

On the fly exploitation of Earth Observation data based on a SpatioTemporal Asset Catalog

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German Aerospace Center (DLR)

Earth Observation Center (EOC)

German Remote Sensing Data Center (DFD)



Knowledge for Tomorrow



DLR High Performance Data Analytics Platform terrabyte

Cooperation terrabyte

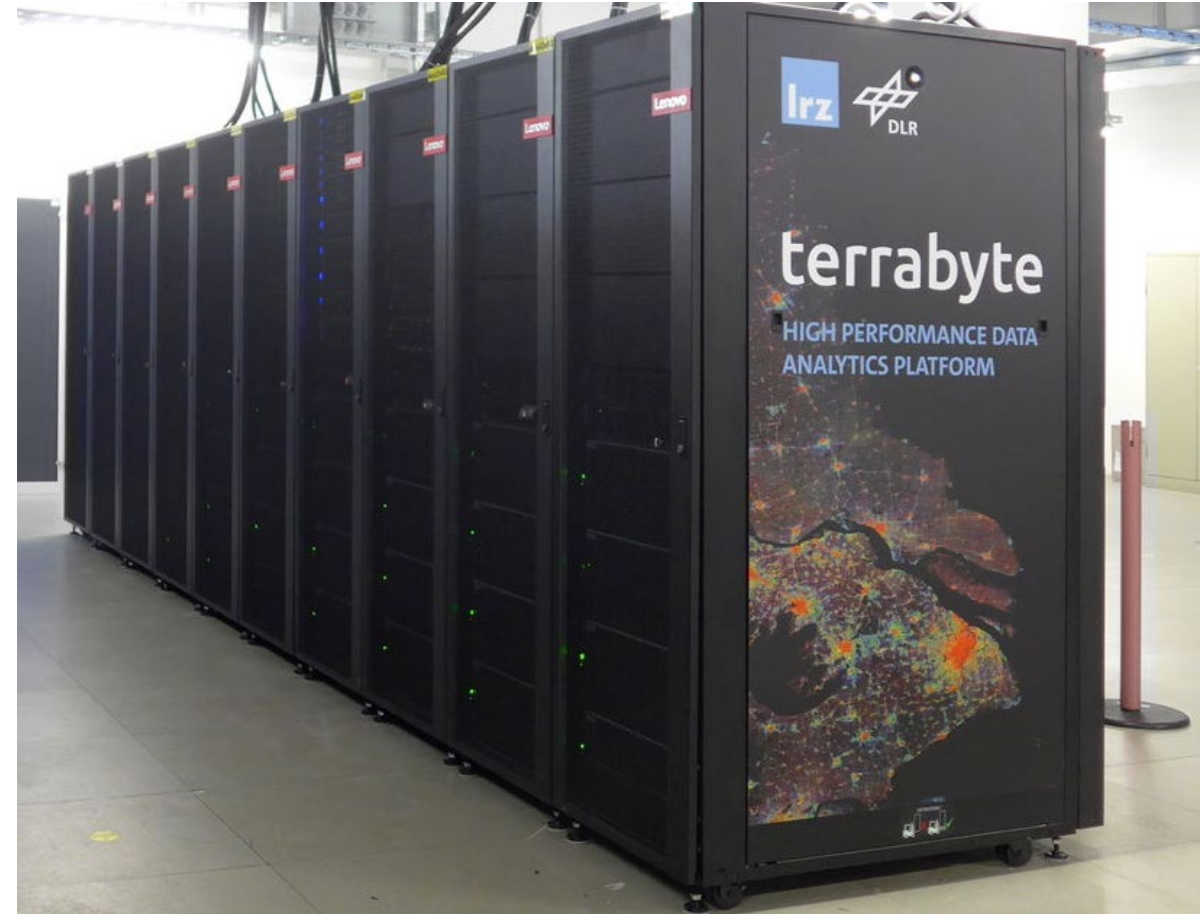
- DLR's Earth Observation Center
- Leibniz Supercomputing Center

Data Science Storage

- 36 PByte (net), 48 PByte (gross)
- Connected to DLR's EO long-term archive (100 PB)

Providing data close to computing infrastructure

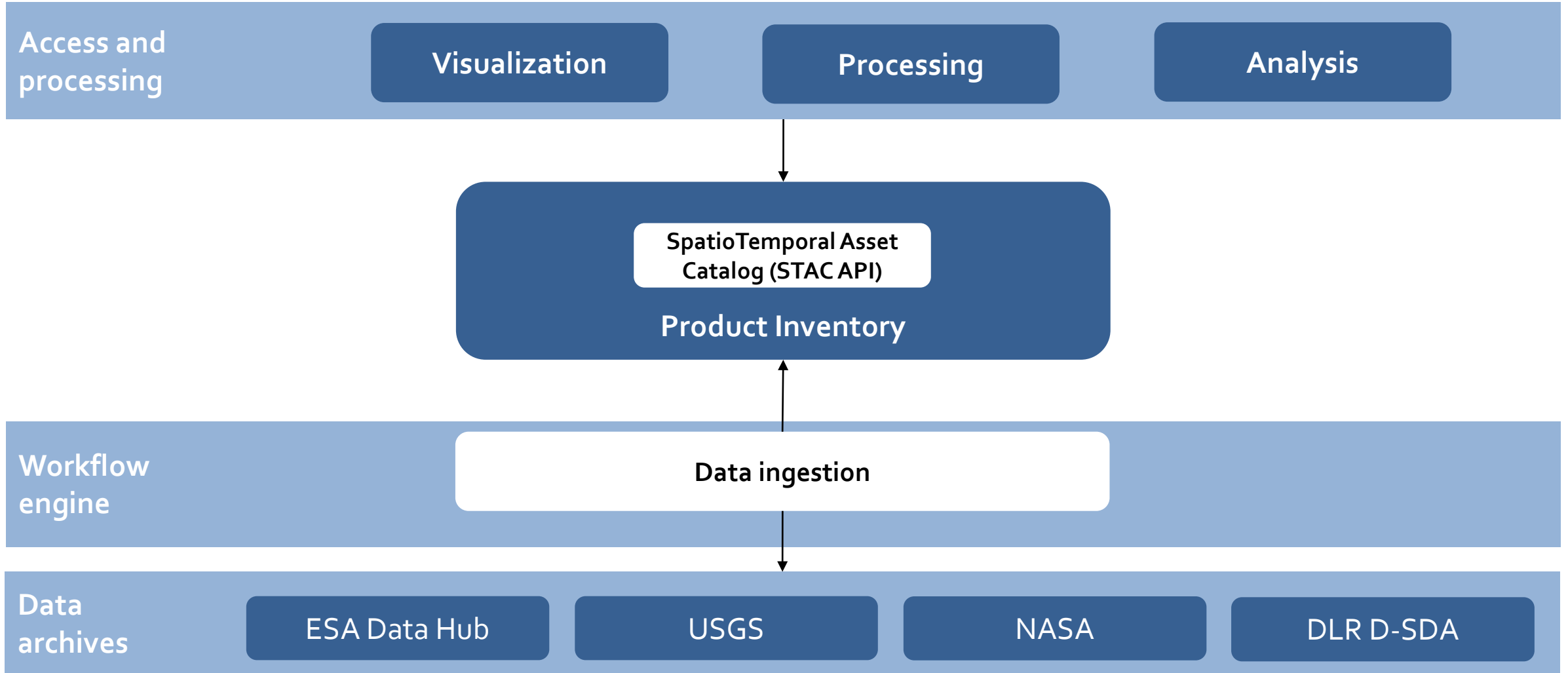
- Sentinel-1/-2/-3/-5p (incl. ARD)
- Landsat Collection 2
- MODIS
- Open Street Map
- Administrative base data
- ...



terrabyte's online data storage at Leibniz Supercomputing Center



Online Data Management



Metadata Catalog

SpatioTemporal Asset Catalog (STAC)

- Community standard
- Not only metadata for data discovery
- Metadata for data processing & analysis

EO data providers and STAC

- USGS Landsat Collection 2
- NASA EOSDIS
- ESA FedEO
- ESA Sentinel-1 NRB (Prototype)

STAC ecosystem

- Visualization (TiTiler, STAC Browser)
- Processing (stackstac, odc-stac, intake-stac)
- Data access (ukis-pysat, EODAG, rio-stac)
- STAC creation (pystac, stactools)

```
- FRC_B2: {
  title: "Surface Reflectance Monthly Composite (FRC_B2)",
  type: "image/tiff; application=geotiff; profile=cloud-optimized",
  - roles: [
    "data",
    "reflectance"
  ],
  href: "https://download.geoservice.dlr.de/S2\_L3A\_WASP/files/32/U/LE/202",
  - eo:bands: [
    - {
      name: "FRC_B2",
      common_name: "blue",
      description: "Monthly surface reflectance synthesis",
      center_wavelength: 496.6,
      full_width_half_max: 98
    }
  ],
  - proj:shape: [
    10980,
    10980
  ],
  - proj:transform: [
    10,
    0,
    300000,
    0,
    -10,
    6000000
  ],
  proj:epsg: 32632,
  gsd: 10
},
```





Data visualization: pgstac, titiler, titiler-pgstac, stac-fastapi

Example: Microsoft Planetary Computer



Explore datasets Advanced | Reset

- Sentinel-2 Level-2A
- Most recent (low cloud)
- Normalized Difference Veg. Index (NDVI)

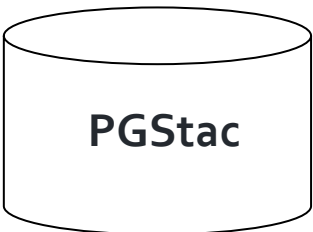
Sentinel-2 Level-2A
Showing the first 50 items that matched your filter.

	S2A_MSIL2A_20220514T102601_R108_T32U LB_20220516T185053	05/14/2022	8.6%
	S2A_MSIL2A_20220514T102601_R108_T31U GS_20220516T191322	05/14/2022	9.0%
	S2A_MSIL2A_20220417T103631_R008_T32U LB_20220417T212623	04/17/2022	6.1%
	S2A_MSIL2A_20220417T103631_R008_T31U GS_20220417T202456	04/17/2022	5.5%
	S2A_MSIL2A_20220328T103641_R008_T32U LB_20220328T235343	03/28/2022	3.4%

[Explore results in the Hub](#)



titiler-pgstac



stac-fastapi

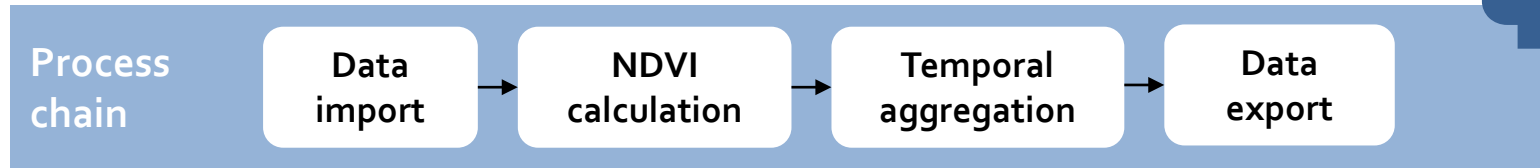


<https://planetarycomputer.microsoft.com/explore>

<https://github.com/stac-utils>

Processing backend: Actinia / GRASS GIS

Web service-based data exploitation

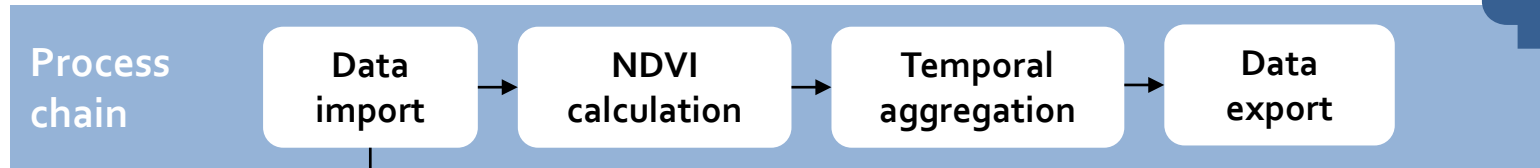


```
"id": "importer_1",  
"module": "importer",  
"inputs": [{  
  "import_descr": {  
    "source": "stac.defaultStac.rastercube.sentinel-s2-l2a",  
    "type": "stac",  
    "semantic_label": "B1",  
    "extent": {  
      "spatial": {  
        "bbox": [[30.192, -16.369, 42.834, -0.264]]  
      },  
      "temporal": {  
        "interval": [["2021-09-09", "2021-09-12"]]  
      }  
    },  
    "filter": {}  
  },  
  "param": "map",  
  "value": "sentinel-s2-l2a"  
}]  
}]
```

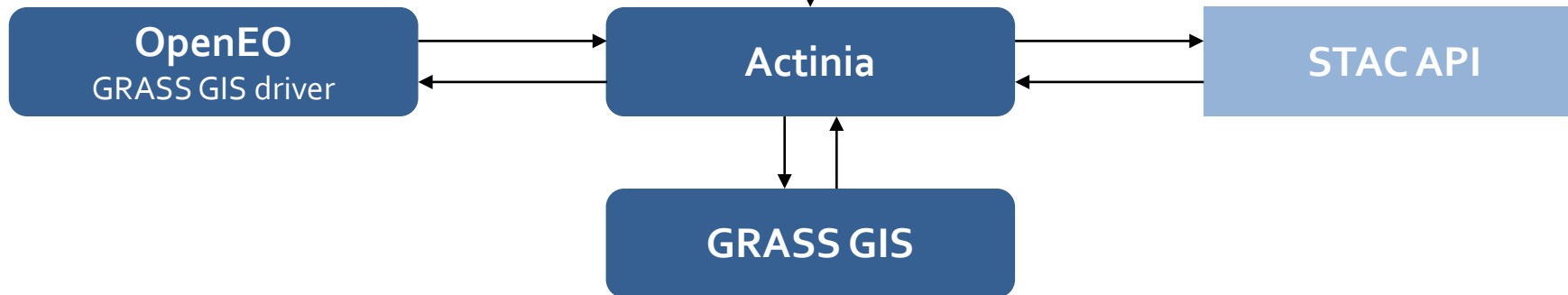


Processing backend: Actinia / GRASS GIS

Web service-based data exploitation



```
# Query STAC API and import data into GRASS GIS
process_chain_stac_import {
  "list": [
    {
      "id": "importer_1",
      "module": "importer",
      "inputs": {
        "import_descr": {
          "source": "stac.defaultStac.rastercube.sentinel-s2-12a",
          "type": "stac",
          "semantic_label": "B1",
          "extent": {
            "spatial": {
              "bbox": [[10.192, -16.969, 42.834, -0.264]]
            },
            "temporal": {
              "interval": [["2021-09-09", "2021-09-12"]]
            }
          },
          "filter": {}
        },
        "param": "map",
        "value": "sentinel-s2-12a"
      }
    }
  ],
  "version": 1
}
```



Processing backend: xarray, Dask

Python-based data exploitation

```

from pystac_client import Client
from odc import stac as odc_stac

items = Client.open("http://localhost:8082").search(collections=['sentinel2_12a'])

ds = odc_stac.load(
    items.get_items(), output_crs='EPSG:32632', resolution=(100, -100)
)

# cast data type to float
B08 = ds.B08.astype(float)
B04 = ds.B04.astype(float)

# conduct NDVI calculation
ndvi = ((B08 - B04) / (B08 + B04)).rename('NDVI')
ndvi_mean = ndvi.mean(dim="time")

# plot temporally aggregated NDVI mean
ndvi_mean.plot.imshow(vmin=-0.50, vmax=0.8, cmap='RdYlGn')

```





Take away messages

Summary & Conclusions

- STAC metadata
 - Metadata for data discovery and access
 - Tools to create metadata for various datasets (e.g., Sentinel, Landsat, MODIS)
 - Users can feed discovery results in their processing tools (e.g., GDAL, Open Data Cube, Actinia)
- STAC-based architecture
 - Large open source software ecosystem to create and use STAC and STAC API
 - Web services for visualization, access, and processing available build on top of STAC API

Next steps

- Ensure metadata consistency and interoperability between platforms (→ mission-specific STAC extensions)
- Enable users to create STAC metadata for their processing results (→ to be integrated into the data catalog)
- Enhance STAC metadata with additional information (e.g., visualization styles)





Thank you for your attention!

Contact details

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