



# ELIXIR CZ Annual Conference 2024

**Onedata** for comprehensive management  
of distributed scientific data

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10.10.2024



# WHO WE ARE

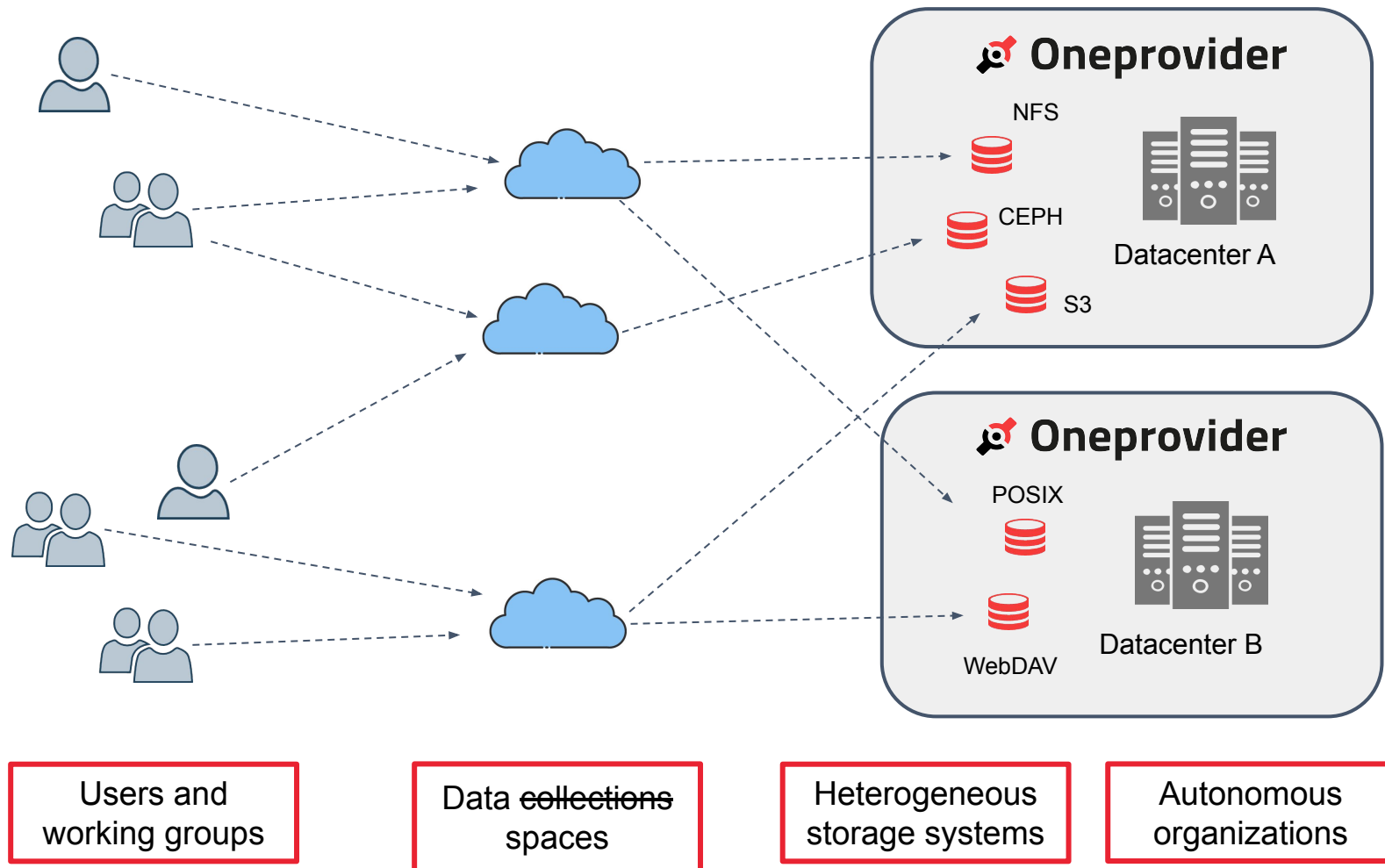
# ONEDATA



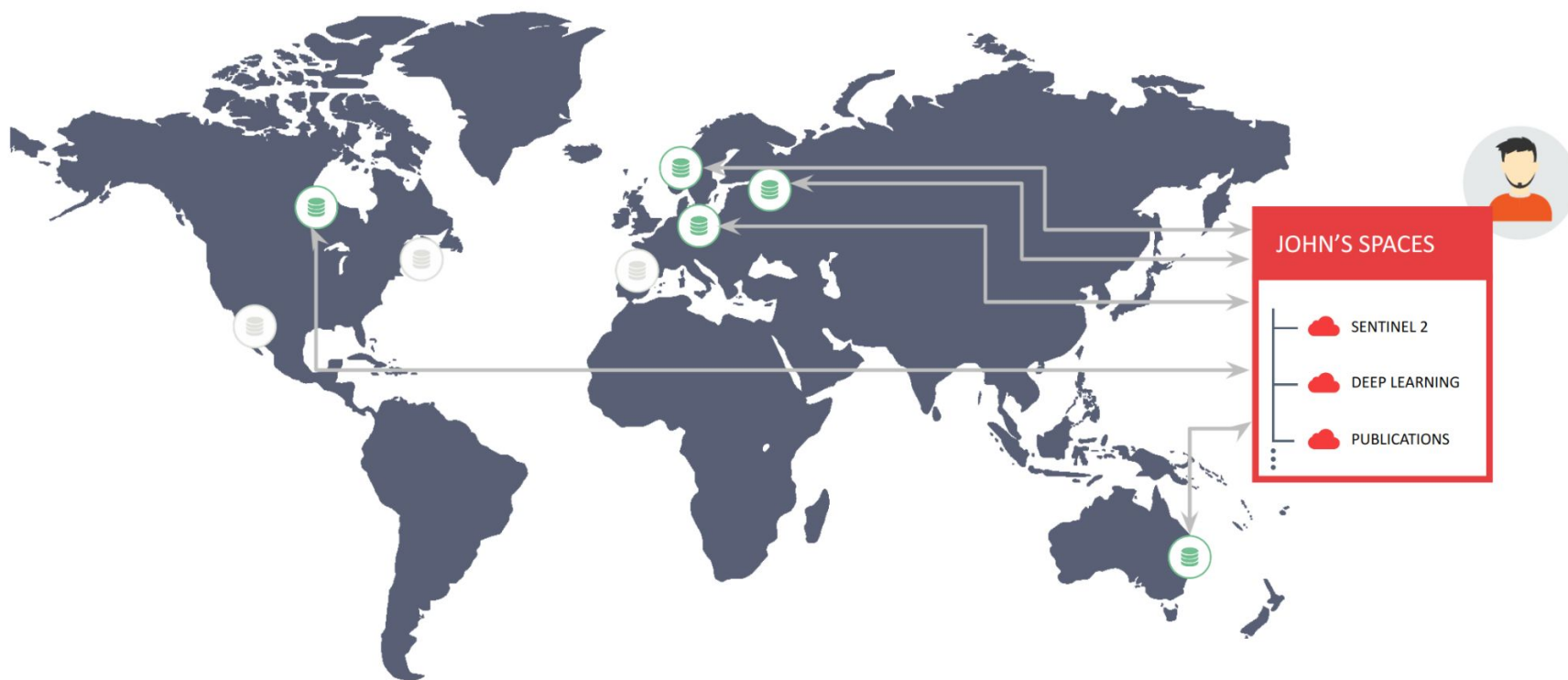
- Open-source, 11 years of devoted development — [github.com/onedata](https://github.com/onedata)
- Developed @ **AGH University of Krakow** and **Cyfronet** supercomputing center, to:
  - deliver a **data management** platform for large-scale and **distributed** problems,
  - enable global collaborative data sharing **across organizational** domains,
  - streamline data processing in **heterogeneous** data storage setups and **hybrid cloud**.
- Our supporters and partnerships:



# UNIFIED ACCESS TO GEOGRAPHICALLY AND ORGANIZATIONALLY DISTRIBUTED DATA



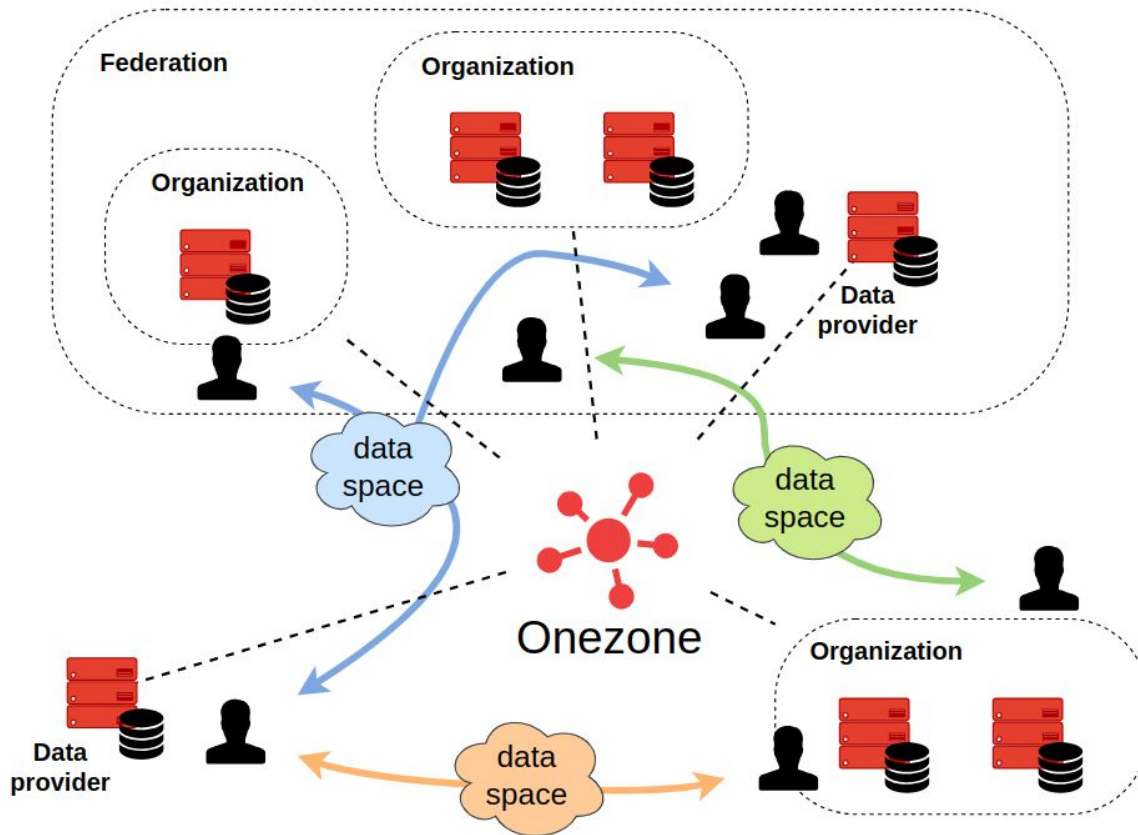
# ONEDATA SPACES FOR DISTRIBUTED DATA



# ONEDATA SPACES FOR DISTRIBUTED DATA



# ONEDATA ARCHITECTURE



## Onezone

- central coordinator
- implements AAI
- entry-point to the system

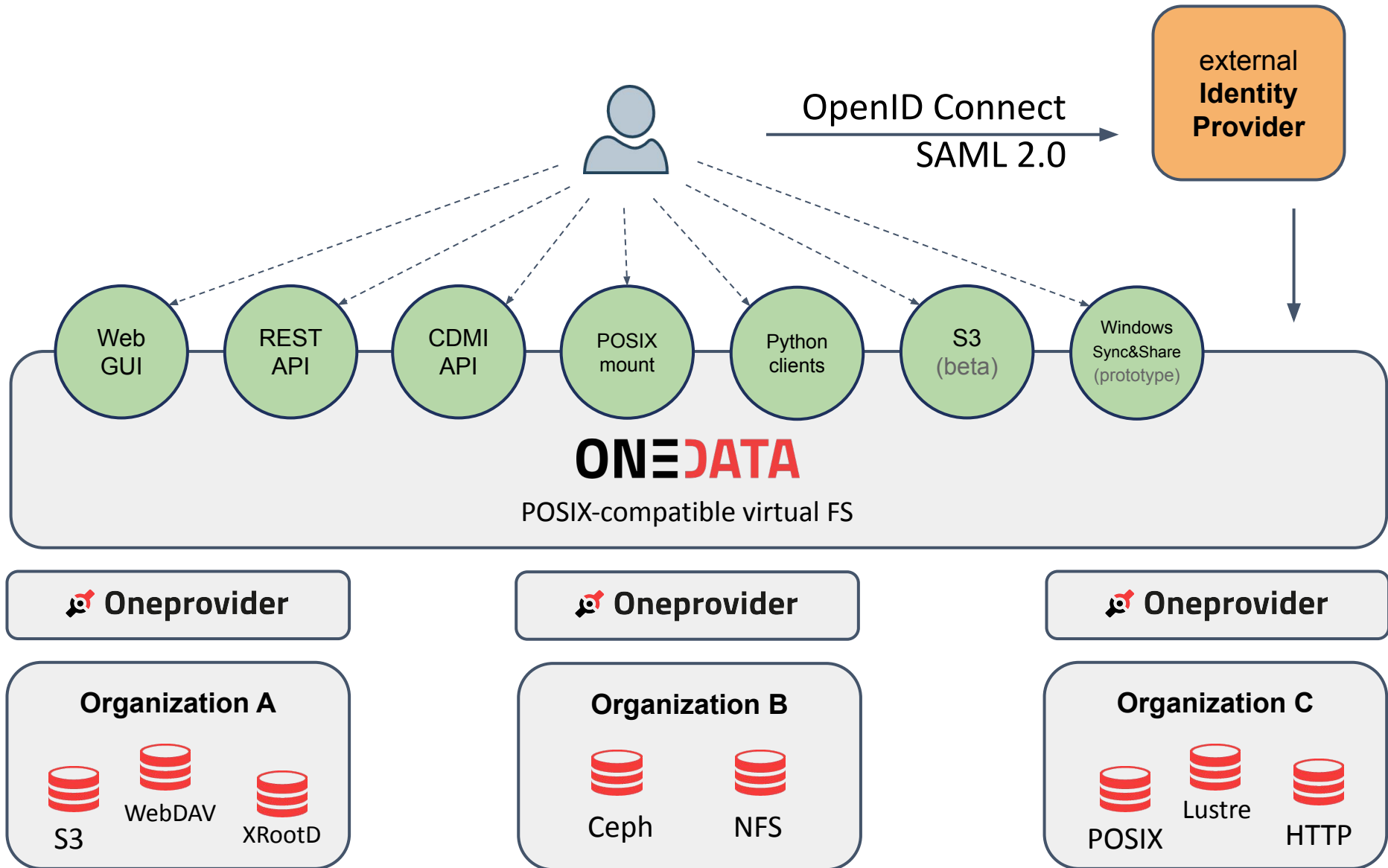
## Oneprovider

- installed at a data provider
- realizes data access & mgmt
- virtualizes physical storage

## Open-source software stack

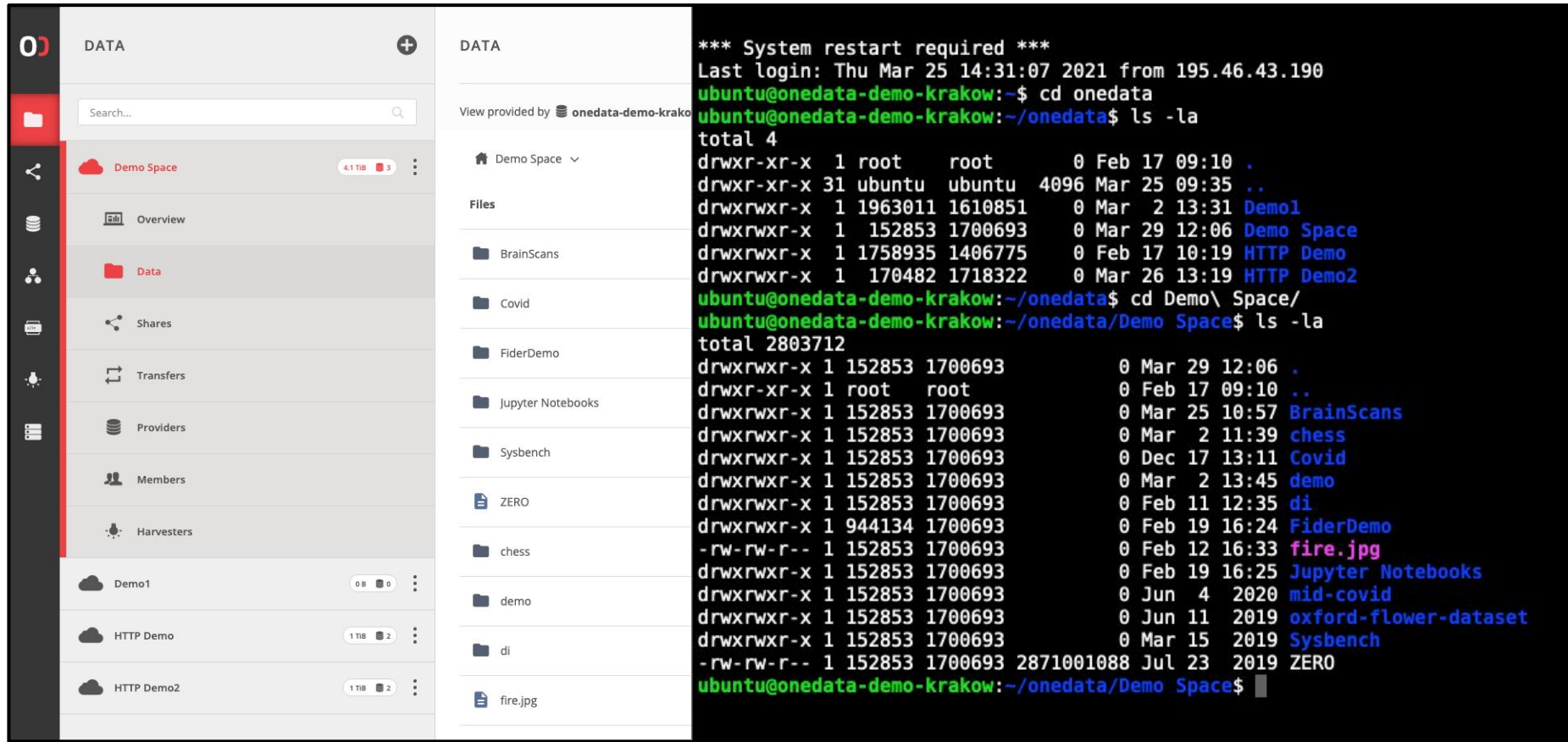
Take it and use it, retaining control over your own storage resources.

# VIRTUALIZED DATA ACCESS





# ONECLIENT — FUSE-BASED POSIX MOUNT



The image displays the OneClient web interface on the left and a terminal window on the right. The web interface shows a sidebar with navigation options like Overview, Data, Shares, Transfers, Providers, Members, and Harvesters. The main content area shows a list of data spaces: Demo1 (0 B), HTTP Demo (1 TiB), and HTTP Demo2 (1 TiB). The terminal window shows a system restart message, login information, and two directory listings. The first listing is for the root directory, and the second is for the Demo Space directory.

**Web Interface Data:**

Space Name	Size
Demo1	0 B
HTTP Demo	1 TiB
HTTP Demo2	1 TiB

**Terminal Output:**

```
*** System restart required ***
Last login: Thu Mar 25 14:31:07 2021 from 195.46.43.190
ubuntu@onedata-demo-krakow:~$ cd onedata
ubuntu@onedata-demo-krakow:~/onedata$ ls -la
total 4
drwxr-xr-x 1 root root 0 Feb 17 09:10 .
drwxr-xr-x 31 ubuntu ubuntu 4096 Mar 25 09:35 ..
drwxrwxr-x 1 1963011 1610851 0 Mar 2 13:31 Demo1
drwxrwxr-x 1 152853 1700693 0 Mar 29 12:06 Demo Space
drwxrwxr-x 1 1758935 1406775 0 Feb 17 10:19 HTTP Demo
drwxrwxr-x 1 170482 1718322 0 Mar 26 13:19 HTTP Demo2
ubuntu@onedata-demo-krakow:~/onedata$ cd Demo\ Space/
ubuntu@onedata-demo-krakow:~/onedata/Demo Space$ ls -la
total 2803712
drwxrwxr-x 1 152853 1700693 0 Mar 29 12:06 .
drwxr-xr-x 1 root root 0 Feb 17 09:10 ..
drwxrwxr-x 1 152853 1700693 0 Mar 25 10:57 BrainScans
drwxrwxr-x 1 152853 1700693 0 Mar 2 11:39 chess
drwxrwxr-x 1 152853 1700693 0 Dec 17 13:11 Covid
drwxrwxr-x 1 152853 1700693 0 Mar 2 13:45 demo
drwxrwxr-x 1 152853 1700693 0 Feb 11 12:35 di
drwxrwxr-x 1 944134 1700693 0 Feb 19 16:24 FiderDemo
-rw-rw-r-- 1 152853 1700693 0 Feb 12 16:33 fire.jpg
drwxrwxr-x 1 152853 1700693 0 Feb 19 16:25 Jupyter Notebooks
drwxrwxr-x 1 152853 1700693 0 Jun 4 2020 mid-covid
drwxrwxr-x 1 152853 1700693 0 Jun 11 2019 oxford-flower-dataset
drwxrwxr-x 1 152853 1700693 0 Mar 15 2019 Sysbench
-rw-rw-r-- 1 152853 1700693 2871001088 Jul 23 2019 ZERO
ubuntu@onedata-demo-krakow:~/onedata/Demo Space$
```



# RICH REST API DEFINED IN SWAGGER (OPENAPI)

```
curl -H "X-Auth-Token: $TOKEN" -H 'Content-type: application/json' \
-X GET "https://$PROVIDER_HOST/api/v3/oneprovider/data/$DIR_ID/children" -d '{
  "attributes": ["name", "size", "xattr.key"],
  "limit": 2
}'

{
  "children": [
    {
      "name": File1.txt,
      "size": 1024,
      "xattr.key": "extended_attribute_value"
    },
    {
      "name": File2.txt,
      "size": 16384,
      "xattr.key": null
    }
  ],
  "isLast": false,
  "nextPageToken": "g2gDZAAKbGlua190b2t1bmgCZAAMY2FjaGVkX3Rva2VuWgADY..."
}
```

# PYTHON CLIENTS AND S3

 OnedataFS (*pyfilesystem*)

 OnedataRestFS (*pyfilesystem*)

 OnedataFileRestClient

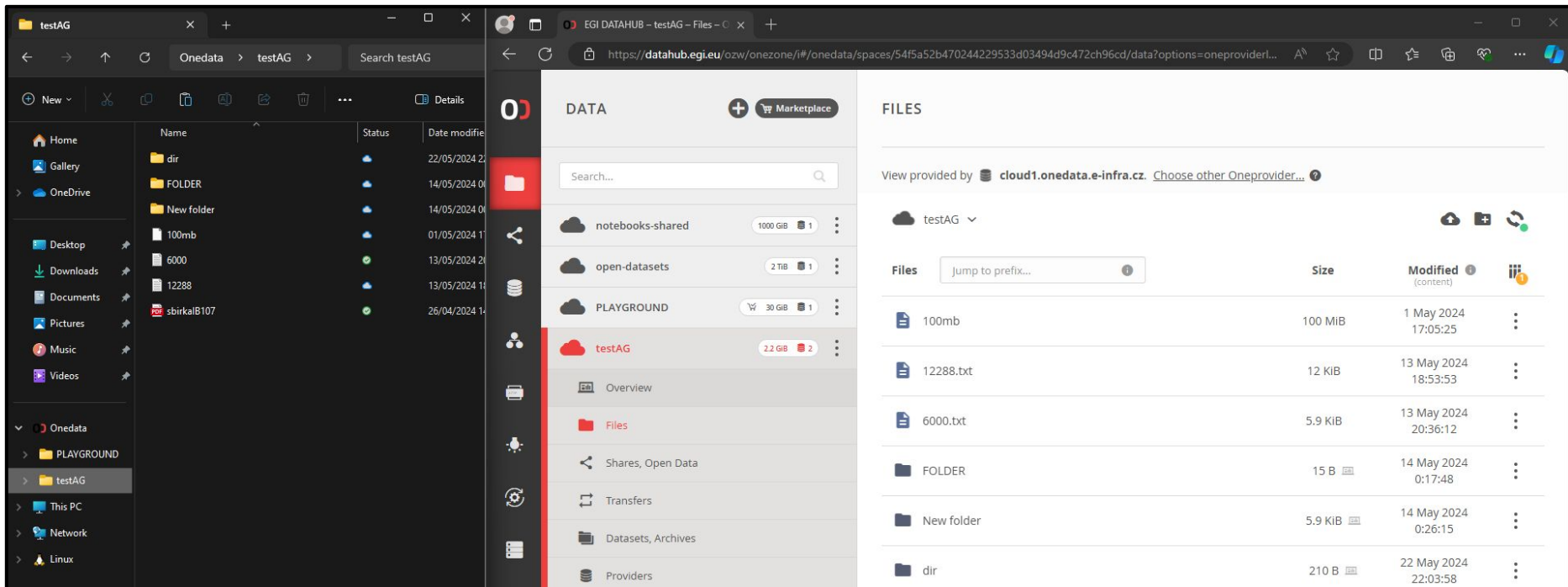


Standard S3 protocol (beta)

```
docker run -it --rm -v 'pwd':pwd -w 'pwd' onedatarestfs bash
root@544de5a58bde:/home/lopiola# python
Python 3.12.6 (main, Sep 27 2024, 06:10:24) [GCC 12.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> from fs.onedatarestfs import OnedataRESTFS
>>> onedata_access_token = 'MDAxY2xvY2F0aW9uIGRhdGFodWlUZWdpLmV1CjAwNmJpZGVudGlmVzci0000NWNjZjBjYmRmYTNmNmEyZTAxZTRiNTBiZTRkZTA1Y2NoNzYwNS9hY3QvOWU4MjY3NjlkZTMzY2ZiNGRhNTg1ZjY00ZmRiZWZMTBjaDQ1YWQKMDAxOWNpZC BpbmRlcmZhY2UgPSByZXN00CjAwMThjaWQgc2VydmJlZSA9IG9wdy00qCjAwMmZzaWduYXR1cm UgDBIxbJLiYuB6WMKy302106gbPS65bYo00qXZk029epxBw8K'
>>> odfs = OnedataRESTFS('datahub.egi.eu', onedata_access_token)
>>> odfs.listdir('/demo-egi-conf-24')
['bagit-archive.tar.gz', 'colourful-and-horizontal', 'cyfronet-photos', 'cyfronet.txt', 'lecce.txt', 'porto-photos', 'porto.txt']
>>> odfs.listdir('/demo-egi-conf-24/porto-photos')
['aleksander.jpg', 'andrei.jpg', 'andrews2.jpg', 'artem.jpg', 'baskin.jpg', 'bella.jpg', 'deepu.jpg', 'digital.jpg', 'dog.png', 'eberhard2.jpg', 'eberhard4.jpg', 'fabian.jpg', 'francesco.jpg', 'hristo.jpg', 'irina3.jpg', 'jakub.jpg', 'lumn.jpg', 'maisa.jpg', 'mali.jpg', 'masood.jpg', 'min.jpg', 'philippe.jpg', 'piccinng.jpg', 'pixabay3.jpg', 'pixabay4.jpg', 'prashant.jpg', 'sasha.jpg', 'stein.jpg']
>>>
```

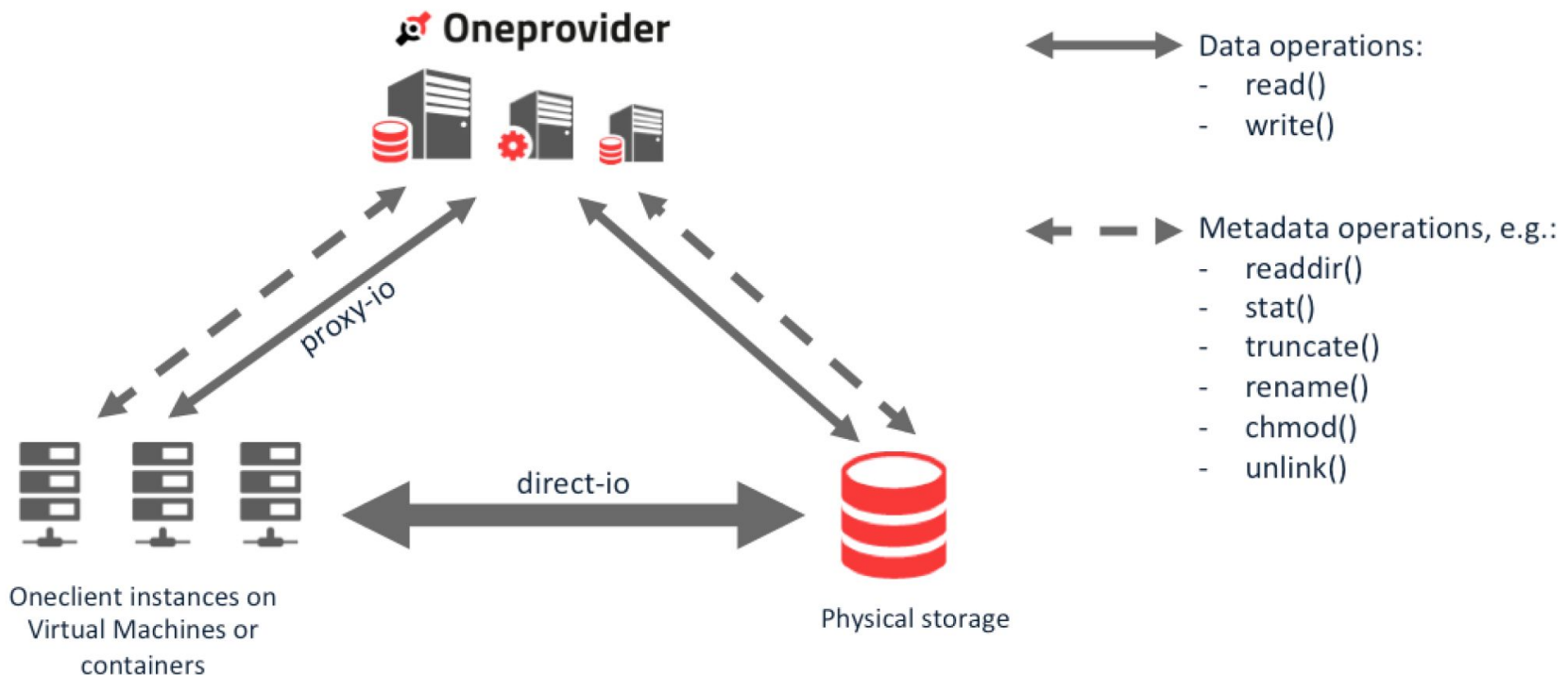
```
lopiola@rzyleta:~
aws --endpoint-url https://lecce.datahub.egi.eu:8443 s3 ls s3://demo-egi-conf-24 --recursive
2024-10-02 14:19:20      6051 bagit-archive.tar.gz
2024-10-02 14:17:33    435507 colourful-and-horizontal/aleksander.jpg
2024-10-02 14:31:08       83 colourful-and-horizontal/baskin.jpg
2024-10-02 14:16:58   689963 colourful-and-horizontal/bella.jpg
2024-10-02 14:17:25   740914 colourful-and-horizontal/eberhard2.jpg
2024-10-02 14:17:29   313295 colourful-and-horizontal/fabian.jpg
2024-10-02 14:31:10       81 colourful-and-horizontal/lumn.jpg
2024-10-02 14:16:34   2528113 colourful-and-horizontal/masood.jpg
2024-10-02 14:17:28   356871 colourful-and-horizontal/min.jpg
2024-10-02 14:17:18   256676 colourful-and-horizontal/pixabay4.jpg
2024-10-02 14:15:59   301629 colourful-and-horizontal/stein.jpg
2024-10-02 14:20:22         0 cyfronet-photos/
2024-10-02 14:20:36   3380936 cyfronet-photos/bagit/alpha.jpeg
2024-10-02 14:20:38   2542904 cyfronet-photos/bagit/beta.jpeg
2024-10-02 14:20:35   1971910 cyfronet-photos/bagit/delta.jpeg
2024-10-02 14:20:35   2260725 cyfronet-photos/bagit/epsilon.jpeg
2024-10-02 14:20:39   1131789 cyfronet-photos/bagit/eta.jpeg
2024-10-02 14:20:35   2574198 cyfronet-photos/bagit/gamma.jpeg
2024-10-02 14:20:43   2639153 cyfronet-photos/bagit/iota.jpeg
2024-10-02 14:20:43   3042851 cyfronet-photos/bagit/kappa.jpeg
2024-10-02 14:20:43   763801 cyfronet-photos/bagit/lambda.jpeg
2024-10-02 14:20:43   1857002 cyfronet-photos/bagit/mu.jpeg
2024-10-02 14:20:51   2599747 cyfronet-photos/bagit/nu.jpeg
2024-10-02 14:20:44   575663 cyfronet-photos/bagit/omicron.jpeg
2024-10-02 14:20:50   855434 cyfronet-photos/bagit/pi.jpeg
2024-10-02 14:20:50   394412 cyfronet-photos/bagit/rho.jpeg
2024-10-02 14:20:51   1411808 cyfronet-photos/bagit/sigma.jpeg
2024-10-02 14:20:53   3764287 cyfronet-photos/bagit/tau.jpeg
2024-10-02 14:20:40   1908966 cyfronet-photos/bagit/theta.jpeg
2024-10-02 14:20:54   2328940 cyfronet-photos/bagit/upsilon.jpeg
```

# WINDOWS SYNC & SHARE CLIENT (PROTOTYPE)



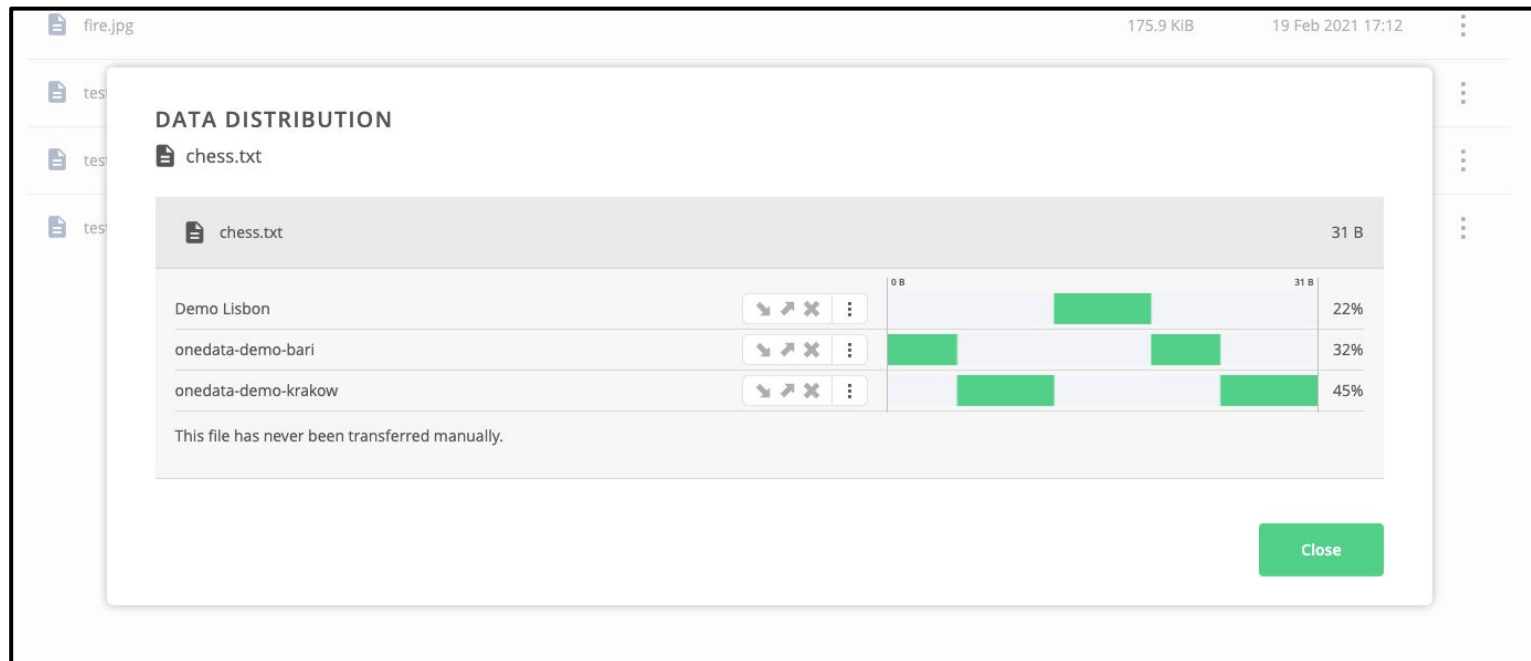
# DIRECT STORAGE ACCESS FOR HPC

- **Oneclient** - Linux **POSIX** mount supporting most of the POSIX operations (C++).
- **OnedataFS** - **Python** `pyfilesystem` plugin reusing the C++ storage drivers.
- All your data accessible in a **unified file system** mountable on a PC, VM, container, or Cloud/Grid worker node.



# ADVANCED REPLICA MANAGEMENT

- **Chunk-based** replica management
- Missing chunks delivered **on-the-fly**
- Handled **automatically**, but **controllable manually** - prestage, transfer, migrate, define QoS rules (policy-based replica management)



# FLEXIBLE, HIGH-THROUGHPUT TRANSFERS

03

DATA

+

Search...

Demo Space4.1 TiB3

Overview

Data

Shares

Transfers

Providers

Members

Harvesters

Demo10 B0

HTTP Demo1 TiB2


HTTP Demo21 TiB2

DEMOOnezone 20.02.7

TRANSFERS

View provided by onedata-demo-krakow. Choose other Oneprovider...

ONGOING TRANSFERS MAP

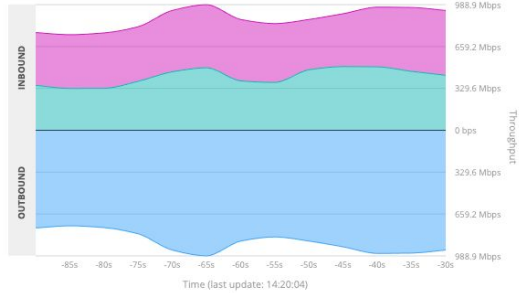


ONEPROVIDERS THROUGHPUT

TotalTransfer jobsOn-the-fly

All Oneproviders

MinuteHourDayMonth



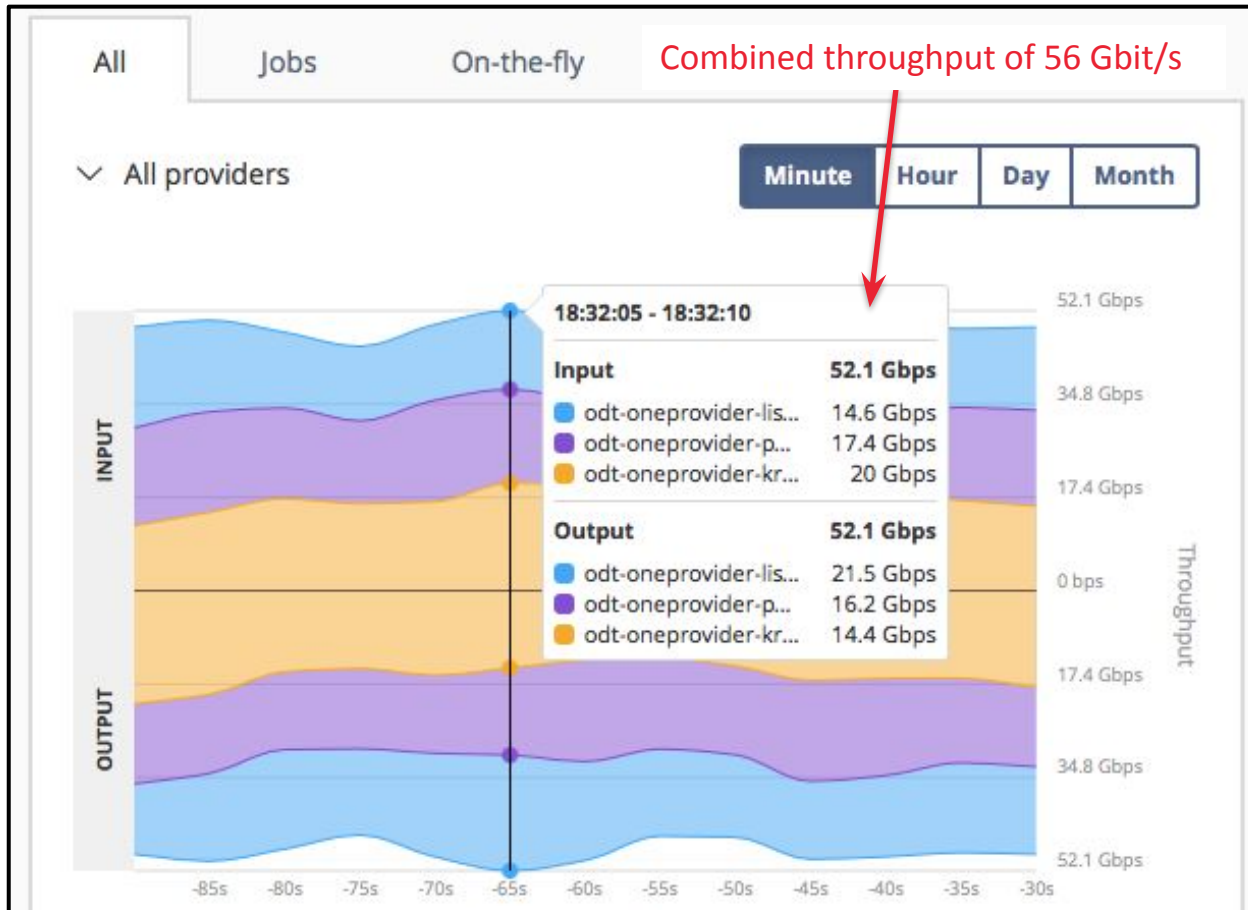
TRANSFER JOBS HISTORY

sysb.1WaitingOngoingEnded

File/directory	Username	Destination	Started at	Replicated	Processed files	Type	Status
sysb.1	Lukasz Dutka	Demo Lisbon	29 Mar 2021 14:18:29	4 GiB	0	📁	🔄
sysb.0	Lukasz Dutka	onedata-demo-krakow	29 Mar 2021 14:17:52	6.7 GiB	0	📁	🔄



# FLEXIBLE, HIGH-THROUGHPUT TRANSFERS

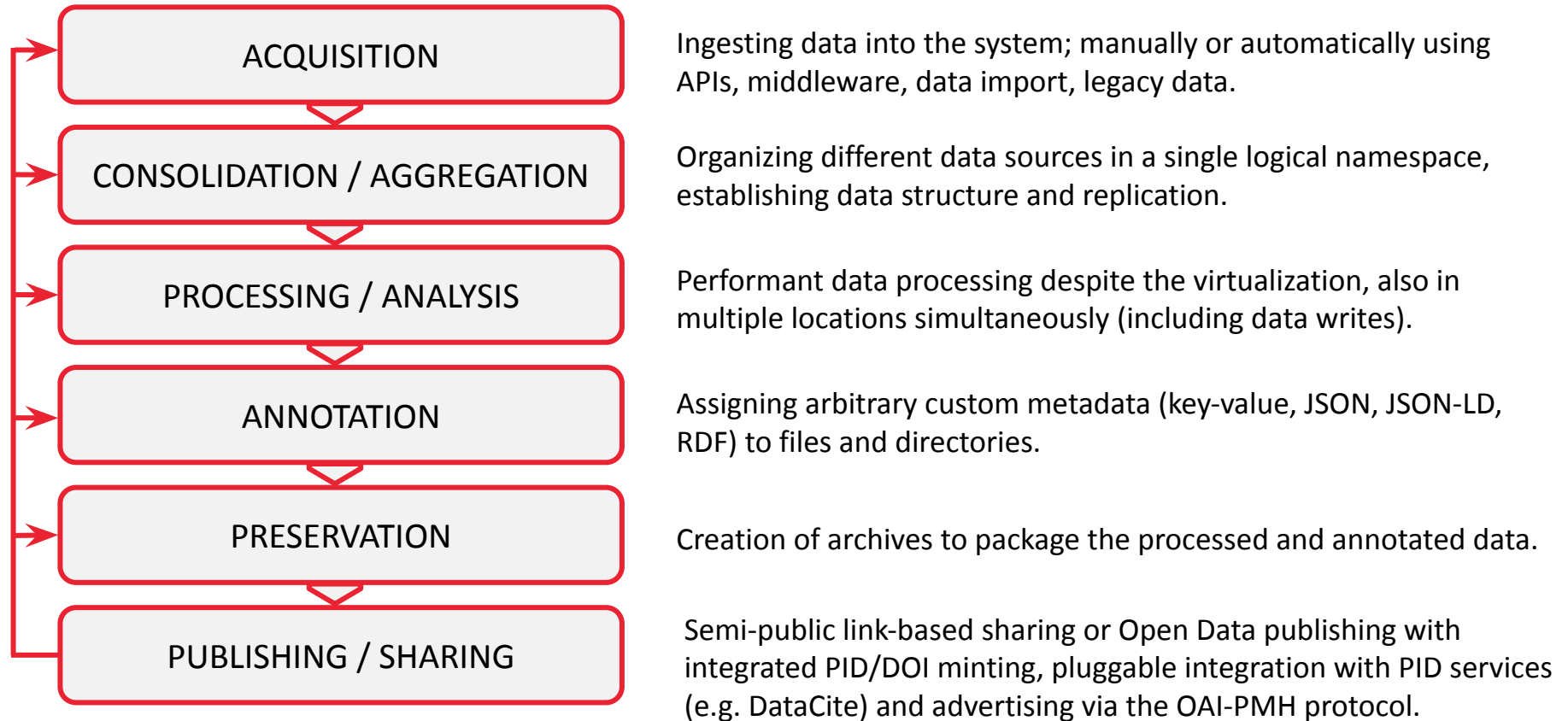


Data transfer “mesh”:

- 3 Oneproviders connected by 20+Gbit/s links
- transfer data in all possible directions
- 1 VM per provider
- almost linear scalability thanks to parallel channels

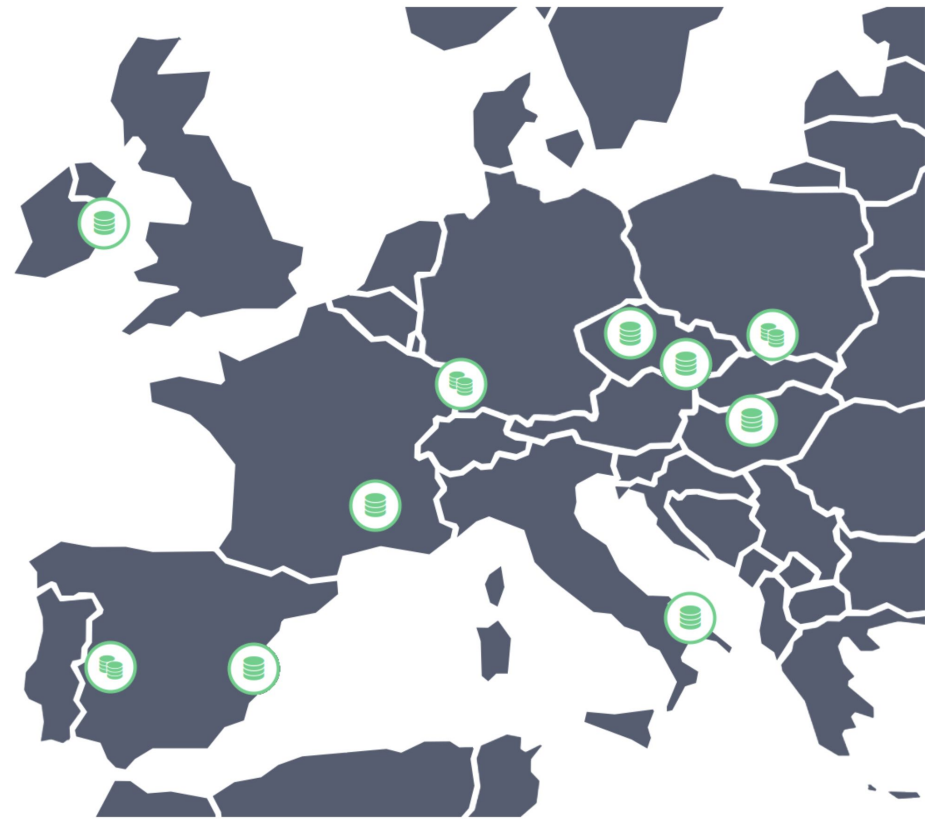


# EXEMPLARY DATA LIFECYCLE IN ONEDATA

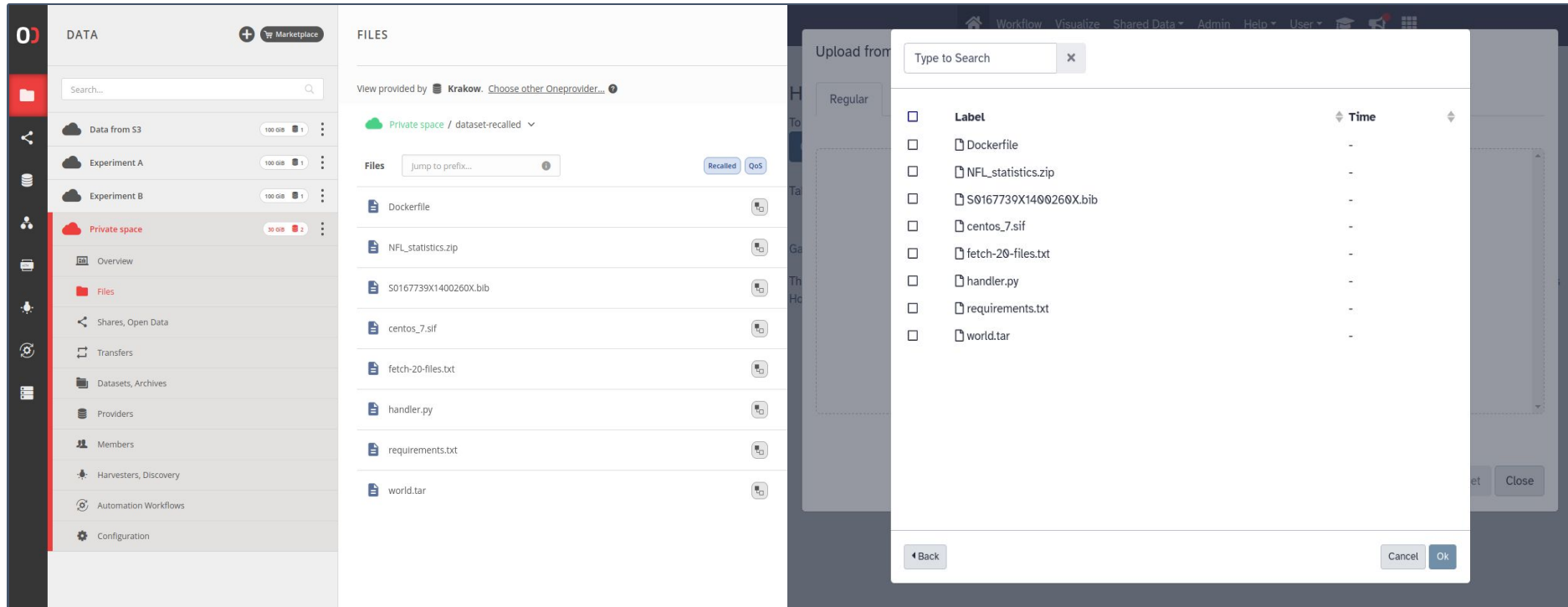


# ONEDATA INSTANCES

- Between 5 and 10 active Zones in Poland and EU (depending on project lifecycles).
- Several instances not maintained by us.
- DataHub (on the map), long haul project:
  - **18** sites (Oneproviders)
  - **2255** data spaces
  - **~2.16PB** total storage size
  - **800+** users
- Archive for Polish National Museums:
  - **5PB** of data — the current phase
  - **10PB** of data — target scale
  - **~100M** files



# ONEDATA & GALAXY INTEGRATION



*Import/export data from/to your spaces  
(using any Onedata ecosystem)*

# ONEDATA & GALAXY INTEGRATION

**Create a new storage location for your data**

**Name \***

Label this new storage location with a name.

**Description** - optional

Provide some notes to yourself about this storage location - perhaps to remind you how it is configured, where it stores the data, etc..

**Onezone Domain**

Domain of the Onezone service (e.g. datahub.egi.eu) to connect to.

**Disable tls certificate validation?**

☐ No

Allows connection to Onedata servers that do not present trusted SSL certificates. SHOULD NOT be used unless you really know what you are doing.

**Space Name**

The name of the Onedata space where the Galaxy data will be stored. If there is more than one space with the same name, you can explicitly specify which one to select by using the format <space\_name>@<space\_id> (e.g. demo@7285220ecc636075ae5759aec7ad65d3cha8f9).

**Galaxy root directory**

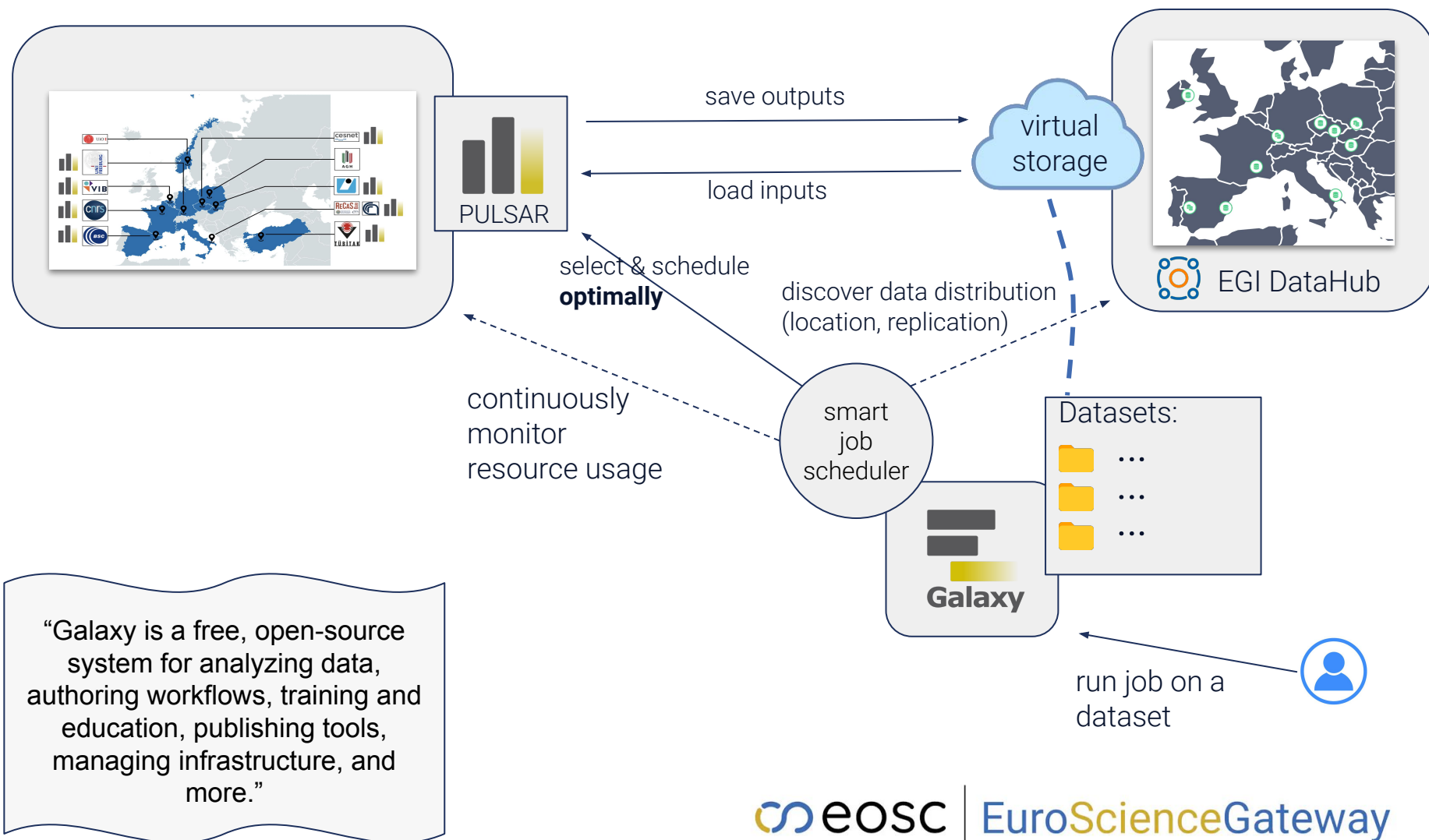
The relative directory path in the space at which the Galaxy data will be stored. If empty, the data will be stored in the space's root directory.

**Access Token**

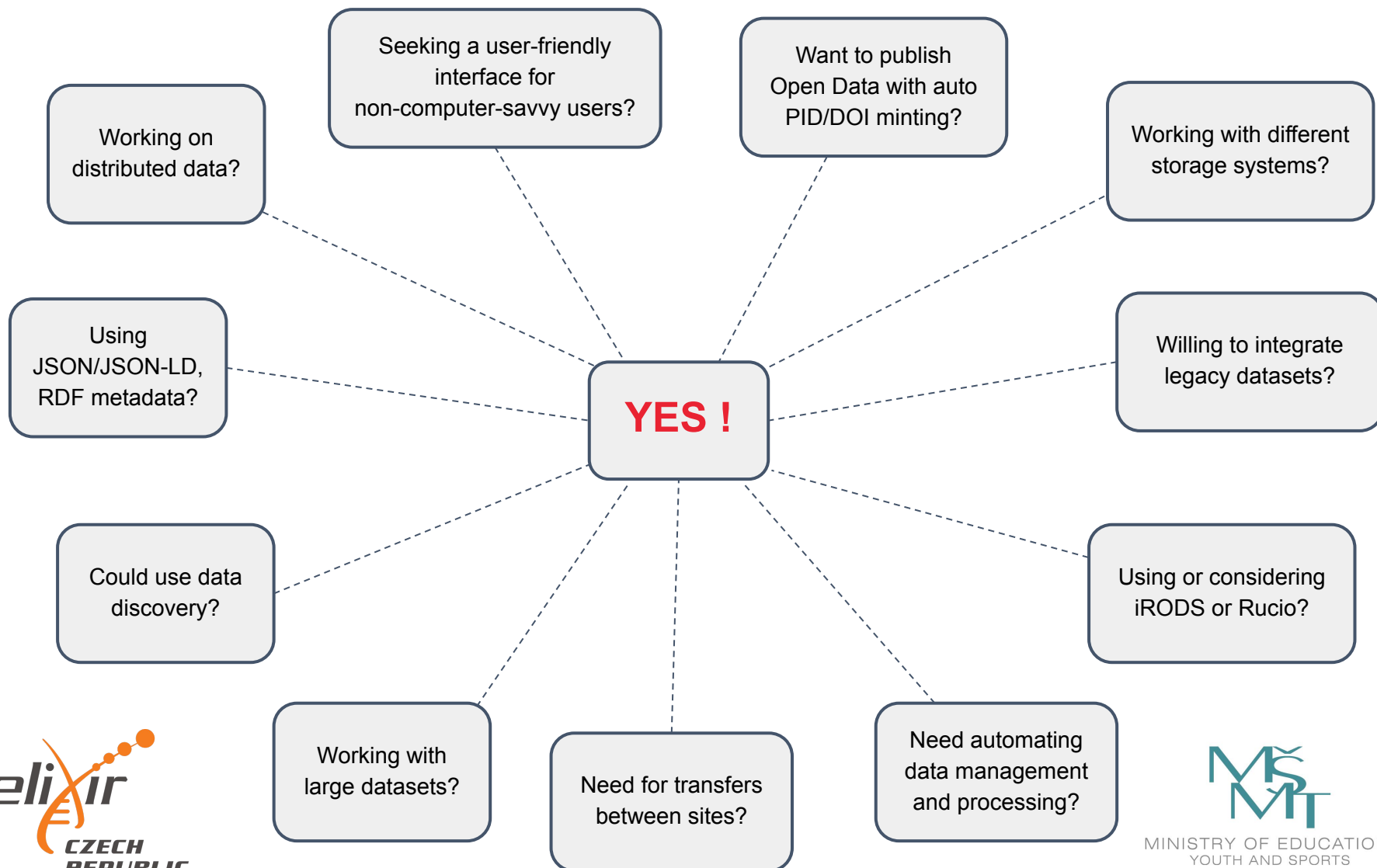
Your access token, suitable for REST API access in a Oneprovider service. Must allow both read and write data access.

*Configure a personal Onedata storage location for Galaxy user data (Object Store)*

# GALAXY + ONEDATA = WORKFLOWS THAT UNDERSTAND AND EMBRACE DATA DISTRIBUTION



# SHOULD YOU LOOK INTO ONEDATA?



# THANK YOU

Let's talk about your use-case!

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Onedata homepage — <https://onedata.org>

Onedata training — <https://onedata.org/training>

Contact me — [lukasz.opiola@onedata.org](mailto:lukasz.opiola@onedata.org)

*special offer: ask me for a personalized demo*



# ELIXIR CZ Annual Conference 2024

This conference was supported by the Ministry of Education, Youth and Sports, Czech Republic, through Grant LM2023055 for large research infrastructures and access to computing and storage facilities.