

Community Clouds for European NRENs

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Executive Summary

Various NRENs (mainly in Europe) are building and operating Clouds, successfully providing services to their users, in a broader European context which is increasingly embracing digital sovereignty policies, data sharing practices and open models. This document aims at stating the current point of view of these NRENs and the value of the “Community Clouds” approach, with an outlook towards the next years, suggesting concrete proposals to work together on Community Cloud platforms interoperability and focused technological and sustainability aspects, tending in the long run towards the creation of a federation between NREN Clouds for their community.

Introduction

Various European NRENs are considering and operating a “Community Cloud”, i.e. an open model of Cloud services based on open source software deployed on the NRENs hardware.

At the time of writing, this model is proving itself to be of interest and in production in several NRENs:

- **AARNet (Australia)** has begun delivering research support services based on underpinning community cloud foundations operated by and hosted by AARNet. For the moment what is delivered is SaaS (e.g., a managed Galaxy cloud service for bioinformatics); if it is found that this can be made to scale efficiently and economically, AARNet is interested in offering services lower down the stack, e.g. at the PaaS level. The offering is set up around a fairly usual set of tools; OpenStack, Rancher, Docker, Harbour, etc.
- **CESNET (Czech Republic)** has deployed an IaaS cloud interface as an alternative method for accessing its computing resources (alongside the traditional and more widely used grid HTC interface) in 2013, providing not only the cloud service but also various integration components that helped the organization and others integrate with Federated Cloud platform under the EGI (then European Grid Initiative), currently integrated under EOSC. In earlier years the cloud service used to be managed by the OpenNebula cloud management framework, more recently by OpenStack. The cloud is now integrated also with the Elixir identity federation and with the EInfra CZ federation. In past few years CESNET has also been developing user-facing services for simple instantiation of managed cloud platforms, delivering PaaS targeted at selected communities.
- **CSC/Funet (Finland)** is providing community cloud services to universities and institutes of higher education in Finland. The Services have been financed partially through funding by the Ministry of Education and through various grants (e.g. Elixir) and collaborations. The services CSC provides are primarily based on Openstack and OpenShift. CSC also functions as a broker of OCRE procured commercial cloud services towards the Finnish universities and consequently has been active both in the commercial and community cloud space in GN4-3.

- **GARR (Italy)** is providing Community Cloud services to universities and research institutes in Italy since 2017, with a steady growth rate, while using an open and federated model, which is being expanded or replicated by several institutions. Among these, hospitals involved in research activities are accessing a dedicated share of resources after an agreement signed between GARR and the Italian Ministry of Health. Finally, GARR has been designated by the Italian government as a Critical National Security Infrastructure in 2020, which highlights the demand for secure and privacy-preserving service provisioning modes and for data sovereignty.
- **GRNET (Greece)** is an integrated electronic Infrastructure service provider with a mandate to provide and support high-quality e-Infrastructure services to the academic, research and educational community of Greece and link these with global e-Infrastructures. GRNET offers an integrated environment of cutting-edge technologies and provides infrastructural and technology support to academic and research institutions, to educational bodies at all levels, and to agencies of the public sector. **GRNET is the main infrastructure/service enabler for Open Science in Greece.** Since 2010, GRNET operates Infrastructure as a Service via large datacenters (135 racks, 1800+ servers, 7000 Virtual Machines active, 5 Petabytes of storage and currently planning a major renewal/extension of its infrastructure and migration to OpenStack IaaS Framework. GRNET as the main R&E Cloud provider in Greece is currently investigating a hybrid model for the provision of cloud services.
- **KIFU (Hungary)** is providing C4E cloud services (i.e. the 2.5th generation Community Cloud services). The 1st generation Community Cloud was based on a heavily modified Open Nebula started to be operational in 2011. The 2nd generation of community cloud services is based on Openstack and started to serve the R&E community in 2015. The latest incarnation of C4E which became operational in 2021 is still based on Openstack, but the architecture has been slightly modernised (Zones, resilient setup etc.), the hardware renewed, and containerised services have started to emerge. The current service portfolio is IaaS, containerised and VM based SaaS, and Sync&Share. The C4E is developed by a ministerial mandate to provide data-sovereignty for Hungarian R&E users.
- **PSNC (Poland)** provides a range of cloud services to the R&E community in Poland since several years. Service portfolio includes IaaS, PaaS, datacenter and distributed storage services, data management services including Data-Science platforms aaS, scalable data bases aaS (including ELK stack), BigData platforms aaS, and Sync&Share. PSNC services form a consistent cloud platform delivery for Polish R&E together with several national centres.
- **RENATER (France)** provides network facilities to interconnect computing infrastructures and distributed services (PaaS and SaaS) for the Higher Education and Research community. In order to meet the growing demand from the community, some digital services, such as the videoconference service, are evolving and an evaluation is ongoing towards outsourced cloud infrastructures, certified SecNumCloud, to respect security requirements. These digital services are accessible from the Identity federation at the national level and from eduGain at the international level.
- **SUNET (Sweden)** provides a variety of e-infrastructure to Swedish universities and institutions, including network, SaaS, IaaS, and other mostly self-hosted cloud-based services.
- **SURF (The Netherlands)** is providing Community Cloud services to university medical centers, research institutions, universities and institutes of higher education in The Netherlands. The services are funded by the Dutch government, SURF members, various grants and collaborations. The community cloud services SURF provides are primarily based on Openstack, Ceph, SWIFT, Owncloud and Kubernetes. Some of these services are made available to researchers through the SURF Research Cloud portal¹. SURF

1 <https://surf.nl/en/researchcloud>

Research Cloud uses infrastructure as code technologies like Terraform and Ansible to bring virtual research environments close to the data on multiple clouds. Archiving and storage solutions are available through iRODS data management solutions. SURF also functions as a broker of OCRE procured commercial cloud services towards SURFs customers through SURFcumulus² and consequently has been active both in the security, identity and commercial and community cloud space, in GN4-3 and EOSC future.

- **SWITCH (Switzerland)** is successfully operating a sustainable Community Cloud service for the Swiss community.

Value of the “Community Clouds” approach

Community Clouds are particularly useful in cases which involve personally identifiable information, such as medical data for research purposes, but also international collaborations which require resource or data sharing, without closed non-interoperable silos or vendor lock-ins, leveraging the high speed networks provided by NRENs themselves and by the GÉANT network and ensuring full control on data locality and applicable regulations. Another advantage of Community Clouds is that reproducibility of data elaborations and lifecycle management are facilitated by having control on the whole stack.

In this framework, know-how related to cloud technologies is deemed an asset, to be fostered and that is expanding. Moreover, as we are witnessing the convergence between networking and cloud technologies, the acquired know-how becomes critical to the success and the quality of the NRENs network services provisioning.

Looking at the larger picture, on the one hand we see the steady growth of hyperscalers, partially hindered by regulatory issues³. On the other hand, Europe aims at achieving digital sovereignty⁴, preserving infrastructural as well as data storage and processing independence from non-European entities, and at building a European data space⁵. These important policies are addressed, among others, through programs and initiatives such as Next Generation Europe, EOSC and GAIA-X⁶.

The Community Clouds approach adds specific short-term and long-term value towards the European vision, with its focus on knowledge sharing and factual collaboration on the infrastructural and service levels, based on ongoing national NREN initiatives.

2 <https://www.surf.nl/en/surfcumulus-safe-and-easy-access-to-the-cloud>

3 Schrems II Court of Justice of the European Union judgement: <https://op.europa.eu/en/publication-detail/-/publication/c93f72bb-c749-11ea-adf7-01aa75ed71a1/language-en>

4 President von Der Leyen about digital sovereignty:

- <https://www.euractiv.com/section/digital/news/eu-punching-well-below-its-weight-in-digital-technologies-von-der-leyen-warns/>
- https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_21_4701

5 European Commission, A European strategy for data: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593073685620&uri=CELEX%3A52020DC0066>

6 In general these initiatives have a focus on federated access to resources, an important objective also in the community cloud activities in GN4-3. The CWL WES technology used in the GN4-3 Geant Cloud Flow effort is proposed also in Gaia-X as technology to be used in precision medicine linked workflows.

Proposals for Community Cloud collaboration between NRENs (possibly in GN5)

The interest of NRENs operating Community Clouds is to evaluate the advantages and feasibility of federating the Community Clouds, being compatible with the implementation of the EOSC, while complementary in its scope and objectives, focusing on cloud platforms' technological aspects, and in particular on breaking data silos models by fostering interoperability between Community Cloud services, based on trust and AAI.

The value and advantages of practical collaboration and of knowledge exchange between NRENs is well recognized and has been highlighted by the work performed by the GÉANT SIG-CISS.

We expect the effort to progress in steps, with results based on the following main lines:

- **Define a Community Cloud AAI common framework** that will foster the adoption of common practices on user registration, authentication and authorization leveraging the existing eduGAIN infrastructure and the AARC Blueprint Architecture.
- Creation of a **“Community Cloud Toolkit”**, enclosing a high level architectural blueprint, that allows independence of implementation in each NREN, while ensuring interoperability, and compliance to AAI and security principle, along with tools and documentation aimed at NRENs and institutions who wish to set up a Community Cloud at their premises, with a highly automated, open and federated approach;
- **Leverage Special Interest Groups work (e.g. SIG-CISS)**, to prototype the operation of service federation of Community Cloud infrastructures. Consider initially key services like videoconferencing, to thereafter encompass other cloud services;
- The increasingly central and critical role of the NRENs in their National contexts mounts the demand for certified security at all layers of service provisioning. Ensure that **knowledge and tools are exchanged between NRENs on security topics⁷** of Community Cloud platforms operation;
- Work collectively on a comprehensive open source **accounting platform** for Community Clouds, targeting the current and emerging infrastructural cloud technologies and adaptable to different workflows.

To reach results a coordinated, multi-faceted and iterative approach is deemed preferable, i.e. starting to address key technical issues, considering service sharing model and tackling cross-border legal and financial constraints⁸. Issues on sustainability, feasibility and interests of specific NRENs need also to be addressed.

Conclusions

NRENs are operating Community Clouds, in a European context which is increasingly oriented towards digital sovereignty and open data management practices, especially in the scientific domain. Factual collaboration, sustainability models design and knowledge sharing between NRENs in the upcoming years is of foremost importance to multiply the outcomes of the current national efforts, functional and complementary to the implementation of the EOSC and other efforts.

⁷ These include security recommendations, certifications, regulations and technologies.

⁸ The need to overcome constraints linked to cross-border resource sharing has emerged also in the activities of Task 4.3 of the GN4-3 project.