Bulgarian Contribution to the Open Science Services in NI4OS-Europe

Aneta Karaivanova[1[0000-0002-6493-7981]], Emanouil Atanassov[1[0000-0002-7442-7096]], Todor Gurov[1[0000-0003-4900-0899]], Peter Stanchev[2[0000-0002-0063-0024]], Georgi Simeonov[2]

[1] Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, Sofia, Bulgaria
[2] Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, Sofia, Bulgaria
(anet,emanouil,gurov)@parallel.bas.bg,
(stanchev, gsimeonov)@math.bas.bg

Abstract. The paper gives an overview on the Bulgarian participation in the e-infrastructure part of the NI4OS-Europe project, funded by EC through H2020 program. NI4OS-Europe team has identified a set of necessary services and the corresponding policies that resources have to produce and publish, clearly stating to the users the ways these resources could be used, as well as the actions that are not allowed. By offering service providers a clear procedure for onboarding, NI4OS-Europe project partners are able to on-board more services with pan-European significance. Here we briefly present some of the services developed by the Bulgarian team.

Keywords: NI4OS-Europe, EOSC, Onboarding, Services, pre-Production Environment.

1 Introduction

In the last decade, a number of coordinated e-Infrastructure initiatives were crucial for enabling high-quality research & ICT developments, by providing integrated networking, computational and storage resources, application support and training, in South East Europe (SEE). These initiatives have helped to reduce the digital divide and brain drain in Europe, by ensuring access to regional e-Infrastructures to new member states, those on the path to ascension, and those in the area identified by the European Neighborhood.

The NI4OS-Europe project (https://ni4os.eu/) – *National Open Science Initiatives in Europe* - brings together the existing e-Infrastructures in SEE and the services developed in a number of regional projects to better utilize synergies, for an improved integration to the European e-infrastructure ecosystem through unified user-facing services and interfaces. The goal is to achieve cohesive integrated e-Infrastructure with compatible interfaces and policies to empower regional cross-border scientific communities.

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A rich set of e-infrastructure services are available for the scientists in the region, where new services or capabilities in the existing services are developed and deployed in order to conform to the needs and requirements arising from the European Open Science Cloud (EOSC, https://www.eosc.eu/) but also from the national priorities. Substantial HPC services, based on existing and future supercomputers and high-performance clusters are provided, fostering cross-country access and collaboration. Data storage services and cloud resources are provided using user-friendly interfaces, enabling transparent, verifiable research and growth of research collaboration around topics that are a priority for the region not only from a scientific point of view but also from a point of view of challenges to the economies and societies in the region.

The Bulgarian participants in this project are IICT-BAS and IMI-BAS (as a third party). In this paper, we will briefly describe the services developed and deployed by the Bulgarian teams.

2 Services in NI4OS-Europe and Their Classification

The NI4OS-Europe project is actively involved in the creation of the European Open Science Cloud (EOSC), which aims to provide easy and secure access to electronic infrastructures, services and data repositories for all researchers. As part of this project, which involves 22 organizations from 15 EU Member States and associated countries of South East Europe, a catalog of digital services has been created which will be included in the EOSC portfolio. In this section we will present the Bulgarian contribution.

The NI4OS catalogue (https://catalogue.ni4os.eu/) contains the full list of service providers – project partners and others, presents available services and distinguishes those that are on-boarded. There is a hierarchical organization of services included in the catalogue:

- Core services (monitoring, usage reporting, AAI);
- Generic services (HPC, cloud, storage, etc.);
- Thematic services;
- Repositories.

The general description of each resource contains the following information: Basic information such as the name of the service and its final destination (endpoint); Marketing information such as slogan/acronym, description, logo, website, targeted communities; Classification, scientific field and category information; Location and language information; Information about the service provider; Technical specification; Technology Readiness Level (TRL); Level of Integration with EOSC (EIL); Management integration level (MIL).

Currently, a total of 53 services are integrated and are onboarding in the EOSC. The IICT-BAS has developed and provided for onboarding 3 generic cervices (Avitohol Cloud, Avitohol supercomputer resources, Data Discovery service) and 1 core service (Accounting system), see Fig. 1. Additionally, two thematic services (ClimCost and ClimHealt) developed by the National Institute of Geophysics, Geodesy and Geography (NIGGG) are candidate for onboarding. They currently are tested in the NI4OS-Europe

Pre-production Environment and should be onboarding very soon in the EOSC (EOSC marketplace, https://marketplace.eosc-portal.eu/).

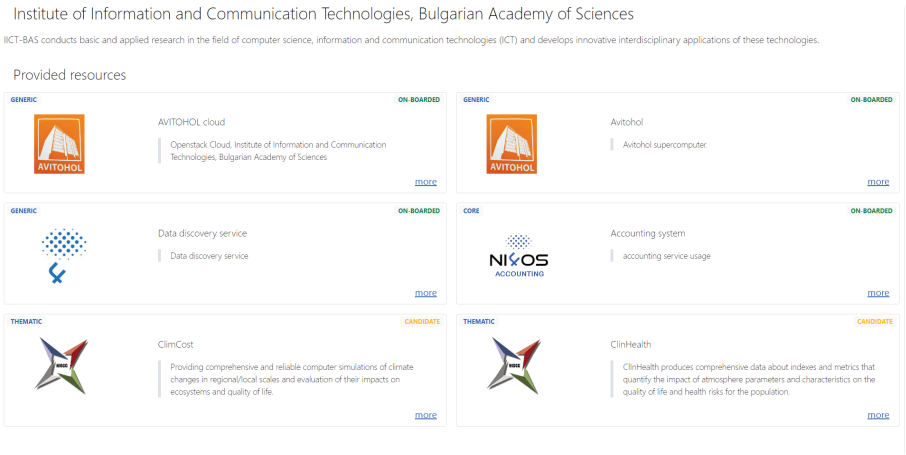

Fig.1. Services provided by IICT-BAS in the NI4OS-Europe Catalogue

IMI-BAS developed and integrated a thematic service for Covid-19 pandemic for long-term and short-term prediction scenarios. Tools are web based/service oriented, scalable and running models in real time where the end-users are able to modify various parameters and do many experiments for lockdowns scenarios, vaccinations plans, seasonal effects, ICU (critical cases) all of these can be analyzed by TVBG-SEIR and ATVBG-SEIR tools/services". This work is a contribution to Digital Epidemiology including areas of Data Modelling, Data Science, Machine Learning (make use of historical epidemic data). Developed services can be applied for different countries and take into account evolving changes in virus properties. It will be added to the list of onboarding services shortly.

Bellow we present the on-boarding services, developed by the Bulgarian team, and offered in NI4OS catalogue.

2.1 Generic Services Provided by IICT for Onboarding in the EOSC

Bellow we present some of the services, developed by the Bulgarian team, and offered in the NI4OS catalogue. We give example of one service in a category.

The Cloud service on Avitohol allows users to launch virtual machines on servers from the Avitohol supercomputer. It allows user groups to launch long running virtual machines with substantial flexibility. It is used by diverse research groups with needs for both advanced computing and data storage. The user manual and access policy of this cloud service are available in NI4OS Catalogue (https://catalogue.ni4os.eu/).

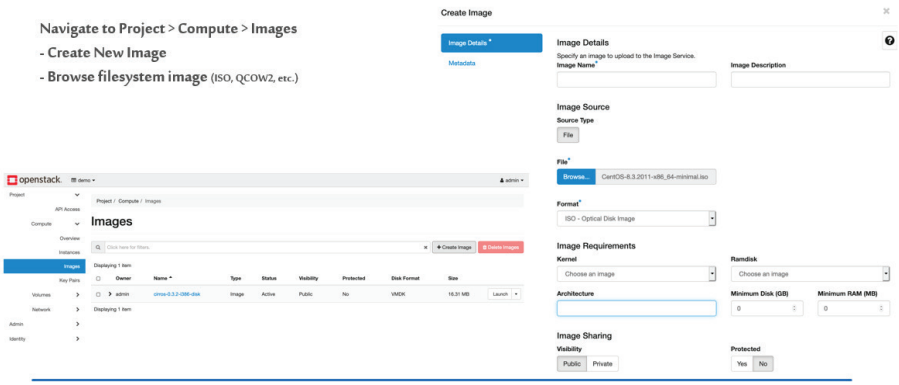

Fig. 2. Creating images using Cloud service on Avitohol

NI4OS Data Discovery Service (DDS) provides flexible search for data discovery. It is a powerful dataset management system that provides publishing, sharing, searching and can use almost any data type and metadata. It is a powerful dataset management system that provides publishing, sharing, searching and can use almost any data type and metadata. The service is supported by IICT-BAS and can be found in DDS (https://search.vi-seem.eu/group).

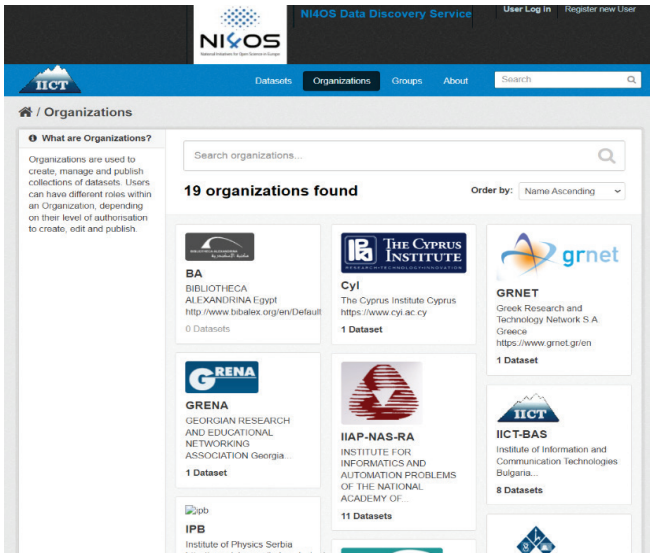

Fig.3. DDS generic service provided by IICT-BAS and availeble in the NI4OS-Europe Catalogue

Avitohol supercomputer: It provides 412 TFlops of performance for diverse scientific and industrial applications. Users from science and industry with substantial computational needs use it to achieve their results faster and to solve bigger problems that are

beyond the reach of ordinary clusters. Full description of the hardware architecture and the software applications available on the Avitohol can be found on http://www.hpc.acad.bg/.

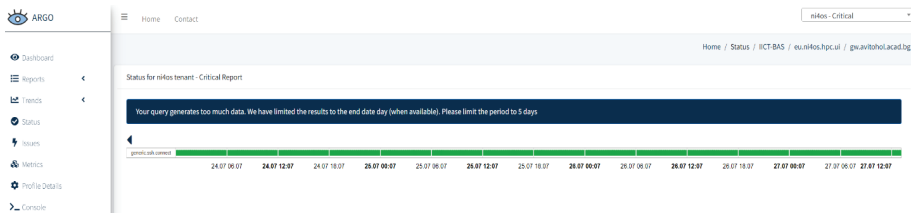

Fig. 4. Status of the Avitohol resources is visible on the monitoring website ARGO (https://argo.ni4os. ue)

2.2 Core Service Developed by IICT

NI4OS Accounting service (https://catalogue.ni4os.eu/): For any EOSC service it is paramount to be able to identify and track its usage. Within the NI4OS project this capability is provided by a system developed in-house by IICT. It covers not only the usage for computing, usually measured by core-hours, but also usage of data storage and aggregates data about the requests that are submitted to the thematic services, which have more complex usage patterns. Data is collected in several different ways and is presented graphically, (see Fig. 6 and Fig. 7). For the administrators of services we provide flexibility in how much they want to rely on our system and code and how much they would like to use their own system and interface with us. Ultimately, we allow data to be exported or observed in textual or graphic format using NI4OS-Europe accounting data dashboard, (see Fig. 5).

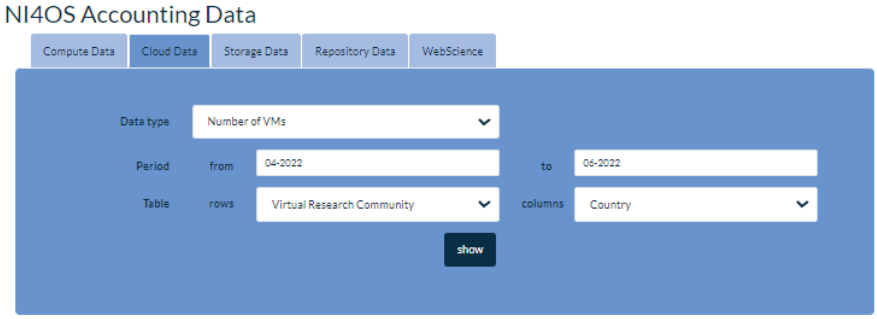

Fig.5. NI4OS-Europe accounting data dashboard

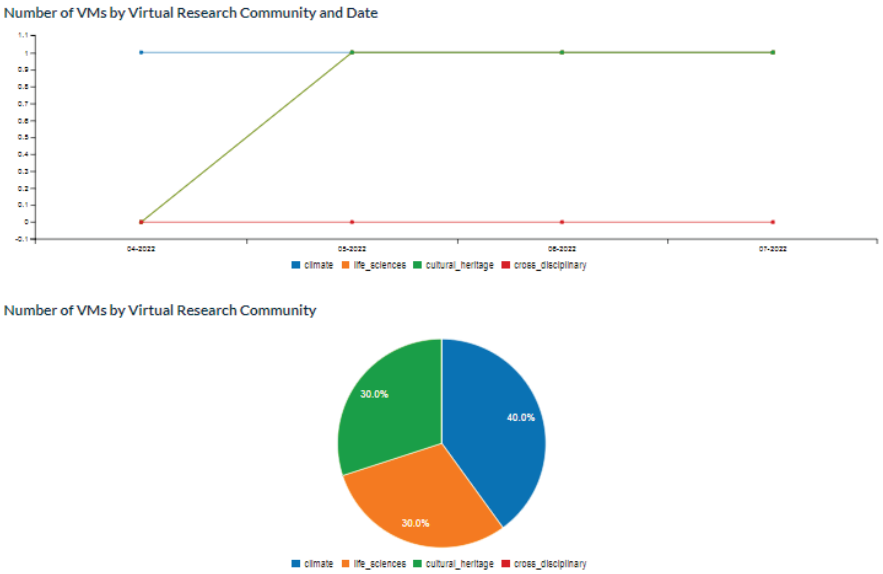

Fig. 6. Number of VMs by Virtual Research Community for the 2nd quarter of 2022

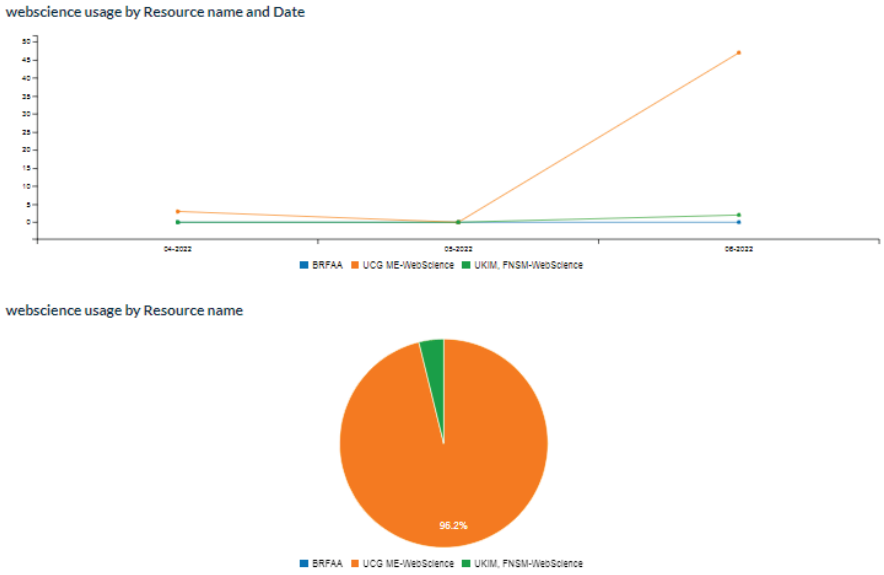

Fig. 7. WebScience Usage by Resource name for the 2nd quarter of 2022

3 Role of the NI4OS-Europe Pre-production Environment

The aim of the NI4OS-Europe pre-production environment is to facilitate the development of services towards full EOSC deployment. In order to achieve this, it maintains a minimum set of core services and supports the deployment and testing of NI4OS-Services up to the phase where they are ready and mature enough for full EOSC deployment. The availability of the NI4OS-Europe pre-production environment has been instrumental in our efforts to improve the TRL level of our services, especially since some problems with scalability or resilience to failures can only be detected during live operation. The ability to rely on the NI4OS-Europe services for monitoring ARGO (https://argo.ni4os.ue) or authentication and authorization NI4OS Login (https://aai.ni4os.eu) simplifies the tasks of development and deployment substantially. The accounting solution, developed by IICT, is also in use for the pre-production environment.

4 Conclusions

EOSC has become a focus point of services supporting open data and open science throughout the European research ecosystem. The active participation of Bulgaria in the NI4OS-Europe partnership has enabled an easier and simpler way of bringing services to EOSC, using NI4OS-Europe core services, its pre-production environment and operational policies and procedures. Several services developed or deployed at IICT-BAS and IMI-BAS are already prepared for onboarding in EOSC. Through the supportive environment and rich ecosystem the project is attractive for further generic and thematic services from Bulgarian research institutions to be onboarded in EOSC and made available to wider European research communities.

Acknowledgments.

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