Deliverable 04
Version 1.0 from 2018/03/26

openEO core API prototype including Proof of Concept
Change history

<table>
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<tr>
<th>Issue</th>
<th>Date</th>
<th>Author(s)</th>
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<td>0.1</td>
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<td>Edzer Pebesma, Matthias Mohr, WWU</td>
<td>First draft</td>
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<td>Jeroen Dries, VITO</td>
<td>Internal review</td>
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<td>Matthias Schramm, TU Wien</td>
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For any clarifications please contact openEO@list.tuwien.ac.at.

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Disclaimer

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List of Acronyms

API  Application Programming Interface
EO   Earth Observation
NDVI Normalized Difference Vegetation Index
1 Executive summary

The openEO EU project [1] develops an open API to connect R, python and JavaScript clients to big Earth observation cloud back-ends in a simple and unified way. This deliverable (of type “demonstrator”) demonstrates the existence of this API and its functioning for a selected number of use cases, by pointing to the API documentation and to functioning software implementation where an R, Python and JavaScript client connect to a variety of back-ends. The purpose of the proof-of-concept is to inform the Earth Observation community about the progress made in openEO by ways of the proof of concept, and this document contains the links to the on-line, public documentation created (API, descriptions, blog post with demonstration videos); it does not copy those.

The API description, the description of the use cases, the client and back-end drivers developed and the demonstrations showing that they actually work well together all indicate that the openEO API is a feasible concept.

2 Links to the demonstrator

2.1 Link to the API specification, documentation, and proof-of-concept

The core concepts and API specification for openEO are found at https://open-eo.github.io/openeo-api/index.html.

The proof-of-concept is described at: https://open-eo.github.io/openeo-api/poc/index.html.

2.2 Selected use-cases

To demonstrate the feasibility of the openEO concept, a prototype has been developed that focuses on using clients for analysing Earth Observation imagery in cloud-based back-ends. Features like user authentication or accounting have, on purpose, not been addressed in this proof of concept.

During the openEO kick-off meeting in Oct 2017, three use cases were selected to demonstrate the openEO proof-of-concept. They include:

1. Deriving minimum NDVI measurements over pixel time series of Sentinel 2 imagery
2. Creating a monthly aggregated Sentinel 1 product from a custom Python script
3. Computing time series of zonal (regional) statistics of Sentinel 2 imagery over user-uploaded polygons

All case studies follow the pattern:

- Check whether data is available at the back-end
- Check that needed processes are available
- Create a job at the back-end
- Define output
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- Retrieve output
- Stop the job (and the service)

In the documentation, found at https://open-eo.github.io/openeo-api/poc/index.html, the example API calls with (example) requests and responses are given.

2.3 Links to blog post and videos

The following blog post on the http://openeo.org/ project home page describes the proof of concept use cases to a wide audience:


2.4 Videos demonstrating client-back-end interactions

The following videos were created to demonstrate successful client-server interactions (also linked from the blog post):

1. GRASS GIS (mundialis) accessed with curl (UC 1,2,3): view
2. WCPS (EURAC) accessed with R client (UC1): view
3. R back-end (WWU) accessed with R client (UC1): view
4. R back-end (WWU) accessed with R client (UC3): view
5. Sentinel-Hub (Sinergise), OpenShift (EODC) and WCPS (EURAC) accessed with the Web Editor, based on the JavaScript client (UC1): view
6. R back-end (WWU) accessed with the Web Editor, based on the JavaScript client (UC3): view
7. GeoPySpark (VITO) accessed with the Python client (UC1): view

3 Succeeded use case/client/back-end combination

The combinations of clients, back-ends and use cases that were successfully executed are listed in table 3.1

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1 https://www.youtube.com/watch?v=NgF1WgCtSiM  
2 https://www.youtube.com/watch?v=NoD0nVGM3ww  
3 https://www.youtube.com/watch?v=Yb_QfIO-ulE  
4 https://www.youtube.com/watch?v=LYna6KkCU  
5 https://youtu.be/zDaQkw0NhpY  
6 https://youtu.be/XsPbKypUuIE  
7 https://www.youtube.com/watch?v=qtlp9OC0qHY
4 Discussion

The API description, the description of the use cases, the client and back-end drivers developed and the demonstrations showing that they actually work well together all indicate that the openEO API is a feasible concept. The amount of working dedicated openEO clients (3) and back-ends (6) exceeds by far the tentative goals that were set in the project proposal for this early stage of the project.

By intention, the use-cases were picked ambitiously: they address variation of multiple attributes (bands) over space and time, user-defined functions in R and Python that need to be evaluated on the back-end, and integration of imagery over polygons, and delivering results in various forms (file formats, web services). It was clear from the start that not all back-ends would be able (or will ever be able) to cope with all of them. This has led to good discussions about the differences between back-ends, and has anticipated upcoming decisions on what can become compulsory and what will have to become optional parts of the openEO API.

5 References