EOSC | Federation

Scientific use case: Imaging data workflows on Galaxy

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This briefing is based on an interview with Björn Grüning. Björn leads the European Galaxy team at the University of Freiburg, where the European Galaxy server is deployed in collaboration with a global community. Grüning also contributes to Galaxy via the Conda ecosystem, which works to make Galaxy's tools widely accessible via software distribution and a training network. Björn serves on Galaxy's executive board, is technical coordinator of ELIXIR Germany, and serves as coordinator of the EU INFRAEOSC project, EuroScienceGateway.

This science case on **imaging data workflows on Galaxy** demonstrates how a federated, open-access computational platform can **transform the way imaging data are processed, shared, and reused** across diverse scientific domains. The use case leverages the Galaxy platform to integrate data from a wide range of imaging-based research fields—such as life sciences (microscopy), astrophysics (telescope data), climate science (satellite data), and marine science (underwater imagery)—into a unified analysis environment. The goal is to demonstrate that Galaxy can be **integrated into the EOSC Federation's common infrastructure** to serve many disciplines simultaneously, allowing researchers to share workflows, reuse methods, and access powerful computational tools without needing specialised technical expertise.

Problem addressed

Different scientific disciplines work with different sources of imaging data, but often confront common analytical challenges, including object segmentation, classification, and quantitative measurement. Traditionally, these communities have built **isolated pipelines and duplicated effort**, limiting interoperability. Researchers also face **challenges in accessing and processing heterogeneous datasets** from various repositories and often lack the computational resources or expertise to run complex analyses. Finally, siloed infrastructure and governance barriers impede cross-disciplinary collaboration and data reuse, **slowing discovery and innovation**.

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Technical solution

The integration of Galaxy into the EOSC Federation addresses these challenges by providing a versatile, **browser- or API- based platform with over 4,000 tools and 40 visualization options** that are simple enough for novice users while remaining powerful enough for advanced workflows. A single image analysis workflow—such as object segmentation, classification, or counting—can be applied across different domains with minimal adjustments, enabling researchers to **process diverse datasets in a unified way**. As part of the EOSC Federation, Galaxy can be enabled to import data from major European repositories, run workflows on distributed computing resources across the continent, and export results with persistent identifiers for citation and reuse. It also supports machine learning and AI tools, from object recognition to protein-structure prediction. Crucially, the EOSC Federation enables Galaxy to distribute jobs via a federated compute network, **scaling analyses seamlessly across multiple national infrastructures**.

Scientific outcomes

Galaxy can be understood as **the app store for the "social network" of research data**, serving as a platform where common software solutions are developed and distributed. It supports thousands of monthly users executing millions of jobs enabling research ranging from **the identification of galaxies and monitoring of light pollution, to classifying fish species and analysing cellular structures**. Its approach has spawned increasingly numerous scientific outcomes over the past decade, informing more than 360 publications in 2024 alone. Galaxy's open-source nature, provenance tracking, and interoperability standards further **promote Open Science** by enabling data sharing, reproducibility, and collaborative research. Its accessibility has **broadened participation**, enabling researchers without programming or high-performance computing expertise to conduct complex analyses.

Added value of the EOSC Federation

Integration into the **EOSC Federation greatly amplifies Galaxy's reach and impact**. The Federation connects the platform to a wider ecosystem of repositories, computing resources, and communities. It ensures that services remain within European jurisdictions, **supporting data sovereignty and resilience**. And by connecting thousands of users and expanding into new scientific domains, the initiative demonstrates how **shared infrastructure can transform research**—turning disparate efforts into a cohesive, collaborative, and innovative ecosystem for data-intensive science.

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