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Abbreviations

Terms	Definitions
AAI	Authentication and Authorisation Infrastructure
AARC	Authentication and Authorisation for Research and Collaboration
AI4HI	AI4HI AI for Health Imaging Network
API	Application Programming Interface
Auth	Authentication
BBMRI-ERIC	European Infrastructure for Biobanking - European Research Infrastructure Consortium
CEPH	A free and open-source software-defined storage platform that provides object storage, block storage, and file storage
DBMS	Database Management Service
DCAT-AP	Data Catalogue vocabulary Application Profile
DCM4CHEE	A Java-based library and set of tools for working with DICOM files
DICOM	Digital Imaging and Communication In Medicine
DNS	Domain Name System
EduGain	Global interfederation service that interconnects multiple identity federations
EGI	European Grid Infrastructure
ELK	Elasticsearch, Logstash, Kibana
EOSC	European Open Science Cloud
EU	European Union
EUCAIM	European Federation for Cancer Images
FAIR	Findable, Accessible, Interoperable, Reusable
FDP	FAIR Data Point
GbE	Gigabit Ethernet
GDPR	General Data Protection Regulation
GPU	Graphics Processing Unit
Guacamole	A clientless remote desktop gateway
GUI	Graphical User Interface
IdP	Identity Provider
IM	Infrastructure Manager
K8S	Kubernetes

KubeApps	In-cluster web-based application for the management of Kubernetes applications
KubeAuthoriser	A federated cloud architecture for processing of cancer images on a distributed storage
Kyverno	A policy engine designed specifically for Kubernetes
LS-AAI	Life Sciences Authentication and Authorisation Infrastructure
LTS	Long Term Support
MOLGENIS	A modular web application for scientific data, initially focused on molecular genetics research (molecular genetics information system) but expanded to other disciplines.
Negotiator	BBMRI-ERIC service for structured negotiator for biomedical resources
NFS	Network Filesystem
OAuth2	Open Authorisation v. 2.0
OpenID	Open standard and decentralised authentication protocol
PACS	PACS Picture Archiving and Communication System
Postgres	Object-oriented relational Database management system
PV	Persistent Volume object
PVC	Persistent Volume Claim
QUIBIM	Spanish company on AI applied to Image Biomarkers
RIS	RIS Radiological Information System
TB	Terabyte
TOSCA	Topology and Orchestration Specification for Cloud Applications
UPS	Uninterrupted Power Service
UPV	Universitat Politècnica de València (Valencia University of Technology)
VAULT	Hasihcorp identity-based secrets and encryption management system
VM	Virtual Machine
VMI	Virtual Machine Image
VO	Virtual Organisation
WP	WP Work Package

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1. Introduction

EUCAIM leverages from the developments on other Research Infrastructures for health data, extending and customising services that are key for metadata cataloguing, federated search, access negotiation, data storage and computing-intensive processing.

Those services have been adapted and customised to deal with the specificities of EUCAIM and to enable their integration. These components have been prepared for being deployed on a Kubernetes infrastructure that manages the availability, network traffic and workloads efficiently. The document describes the backend infrastructure and the deployment manifests for each one of the core services of EUCAIM.

EUCAIM constitutes a federated infrastructure. The Reference (sometimes called central) storages are reference implementations of storage and processing nodes that can be replicated around the federation. The basic federation of EUCAIM described here involves two reference storages and two AI4HI providers.

EUCAIM also deploys two core service infrastructures, one for production and one for development, using the same components and under two different DNS. Both infrastructures have the same AAI registrations and use configuration files and environment variables for customising each deployment.

The document is intended to be brief, as the core part of the deliverable is the availability of the services. The document includes a minimal summary with the links to other documents, the endpoints of the services in both production and development, and a table with the source codes and the deployment Infrastructure as Code recipes.

2. Brief description of the architecture

The EUCAIM architecture focuses on a federated model in which nodes connect to the central core services but which also keep a reasonable degree of independence and autonomy. The technical requirements for the integration in the federated infrastructure relies on the model of tiers, with two different meanings (interoperability at the level of the node services and interoperability at the level of the data).

Tier	Data Interoperability	Node Interoperability
1	Compliance with the metadata model for the datasets' aggregated data.	Registration of the metadata in the catalogue
2	Compliance with the data model for searching purposes, including the 27 variables of the federated search.	Integration of the searching API in the federated search system, by using a mediator or by the transformation of the data in the hyperontology model for the 27 searchable variables.
3	Full compliance with the data model.	Integration of a federated processing endpoint.

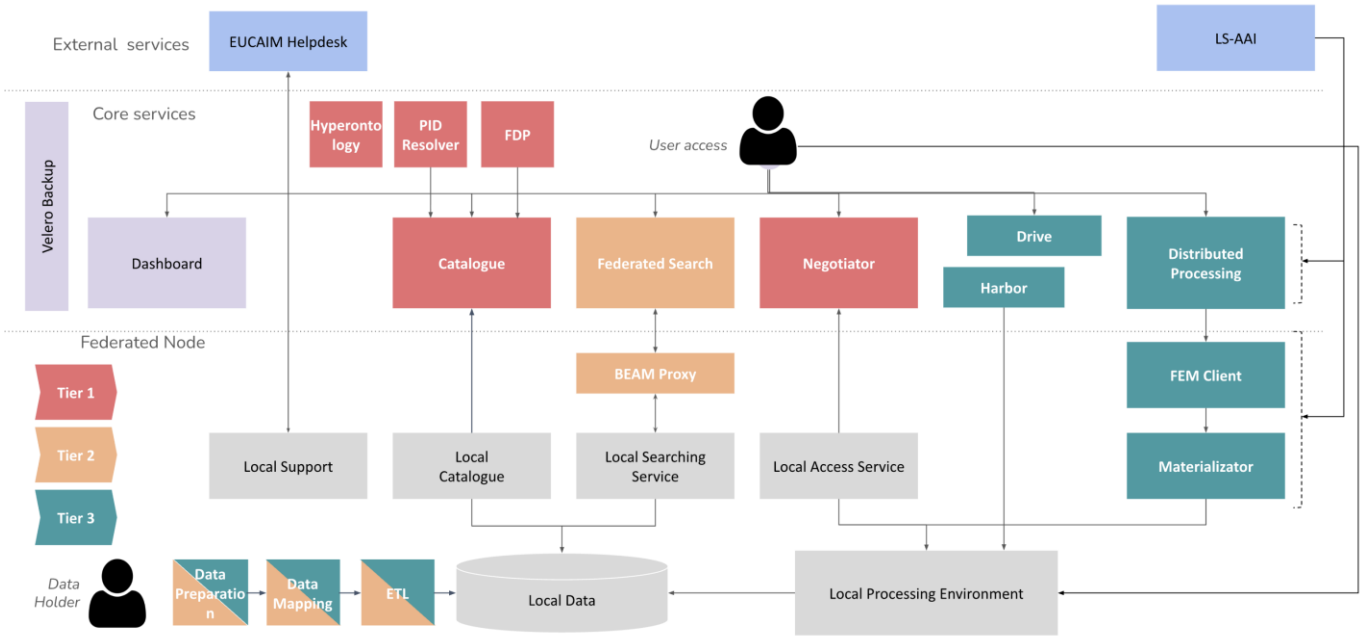
More information on the architecture can be found in the following documents:

- End user guide (https://eucaim.gitbook.io/enduserguide), sections 2 (Architecture) and 3 (Components of the Platform) - Brief information relevant for a data user.
- Data Holders handbook (https://eucaim.gitbook.io/handbook), section 7 (Setting up a federated node) - Brief information on the architecture of a node, relevant for a Data Holder
- Architecture document (https://eucaim.gitbook.io/architecture-of-eucaim) - Detailed information describing use cases and data flows.

EUCAIM's platform architecture comprises four types layers of services:

- External services: Services managed by third parties (The LS-AAI and the helpdesk).
- Central Hub services: Services managed centrally at the Central Hub resources (Dashboard, catalogue, Negotiator, Hyperontology, PID resolver, Document server and OCI registry.
- Services host both at the Central Hub and the federated nodes: Federated Search, Federated Computing.
- Services at the federated node only (optional): Secure Processing Environment, Local Catalogue, Local AAI service, Data Warehouse.

An updated diagram of the architecture is provided next.



The architecture diagram includes the additional services and the data ingestion workload which enables achieving the Tier2/3 compliance at the level of the data interoperability.

The following table lists the URLs of the different EUCAIM Platform services, both in the development and in the production deployments. There are cases in which the service is not deployed on a development service due to the specific constraints of the service or the way it is managed.

Service	Production endpoint	Development endpoint
Dashboard	dashboard.eucaim.cancerimage.eu	dashboard-eucaim.grycap.i3m.upv.es
Catalogue	catalogue.eucaim.cancerimage.eu	catalogue-eucaim.grycap.i3m.upv.es
Federated Search	explorer.eucaim.cancerimage.eu	N/A
Negotiator	negotiator.eucaim.cancerimage.eu	negotiator-eucaim.grycap.i3m.upv.es
Helpdesk	helpdesk.eucaim.cancerimage.eu	N/A
Federated Processing Dashboard	fedcomp.eucaim.cancerimage.eu	fedcomp-eucaim.grycap.i3m.upv.es
Hyperontology	hyperontology.eucaim.cancerimage.eu	hyperontology-eucaim.grycap.i3m.upv.es

service		
PID resolver	pid.eucaim.cancerimage.eu/dataset-id	N/A
Document server	drive.eucaim.cancerimage.eu	N/A
OCI registry	harbor.eucaim.cancerimage.eu	N/A
LS-AAI	lifescience-ri.eu/ls-login/ and EUCAIM VO group	N/A
EUCAIM VO group	signup.aai.lifescience-ri.eu/fed/registrar/?vo=lifescience&group=communities_and_projects:EUCAIM	N/A
Monitoring	https://monitoring.eucaim.cancerimage.eu/	N/A
Reference Node at UPV	eucaim-node.i3m.upv.es	eucaim-node.i3m.upv.es/dataset-service-test/
Reference Node at Health-RI	xnat.health-ri.nl	N/A

The listing of the Infrastructure as Code (IaC) manifests for the deployment of the previous components is provided in the next table. Additionally, if development has been done in the context of EUCAIM for the service, a link to the SW repository is also included.

Service	**Deployment repository**	**Source Code**
Dashboard	https://github.com/EUCAIM/k8s-deployments/tree/main/dashboard	https://github.com/EUCAIM/dashboard
Catalogue	https://github.com/EUCAIM/k8s-deployments/tree/main/emx2	https://gitlab.com/radiology/infrastructure/studies/eucaim/molgenis-emx2-eucaim
Federated Search	https://github.com/EUCAIM/k8s-deployments/tree/main/federated-search	https://github.com/samply
Negotiator	https://github.com/EUCAIM/k8s-deployments/tree/main/negotiator_v3	https://github.com/BBMRI-ERIC/negotiator
Helpdesk	N/A	N/A
Federated Processing Dashboard	https://github.com/EUCAIM/fed-computing-dashboard	
Hyperontology service	https://github.com/EUCAIM/k8s-deployments/tree/main/hyperontology	https://zenodo.org/records/17237843
OCI registry	https://github.com/EUCAIM/k8s-deployments/tree/main/harbor	N/A
LS-AAI	N/A	N/A
Velero	https://github.com/EUCAIM/k8s-deployments/tree/main/velero	N/A

Reference Node at UPV	https://github.com/EUCAIM/mini-node	https://github.com/EUCAIM/dataset-explorer
Reference Node at Health-RI	N/A	N/A