocated budget, and project across systems. In short, the graphical user interface of EuroFP should be sophisticated, portable and be able to satisfy even the advanced users.

4. Federated smart scheduler of jobs across HPC systems and/with integrated quantum accelerators

It is common in HPC world that even if two or three systems have very similar architectures one of them becomes more popular for users than the other. The reasons can be many however in most of the cases it showed to be simply a question of habit of users to use the one “they are acquainted with”. Additional many of the EuroHPC JU systems have quite similar architectures thus to assure of

the optimal use of the resources as well as to minimize the time-to-solution for industrial users there is a need of a federated smart scheduler.

This component should be coupled with the federated resources management component and should be capable to either automatically shift the submitted jobs to the less overloaded systems with similar architecture and/or prior to submission propose to the user the systems where the submitted jobs are most likely to be executed immediately or with a shorter queuing time.

Another attribute of this component should be the possibility of selection of multiple HPC systems with heterogeneous resources for complex workflow execution. Especially for industrial use and for strategic programme projects it is imperative to have this attribute to be able to switch between traditional HPC systems and cloud solutions and even quantum systems in the future within one complex workflow.

5. Federated complex workflow management possibilities including exporting and importing external workflows.

With the merge of AI, the traditional use of HPC is not only straight forward pre-processing, simulation, and post-processing but also combination of many components such as data analytics, orchestration, and AI methodologies. These make the project workflows complex due to the multiple components to be considered. Moreover, another complexity parameter comes from the type of computations these workflow components perform.

Additionally, as the creation of these workflows is complex, there is a need for these to be portable across systems and different types of architectures. The HPC deployment and execution complexity of porting different workflows on multiple systems should be hidden from the users. Thus, the implementation of the federated complex workflow management possibilities within EuroFP should support “portable workflows as a service” concept that will include workflow accessibility and reusability, dynamic adjustment of workflows and optimal distributed execution.

6. Availability of containerised solutions, including JupyterLab and Kubernetes.

With the merge of AI on HPC the use of containerised solutions increased substantially. Two of the most used container orchestration and management solutions are JupiterLabs and Kubernetes. While JupiterLabs have been embraced by HPC systems, Kubernetes has not been deployed on many HPC systems across Union due to the complexity of its security assurance components on HPC systems. However, Kubernetes is widely used especially by industry on commercial systems such as commercial clouds.

JupiterLabs allow users to create workflows while Kubernetes API gives the possibility to users to automate consistent and isolated environments for each user. Thus, to further support and foster the use of HPC for AI communities and industries these containerised solutions and similar ones in future must be an integral part of the EuroFP.

7. Federated scientific software catalogue across systems

Federation of scientific software catalogues across HPC systems as well as simplification of their use on HPC systems is not a new concept. The result of early attempts is the implementation of the environment setting modules to load the appropriate libraries and dependences through “module load” commandos and then use the adequate software. This method is currently widely used on most of the HPC systems across Union.

Another relatively new development is the EasyBuild, a software build and installation framework that hides the complexity of compiler specific adjustment and allows management of the software installation of HPC systems in an easy way. It is even capable of installations of workflows on HPC systems.

Additionally, during the last decade a set of HPC software used in different disciplines became more stable, sophisticated, and popular than others, mainly due to the efforts of Centres of Excellences (CoEs) in Europe, but also due to the support and use by large scientific communities. Recently the European CoEs have joined their forces to establish a common GitHub framework for continuous software development and stable production releases of the European scientific software base portable across EuroHPC JU systems called Continuous Integration Platform.

However, despite all the attempts and simplifications, the software available on HPC systems across the Union are not homogeneous. Different systems at different HPC centres may have multiple and different versions of the same software, where some run smoothly others need more library dependences at a given system. Some software packages are available on systems, others may need to be requested to be installed. Thus, the current state of available scientific software is not regulated and can be obscure for most of the users.

To improve the situation, there is an urgent need of synchronisation and orchestration of the scientific software catalogue across EuroHPC hosting entities. This of course needs to be done with considerations of the differences of system architecture requirements.

The federated scientific software component of EuroFP should enable a common catalogue of scientific software with version control on all EuroHPC JU systems and assure a homogeneous software availability for users across the systems. Moreover, it should provide repositories/continuous integration platform for European open-source scientific libraries and applications.

8. Federated application license access across systems

Software licenses are expensive, complex, and provided by ISVs based on different business portfolios. While some software licenses can be bound to an individual other can be group based. Some provide licenses to be used within given geographical area, others can be used only on a given HPC system. Despite the availability of open-source alternatives for many software, the use of commercial or

licensed software is still popular especially for industrial HPC users. Unfortunately, there is no common regulation on how the licensing schemes of HPC software work.

Considering the complexity of license schemes, EuroFP should be capable to integrate and orchestrate the license servers at EuroHPC hosting entities. Additionally, it should establish federated policies to support and enable the variety of user software licences across EuroHPC JU systems.

9. Federated software stack access as well as version control and request generation for synchronisation possibilities across systems.

Different HPC systems may have different software stacks that include operating system, architectural layers, protocols, runtime environments based on the differences of their architectures. However, these still have common components and features that can be orchestrated across systems to create a homogeneous environment. This environment may even foster and enable common security attributes and procedures across systems. Additionally, it will smoothly support the federation of scientific software layer across systems.

Thus, the federated software stack component should enable version control and request generation for synchronisation possibilities of the software stack across EuroHPC systems.

10. Distributed data management

Data federation is not in the scope of EuroFP; however, data lies in the core of HPC use. To be able to use HPC resources scientists and research communities, users from industries and the public sector need to be able to access and transfer their data or metadata in a quick, direct, and smooth way to HPC and quantum resources and back. These data usually reside at different data repositories such as data lakes, data spaces, data warehouses, community repositories etc.

Currently there are Data federation platforms that either already available or are being developed such as EOSC data platform for scientific community data or SIMPL for commercial data as well as many European data repositories and initiatives such as AI digital twins, Gaia-X, ESFRI other European data spaces and data lakes.

Thus, the EuroFP should be able to connect to different data federation platforms and enable data transfer and data share between these and EuroHPC systems. It should also be capable to establish connections and links to large scale scientific instruments for data transfer. Additionally, it should have an API component integrated into the platform for data movement between archive and active storage and back.

11. Federation of pre-processing and post-processing possibilities such as (in-situ) visualisation across systems

Pre- and post-processing of data are the two of the major components of the workflows on HPC systems. Examples of pre-processing can be metadata creation while examples of post-processing can be image processing or visualisation. In some cases, there is a need even for in-situ visualisation

components within the workflows. The complexity of this can be the direct data transfer to a post-processing system or repository which is not part of the EuroHPC system.

EuroFP should be capable to connect to different pre- and post- processing tools across EuroHPC systems to enable these workflows. If the pre- and post- processing should be done on external to EuroHPC systems, the platform should be capable to connect to external systems transfer of the data in real time to the external systems.

1.2.3. **Features**

The above-mentioned list of EuroHPC Federation platform components is large but not exhaustive as all of these are based on current needs of HPC users. However, as the HPC ecosystem evolves rapidly and with the addition of future quantum systems there will be an urgent and strong need for implementation of additional functionalities, components, and features within the EuroHPC Federation Platform. Thus, the adopted solution should be flexibility enough for future implementation. Additionally, during the solution adoption period by the EuroHPC hosting entities possible minor adjustments may be needed. These adjustments should be implemented as smoothly and quickly as possible to ensure timely delivery of the EuroHPC federation Platform on all EuroHPC JU systems.

EuroHPC JU is constantly procuring new HPC and quantum systems across the Union. These systems have heterogeneous architectures and features. The adopted solution should be flexible enough to be able to accommodate these future systems as well. Moreover, as the vision of the European Commission is not only federation of EuroHPC JU systems but also federation of even regional/ national and institutional systems across the Union it is utterly important that the adopted federation solution will already from the beginning consider this in its planning and implementation phases.

Another important feature of the platform is the ownership of the user database it will act upon. Currently each EuroHPC JU hosting entity maintains its own user database that constitutes from both national (or consortia) and EuroHPC JU users. The Contractor by no means shall have any ownership or rights to these user databases. The ownership of the generated EuroHPC JU user database shall be laying only with the Contracting Authority (EuroHPC JU) and can be physically located or replicated at the EuroHPC JU hosting entities. The national or consortia user databases shall be laying only with the hosting entities.

The contractor should provide an SLA based support of the federated solution for maintenance, new implementation, and upgrades during all five years.

1.3. **Implementation stages and results assessment**

Implementation:

The procurement period of five years will be divided into two phases the durations of two (2) + three (3) years.

During the first two years the Contractor should establish the project portfolio, actions, and time planning, define work packages, execution schemes, key performance indicators and the GANTT charts of the implementation. It should also submit a detailed risk and quality assessment plans, failure mitigation plan and a complete portal and service handover plan. During the whole implementation phase the process will be closely monitored through periodic reviews of at least every six months as well as through periodically submitted by Contractor progress reports to the Contracting Authority. The planning of activities should be orchestrated towards implementation of components depicted in the Figure 3 phase one part across all the EuroHPC JU systems that are listed in this technical specification document.

Most importantly, the Contractor should develop a commitment and engagement scheme and budget distribution plan together with the EuroHPC hosting entities to assure their direct engagement in implementation and adoption of EuroFP on the EuroHPC systems. The contractor should provide a document listing the specific requirements that the EuroHPC JU hosting entities would need to adjust/implement for integration of EuroFP. Similarly, the contractor should provide a document listing the specific requirements for European digital services or initiatives willing to interoperate with EuroFP.

Finally, by the end of the second year EuroFP should be installed, available and the main components should be properly functioning on all the active EuroHPC JU systems. The decision for continuation to the second phase and the implementation will be evaluated against the Key Performance Indicators (KPIs) defined during the tendering stage.

During the second period of the three years, if the first period is successfully implemented, further upcoming EuroHPC JU systems should be integrated into EuroFP as well as all the remaining components should be properly functioning on all systems. Moreover, if needed additional improvements and small updated components should be added to the platform if needed for the smooth operability of the platform.

To clarify the workflow of the implementation of EuroFP as well as to structure the whole process into a two-phase implementation, in Figure 3 we divide the implementation of the platform components and services into two phases. These phases are also based on the current and shortly upcoming EuroHPC JU systems:

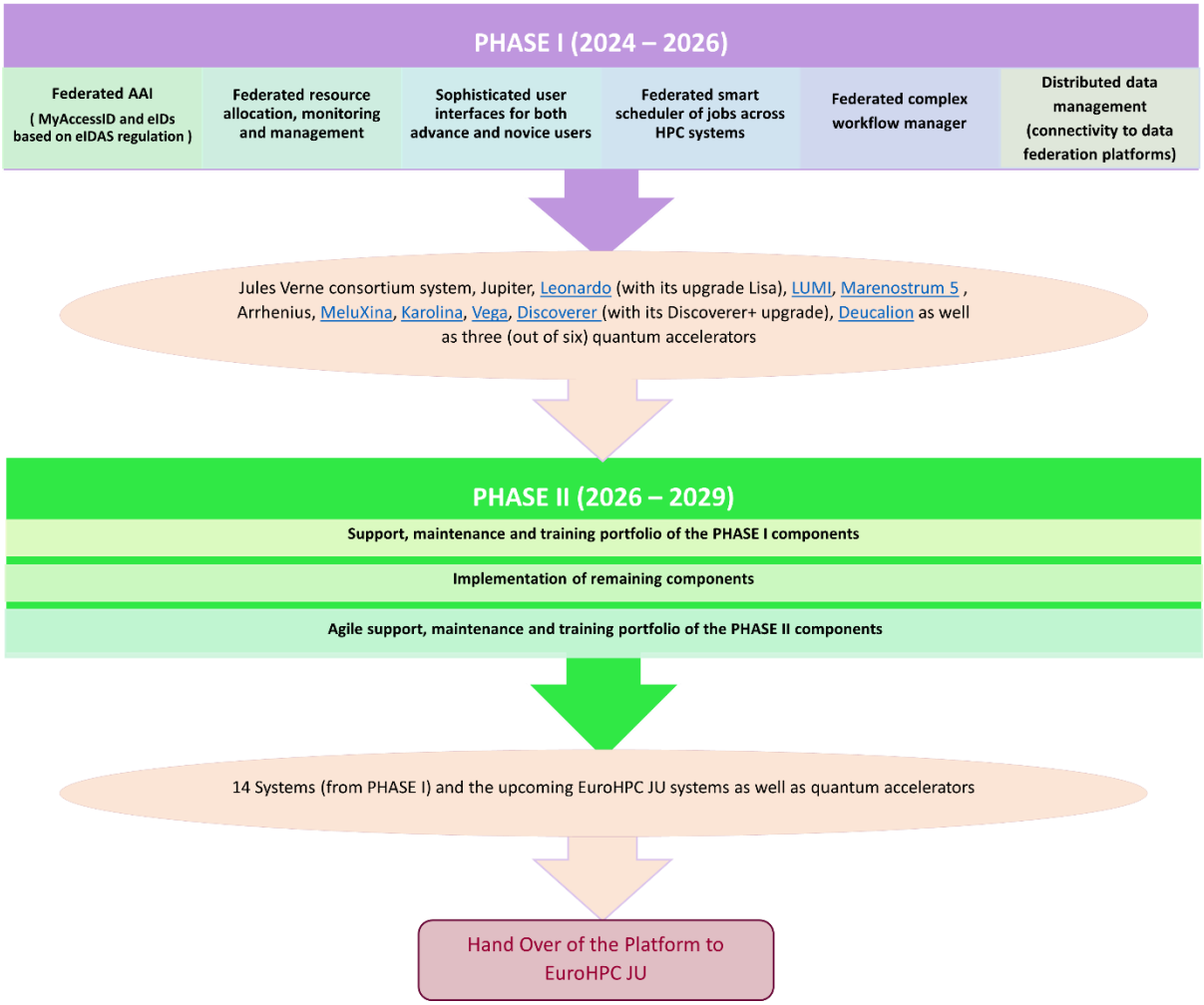

Figure 3: EuroHPC JU Federation Platform components distribution between the two implementation phases

Support helpdesk of EuroHPC hosting entities:

During the whole period of five (5) years the Contractor should commit to 12/7 support helpdesk service for the EuroHPC JU hosting entities to ensure uninterrupted deployment of the platform. While the user support of actual HPC and quantum accelerators' users should be delegated to the hosting entities and the user requests should be escalated to the Contractor if and only if the hosting entity has not the capability or knowledge to solve them or if these are directly connected to the malfunctioning of the platform itself or its incompatibility issues with the HPC and quantum system.

1.3.1. The EuroHPC federation solution at the European level

The EuroHPC Federation Platform procurement action is to build and deploy a fully operational federated HPC and quantum ecosystem at the European level. EuroFP may act as the core solution for the federation and may serve as a deployment blueprint and operations guideline for future national, regional and/or institutional implementations HPC and quantum federations across Union.

- The (first) EuroHPC HPC and quantum federated ecosystem at the European level should consist of the procured EuroHPC Federation Platform and a set of horizontal services across all the EuroHPC hosting sites.
- The (later) National/Regional/Institutional federated HPC and quantum ecosystem can be replicas and/or sub-sets of the "blueprint" EuroFP at the European level, operated by their national/regional/institutional administrators/owners tailored to their specific needs (set of services inside their boarders, local languages supported, etc.). All connected, forming EuroFP.

EuroFP at the European level, by its definition, is going to operate in the cross-section of the Scientific Research and Academic domain, Industrial sectors, and the Public Administration sector.

1.4. Description of the services

Below the following four service requirements and implementation guidelines are detailed:

1. Overall Service Management Requirements
2. Operations Maintenance and Support
3. Evolution and Development
4. Handover

1.4.1. Overall Service Management Requirements

Overall Service Requirements are the services required to support the Contracting Authority's overall relationship with Contractor and are set forth in the "roles and responsibilities" of the parties.

The Contractor will provide overall service management across all services, as well as the required Key Roles and Governance structure (with the setup of steering committees, monthly meetings and working meetings).

In particular, the Contractor must provide processes and procedures that are acceptable to the Commission and can be used to manage day-to-day relationship processes. These shall include:

- Dispute resolution
- Contract change
- New business request
- Performance reporting (e.g., Service Level Requirements (SLRs), project status, outstanding service request status)
- Relationship management
- Service level monitoring and reporting
- Contract management
- Fiscal management
- Resource management services
- Strategy, architecture, and planning
- Security services
- Evolution and development proposals
- Software license management

- Documentation

1.4.2. Operations Maintenance and Support

The Service Management and Operations Services are the requirement to have a solid framework in place to manage the operation of the EuroHPC federation platform. It must be implemented according to a state-of-the-art ITSM framework (e.g., ITIL, FitSM).

- ITSM Framework - The Contractor shall use a recognized ITSM framework (such as ITIL or similar) to implement and operate the federation platform. The Contractor shall operate a Help Desk for support to EuroHPC hosting entities and specifically describe the planned processes with regards to Incident, Problem, and Change management.
- Quality Assurance - The Contractor shall operate the federation platform according to a Quality Assurance System based on a quality management standard such as ISO 9001 or equivalent.
- Availability - Disaster Recovery SLA - Where an event results in the complete destruction of the software part of the federated environment, the Contractor shall reconstruct that environment within four days for a single incident.
- Security - The Contractor should an Information Security Standard certification (such as ISO 27001 or similar). The Contractor shall implement sufficient security to defend the federation platform against attacks such as Account hijacks, Malware injection, federation service abuse and resource starvation, Insecure APIs, and Denial-of-service attacks.
- The Contractor shall describe which security measures and which security monitoring framework will be implemented to accomplish this. The Contractor shall perform regular security assessments (such as penetration tests and similar) at intervals no longer than 12 months and shall provide a report with all findings and recommended actions to the Contracting Authority. The Contractor shall permit the Contracting Authority, or any third party designated by the Contracting Authority to perform penetration testing on the systems.
- Monitoring and Alerting - The Contractor shall operate a 24x7 monitoring and management service to ensure reliable operation of the environment and compliance with the SLAs. The Contractor shall explain which software packages it plans to use and how it will architect a monitoring and alerting system that is timely, accurately targeted, highly available, filtered and layered for quick diagnosis of most issues, and automatically escalated where necessary to appropriate levels of support.

The EuroFP's application maintenance and support services are the activities associated with repairing defects and developing minor functional enhancements (less than 2 person-) for production of EuroFP. Application maintenance and support services include all life-cycle support activities including maintenance services described in the following subsections.

- Corrective and emergency maintenance (bugs/defects)
- Preventive maintenance
- Adaptive maintenance
- Perfective maintenance
- Release packaging
- Technical support
- Training
- Documentation
- Monitoring, reporting, and review services.

Upon request from Contracting Authority, the Contractor shall provide a test environment, which may need to be connected to various other test environments.

1.4.3. Evolution and Development

Evolution and Development Services (Project Services) are the activities needed to integrate the new functionalities requested by the Contracting Authority into the EuroHPC Federation Platform, if those are equal to or more than 2 person-weeks (otherwise they shall be covered under the context of Application Maintenance and Support, because they are considered as a minor enhancement).

Evolution and Development of the EuroHPC Federation platform covers all software development activities related to extensions, improvements, and functional enhancements, including development of the complementary components and technical migrations of any components of the EuroHPC Federation Platform.

These services are:

- Project management
- Requirements definition
- Design specifications
- Software package configuration and development
- Integration and testing (including regression testing)
- Implementation and data migration
- Code migration
- Software configuration management
- Change management
- EuroHPC Federation Platform administration services
- Training and knowledge transfer
- Documentation

1.4.4. Handover

The Handover services are the activities expected from the contracted managed service provider to transition EuroFP services from the Contractor to a future Contractor.

The Contractor shall prepare for and contribute proactively to a complete, timely and smooth handover of the services to another Contractor, in case of termination or upon expiry of the contract Additionally, in case of a default of Contractor's or subcontractor thereof, which may affect the provision of the Services, all data shall be made available to the Contracting Authority forthwith. This will include all data necessary to completely set up a new EuroHPC federation environment from scratch (i.e., complete recovery).

During the handover period, the Contractor will fully cooperate with the Contracting Authority to achieve the continuation of high-standard service quality and remains solely and fully liable in case of deviations from the agreed service quality. When applicable and where needed, support will be given to the future Contractor that is taking over the services. Other than a possible support of the takeover

by the future Contractor, no distribution of the ongoing work or any other kind of shared work between the Contractor and the future one is foreseen.

Handover services are:

- Handover Planning Services
- Pre-Transfer Services
- Transfer Services
- General Acceptance and Sign-off requirements
- Post transfer Services

All documentation shall be handed back by the Contractor to the Contracting Authority.
The effective duration of the handover will be approximately six (6) months and will be adapted to the foreseen duration of the takeover by the next Contractor, if applicable.

2. REFERENCES

[1] [Online]. Available: https://wiki.geant.org/display/MyAccessID/Privacy+Notice.

[2] [Online]. Available: https://digital-strategy.ec.europa.eu/en/policies/discover-eidas.