Task 4.2: Common NIVA API

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NIVA meeting – 12/05/2020

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Main Concept of Common API

- ✓ Earth Observation API:
  - ✓ Provide a unique API layer as broker of EO based services based on OpenEO
  - ✓ Integrate NIVA available EO based services such as Sen4CAP
  - ✓ Provide a common approach to evolve the common API layer by incrementally adding new EO services over time
- ✓ Traffic Lights API:
  - ✓ Provide access to different information (EO, FMIS ...)
  - ✓ Provide a standard layer NIVA data model (semantics) specifications
- ✓ Linked Data AgroEnvironmental API
  - ✓ Provide an AgroEnvironmental Linked Data end-point aggregating data coming from different sources (LPIS, Crop Type, Farm Registry ...)
  - ✓ Facilitate the machine-to-machine interaction

Earth Observation API

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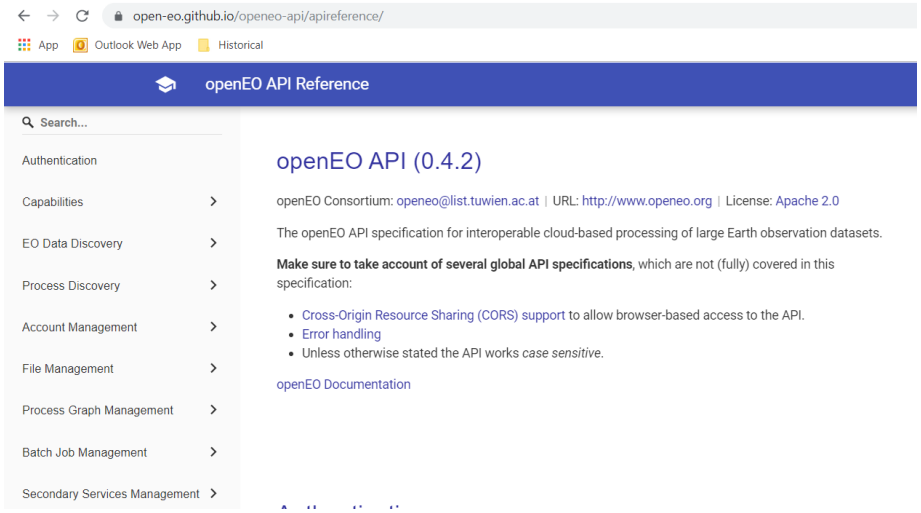
Earth Observation API Services for CAP

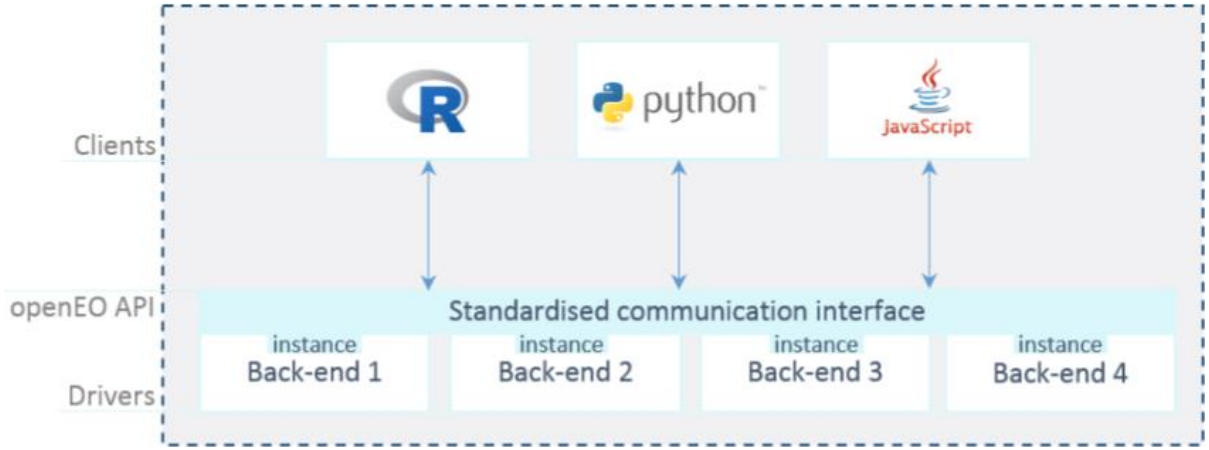
Data and products necessary for CAP needs are at different level of complexity; the aim is to access existing and other under development external systems and internal components (e.g. those from UCs) and to cathegorize available data/products for an easy use

- Base L3 products markers (Sen4CAP, any other marker generator)
  - Sentinel 1 weekly averaged markers and features
  - Sentinel 2 derived spectral indexes, FAPAR, LAI
  - …
- Advanced L4 products markers (Sen4CAP, any other marker generator)
  - Grassland Mowing, Crop Type
  - Harvesting, ….
- Processing services:
  - Markers calculation for parcels
  - Anomaly detection (analysis of time series, inter-field, intra-field analysis…)
  - ….

EO Broker API



- It is based on OpenEO specification
- Allow to discover:
  - Data
  - Processing services
  - User Defined Functions
- Allow to consume such services
- It implements also mechanism to access subscription based services



OpenEO API specification

- The openEO API defines a HTTP API that lets cloud back-ends with large Earth observation datasets communicate with front end analysis applications in an interoperable way.
- As an overview, the openEO API specifies how to
  - discover which Earth observation data and processes are available at cloud back-ends,
  - execute (chained) processes on back-ends,
  - run user-defined functions (UDFs) on back-ends where UDFs can be exposed to the data in different ways,
  - download (intermediate) results, and
  - manage user content including billing.
- The API is defined as an OpenAPI 3.0 YAML file.

https://openeo.org/documentation/1.0/developers/api/reference.html

OpenEO Advantages

- Specification is open to contribution and it still support several use cases
- Data catalogue is done using STAC (Spatio-Temporal Asset Catalogue) specification which is generic enough to include also non-EO data (e.g. Geotagged Photos)
- It embraces the micro-service paradigm allowing a sustainable development of functions
- Decouple the UI from the back-end and provide a common interface to different platforms (there are already 5 DIAS and many other EO platform)

OpenEO API Example 1 (Spectral Index)

- Example: Calculate custom spectral index by giving a specific UDF (e.g. normalized_difference)

Arguments such as collection and spatio-temporal interval

Process description: Selected Band, Formula

JSON Request

OpenEO API

File API: Cloud Storage (e.g. S3)

Secondary Services: OGC Services like WMS, WCS, WFS

Direct Access: Download

Different Output

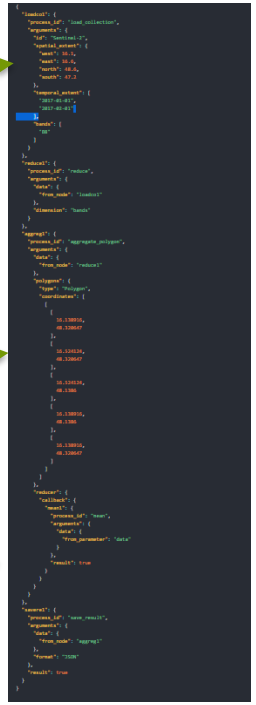
OpenEO API Example 1 (Zonal Stats)

- Example: Calculate zonal stats on existing raster layer and store the results using the NIVA information model

Collection details and spatio-temporal interval

Arguments such as Parcels GeoJSON

Process description: List of computation or services



JSON Request

OpenEO API

File API: Cloud Storage (e.g. S3)

Secondary Services: OGC Services like WMS, WCS, WFS

Different Output

Earth Observation API – Microservices (1)

	Service	Description
1	mean and standard deviation of 8 reflectance S2 bands	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
2	mean and standard deviation of NDWI	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
3	mean and standard deviation of pixel brightness	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
4	weekly backscatter mosaics, grouped by orbit type and polarization: ASC/DESC × VV/VH/VV÷VH	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
5	weekly coherence mosaics, grouped by orbit type and polarization: ASC/DESC × VV/VH	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
6	temporal features from the weekly temporal backscatter mosaics: mean value and coefficient of variation × ASC/DESC × VV/VH/VV÷VH	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
7	the standard deviation across the season (VV/VH) from the weekly coherence mosaics	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
8	the minimum coherence value across each month (VV/VH) from the weekly coherence mosaics	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
9	mean coherence value across each month (VV/VH) from the weekly coherence mosaics	Markers calculated at parcel level on the basis of Sen4CAP available pre-calculated data
10	Sentinel L2A true color – imagery	Bounding box or parcel-clipped imagery for a specific date/time. Available on pre-processed data.
11	Sentinel L2A false color – imagery	Bounding box or parcel-clipped imagery for a specific date/time. Available on pre-processed data.
12	Sentinel 2 L3A NDVI	Parcel-level time-series statistics (average, mean, min, max; for each date/time) Available on Sen4CAP pre-calculated data.

Earth Observation API – Microservices (2)

	Service	Description
13	Sentinel 2 L3A NDVI – imagery	Bounding box or parcel-clipped imagery for a specific date/time. Available on pre-processed data.
14	Sentinel 2 L3A LAI	Parcel-level time-series statistics (average, mean, min, max; for each date/time) Available on Sen4CAP pre-calculated data.
15	Sentinel 2 L3A LAI - imagery	Bounding box or parcel-clipped imagery for a specific date/time. Available on pre-processed data.
16	Sentinel 2 L3A FAPAR	Parcel-level time-series statistics (average, mean, min, max; for each date/time) Available on Sen4CAP pre-calculated data.
17	Sentinel 2 L3A FAPAR – imagery	Bounding box or parcel-clipped imagery for a specific date/time. Available on pre-processed data.
18	Crop type mapping	Products (Sen4CAP does not refer to these as markers) calculated at parcel level on the basis of Sen4CAP available pre-calculated data
19	Grassland mowing detection	Products (Sen4CAP does not refer to these as markers) calculated at parcel level on the basis of Sen4CAP available pre-calculated data
20	Agricultural practices monitoring	Products (Sen4CAP does not refer to these as markers) calculated at parcel level on the basis of Sen4CAP available pre-calculated data
21	Interfield	Analysis of anomalies in the time-series of pixels of a parcel
21	Intrafield	Analysis of anomalies at scale using reference data

Traffic Lights API

NIVA meeting – 12/05/2020

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Traffic Lights component API

- Provide an umbrella API capable to provide heterogeneous information from multiple sources that adhere to NIVA data model (semantics) specifications
- Use a standardised OGC compatible API. Information sources examples include:
  - Multiple EO classification engines (e.g. Sen4CAP)
  - geotagged photos applications
  - farm management information systems.

Traffic Lights component API - Microservices

	Service	Description
1	Crop type provision	Crop type classification information (e.g. Sen4CAP) registered with this common component as parcels attributes
2	Land type provision	Land type classification information (e.g. Sen4CAP) registered with this common component as parcels attributes
4	Selected Farm calendar entries provision	Farm management information such as calendar data will be provided as parcel's attribute- metadata
5	Geotagged photos provision	Geotagged photo applications that are registered with this common component.

AgroEnvironmental Linked Data API

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AgroEnvironmental Linked Data API

- Publication of Linked Data API for different sources
- Previously Open Databases
- NIVA Databases as:
  - Crop type declarations
  - Parcels
  - Farm Registry
  - LPIS
- External Databases, models and ontologies

AgroEnvironmental Linked Data API

- Select pre-existing ontologies
- Complete a NIVA agroenviromental data model
- Clean the data to remove inconsistences or data problems
- Populate/publish de Linked Data Endpoint through ETL process

Next Steps

- Finalize D4.2 Technical Note
- Define a plan for the development of the common components including:
  - OpenEO Broker API
  - Back-end EO API services (Data, Processing) integration
  - Traffic Lights API services integration
  - Linked Data API services integration
  - Client Libraries (Python) to facilitate the integration into UC as open source library

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THANK YOU!

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