

Deliverable D3.8: Programmatic access and resource provisioning of Nordic services via EOSC Marketplace

Author(s)	Ilja Livenson (UT/ETAIS), Claudio Pica (SDU), Lorand Szentannai (Sigma2)
Status	Final
Version	1.0
Date	29/11/2022

Document identifier:	
Deliverable lead	Ilja Livenson (UT/ETAIS)
Related work package	WVP3
Author(s)	Ilja Livenson (UT/ETAIS), Claudio Pica (SDU), Lorand Szentannai (Sigma2)
Contributor(s)	Sander Kuusemets (ETAIS/UT), Lauris Cikovskis (RTU), Andres Toomsalu (ETAIS/KBFI), Ahti Saar (ETAIS/UT), Sergei Zaiaev (ETAIS/UT), Viktor Mirieiev (ETAIS/UT), Dan Sebastian Thrane (SDU), Torkel Lyng (Sigma2), Thomas Thaulow (ETAIS/UT)
Due date	30/11/2022
Actual submission date	
Reviewed by	Adil Hasan (Sigma2)
Approved by	
Dissemination level	
Website	https://www.eosc-nordic.eu/
Call	
Project Number	857652
Start date of Project	01.09.2019
Duration	39M
License	Creative Commons Creative Commons CC-BY 4.0
Keywords	

Abstract :

Within EOSC-Nordic we started with the hypothesis that the European Open Science Cloud (EOSC) is being constructed from many services which already exist and are made available by various stakeholders: national providers, universities, research organisations, commercial companies, etc. Furthermore, we made an assumption that to engage service providers in the region, EOSC needs to provide a value-add that goes beyond increasing the visibility of services. In this deliverable, we provide an overview of the work we have done, present results of the EOSC Nordic service gateway that was setup and discuss what lessons we have learnt. We conclude by highlighting possible directions for future work.

Abstract:

This deliverable reports on the results of connecting Nordic and Baltic services to EOSC Core services through the programmatic interface. It presents the requirements as well implementation of the service for EOSC-compliant cross-border service usage.



Copyright notice: This work is licensed under the Creative Commons CC-BY 4.0 licence. To view a copy of this licence, visit <https://creativecommons.org/licenses/by/4.0>.

Disclaimer: The content of the document herein is the sole responsibility of the publishers and it does not necessarily represent the views expressed by the European Commission or its services.

While the information contained in the document is believed to be accurate, the author(s) or any other participant in the EOSC-Nordic Consortium make no warranty of any kind with regard to this material including, but not limited to the implied warranties of merchantability and fitness for a particular purpose.

Neither the EOSC-Nordic Consortium nor any of its members, their officers, employees or agents shall be responsible or liable in negligence or otherwise howsoever in respect of any inaccuracy or omission herein.

Without derogating from the generality of the foregoing neither the EOSC-Nordic Consortium nor any of its members, their officers, employees or agents shall be liable for any direct or indirect or consequential loss or damage caused by or arising from any information advice or inaccuracy or omission herein.

1. Introduction	5
2. Requirements for the community platform	6
3. Architecture and implementation	7
Integration with with EOSC Core	8
3.1. EOSC Nordic gateway services	8
3.2. Authentication and Authorization Infrastructure (AAI)	9
3.3. Approval flow	9
3.4. Resource allocation	10
8.1. Approval vs review	12
3.5. Interoperability and maturity	15
3.6. Legal documents	15
3.7. Production status	15
4. Example of the ordering process	15
5. Experiences in integration	21
6. Lessons learnt	23
7. Sustainability	25
8. Future plans	25
Appendix A: Sigma2 experience of deep integration with a regional EOSC platform	26
Motivation	26
What worked well	26
What was hard/required integration effort	26
What is the planned sustainability for the integration code	26
What is the expected adoption/usage	27
Appendix B: SDU experience of deep integration with regional EOSC platform	28
Motivation and background	28
What worked well	28
What was hard / required integration effort	29
10.4. What is the planned sustainability for the integration code	29
What is the expected adoption / usage	30
Appendix C: EOSC Nordic gateway Rules of Participation	31
What groups can onboard to EOSC as a provider?	31
Who can onboard resources to EOSC?	31
What resources may be connected to EOSC?	31

Appendix D: Terms of Use of the EOSC-Nordic Gateway Platform	33
Definitions and interpretation	33
1. Who can use the EOSC-Nordic Gateway platform?	33
2. How to use the EOSC-Nordic Gateway platform?	33
3. When can I start using the EOSC-Nordic Gateway platform?	34
4. EOSC-Nordic Gateway platform usage fee	34
5. User support	34
6. Intellectual Property rights	34
7. Platform operator's rights and responsibilities	34
8. Users' rights and responsibilities	34
9. Exclusion of Encouragement	35
10. Governing law	35

I. Introduction

This document summarises the work done in WP3 on establishing a functioning method for fully programmatic access of services in the Nordic and Baltic region via EOSC Marketplace.

The approach for the so-called EOSC Nordic gateway¹ has evolved following the developments in the policies as well as technical solutions from EOSC Core. Our initial hypothesis for this task was that fully digital service provisioning in a standardised way is a key to getting cross-border service delivery to work. During the project, we also followed the evolution of the EOSC Sustainability as well as value proposition for EOSC service providers to better understand what value such a platform could bring.

Along with EOSC Core developed and operated by EOSC Future, a number of WP3 partners was engaged in the development of the access layer for EuroHPC LUMI - a supercomputer ranked 3rd on Top500 in Nov 2022, owned by several countries with access being controlled by one or more designated organisations in each of LUMI countries². This access layer was partially developed in the NeIC Puhuri project with development based on the maturity model and interoperability guidelines developed within the EOSC Nordic project. NeIC Puhuri is providing several services that are intended for connecting service providers with resource allocators across the border with end-users coming from a wide range of environments - academia, public sector and industry - using a common AAI solution MyAccessID³ provided by GEANT.

Experience from mapping and on-boarding Nordic and Baltic services to EOSC has shown a significant complexity of justifying reasons for an extra burden on service providers when integrating a new access and resource allocation method, especially for any methods of automated resource access. The reasons for that have become more apparent during the analysis in WP2, and basically comes down to the fact that resource allocation for end-users on a local, national or regional level is done only by specifically mandated organisations, typically national e-Infrastructures or universities. We have taken that into account when developing the architecture for the programmatic access platform and eventually realised that we can achieve better efficiency as well as sustainability by adopting NeIC Puhuri services for the EOSC Nordic gateway. This has led to further benefits with additional national infrastructure portals being integrated to allow service provisioning in a programmatic way. The initial on-boarding platform developed and reported in D3.4 has been modified to become a Puhuri portal and additional microservices have been added to connect to EOSC Core services.

It should be highlighted that by the end of the EOSC Nordic project EOSC Association has not yet provided a sustainability plan for the

EOSC Exchange - collection of services available for cross-border usage. It is a significant obstacle for adoption of the programmatic access method for requests coming from EOSC Marketplace. We see clarity on EOSC Sustainability for EOSC Exchange as critical for the success of both EOSC Core as well as regional EOSC integrators (alias pre-boarding platforms) for programmatic access to EOSC services.

The rest of the document is structured in the following way:

1. We first provide the **requirements** we had for the EOSC Nordic gateway as a community platform.
2. In the following chapter, we provide a more detailed **architecture** of the EOSC Nordic gateway.

¹

<https://eosc-nordic.atlassian.net/wiki/spaces/EN/pages/473792558/Nordic+gateway+to+EOSC+for+service+providers>

² <https://www.lumi-supercomputer.eu/lumi-consortium/>

³ <https://wiki.geant.org/display/MyAccessID/MyAccessID+Home>

⁵

- Several organisations have decided to adopt Puhuri services as part of the EOSC Nordic work on cross-border service delivery. Their experience is summarised in Chapter “**Experiences in integration**”.
- A big emphasis was made on making sure that whatever is done by the end of EOSC Nordic within WP 3 on programmatic cross-border access to services has a clear sustainability plan. The plan is summarised in Chapter “**Sustainability**”.
- Finally, as we will sustain the EOSC Nordic gateway beyond the end of the project, we provide more detailed information about the **future plans**.

2. Requirements for the community platform

Building a single platform covering all possible scenarios is a very challenging task with high risks. Splitting a platform into smaller regions can reduce the risks and increase adoption. This is what drove our decision to establish a smaller regional community platform for cross-border collaboration that is linked with the main EOSC platform according to the EOSC vision of a system of systems⁴. From the EOSC Architecture vision in Figure 1, EOSC Nordic gateway acts as “community platform”.

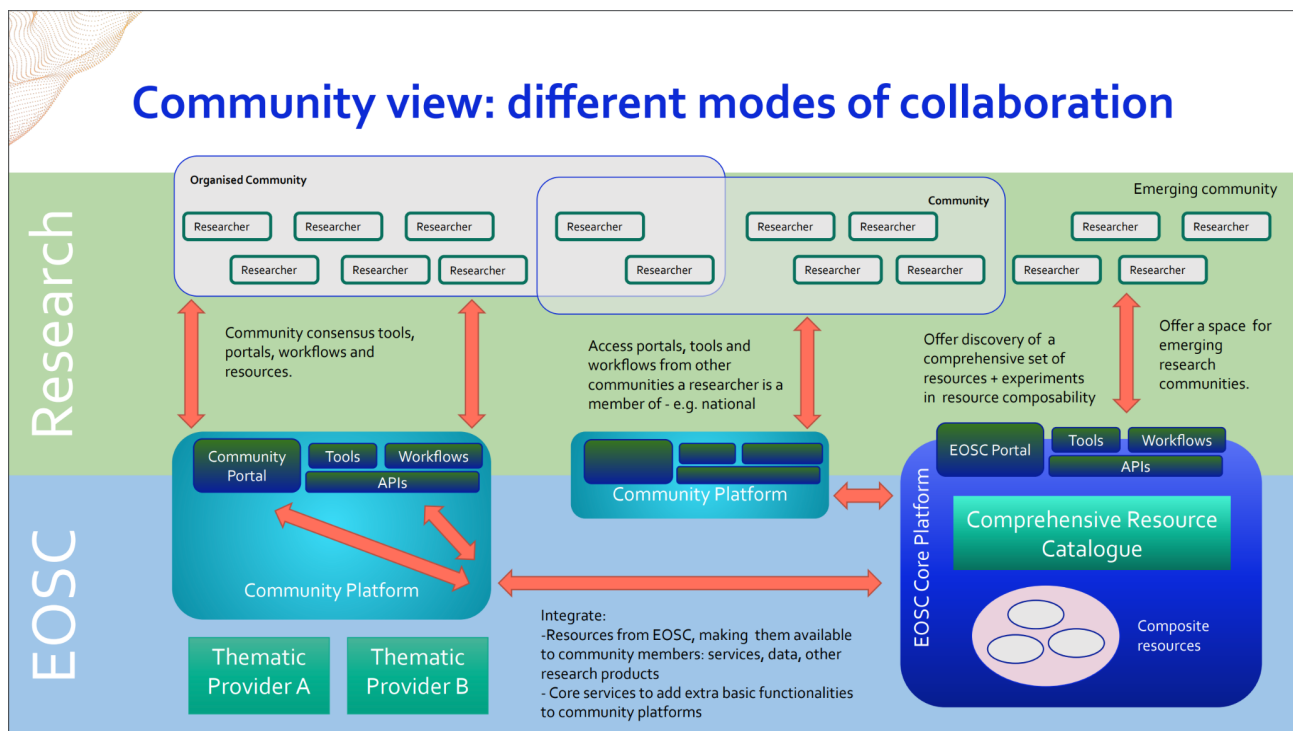


Figure 1: Vision of EOSC collaboration models according to the presentation by EOSC Future in April 2022. EOSC Nordic gateway is a “community platform” on the diagram.

This however raised a question, what are the main requirements for such a community platform? Below is a list of requirements that we considered the most important when building the platform. The list of requirements evolved during the duration of the EOSC Nordic project, we present the latest state.

- Support **publishing of entries in EOSC Core registry** aka EOSC Provider portal. Information discovery on an aggregated level is important for the visibility of offerings. It is also one of the main value

⁴ <https://eosc-portal.eu/glossary>, 3.58, <https://eoscfuture.eu/wp-content/uploads/2022/04/EOSC-Core.pdf> (slide 5)

propositions for the service providers by EOSC at the moment, so including such functionality is a must. The EOSC Provider portal started supporting such capability via Catalog profiles in November 2022, i.e. last month of the EOSC Nordic.

2. Support **processing of orders** from EOSC Marketplace. The main initial goal of the platform was to simplify access to cross-border services with EOSC being a channel of requests.
3. EOSC-compliant **Rules of participation**. The EOSC ecosystem is intended to be governed by a set of rules and regulations, including “Rules of participation”, defining applicable participants and behaviour. A community set of rules should be compliant with that of EOSC.
4. **Branded catalogue**. Community platforms should be able to display the service catalogue with attribution to a specific community, e.g. custom domain name, logos, etc.
5. Digital delivery. A key feature of the platform is support for **fully digital service delivery**. Manual steps could be introduced however the workflow state management should be fully digital.
6. **Trusted identities**. The question of trust in cross-border interactions is of very high importance and assuring that the platform is used to provide access to trusted digital identities is paramount.
7. There must be a **helpdesk** provided with the platform to assure resolution of issues at least connected with the usage of the platform, at best - usage of services accessible through a platform.
8. **API-based** and supporting integrations with other solutions. Such a community platform should not compete with existing solutions, especially existing on the national level and supported by national agenda. Intrusive solutions are complicated to adopt and would require a concrete sustainability plan, which was not available for EOSC.

3. Architecture and implementation

Based on the requirements, an architecture of the EOSC Nordic platform was devised. Initially, the architecture was based on the direct integration with EOSC Core services, but with migration to Puhuri services, the architecture changed as shown in the Figure 2 below.

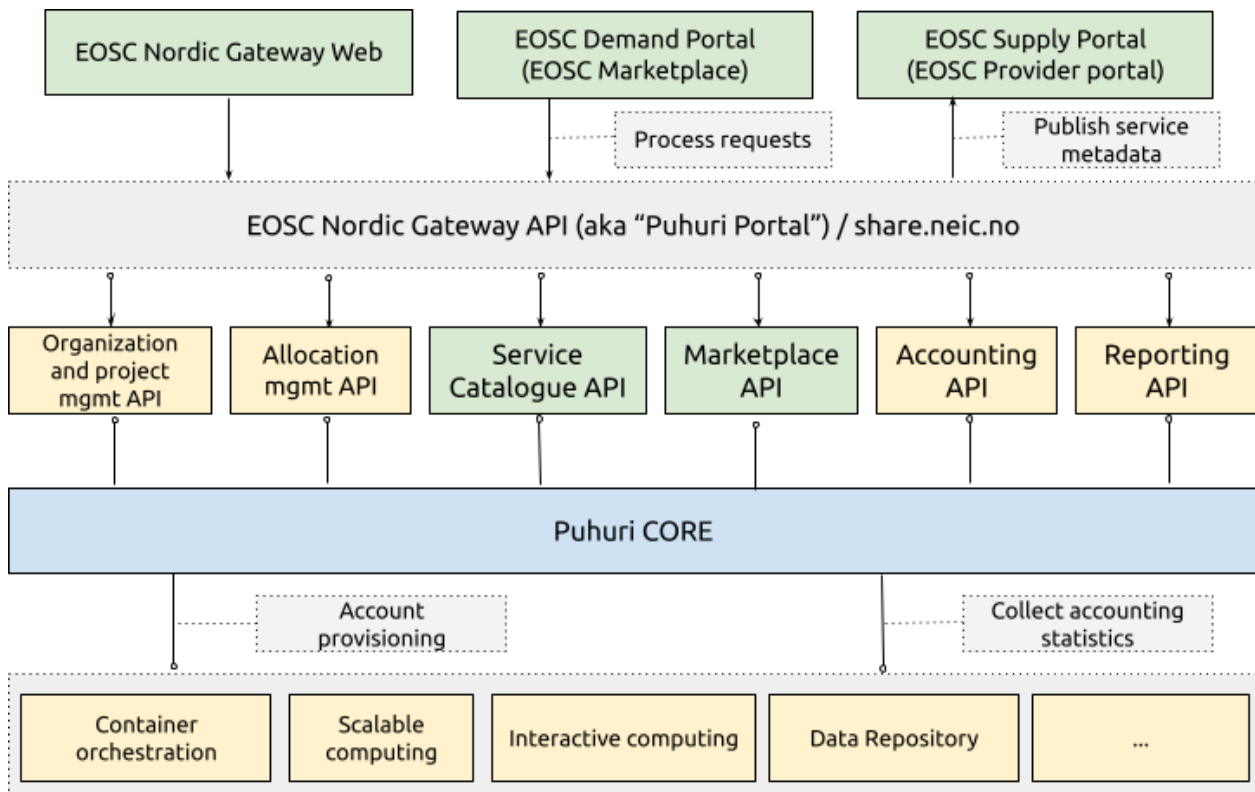


Figure 2. Architecture of the EOSC Nordic gateway.

The bottom layer consists of services connected with Puhuri Core - a service from Puhuri for sharing project, allocation and membership information in a cross-border environment. The Puhuri Core exposes several APIs for cross service discovery, organisation and project management, resource allocation as well as accounting and reporting. These APIs are consumed by the EOSC Nordic Gateway, which in turn exposes APIs for a web-based graphical client that is accessible at <https://share.neic.no> and microservices for integration with EOSC Core.

Integration with with EOSC Core

On a technical level, EOSC Core does not provide a common API for all of its services, services are implemented and operated by different EOSC Future partners using different technologies. Moreover, these technologies have different lifecycles and evolve at different speeds. In such a setup, we decided to implement microservices for linking the EOSC Nordic gateway services with those of EOSC Core. Not all of the EOSC Core services were selected for integration. For example, accounting and monitoring information is generally very sensitive and republishing it without clear added value for the service providers did not make sense.

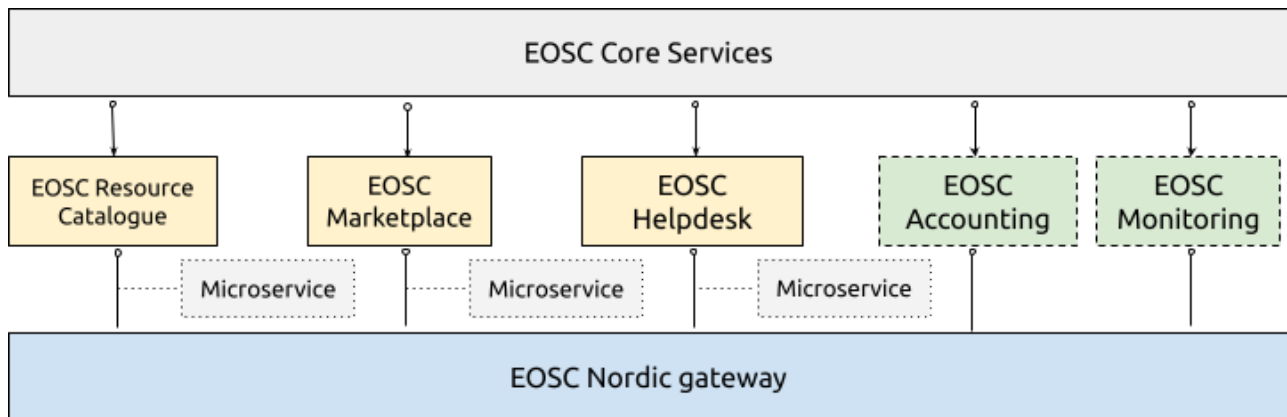


Figure 3. Summary of integration between EOSC Core and EOSC Nordic gateway.

The EOSC Nordic Gateway API (shown in the Figure 3 above) is linked with EOSC Core using the following microservices:

- For publishing offerings from EOSC Nordic Gateway to EOSC Core Resource Catalogue; <https://github.com/waldur/waldur-eosc-publisher>;
- That listens for requests for offerings coming to EOSC Core Marketplace Order Management - <https://github.com/waldur/waldur-eosc-order-processor>;
- For listening to EOSC Helpdesk issue for the services in EOSC Nordic gateway - <https://github.com/waldur/waldur-helpdesk-sync>.

3.1. EOSC Nordic gateway services

Overall, the EOSC Nordic gateway provides a number of services, the main ones being:

- Catalogue: registry of offerings;
- Marketplace: common ordering and accounting mechanism;
- Helpdesk: issue resolution;
- Reporting: aggregated accounting;
- AAI: support of reliable identities;
- Organisation management: management of organisations requesting services;
- Project management: management of projects within organisations for which projects can be created.
- Team management: support of grouping of identities with different roles to work on common projects or represent separate organisations.

Many services come from the Puhuri project. For simplicity, in the document below we refer to Puhuri Core when we want to highlight the information bus that includes allocations for service providers abroad using references to global user identities.

3.2. Authentication and Authorization Infrastructure (AAI)

The AAI system used in EOSC Nordic Gateway and Puhuri is called MyAccessID. It is based on GEANT's EduTeams and provides a single common unique ID (aka CUID) that can be used and referred to by different

systems. MyAccessID includes integration with eIDAS as well as a number of custom Identity providers and is shared with Fenix RI⁵. MyAccessID aims to provide high quality digital identities with a clear level of assurance to services. There is however no way to map an EOSC Portal AAI identity into MyAccessID. The mapping is not needed for publication - as the EOSC Provider portal relies on trust organisation and identities are defined by their emails at the time of writing. However, for processing of orders, EOSC Nordic needs to revalidate the identity reference - email - received from the EOSC Marketplace. This is achieved through an invitation flow, when references to identities from EOSC Marketplace are sent invitations to join projects in the EOSC Nordic gateway.

3.3. Approval flow

A significant difference in the model of EOSC Marketplace and the adopted model of Puhuri is the approval flow of requests.

The EOSC Marketplace models requests as single orders that can be fulfilled⁶. The order can be fully set up by a single user with some additional project related metadata. However, the order model of the EOSC Nordic Gateway is more complicated, as seen in Figure 4. It first requires identifying the organisation on behalf of which requests are done. Secondly, approval of the request by the user representing a project, e.g. Principal investigator is expected. Then, approval of the user representing the Resource allocator (RA), e.g. national allocation board, is required. And finally, approval of the service provider is needed, which typically means that the requested order can be processed. In the EOSC Nordic gateway, successful order processing results in a Resource, which can be modified, e.g. requested limits can be extended or the request terminated. Corresponding functionality is missing at least for the moment from the EOSC Marketplace. Another missing functionality is team management, which means that for all requests from EOSC Marketplace a separate project and resource is created for each new user.

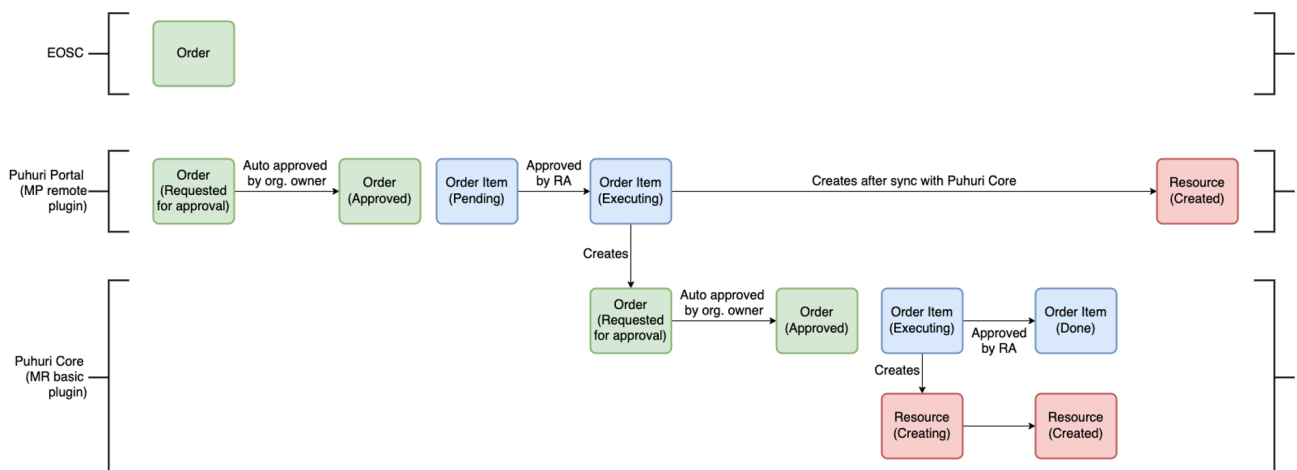


Figure 4. Approval flow for EOSC Marketplace integration. Puhuri Portal is a generic term for end-user portal. EOSC Nordic Gateway represents a Puhuri portal on the diagram. For EOSC Nordic, auto-approval of steps were enabled.

⁵ <https://fenix-ri.eu/>

⁶ <https://wiki.eoscfuture.eu/display/PUBLIC/Order+Management+Architecture+and+Interoperability+Guidelines>

3.4. Resource allocation

In the Puhuri model, resources are allocated by mandated organisations. These organisations typically operate their own infosystems for the allocation of resources. From this perspective, the EOSC Marketplace can be seen as the infosystem of EOSC for resource allocation. Below we show an example of how a similar service can be seen in different systems. For example, we have chosen an EuroHPC LUMI, which can be allocated by several organisations: The EOSC Marketplace, the Estonian national portal, the PRACE portal and the Swedish national portal. The EOSC Nordic gateway is responsible for the publication of offerings to the EOSC Provider portal and processing order requests from EOSC Marketplace hence serving as a link between EOSC and service providers.

Figures 5 to 8 show examples of existing resource allocation portals. We strongly believe that a successful EOSC model must support coexistence of such systems as they represented established national or regional processes.

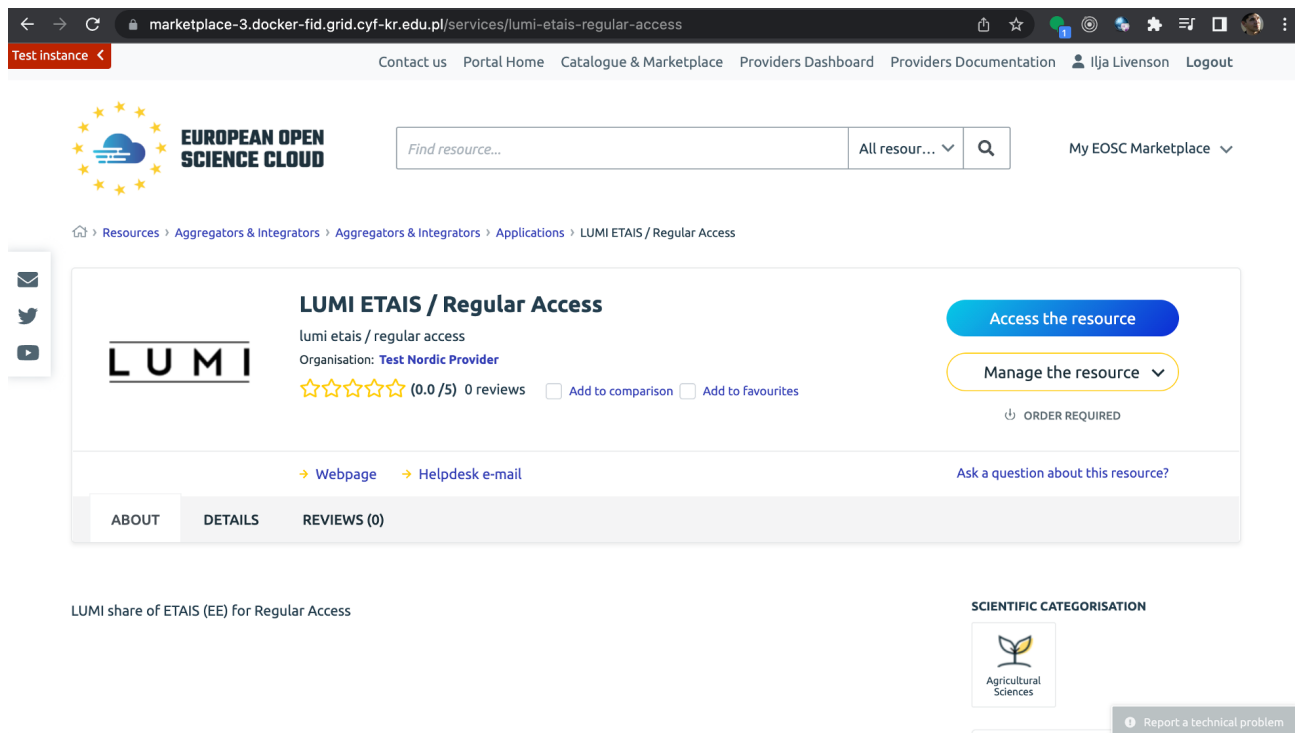


Figure 5: Example of a LUMI ETAIS service published and accessible via EOSC Marketplace.

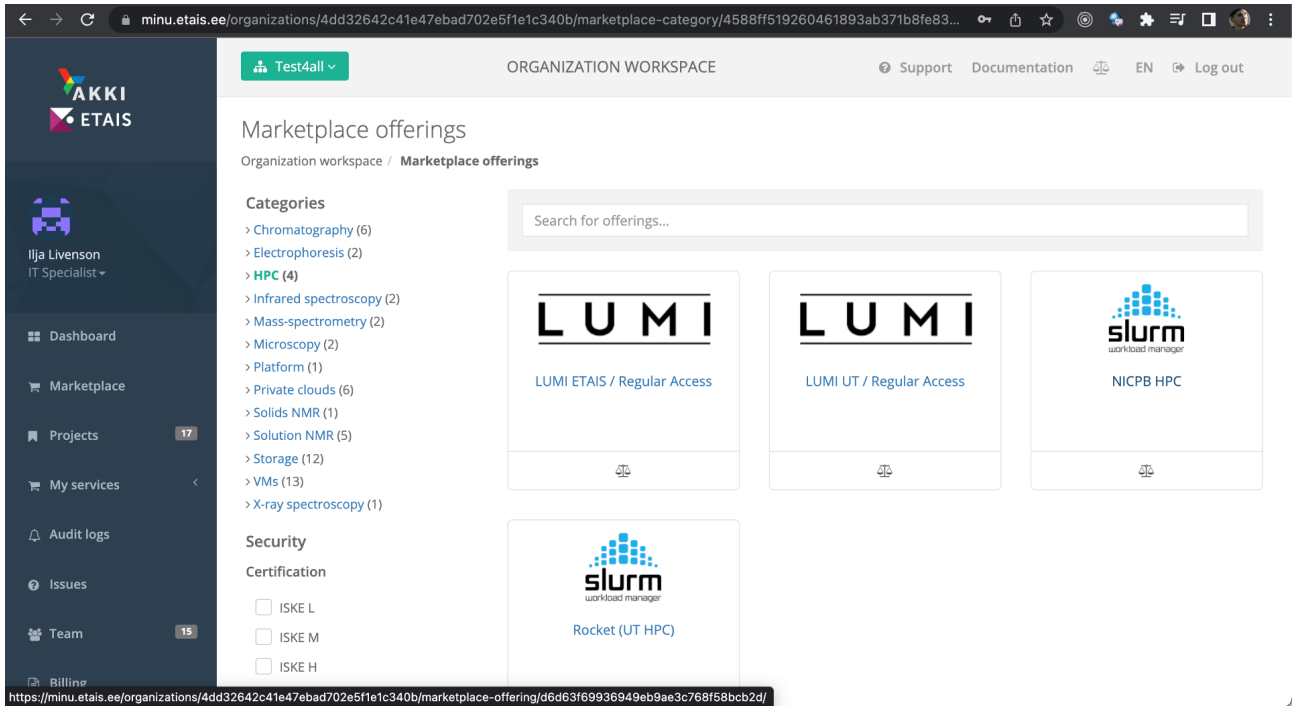


Figure 6. Representation of LUMI service in Estonian national allocation portal.

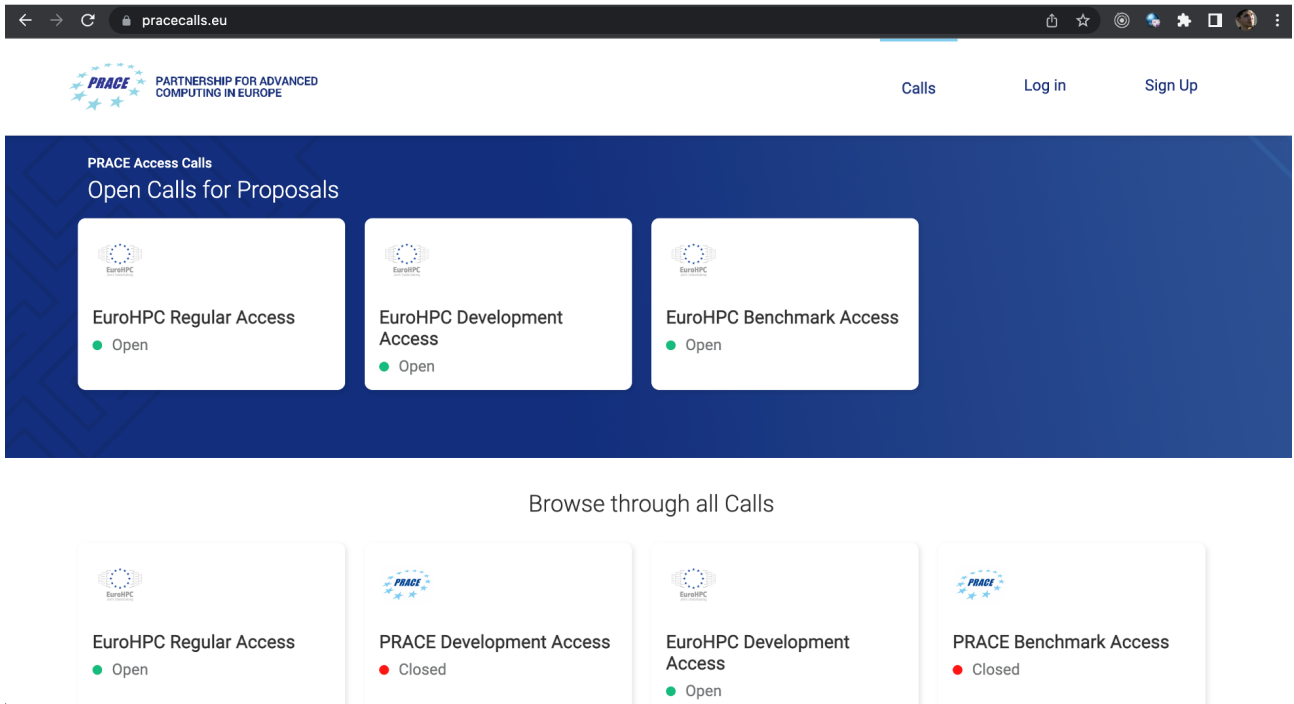


Figure 7. Representation of LUMI access portal for EuroHPC. Allocations are handled by PRACE via a common PRACE portal.

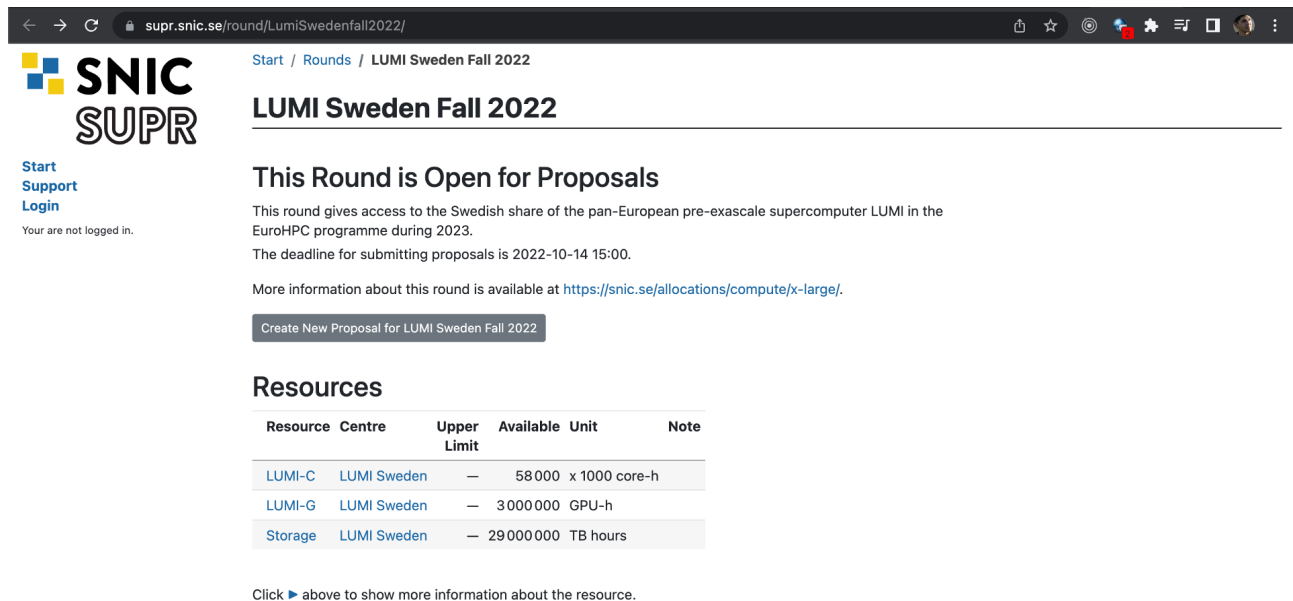


Figure 8. LUMI in the national Swedish allocation portal.

In the case of the EOSC Nordic gateway, we have created a sample organisation representing EOSC that was used as a catch-all for all projects from EOSC Marketplace as the EOSC Marketplace does not have a clear organisation structure yet.

8.1. Approval vs review

Our current analysis assumes that requests coming from EOSC Marketplace are valid and do not need any additional reviews in terms of being legal or not. This, however, is a strong assumption that does not seem to be correct - there is only self-assertion in the process of creating a Marketplace request and EOSC Portal AAI is not providing levels of assurance for the identities. While the number of requests is low, this is not a problem and the approval flow described above can work. On the other side, many resources on the national level are granted based on open competition organised into calls or rounds and that include scientific or technical review. This means that also EOSC requests must pass through such a review for resources to be allocated.

To scale the processing of order from EOSC hence, a review system would need to be added to the EOSC Nordic gateway.

As the evolution of EOSC Marketplace is not under our control, we have analysed options for introducing review functionality into the regional platform. We used SNIC's review portal for inspiration and composed a number of mock-ups to understand how it could fit the Nordic community platform. The review flow typically includes references to the previous research outcomes and as such benefits a lot from the FAIR activities in EOSC.

The main idea is to allow service providers to expose services not just for direct integration, but to provide the ability to request an external review before accepting requests from external resource allocators. Based on our initial analysis and interactions with resource allocating bodies both within the EOSC Nordic region

and outside, such a functionality would be required and used. Such an extension could potentially be exposed also as a standalone EOSC service or provided as part of EOSC Core service offering. Examples of mocks are shown in Figures 9 to 12.

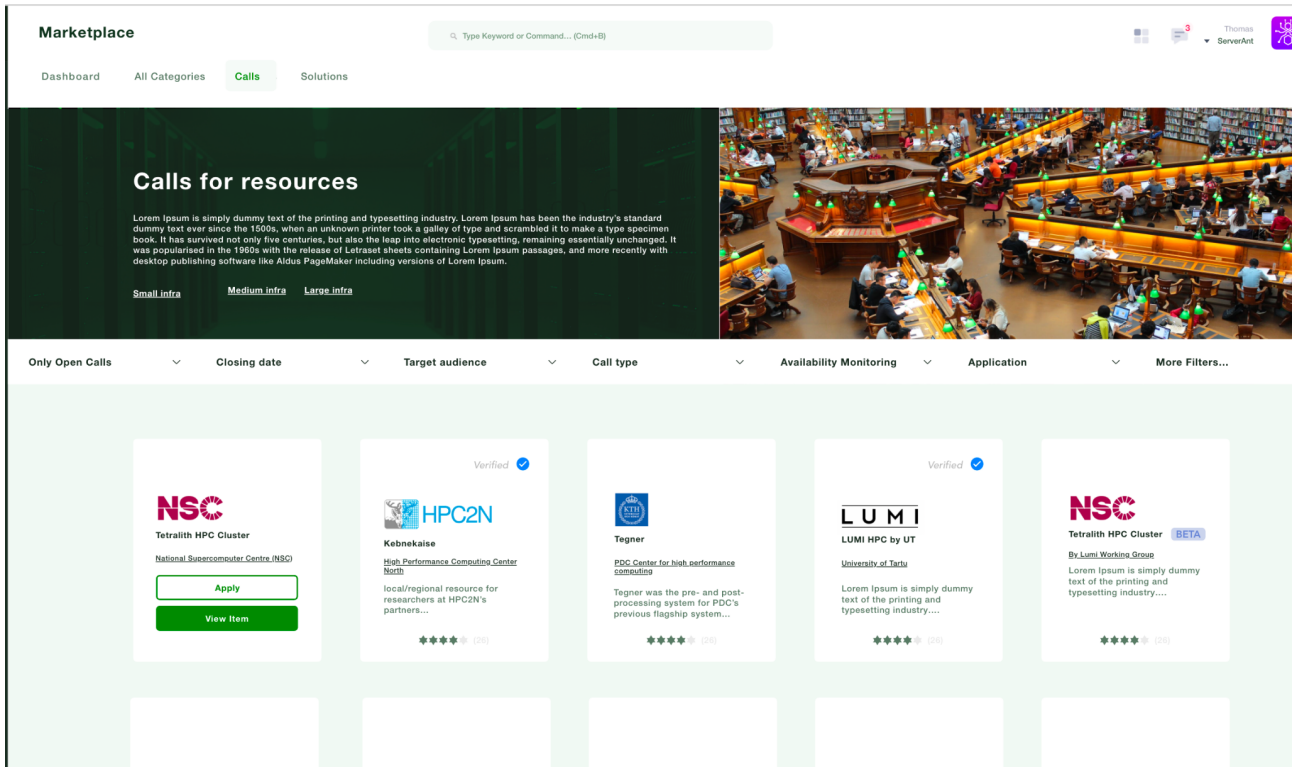


Figure 9: A mock view of all resources available in the regional catalogue.

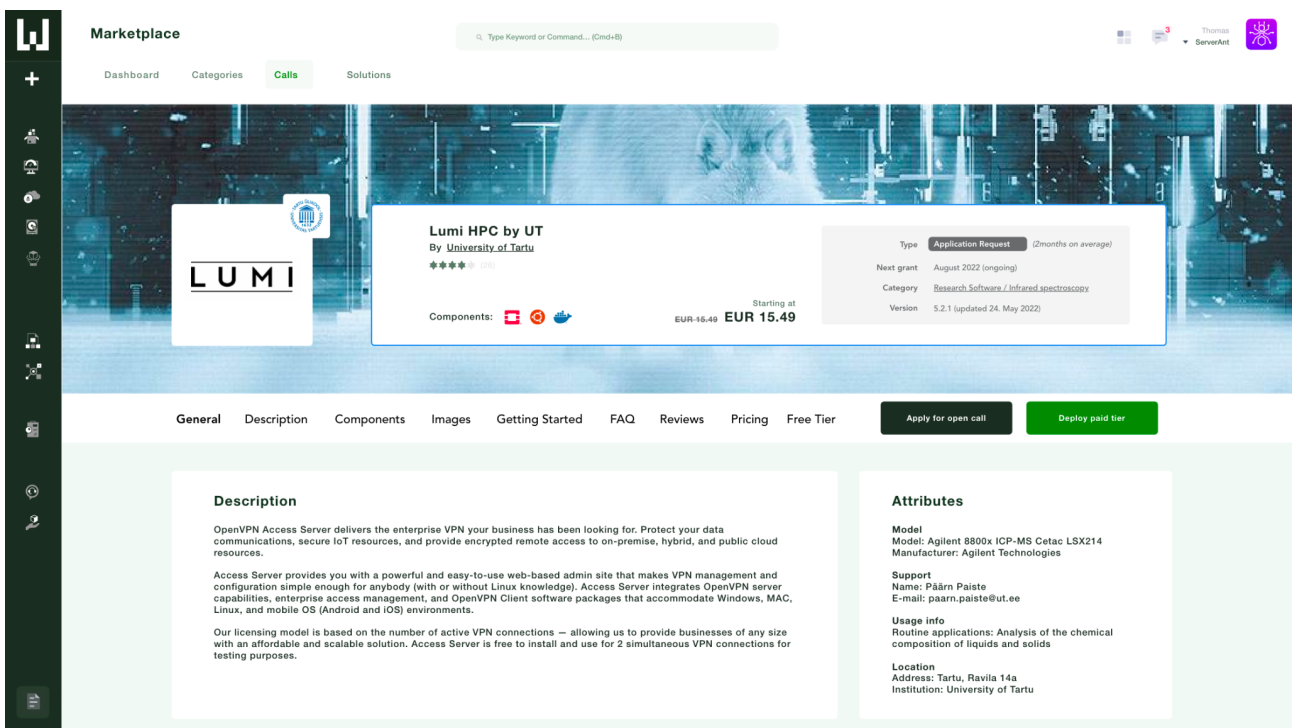


Figure 10. A mock detailed view of the resource. Note the button 'Apply for open call', which leads to request of resources via external review.

Available Rounds

Resources are made available for free to academia through application rounds. There are three different sizes of allocated rounds, as well as local rounds at centres. Select the size of round to apply for:

Small Compute	Medium Compute	High Compute	Cheapest plan
<p>Max 2000 GPU-h Month Available: 390.0000 GPU-h Month</p> <p>Weekly evaluation of proposals during the year. The Alvis resource is dedicated for AI/ML research.</p> <p>2022 round (ongoing) Evaluations weekly</p> <p>Deadline: 24.01.2022 08:00</p> <p>Apply</p> <p>• Minimum: PHD Student</p>	<p>Max 20.000 GPU-h Month Available: 390.0000 GPU-h Month</p> <p>Monthly evaluation of proposals during the year. The Alvis resource is dedicated for AI/ML research.</p> <p>February 2022 round Evaluations monthly</p> <p>Deadline: 24.01.2022 08:00</p> <p>Apply</p> <p>• Minimum: Assistant professor • Subject to: Technical Evaluation</p>	<p>Max 200.000 GPU-h Month Available: 2.090.0000 GPU-h Month</p> <p>Yearly evaluation of proposals. The Alvis resource is dedicated for AI/ML research.</p> <p>February 2022 round Evaluations bi-yearly</p> <p>Next Round: 24.01.2022 08:00</p> <p>Closed</p> <p>• Minimum: Assistant professor • Subject to: Technical Evaluation</p>	<p>Max 20.000 GPU-h Month Available: 390.0000 GPU-h Month</p> <p>Yearly evaluation of proposals. The Alvis resource is dedicated for AI/ML research.</p> <p>February 2022 round Evaluations 2 times a year</p> <p>Deadline: 24.01.2022 08:00</p> <p>Apply</p>

All grants require:

- Swedish Scientist in Academia
- Minimum PHD Student
- Swedish Scientist in Academia

Figure 11. Mocks of a view when there are several options for getting access to a resource via review.

Proposal Dashboard

Applications Open Calls

Proposal: #:2282050 - Evaluating HPC performance in Sweden **DRAFT**

Looks good,
Please review the application information once more, before pressing the submit button.

Application Progress **95%**

1. Basic Information [Edit](#)

Proposal ID: 2282050
State: **DRAFT**
Project Title: Evaluating HPC performance in Sweden
Abstract: Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been. Fried frrefry fry ...
Classification Code: 10104: Discrete Mathematics
Duration: 1 year

2. Users [Edit](#)

Affiliation: Linköping Universitet
Principle Investigator (PI): Kent Engström
Co-PI: -
Co Investigators: Ilja Livenson, Thomas Thaulow

Resources [Edit application cart](#)

Name	State
TetraIth@NSC-Medium Edit	Not Reviewed
Provider: SNIC	
Type: LargeCompute	Requested: 50 GiB
Calls: 05/22	Allocated: 50 GiB
TetraIth@NSC-Medium Edit	Not Reviewed
Provider: NAIS	
Type: LargeCompute	Requested: 100 x 1000 core-h/month
Calls: 05/22	Allocated: 100 x 1000 core-h/month
TetraIth@NSC-Medium Edit	Not Reviewed
Provider: NAIS	
Type: LargeCompute	Requested: 50 GiB
Calls: 05/22	Allocated: 50 GiB
TetraIth@NSC-Medium Edit	Not Reviewed
Provider: SNIC	
Type: LargeCompute	Requested: 50 GiB / 1000 files
Calls: 05/22	Allocated: 0 GiB / 0 files

Submit

By submitting, you agree to the [terms of service and privacy policy](#).

Figure 12. Mock of the review form for submission of request.

3.5. Interoperability and maturity

EOSC Nordic gateway was built in accordance with EOSC Nordic Interoperability guidelines⁷ developed in work package 3. While the technical components behind the solution are technically OK, the lack of signed agreements with operators of EOSC Core services allows the evaluated maturity of the solution to be only at TRL 8. The lack of agreements also is a blocker for launching order processing in a fully automated fashion.

3.6. Legal documents

The EOSC Nordic gateway is governed by two main documents:

- Rules of participation, defining what services are eligible to be added to the EOSC Nordic gateway. The Rules of participation are based on the current active rules for the EOSC Portal. See Appendix C for the full text.
- Terms of Use, defining what is acceptable to be done using the service. Terms of use are provided in Appendix D.

3.7. Production status

While the Puhuri Core and AAI service that the EOSC Nordic gateway is based upon are in production mode. The EOSC Nordic gateway connectors to the EOSC Core production system have not been fully operational as there were no established contracts for the integrated components. Only the publication offering has been enabled in the production environment, with the additional caveat that all personal identifiable information for a service is replaced by placeholders for the EOSC Nordic gateway operator. Integration has been tested on non-production environments for ordering.

4. Example of the ordering process

To give a feeling about the ordering process, an example was created using the EuroHPC LUMI supercomputer. Its Estonian part (operated by ETAIS) was added as an offering to the EOSC Nordic gateway. LUMI is a very interesting example as a number of resource allocating organisations in LUMI are also partners in EOSC Nordic WP3, which allows comparing processes in LUMI and those in EOSC and finding the optimal approach.

The overall flow of the ordering is as follows:

1. Find LUMI offering from the resource catalogue - Figures 13-14.
2. Request it using EOSC Marketplace - Figures 15-16.
3. Process it with microservices in EOSC Nordic gateway - Figures 17-19
4. Provision resource at the integrated service provider. Figure 20.
5. Notify the end-user about steps required to get access to the provisioned resource. Figure 21-22.

⁷ <https://eosc-nordic.atlassian.net/wiki/spaces/EN/pages/1277067265/Methodology>

lumi	All resour... ▾	Q
<p>RESOURCES</p> <p>LUMI LUST / Benchmark Access</p> <p>LUMI ETAIS / Regular Access</p> <p>Identifiers.org Resolution Services</p> <p>Access to Untargetd and Targeted Metabolomics Services</p> <p>GEP - High-Resolution Change Monitoring for the Alpine Reg...</p>		

Figure 13. Lookup of a LUMI service from the EOSC Resource catalogue.

The screenshot shows the EOSC Marketplace interface. At the top, there is a search bar with the text "Find resource..." and a dropdown menu set to "All resour...". The main content area displays the details for the "LUMI ETAIS / Regular Access" service. The service is provided by "Test Nordic Provider" and has a rating of 0.0/5 based on 0 reviews. There are buttons for "Access the resource" and "Manage the resource". Below the service details, there is a section for "SCIENTIFIC CATEGORISATION" which is "Agricultural Sciences". At the bottom right, there is a button to "Report a technical problem".

Figure 14: The user can then request ordering of the service access using EOSC Marketplace functionality.

Test instance < NAME

model training

Name will be visible in accounting

CPU ALLOCATION

10

Amount of CPU allocation in LUMI Common.

GPU ALLOCATION

0

Amount of GPU allocation in LUMI Common.

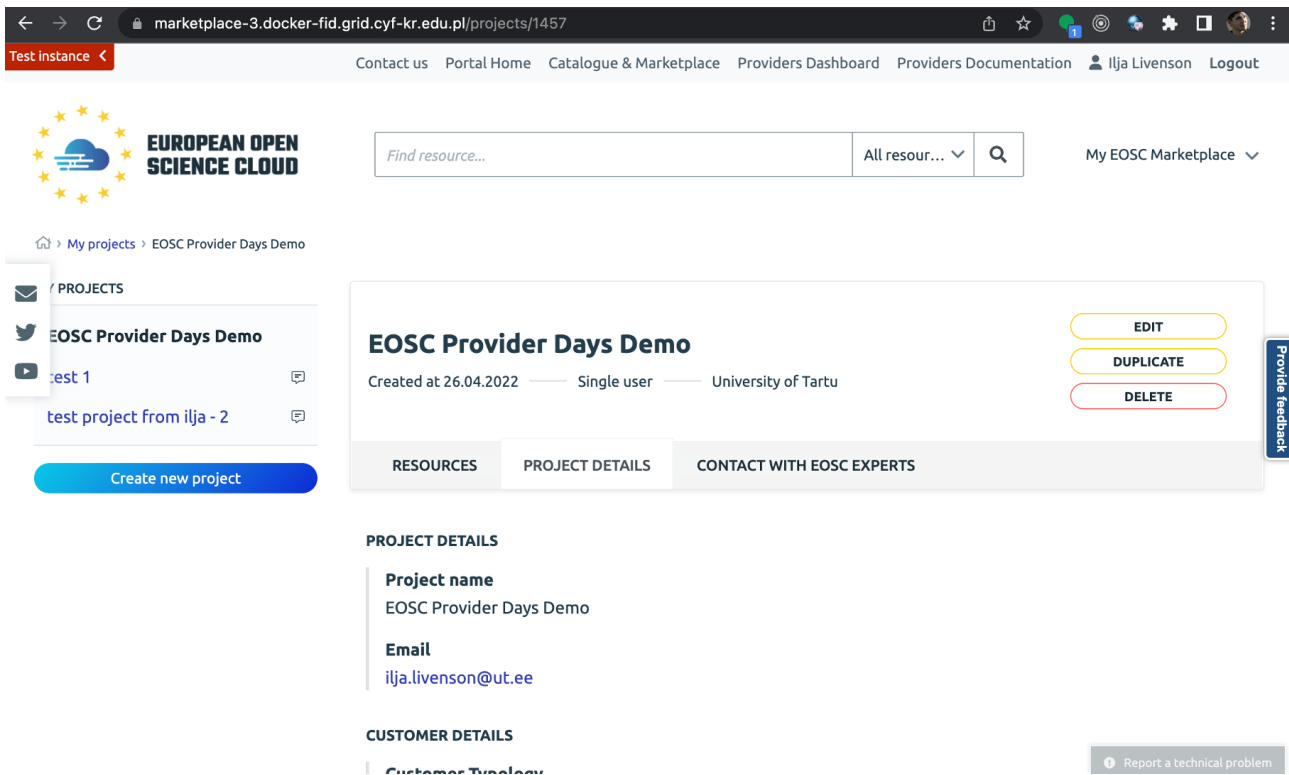
STORAGE ALLOCATION

1

Amount of Storage allocation in LUMI Common.

BACK TO PREVIOUS STEP - ACCESS INSTRUCTIONS Next

Figure 15. Ordering model from EOSC Nordic gateway is configured also in the EOSC Marketplace.



marketplace-3.docker-fid.grid.cyf-kr.edu.pl/projects/1457

Test instance < Contact us Portal Home Catalogue & Marketplace Providers Dashboard Providers Documentation Ilja Livenson Logout

EUROPEAN OPEN SCIENCE CLOUD

Find resource... All resour... Q My EOSC Marketplace v

My projects > EOSC Provider Days Demo

PROJECTS

- EOSC Provider Days Demo
- test 1
- test project from ilja - 2

Create new project

EOSC Provider Days Demo EDIT

Created at 26.04.2022 — Single user — University of Tartu

DUPLICATE

DELETE

Provide feedback

RESOURCES PROJECT DETAILS CONTACT WITH EOSC EXPERTS

PROJECT DETAILS

Project name
EOSC Provider Days Demo

Email
ilja.livenson@ut.ee

CUSTOMER DETAILS

Customer Type...

Report a technical problem

Figure 16. Summary of the project created in EOSC Marketplace.

Once the EOSC Nordic gateway detects that a new order has been created, it triggers provisioning of the resource in the corresponding service provider and adds the requestor as a new member into the target

project. The team member is added through an invitation to the email provided by EOSC Portal to assure that correct identity is used.

Figure 17. Order history for a request from EOSC Marketplace. Order is processed automatically and hence is very quick.

Figure 18. Once an order has been approved, a separate email is sent to the user for revalidation of identity. In the background, the user receives emails referring to the service allocation and also about a new invitation for a project.

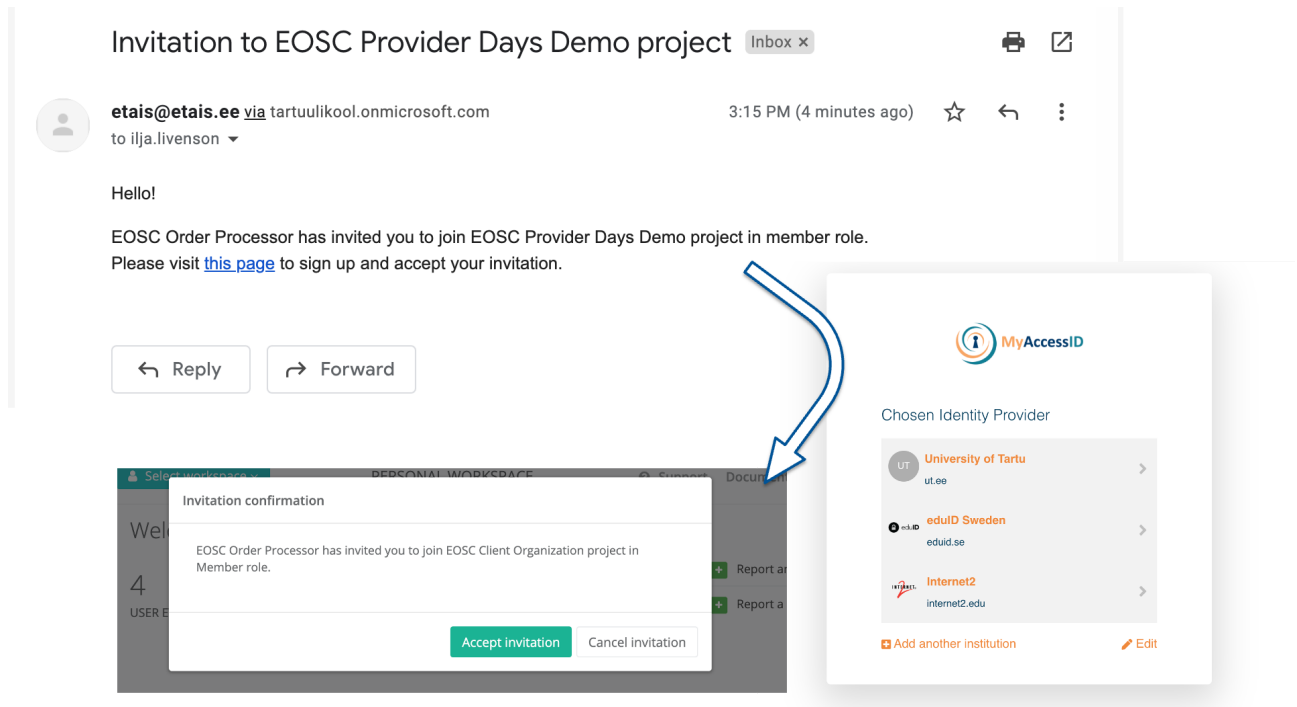


Figure 19. Screenshots of the user view of the identity revalidation. Arrived email contains an invitation that can be accepted using MyAccessID identity - registration is triggered if user does not have MyAccessID identity.

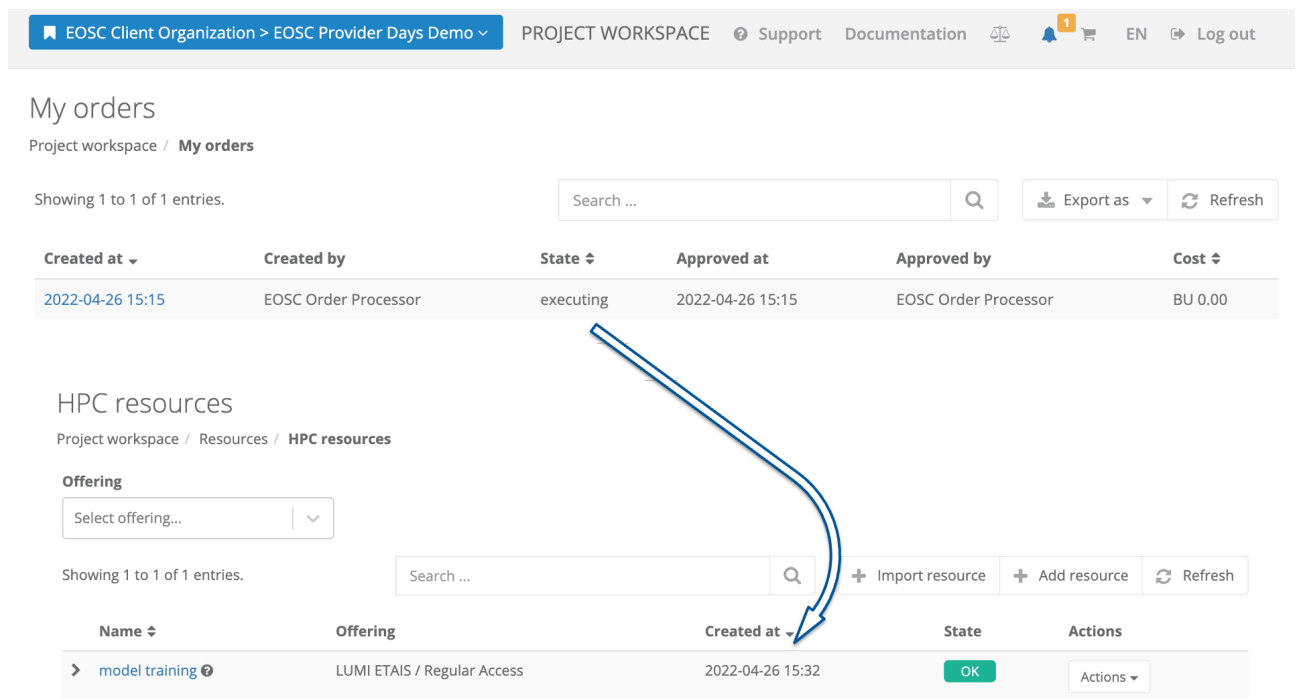


Figure 20. Once the invitation is accepted, user is able to see the status of the order also in EOSC Nordic gateway portal.

5. Experiences in integration

Within EOSC Nordic WP3 we agreed that the most valuable outcome for the project from the point of view of the technical integration of services would be actually working transactions. And as demonstrated by the example in the previous chapter, it is possible to provide a cross-border service in a transparent fashion using the tools that are most convenient for the resource allocators. We strongly believe that such technical integrations open up services for cross-border usage in a much more efficient way than creation of a new method of accessing resources. An Integrated and efficient regional service exchange bus can work both as a reference as well as an example for the federated EOSC model. Therefore, we made efforts to ensure that the community platform EOSC Nordic gateway linked with the EOSC Core gets higher adoption.

To validate the hypothesis, several integrations were done. For each of the integrations we wanted to assure that sustainability would be assured by the partner doing the integration beyond the end of the project.

1. Sigma2 from Norway has integrated their NIRD Service platform with the Puhuri Core to expose the service catalogue and provide digital access to users. A more detailed explanation of the integration is provided in Appendix A. In short, a generic integration for a variety of services provided by Sigma2 to Norwegian researchers allows researchers to request them via the Puhuri Core and in turn connect to EOSC Core via EOSC Nordic gateway. Figure 22-24 below shows integration methods that were taken to integrate the national system with a regional cross-border platform Puhuri. With that NIRD Service platform services can also be published and requested from EOSC Marketplace.

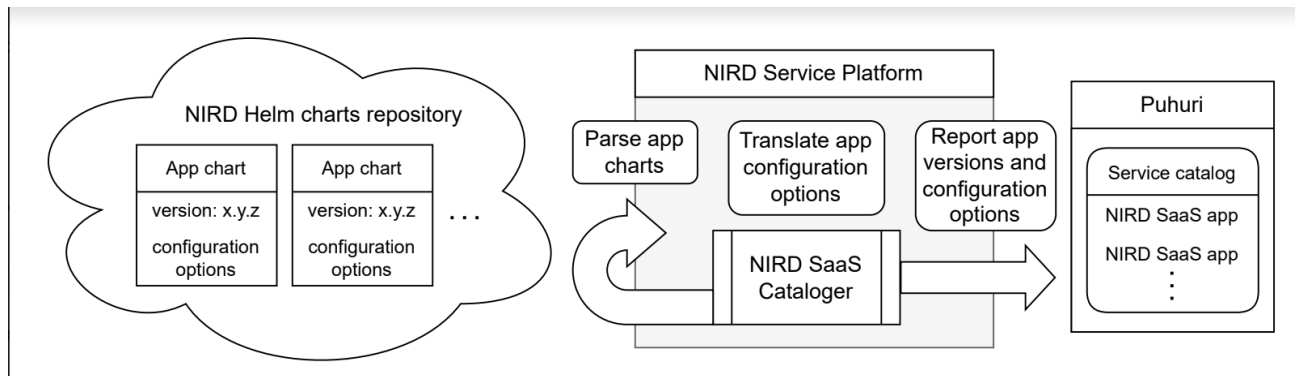


Figure 22: Example of an approach with publishing all services of NIRD Service Platform into Puhuri Core.

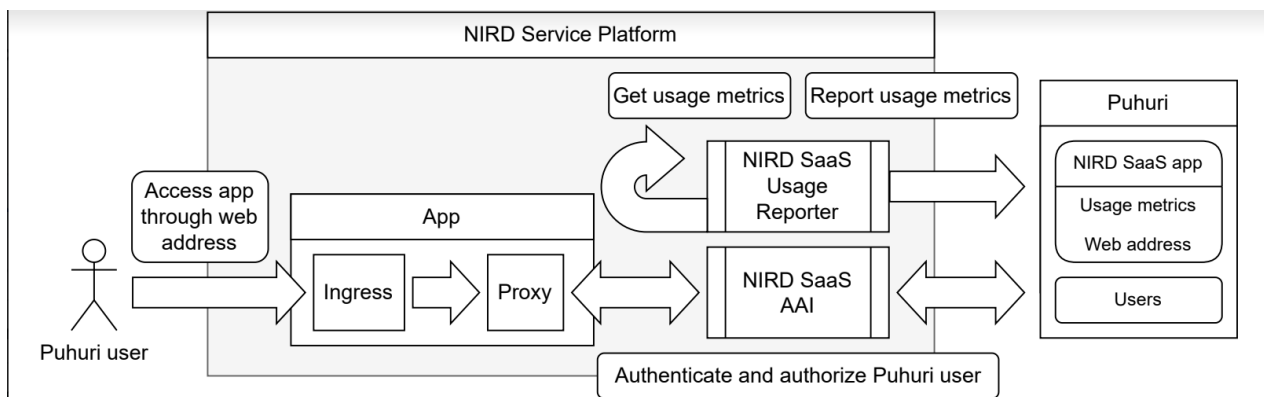


Figure 23: Validation of user access to NIRD Service platform and reporting of usage.

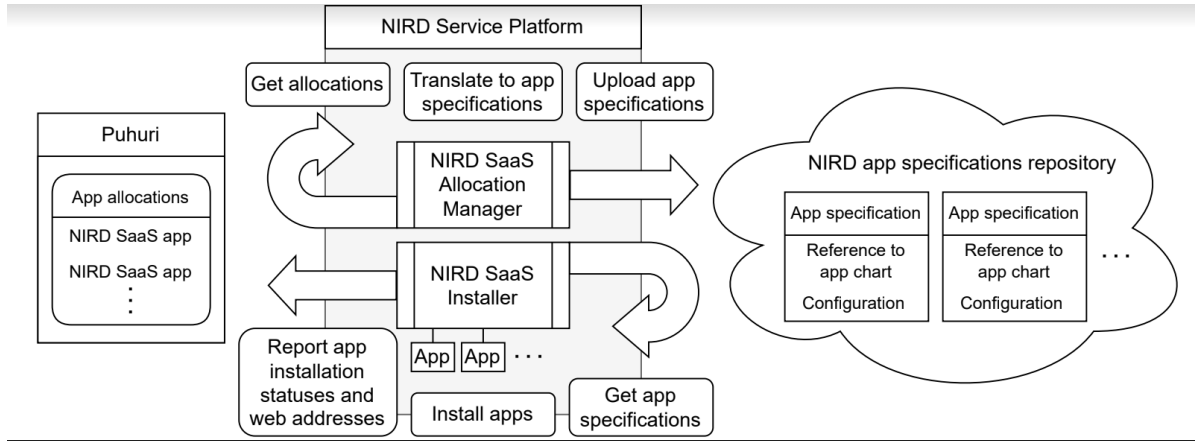


Figure 24: Deployment of allocations received via Puhuri Core.

- In Denmark, SDU has integrated their portal - UCloud - with the Puhuri Core in a way that allows them to allocate resources from the same environment. A more detailed explanation is provided in Appendix B. UCloud is used for both project application management, team management and resource allocation by researchers in Denmark. Integration allowed the option for handling cross-border service offerings without changing existing allocation approval flows. An example of usage of SDU share of EuroHPC LUMI via Puhuri is shown in Figure 25. Note that in this case resource consumption is not passing through EOSC Marketplace but instead uses the regional allocation platform directly. The approach however is very similar and follows EOSC Interoperability guidelines. As such, EOSC services integrated with the regional platform Puhuri become visible for integration with UCloud.

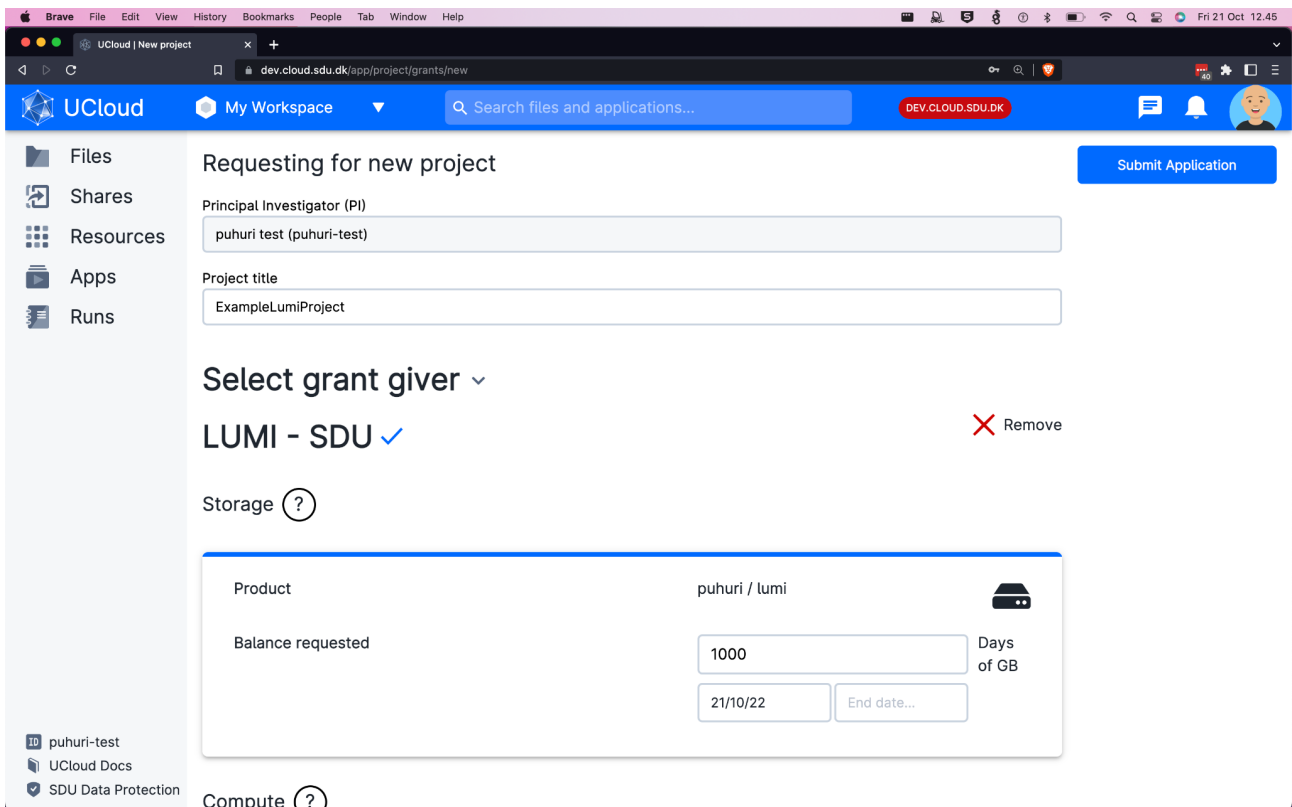


Figure 25. Example of SDU's UCloud allocating resources located abroad.

- RTU from Latvia have deployed the Puhuri Portal for accessing the services. RTU is also planning to expose its own HPC clusters via Puhuri to EOSC Core and other stakeholders.
- ETAIS from Estonia has integrated a common AAI solution from Puhuri and is planning to make available all of its services through Puhuri to other members of the community platform.

6. Lessons learnt

We started implementation of the integration with EOSC Core services a long time ago, when services were provided by EOSC Hub. We witnessed an evolution and slow transition from the approach that a single centralised EOSC should be in place to a more federated approach. It took even longer for the technological readiness of many components in EOSC Core to start supporting at least some federation capabilities. Unfortunately, the lifetime of regional 5b projects is different from the EOSC Future as well as planned EOSC tender for core services. It was hence paramount to decide on the approach to take: consider that the regional EOSC platform as a concept was built too early or to figure out if we can connect EOSC with an existing regional platform.

Fortunately, the NeIC Puhuri project was being developed in parallel due to the parallel deployment of the EuroHPC LUMI supercomputer. The model of LUMI with members co-funding the machine and then using it as their own provided a very strong motivation for the members to actually start using the service - and basically replaced the EOSC Sustainability model for EOSC Exchange that we were expecting from EOSC Association. In EOSC Nordic WP3 several organisations - CSC, DeIC, ETAIS, Sigma2 - were also mandated organisations in LUMI. While partially this can be attributed to a lucky coincidence, it has allowed us to select NeIC Puhuri as a basis for a community platform for cross-border collaboration and streamline efforts in EOSC Nordic.

NeIC Puhuri has provided a sustainability plan for EOSC Nordic WP3 key exploitable results, however it does not help with the motivation to service providers to actually share their services across the border. We believe that EOSC will provide a plan for EOSC Exchange sustainability and hope that it will arrive during the upcoming year.

On the technological side, we learnt that providing a new method of resource access works primarily in greenfield deployments, i.e. when there are no or very limited means of supporting researchers with services. The latter is not true for many of the EOSC Nordic partner-countries and hence new methods of access - e.g. via EOSC Marketplace - have not been successful in adoption. On the other side, integrating with infosystems that end-users are already familiar with allowed such infosystems to extend the service options for their end-users. We believe that such non-intrusive integration methods that allow combining local, national, EOSC, commercial or any other services is a key to success for improving cross-border collaboration.

Some data supporting this hypothesis can be seen from the statistics of ordering data in EOSC Marketplace (Figure 26) and Puhuri (Figure 27) shown in the figures below.

Service	2022		Total	
	08	09	Sum	Approved SO
B2SAFE	2	3	5	3
B2DROP	1	3	4	2
ADAM SPACE	1		1	1
AMNESIA	1		1	1
ARGO MARINE FLOATS DASHBOARD, ...	1		1	1
ARIA (ACCESS TO RESEARCH INFRA...	1		1	1
ATMO-4CAST		1	1	1
DATAVERSENO		1	1	1
DE.NBI CLOUD: CLOUD COMPUTING ...	1		1	1
DEEP TRAINING FACILITY	1		1	1
Total Sum	11	16	27	17

Figure 26. Orders for all services in EOSC Marketplace during August-September 2022. <https://opsportal.eosc-portal.eu/metricsEOSC/ServiceOrder/2022-08-01/2022-09-30/list/off#stats> In total, **17** approved orders.

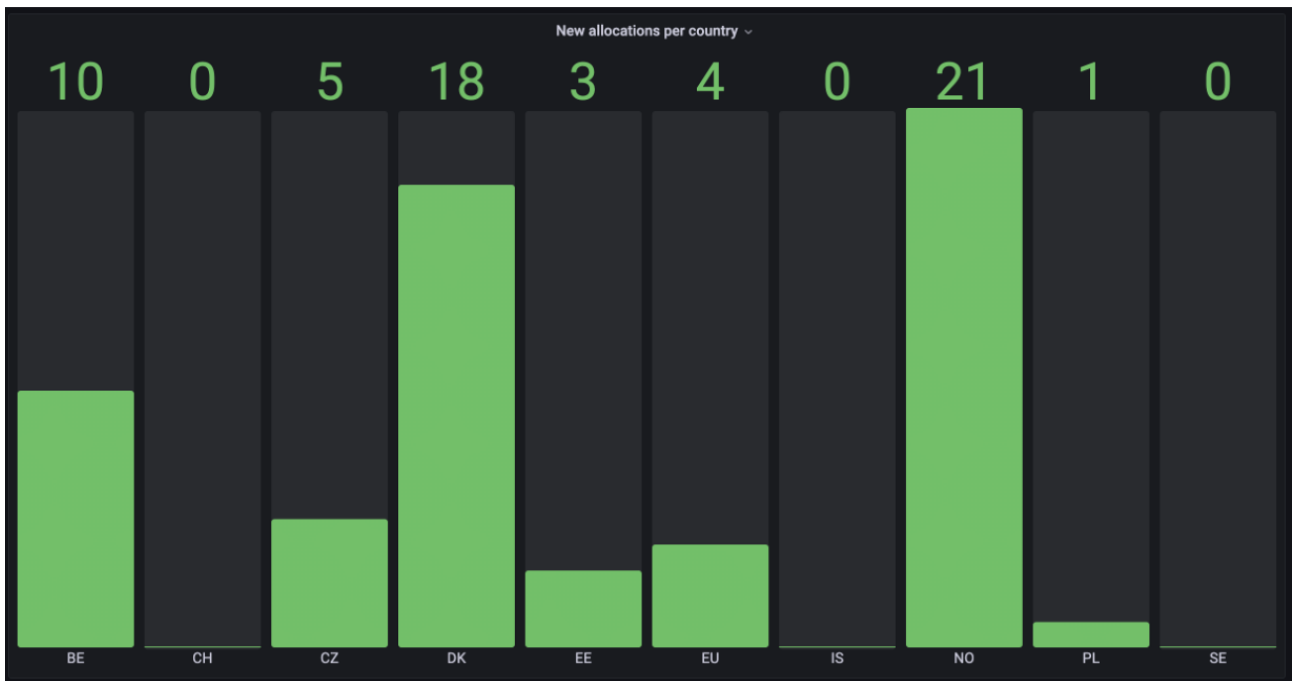


Figure 27. Approved orders for a single service - LUMI - during the same period of time. Data is partial with some countries removing the information. In total, **62** approved orders for a single service.

7. Sustainability

To assure sustainability of the platform, several measures were taken.

1. The sustainability of the EOSC Nordic gateway is assured by ETAIS for the coming 2 years at least. ETAIS will cover costs connected with using Puhuri services, including costs connected with services procured from Geant - Puhuri AAI.
2. For all integrations with national infosystems for service management or project allocations, we had an organisation - typically the same that did the integration - take responsibility for the upkeep of source code or a service during at least 1-2 years.
3. All extensions to the Puhuri services, either microservices or Waldur⁸ platform, which serves as a basis for the Puhuri Core and Portals, were released as open-source under non-viral MIT or GPL licence to simplify possible handover or reuse.
4. New joint projects where cross-border collaboration was foreseen, where possible, were planned with EOSC Nordic gateway and its underlying Puhuri platform in mind. For examples, these include NeIC Nordquest⁹ project, Biodiversity DT¹⁰ and EuroHPC LUMI-Q¹¹.

8. Future plans

We are planning to follow the further evolution of EOSC Core services, both in technical terms, in terms of governance as well as value propositions for service providers. Several of the integrations that have been achieved in non-production environments are planned to be launched in production in Q1 2023.

We plan to extend the platform with the ability to request services from EOSC that would enter a review process by resource allocators instead of direct provisioning. The activity will also follow the evolution of EOSC Core and in particular outcomes of the EOSC tender.

Finally, we plan to expose the created platform as EOSC service itself, aiming primarily at organisations that already have in place processes for cross-border access and would like to automate the process.

⁸ <https://docs.waldur.com/>

⁹ <https://neic.no/nordiquest/>

¹⁰ <https://biодt.eu/>

¹¹ <https://www.lumi-supercomputer.eu/czechia-will-host-the-european-lumi-q-quantum-computer/>

Appendix A: Sigma2 experience of deep integration with a regional EOSC platform

Motivation

Cloud services can give researchers an effortless way to access large storage and computational resources, through familiar software interfaces. In Sigma2, we deliver a software-as-a-service platform that can be accessed online, the NIRD (National Infrastructure for Research Data) Toolkit. The platform can be used for installing customizable and web-accessible scientific software services on the Kubernetes-based NIRD infrastructure, which includes large storage (32 PB) and medium-scale computation resources. The available software includes the popular JupyterLab environment, with pre-installed machine learning packages, RStudio for statistics, and VNC for an environment reminiscent of the graphical user interface of personal computers. The software services available in NIRD Toolkit are however independent of the toolkit itself, and their setup and management can be handled by other platforms.

The goal of Sigma2 is to provide our cloud software and related infrastructure to students and researchers across Europe as a Puhuri Service Provider. Our services will provide an alternative to traditional research infrastructure services, which often require users to be knowledgeable about the Linux command line, software modules and/or compilation and batch systems. We hope that this will lower the barrier of entry for scientific computation, enabling additional users from various fields to enhance their research with powerful tools.

What worked well

In the initial stages of our work, we developed a model of how our scientific software could be integrated into the Puhuri platform. We were able to describe the integration efforts as a set of software components we believe will give a sustainable interface to Puhuri. We then started developing these components. First, we set up an authentication and authorization infrastructure (AAI) that will allow for integrating Puhuri users into our services. Next, we set up an accounting system on our platform, which will be used when reporting usage metrics to Puhuri. We then started developing a component that will automatically register the available software and configuration options to Puhuri.

What was hard/required integration effort

As with a lot of systems development, we encountered several technical issues. First, the previous user authentication workflow was a bit more complex than expected, involving several access tokens and automatic registration of new applications as OAuth clients. This workflow had to be simplified for Puhuri compatibility, which was done during the AAI development. During deployment of this component, we encountered some unexpected browser-related issues and a Kubernetes system certificate expiration issue. The deployment was also done during a planned migration of NIRD to new hardware. In combination, these issues added quite a bit of complexity to our work.

What is the planned sustainability for the integration code

The integration code is based on modular components, which interface to both our national identity provider Feide, NIRD Toolkit and Puhuri. Since Puhuri has been integrated into the framework we

27

use for installing software on the NIRD infrastructure, we will continue to maintain the integration code as part of the regular maintenance of our services. Many of the components are developed in accordance with the Kubernetes operator pattern, which is emerging as the standard solution for extending the Kubernetes API. This implies that we can expect relevant competence for maintaining the components to be available in the market in the coming years. The integration code is also version controlled and documented, which adds to its sustainability.

What is the expected adoption/usage

We expect that the services will be used by researchers and students who want easily accessible and powerful software solutions for data processing, without the inconvenience of storing and processing the data on their personal computers. Our services are particularly suited for people who want a convenient solution for statistics and machine learning on large data sets. The services are also useful for teaching, as the services can be customised and can accommodate multiple users, and many of the services also involve integrated development environments and shared file access. Overall, we believe there will be significant interest in these solutions in the European research environment.

Appendix B: SDU experience of deep integration with regional EOSC platform

Motivation and background

As part of the renewal of the national services for High Performance Computing (HPC) and Data Management which is currently underway, Denmark is developing a national portal for HPC services that will give researchers simple and secure access to the national computer systems, as well as managing the resource distribution at the individual facilities (see figure below; taken from the [DeiC website](#)). The project goes under the name “DeiC Project5” and it builds upon the [UCloud software platform](#). The goal of Project5 is to extend the UCloud platform to provide:

- An overview of available resources at the computing centers;
- Managing projects and users at the HPC centers;
- Access to the functionalities exposed by HPC centers, such as jobs submission and storage;
- Accounting for projects and grant givers.

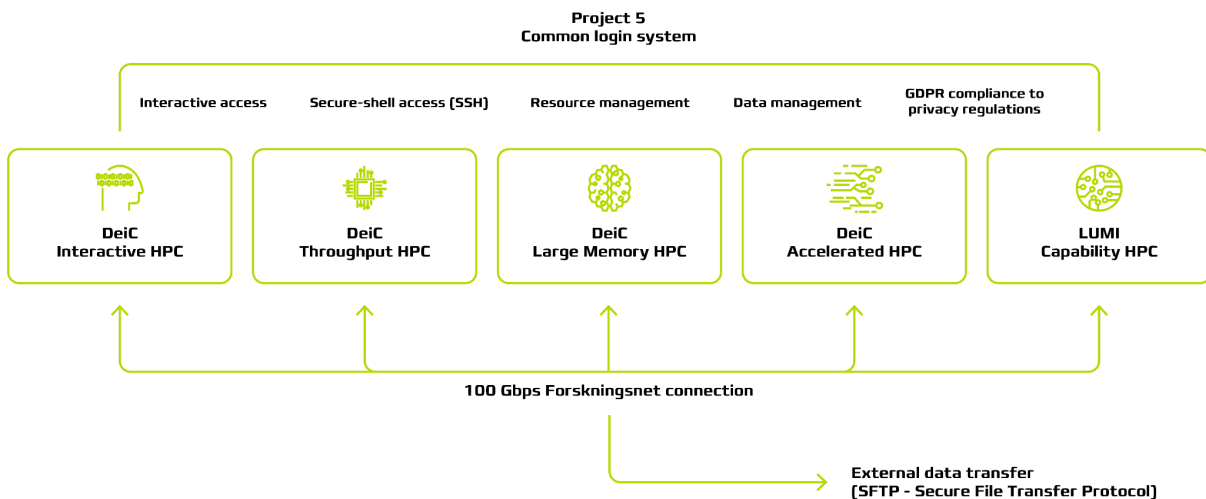


Figure X. Overview of the national Danish project for improving HPC access.

Denmark is part of the LUMI consortium and the [LUMI supercomputer](#) is one of the HPC facilities in scope for the project. LUMI uses [Puhuri](#) as the portal for managing users, projects and allocations on the supercomputer. Puhuri exposes a [REST API interface](#) suitable for the integration of national allocators. In this task, we integrated the Danish portal based on UCloud with Puhuri. The features in scope for the integration are:

- Creation of projects;
- User management (add/remove users to a project with appropriate roles; changing roles);
- Management of resource allocations (add resources of different kinds to the projects).

What worked well

Both Puhuri and UCloud have a modern architecture and follow best practices as web-based services. Both systems expose REST APIs and it was easy to use these APIs to interface the two systems. The fact that UCloud itself is built upon web technologies meant that the use of REST APIs to interface to Puhuri is not dissimilar to how UCloud itself communicates internally among its different subsystems. From this point of

view the use of REST APIs for the integration was frictionless. The Puhuri API is clean, simple and well documented. The documentation contains an [integration guide for resource allocators](#) which is well written and generally useful for the task. The communication with the Puhuri core development team was also very good to clarify any remaining doubts and to set up a proper development environment for the integration.

At a higher level, the integration between Puhuri and UCloud required a mapping between the relevant concepts such as description of projects, description of resources and allocations, user roles, etc. The conceptual models used by Puhuri and UCloud are, however, quite similar and this mapping was straightforward. In addition, both systems are quite flexible in how they model resources, which meant we could easily add the new LUMI resources existing in Puhuri to UCloud and such resources could be used in projects with no changes required to the core UCloud code.

What was hard / required integration effort

The integration required to create a new “UCloud provider” for Puhuri/LUMI. The UCloud provider abstraction is the mechanism in UCloud which is used to federate datacenters or service providers in UCloud. The mechanism is generic and flexible based on plugins which allows it to integrate a wide range of services in UCloud. The federated services can be based on different technologies (currently there are services based on K8s, OpenStack and traditional HPC clusters which are federated with this mechanism).

For the integration with Puhuri, this task created a new UCloud provider called “LUMI”. This involved the creation of new plugins specific for Puhuri, i.e. plugins which can use the Puhuri REST API to perform the necessary operations, such as create a project with a given name or add a user to the project with a given role. The creation of this new plugin was the most time consuming part of the task.

In addition to creating a new specific plugin for Puhuri, the integration also makes use of other already existing plugins, such as the OpenID Connect plugin for authentication. For the integration to work, the additional plugins needed to be properly configured to match the target Puhuri system.

For the integration to work, a new resource allocator user must exist in the Puhuri system. This “user” corresponds to the service account used internally by the UCloud LUMI provider for the integration. The setup of the service account with the required permissions, was not obvious to the UCloud team, but the Puhuri core dev team helped with the required setup.

Another point which required attention was the authorization workflow for allocations. Since authorization is handled in the national portal (in this case UCloud), one can assume that requests coming from UCloud to Puhuri do not require further review and approval. This also requires proper permission settings for the service account and the Puhuri organisation used for the integration.

10.4. What is the planned sustainability for the integration code

The code developed for this task is part of the Danish national allocation portal. This portal is planned to enter production at the beginning of 2023. As all other national infrastructure projects in Denmark, the portal is evaluated and its contract renewed on a yearly basis, while the length of the contract is three years. This means that the existing service contract runs until 2025, it will be evaluated annually and if approved extended for another three years. With this mechanism the project can be extended indefinitely. The funding for the national allocation portal from 2023 includes operation of the portal and bug and security fixes. However if major rework of the portal

or, for example, a major breaking change in the Puhuri API will take place, additional funding is likely to be required for the work.

As a final note, all the code produced for this task, as well all the code of UCloud is publicly available on github under the EUPLv1.2 licence.

What is the expected adoption / usage

The portal is based on UCloud and it is therefore easily accessible by all Danish researchers. Currently UCloud is used by ~5000 researchers with ~200 new users every month. UCloud itself is a rather new service, started less than two years ago, and the rate of adoption is increasing over time. The portal will expose services like Puhuri and LUMI to a broader audience of researchers in Denmark, which are currently not using, and are maybe even unaware of, LUMI services. In particular, a number of user communities not using traditional HPC systems are present on UCloud from the social sciences, humanities and life science. It will be interesting to see to what extent lowering the barrier to enter systems like LUMI via the present integration will bring new user communities to large HPC systems such as LUMI.

Appendix C: EOSC Nordic gateway Rules of Participation

EOSC-Nordic adopts the Inclusion Criteria which is developed by EOSC Future and EOSC Enhance. This criteria is the lightweight version of EOSC Rules of Participation which describes the high-level guidelines. Inclusion Criteria describes a more concrete way, which Service Providers can offer their services through the EOSC-Nordic gateway and the requirements for these services.

What groups can onboard to EOSC as a provider?

Any group can onboard to EOSC as a Provider, as long as it fills in the necessary information in the EOSC Provider Profile.

Those onboarding as a provider should either be a legal entity or connect to the registration of a hosting legal entity already onboarded as a provider under their own profile.

Who can onboard resources to EOSC?

Providers onboarding a resource must assert that they are able to ensure the resource is delivered by them or their collaborators and agree to remove resources that are no longer operational or available.

Resources should be onboarded by the coordinating or lead provider in case of a federated or jointly provided resource (they are the 'Resource Organisation'). Other onboarded providers may be added as supporting or supplementary providers ('Resource providers').

What resources may be connected to EOSC?

Services. At present only services are being onboarded.

It must be a specific service offered 'live' to customers [1]. This may be an IT service, or a human service (e.g. training, consultancy).

It may not be a research product, for instance, a document, a dataset or a piece of software [2].

The Service must be discrete. It must be available and offer value on its own. It may not be only a feature of a larger service available while already using that service.

The Service must be of a reasonable maturity, Technology Readiness 7 or above in order to be listed in the catalogue (and TRL8 or above to allow for integration of ordering).

Services must meet at least one of:

1. The service must be targeted to EOSC and EOSC communities [3].
2. The service must build on or leverage EOSC capabilities to serve some other community [4].

Other resources, such as research products (data sets, publications, software and other types) will be able to be onboarded at a later date.

NOTE: while research products are not being directly onboarded, services that contain them such as data, software or publication repositories can be onboarded as services.

A provider profile and resource profiles for each resource must be filled, including at a minimum all required fields.

- URLs must be Fully Qualified Domain Names (FQDN)
- Key information must be in English due to the limitations of current project resources (though this may change in future)
- The provider and resource profiles must be in English
- The basic information in the User Interface for the service must be available in English
- Privacy statements, terms of use and Service Level Agreements, Specifications and Descriptions must be available in English. Other documentation may be in the native language only.

The Helpdesk or support function must be able to answer queries in English at a minimum.

Resources must be both available in Europe and available in a European language [5].

The provider must agree to periodically update data on themselves and their resources to keep it current (to be covered in an EOSC Provider agreement, under development).

[1] Filling e.g. the definition according to FitSM-0 - Service: Way to provide value to customers through bringing about results that they want to achieve. Note: In the context of the FitSM standard series, when referring to services, usually IT services are meant. From <https://www.fitsm.eu/download/280/> It should not be a generic menu of services from a provider, but the specific services themselves.

[2] A data repository service providing some annotation, tools over the data sets, enhanced features is likely a service. A simple link to a data file is not.

[3] For instance, could be a service from the research community for researchers, or if a commercial service, includes a clear offer targeted at EOSC and research customers which addresses them, rather than be a generic commercial service. One example of the latter is a joint procurement framework targeting EOSC.

[4] For instance, services through the Digital Innovation Hubs which build on EOSC expertise, resources and capabilities to create new, innovative commercial services.

[5] See https://europa.eu/european-union/about-eu/eu-languages_en.

Appendix D: Terms of Use of the EOSC-Nordic Gateway Platform

The University of Tartu (hereafter called the Platform operator) reserves the right to change, add or remove portions of these Terms of Use at any time. It is your responsibility to check these Terms of Use periodically for changes. The most recent version of the Terms of Use is posted on this website and you are deemed to have accepted the Terms of Use on your first use of the EOSC-Nordic Gateway platform following the alterations.

Definitions and interpretation

In this Terms of Use, the following definitions are used:

- EOSC-Nordic Gateway platform - community order management system for the Nordic region which holds a set of Nordic services synchronised with the EOSC Portal Catalogue and Marketplace. Each entered service will be assigned with DOI PID (persistent identifier), which can then be used to refer to a particular digital service (<https://share.neic.no>).
- Platform operator - the University of Tartu, which operates the EOSC-Nordic Gateway platform.
- User or you - any third party that accesses the EOSC-Nordic Gateway platform and is not either (i) employed by the Platform operator and acting in the course of their employment or (ii) engaged as a consultant or otherwise providing services to the Platform operator and accessing the EOSC-Nordic Gateway platform in connection with the provision of such services;
- EOSC Portal Catalogue and Marketplace - Integrated platform that allows easy access to lots of services for various research domains along with integrated data analytics tools (<https://marketplace.eosc-portal.eu/>).
- Service - any asset made available (by means of the EOSC system and according to the EOSC Rules of Participation) to EOSC System Users to perform a process useful to deliver value in the context of the EOSC. EOSC Resources include services, datasets, software, support, training, consultancy or any other asset.
- Service provider - an organisation, a part of an organisation or a federation that manages and delivers Service to End-User
- Content - the information about the service, provided by the service provider.

1. Who can use the EOSC-Nordic Gateway platform?

All users can log into the EOSC-Nordic Gateway platform, but services can be added only by persons with the right to represent the institution or organisation.

2. How to use the EOSC-Nordic Gateway platform?

To gain access to the EOSC-Nordic Gateway platform you have to register yourself by creating an account in the EOSC-Nordic Gateway platform. For that, you must identify yourself with the MyAccessID authentication service. If you have any problems regarding registering and creating the account, please contact support@eosc-nordic.eu

3. When can I start using the EOSC-Nordic Gateway platform?

Access to the platform is granted right after successful authentication. Persons with the right to represent the institution or organisation can add new services to the catalogue.

4. EOSC-Nordic Gateway platform usage fee

EOSC-Nordic Gateway platform can be used free of charge.

5. User support

All registered users can use the provided helpdesk, which is available in the EOSC-Nordic Gateway platform after successful login. Also, it is possible to use the helpdesk email support@eosc-nordic.eu.

6. Intellectual Property rights

Intellectual property rights on Content belong to the person(s) indicated as rightholder(s) of the said rights; specific licences apply to certain Content, as indicated.

7. Platform operator's rights and responsibilities

- 7.1. Users personal data will be processed in accordance with the Privacy Policy.
- 7.2. Platform operator can restrict or suspend Users access for administrative, operational, or security reasons, without prior notice and without compensation.
- 7.3. Platform operator can restrict access of Users who have violated the Terms of Use.
- 7.4. Platform operator provides users with user guides (published on the website) and additional guidance (by email, phone, in-person) when needed.
- 7.5. Platform operator is not held responsible for any data loss, leakage or damage caused by force majeure, user activity or inactivity or a third party whose access has become possible due to (in)activity of the user.
- 7.6. Platform operator reserves the right to remove any data at any time and/or transfer data to other individuals (working on the same or similar project) after a user account is deleted or closed.
- 7.7. Platform operator may elect to make backup copies of some data files. When backup copies are made, the Platform operator reserves the right to hold such backup copies indefinitely or to delete them.
- 7.8. Platform operator may, at its discretion, transfer part or all of the services entered into the EOSC-Nordic Gateway platform to the EOSC Portal Catalogue and Marketplace.

8. Users' rights and responsibilities

- 8.1. Users must follow the Terms of Use, read and accept the Privacy Policy and follow all legal acts of Estonia and EU without exception when using the EOSC-Nordic Gateway platform.
- 8.2. Users must keep their login data private. Accessing the EOSC-Nordic Gateway platform with someone else's login credentials is strictly forbidden.
- 8.3. Users may not attempt to gain unauthorised access to any portion or feature of the EOSC-Nordic Gateway platform.
- 8.4. Users may not probe, scan or test the EOSC-Nordic Gateway platform's vulnerability or any network connected to the EOSC-Nordic Gateway platform.

- 8.5. Users may not reverse look-up, trace or seek to trace any information on any other EOSC-Nordic Gateway platform users.
- 8.6. In case of any possible security threats (e.g. leakage of login credentials), the user must inform the EOSC-Nordic Gateway platform helpdesk (support@eosc-nordic.eu) immediately and also give his/her best to avoid potential damage to the platform.
- 8.7. Users are accountable for their actions. Violations of Terms of Use, Privacy Policy, procedure, and security rules may result in applicable administrative sanctions or legal actions.

9. Exclusion of Encouragement

No part of the website content can be considered, directly or indirectly, as encouragement, recommendation, advice or encouragement for any act or omission. The User bears the sole responsibility for his use, while University of Tartu, on behalf of the EOSC-Nordic Gateway platform, assumes no responsibility.

10. Governing law

- 10.1. The Terms of Use are governed by and construed by the laws of the Republic of Estonia.
- 10.2. Disputes related to the Terms of Use will be resolved through negotiations.
- 10.3. If the dispute cannot be resolved through negotiations, the parties have the right to go to court of the Republic of Estonia to resolve the dispute by the legislation in force in the Republic of Estonia.

Updated: November 2022