



Copernicus - eoSC AnaLytics Engine

Contribution of C-SCALE to the EOOSC Exchange capabilities

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The C-SCALE Project



Europe lacks an **integrated compute** and **storage infrastructure** for the exploitation of **Copernicus** datasets in scientific and applied applications.



C-SCALE responds to that challenge by **enhancing the EOSC Portal** with **pan-European federated data** and **computing infrastructure** services for Copernicus.

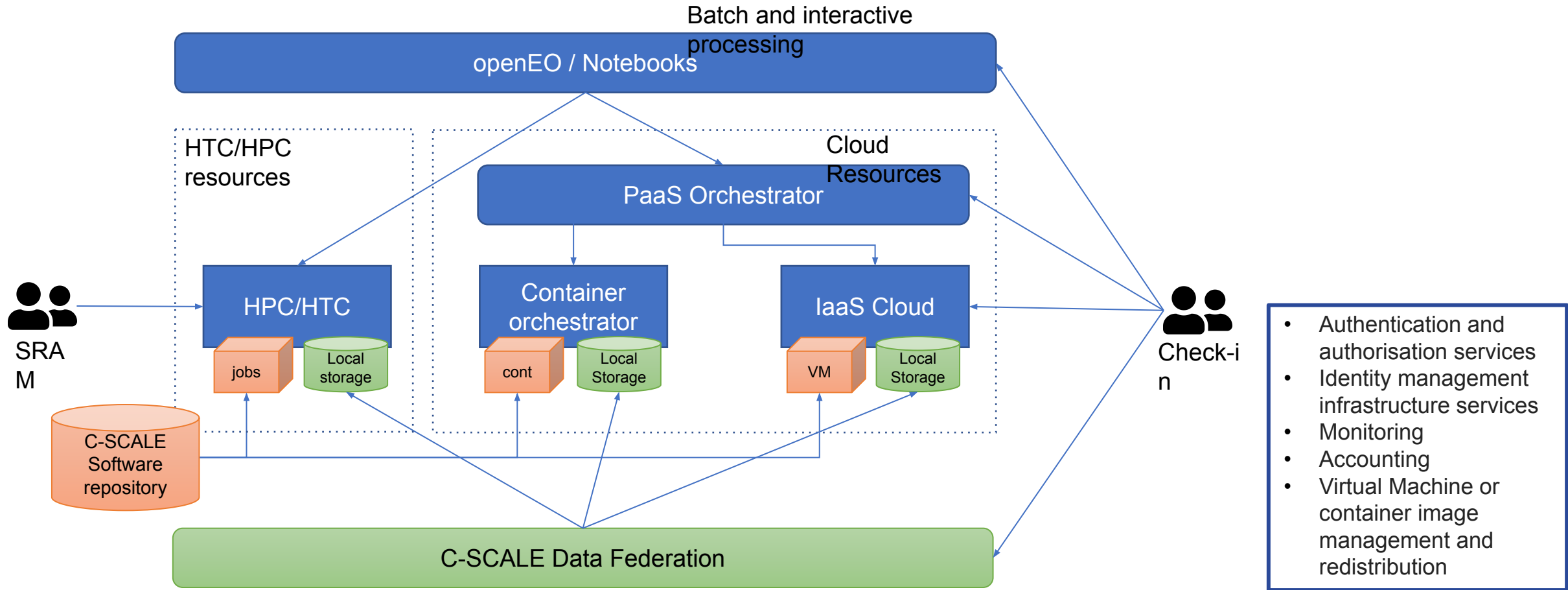
C-SCALE: Copernicus - eoSC AnaLytics Engine

- Project duration: Jan 2021 – June 2023
- Budget: ~ 2 million Euros
- Consortium of 11 partners with pan-European coverage



The infographic is a dark blue vertical panel. At the top is the C-SCALE logo in a white circle, with the word "enables" below it. Below this are four sections, each with an icon and a title. 1. "Seamless access" with a key icon: "C-SCALE seamlessly integrates access to EO and Copernicus data into the EOSC portal service offerings, exposing Copernicus data to a much broader audience". 2. "Easy Processing & Analysis" with a magnifying glass icon: "C-SCALE federates European e-infrastructures and lay the foundation for a European open Big (Copernicus) Data Analytics platform". 3. "Cross-disciplinary research" with a network icon: "The integration enabled by C-SCALE helps to make the Copernicus data FAIR and create optimal conditions for cross-disciplinary research". 4. "Knowledge for sound decision making" with a person icon: "Data and service-based knowledge facilitated by C-SCALE will help to monitor and mitigate climate change and improve the quality of life for citizens of Europe and around the world".

FedEarthData: federation of Earth observation data archives and computing resource providers, enabling execution of Earth observation processing workflows with seamless access to data

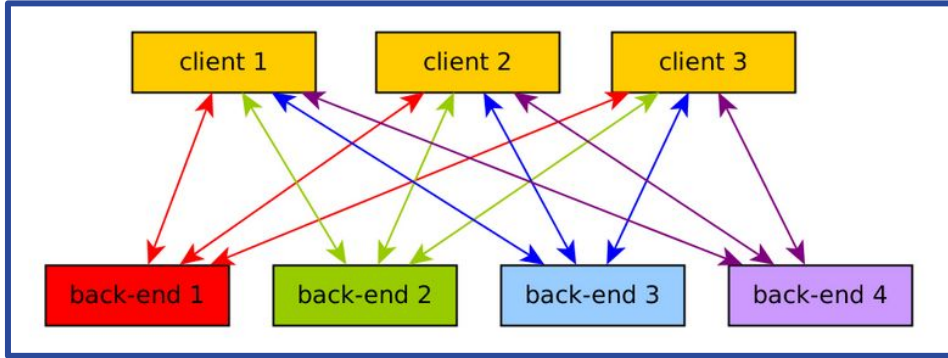




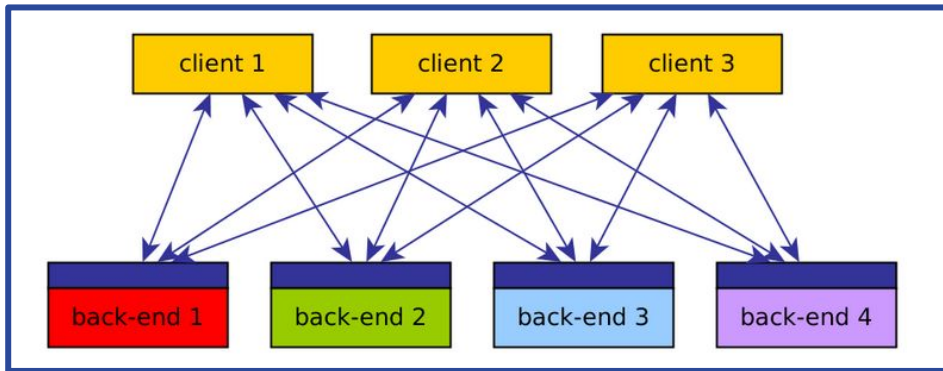
openEO Platform



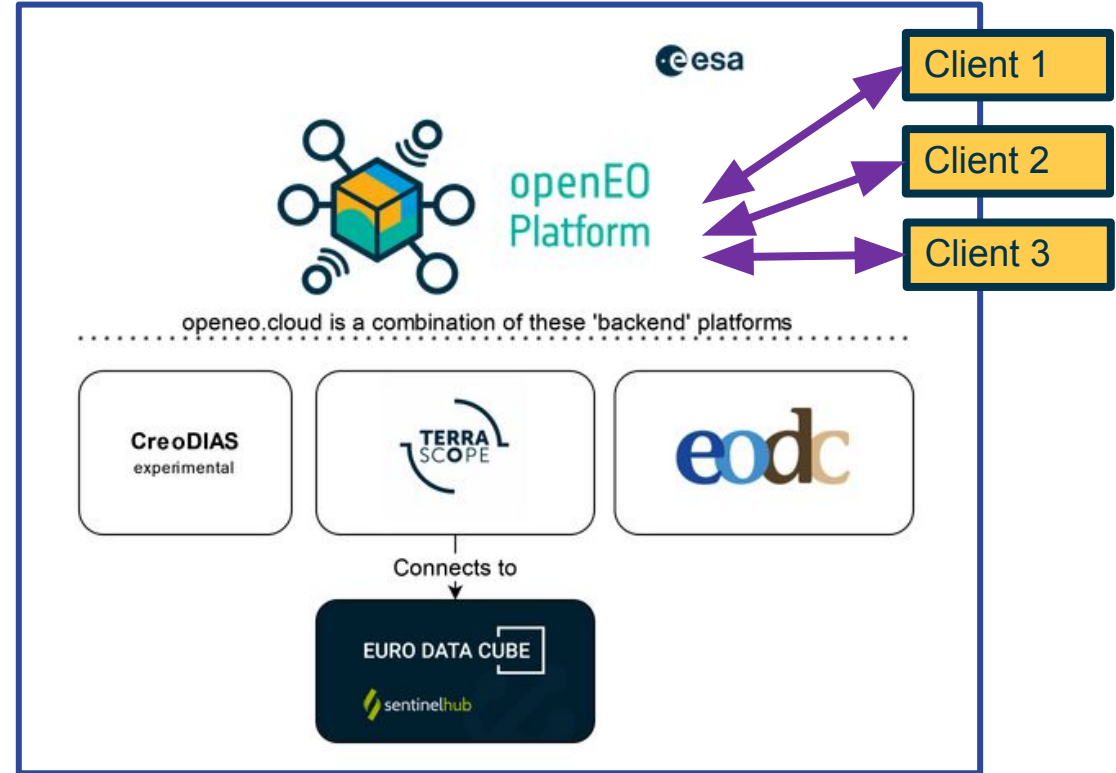
Situation before openEO:



openEO API:



openEO Platform:



- Clients: Python, R, Javascript
- Web Editor
- JupyterLab

⊗ Metadata Query Service (MQS)



- ❑ Earth Observation data discovery service arching over FedEarthData member providers
- ❑ Data providers already know where their data are
 - Bring their discovery interfaces under a common one
 - single point
 - shared protocol
- ❑ Spatio-Temporal Asset Catalogue (STAC) interface to enable queries across the federation
- ❑ MQS is a query broker and aggregator, it is not yet another metadata database.
- ❑ Focus and data retention policies at member sites - avoiding polling resources irrelevant to the given query

C-SCALE Metadata Query Service (MQS) (stac-fastapi)

<https://mq.s.eodc.eu/stac/v1>

The Metadata Query Service (MQS) is the central entry point to query for metadata across the C-SCALE federation.

The screenshot shows the C-SCALE Metadata Query Service (MQS) interface. The main heading is "Sentinel-1 SAR L1 GRD (EODC|sentinel1-grd)". Below this, there is a description of the data: "Level-1 Ground Range Detected (GRD) products consist of focused SAR data that has been detected, multi-looked and projected to ground range using the Earth ellipsoid model WGS84. The ellipsoid projection of the GRD products is corrected using the terrain height specified in the product general annotation. The terrain height used varies in azimuth but is constant in range (but can be different for each IW/EW sub-swath). Ground range coordinates are the slant range coordinates projected onto the ellipsoid of the Earth. Pixel values represent detected amplitude. Phase information is lost. The resulting product has approximately square resolution pixels and square pixel spacing with reduced speckle at a cost of reduced spatial resolution. For the IW and EW GRD products, multi-looking is performed on each burst individually. All bursts in all sub-swaths are then seamlessly merged to form a single, contiguous, ground range, detected image per polarisation."

Below the description is a table of items with columns for Title and Date Acquired. The table lists several items with their respective titles and acquisition dates.

Title	Date Acquired
S1A_IW_GRDH_1SSH_20220401T233117_20220401T233146_042586_051487_C4D2	Fri, 01 Apr 2022 23:31:31 GMT
S1A_IW_GRDH_1SDV_20220401T105102_20220401T105127_042579_05143E_8532	Fri, 01 Apr 2022 10:51:15 GMT
S1A_IW_GRDH_1SSH_20220401T015411_20220401T015436_042573_051408_45BD	Fri, 01 Apr 2022 01:54:24 GMT
S1A_IW_GRDH_1SDH_20220329T091454_20220329T091519_042534_0512C4_FD57	Tue, 29 Mar 2022 09:15:06 GMT
S1A_IW_GRDH_1SDV_20220324T020806_20220324T020831_042457_051023_3F41	Thu, 24 Mar 2022 02:08:19 GMT
S1A_IW_GRDH_1SSV_20220314T095817_20220314T095848_042316_050B54_9E4A	Mon, 14 Mar 2022 09:58:33 GMT
S1A_IW_GRDH_1SDV_20220101T234855_20220101T234921_041274_04E7D7_27C0	Sat, 01 Jan 2022 23:49:08 GMT
S1A_IW_GRDH_1SDV_20220101T234510_20220101T234535_041274_04E7D7_182F	Sat, 01 Jan 2022 23:45:22 GMT
S1A_IW_GRDH_1SDV_20220101T234445_20220101T234510_041274_04E7D7_79CF	Sat, 01 Jan 2022 23:44:57 GMT
S1A_IW_GRDH_1SDV_20220101T234420_20220101T234445_041274_04E7D7_D3C2	Sat, 01 Jan 2022 23:44:32 GMT

<https://mq>

The screenshot shows the STAC Browser interface for a Sentinel-1 SAR L1 GRD product. It displays a world map with a yellow line indicating the location of the data. Below the map is a metadata section with the following information:

- METADATA**
- STAC Version:** 1.0.0
- Keywords:** sentinel, copernicus, esa, sar, radar
- License:** proprietary
- Temporal Extent:** 03/10/2014, 02:00:00 - now
- PROVIDER**
- ESA (producer, processor, licensor)**
- ITEM SUMMARY**
- Platform:** sentinel-1a, sentinel-1b
- Constellation:** sentinel-1

Powered by STAC Browser v2.0.0

C-SCALE Use Cases



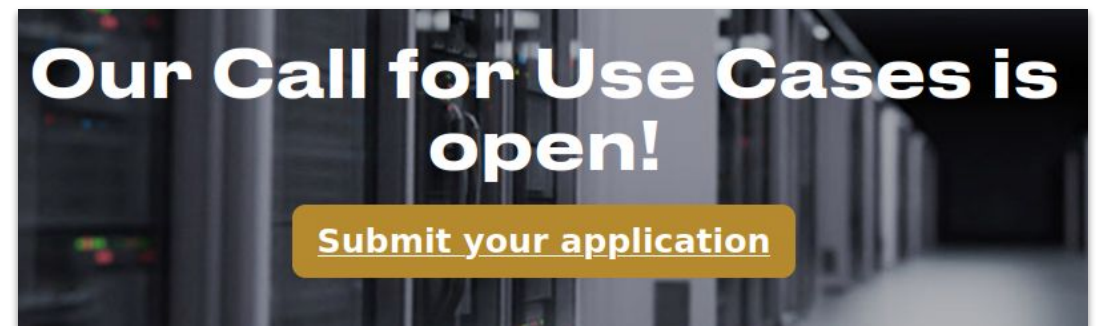
Use cases identified in the proposal stage

- **Aquamonitor**: track land-to-water and water-to-land changes worldwide
- **WaterWatch**: quantify water availability in reservoirs worldwide
- **HiSea**: weather and water quality information for ports and aquaculture industry.
- **LSDA**: seasonal river discharge forecast for any river basin in the world
- **RETURN**: quantify tropical forest recovery capacity
- **Wetland Water Stress Analysis**: identify and protect healthy wetlands as methane sinks



Use cases from the Open Call and EOSC DIH

- **4 already onboarded**: SAR on the fly, SPOTLIGHT, In SAR Cubes, Coastmonitor
- **6 currently being onboarded**:
 - energie.family
 - ubicube
 - TAMA
 - ITAINNOVA
 - KappaZeta
 - BioCarbon

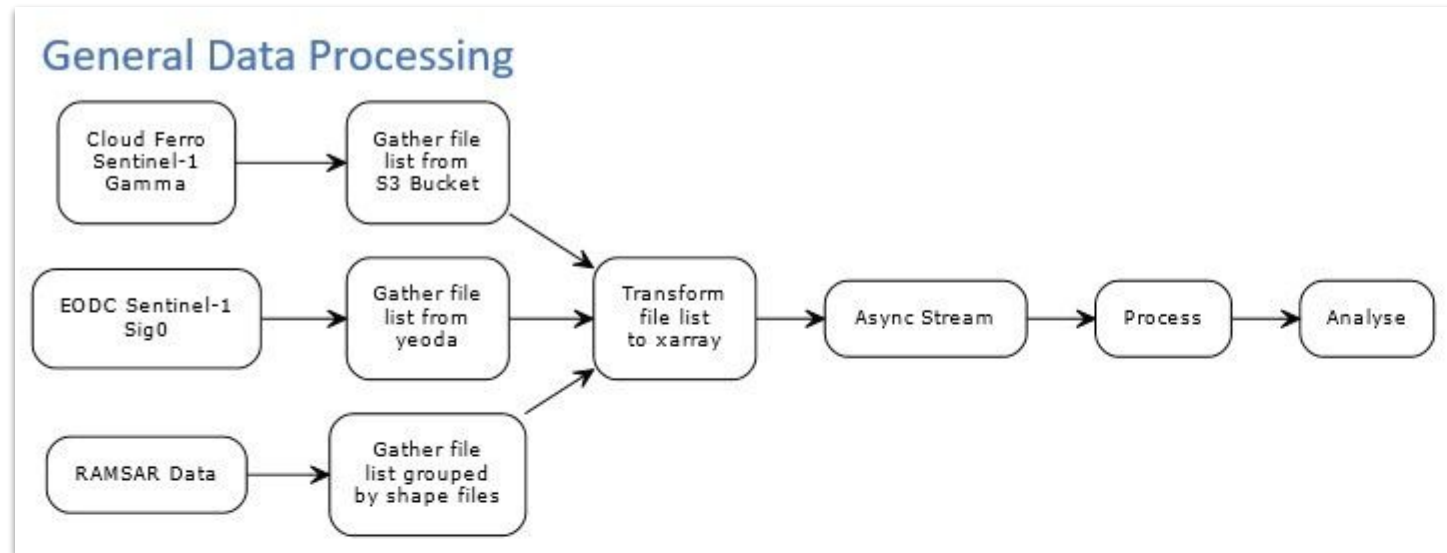


C-SCALE workflow solutions



Workflows for Copernicus data processing

- Set of **steps** from raw data to figures
- **Reusable**: changing spatial and temporal scales
- Provided by **C-SCALE Use Cases**
- Goal: providing solutions for **monitoring**, **modelling** and **forecasting** of the **Earth** system



Contribution to the EOSC Exchange



- The C-SCALE services will be onboarded in the EOSC Marketplace by the end of the project lifetime.
- Their sustainability plans will be the focus of the last period of the project.



Deltares





Deltares



C-SCALE

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Thank you for your attention.

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