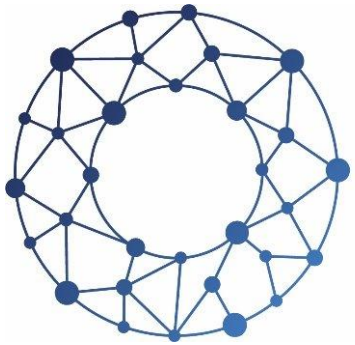

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Data transfer, synchronization and sharing solution for PSDI

Amali Pawula Hewage, Vasily Bunakov, Alexander Belozerov, Paul Wright, Stuart Meacham, Tom Underwood

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CS3 2025 Conference, LMU Munich

About Us

STFC (Science and Technology Facilities Council)

STFC is a part of UKRI (UK Research and Innovation). We operate large-scale facilities: ISIS neutron and muon source, Central Laser Facility, also co-own Diamond Light Source (synchrotron)

STFC do research beyond facilities:
in Particle Physics Department, Space Department, Scientific Computing Department

More about STFC Scientific Computing:
https://www.sc.stfc.ac.uk/

PSDI (Physical Sciences Data Infrastructure)

STFC Scientific Computing co-deliver PSDI with a few other partners in the UK

What PSDI do: engage with research communities, promote best practices, offer training, develop services

What is presented today is a part of PSDI service development: we foresee a need in Data Transfer, Synchronisation and Sharing (DTSS) solution

More about PSDI: www.psdi.ac.uk

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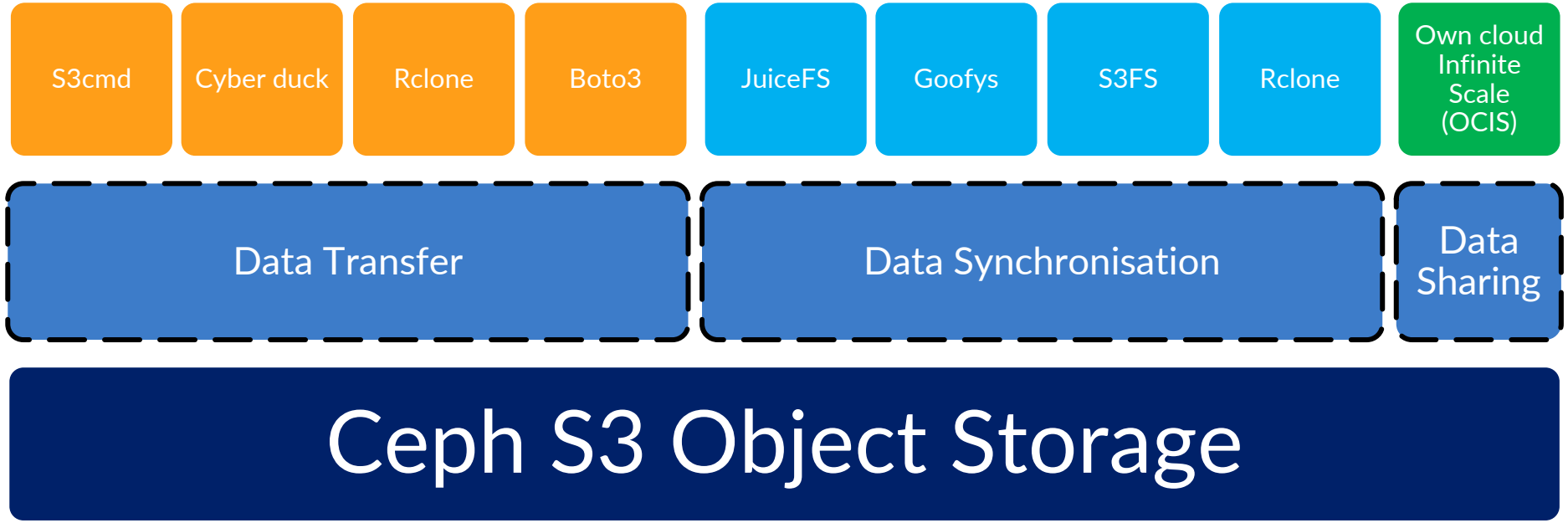
Overview of technology trials and use cases of PSDI DTSS Solution



Purpose of Experiments Each tool was assessed to understand its strengths and limitations in handling data workflows, including:

- **Data Transfer**: Efficiently moving large datasets between storage systems.
- **Data Synchronization**: Keeping data in sync across distributed locations or multiple devices.
- **Data Sharing**: Facilitating collaboration and secure data access for users across our network

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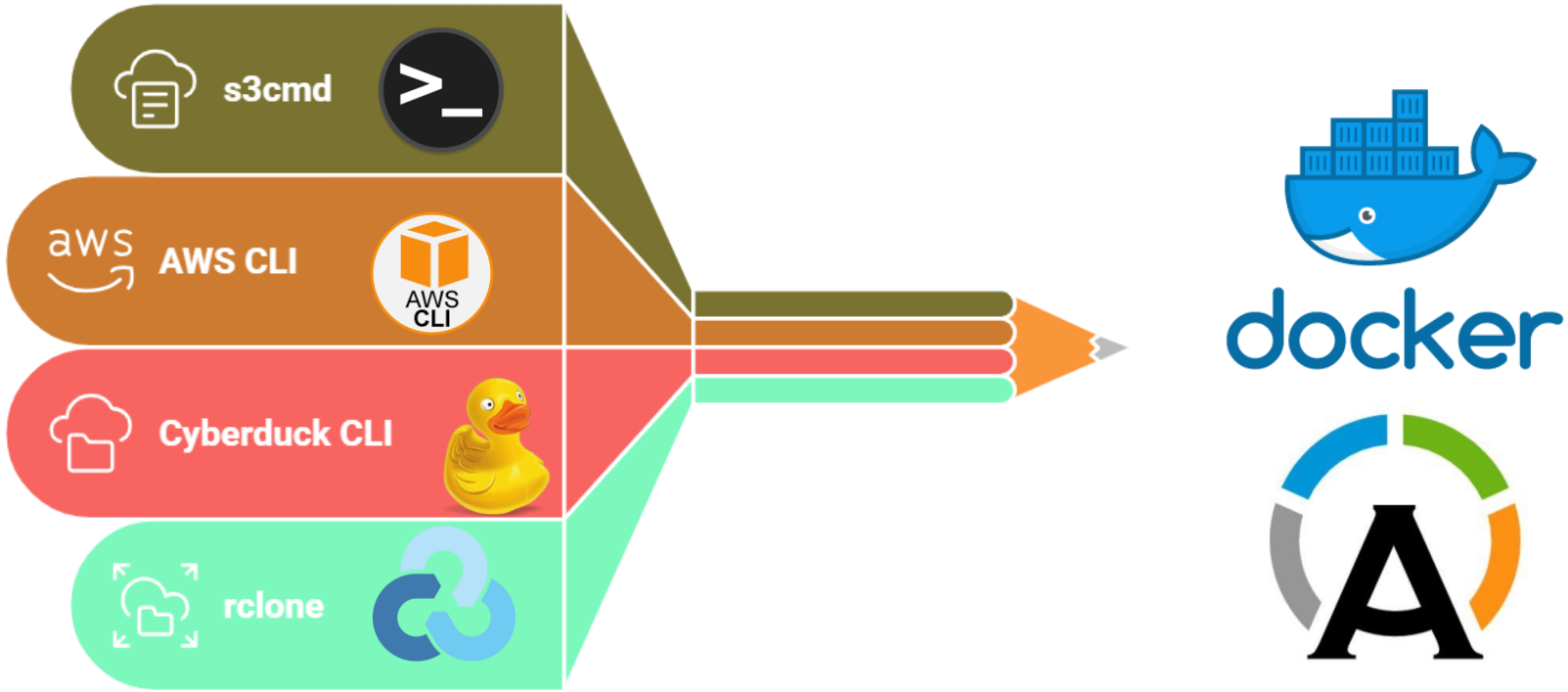
Docker & Apptainer containers for data transfer



- **Docker Format**
  - The Docker format is specifically designed for running the data transfer container using the Docker runtime and infrastructure
- **Singularity/Apptainer**
  - Apptainer is particularly well-suited for High-Performance Computing (HPC) environments and shared clusters where many users share the same resources, and security is a primary concern

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Data Sharing : OCIS

Enabling effective and secure data sharing among teams, departments, and even external partners

Why oCIS?

- Works well with **Ceph Object Storage**.
- Open-source and customizable.
- Supports **scalability & Kubernetes deployment**.

Use Cases:

- e.g., research data management, collaboration.
- Integrations with other PSDI components e.g., Indexing / Computational Notebooks

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Architecture & Deployment

4 Implement Policies

Use Apache Airflow to automate data retention and release policies.

3 Enable Access

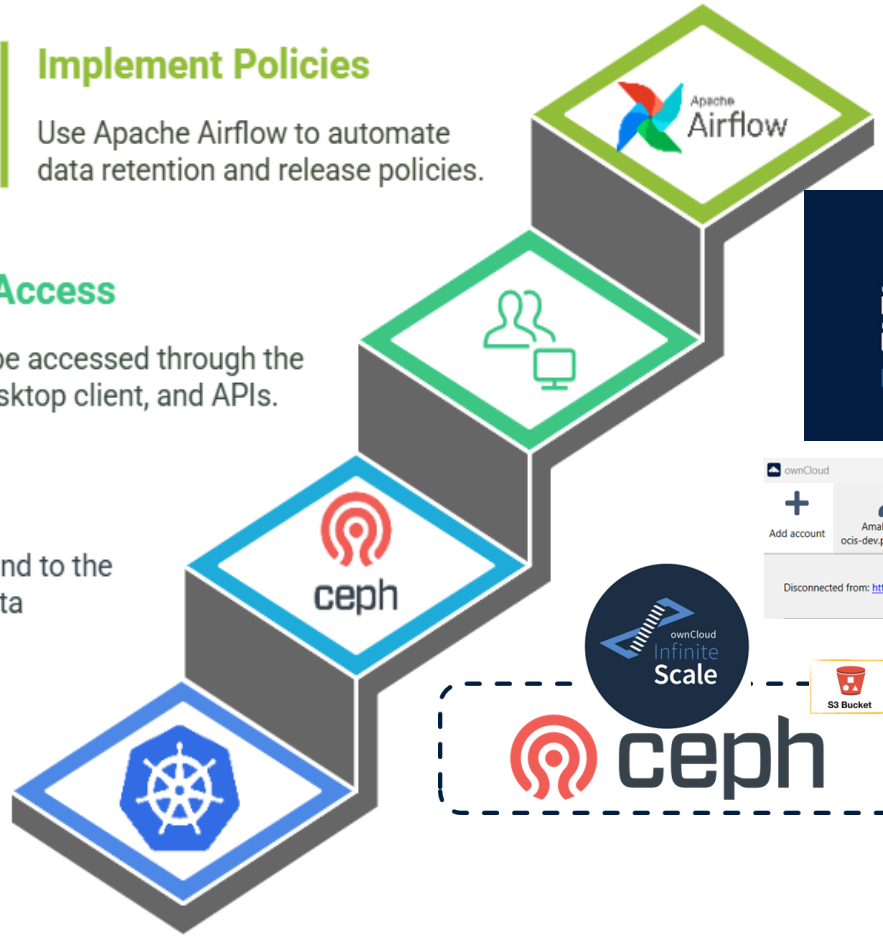
OCIS can be accessed through the web UI, desktop client, and APIs.

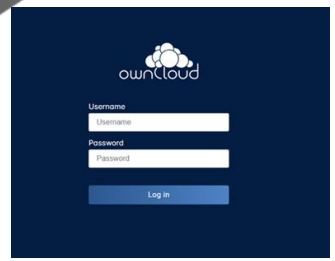
2 Integrate Ceph

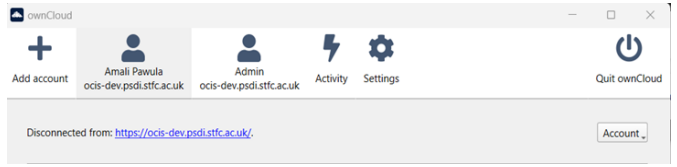
Connect the OCIS backend to the Ceph object store for data management.

1 Deploy OCIS

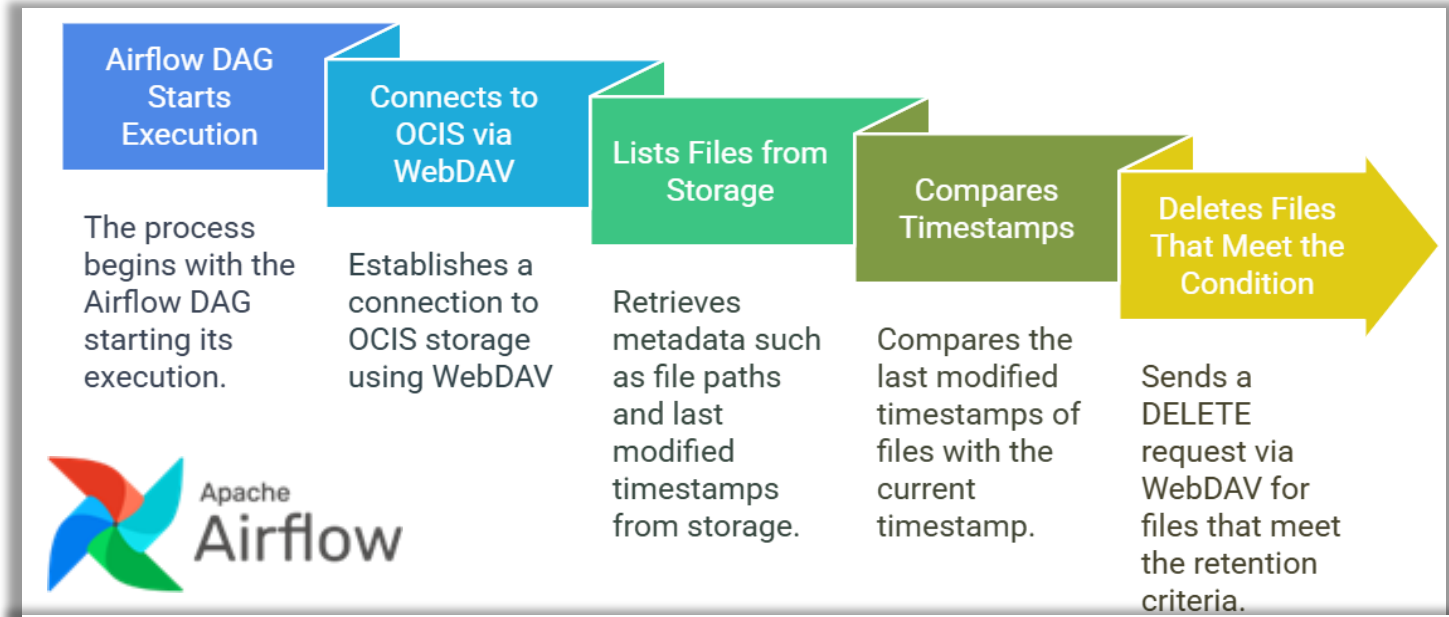
Deploy the OCIS service using Helm charts in the Kubernetes cluster.





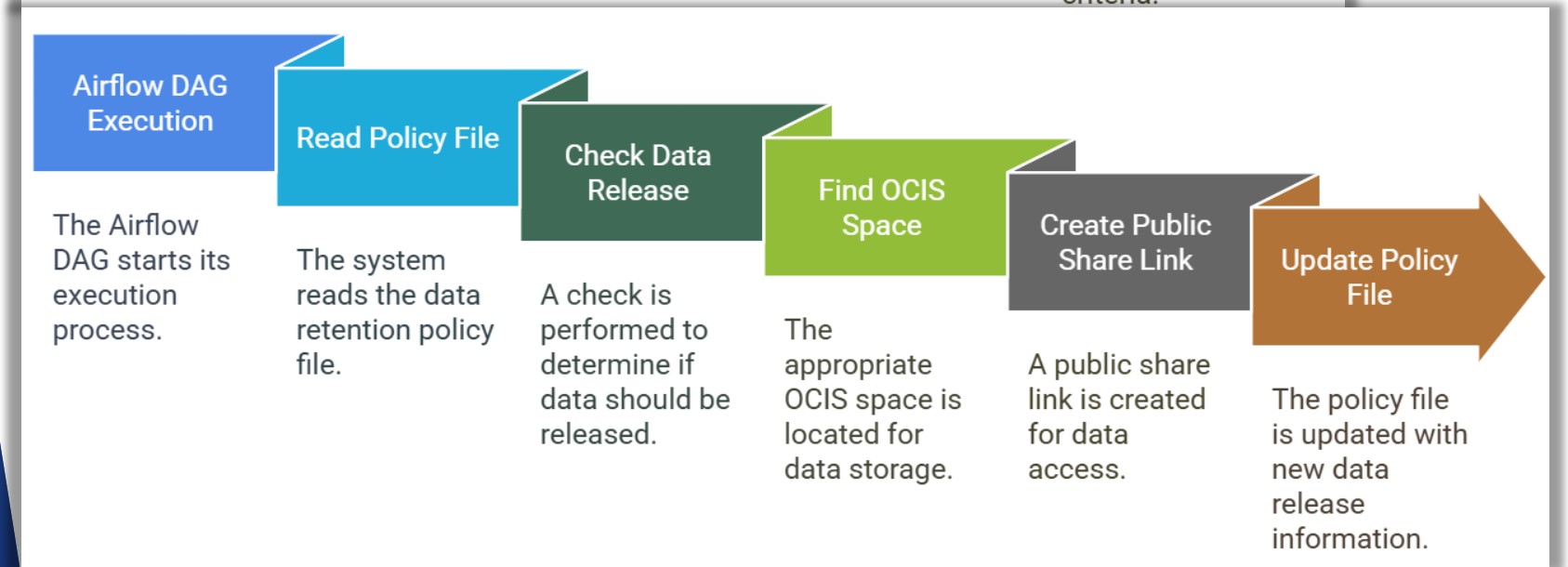


DTSS solution can be combined with workflows solution for defining (and operating) data policies



Data retention policy

- **WebDAV**



Data release policy

- **WebDAV**
- **LibreGraph**

Performance & Challenges

Ref: https://jmeter.apache.org/

Load Testing - Aggregate Report for Login Request with 100 concurrent users – GET HTTP Request

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Max	Error %	Throughput	Received KB/sec	Sent KB/sec
OCIS Login Request	100	78	70	105	125	169	62	179	0.00%	48.87586	69.16	24.1
TOTAL	100	78	70	105	125	169	62	179	0.00%	48.87586	69.16	24.1

Aggregate Report for File Uploading Request with 100 concurrent users – PUT HTTP Request

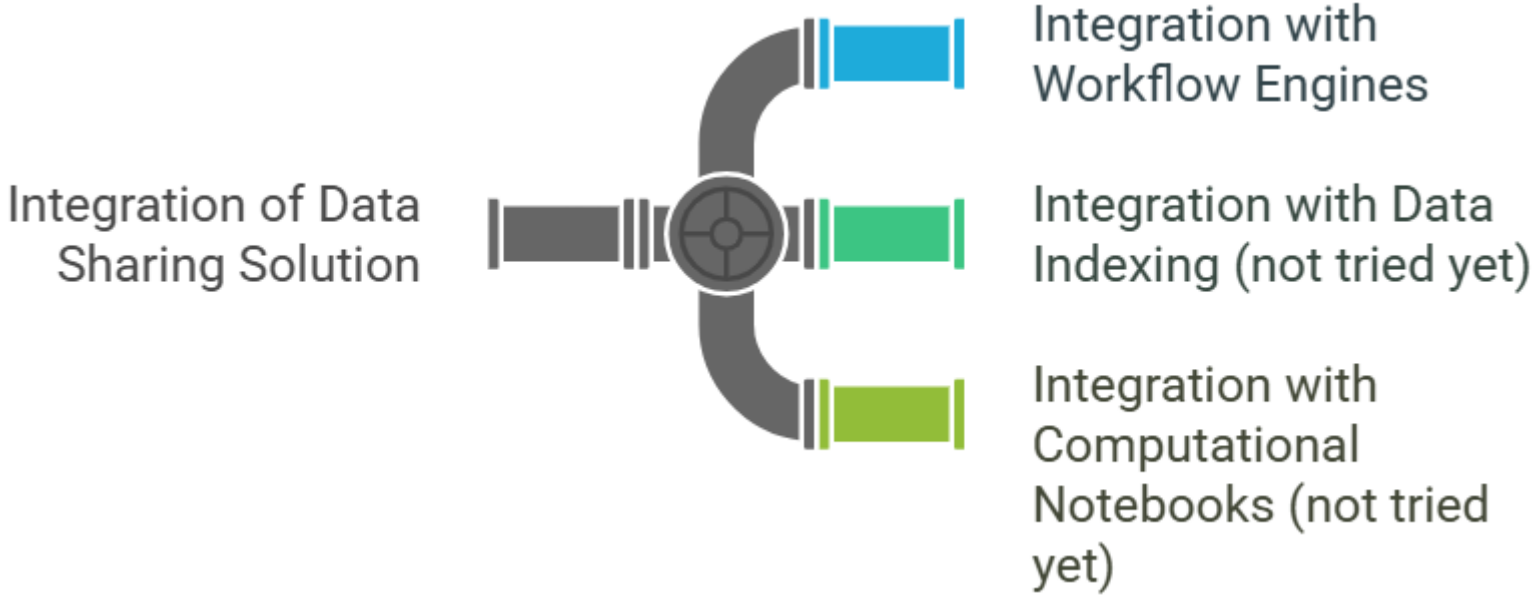
Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Max	Error %	Throughput	Received KB/sec	Sent KB/sec
OCIS File Upload Request	100	290	281	414	441	461	162	463	0.00%	19.33862	12.35	7.88
TOTAL	100	290	281	414	441	461	162	463	0.00%	19.33862	12.35	7.88

Aggregate Report for File Downloading Request with 100 concurrent users – GET HTTP Request

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Max	Error %	Throughput	Received KB/sec	Sent KB/sec
OCIS File Download Request	100	307	289	425	508	582	168	595	0.00%	30.75977	29.83	9.22
TOTAL	100	307	289	425	508	582	168	595	0.00%	30.75977	29.83	9.22

Conclusion and next steps

- Containerised DTSS tools offered on top of Ceph storage can be an interim DTSS solution for our project, especially with newer versions of Ceph that support multitenancy *)
- The adoption of a feature-rich data sharing solution like OCIS or OpenCloud will be of course advantageous, and we will keep looking into it
- Integrations of a data sharing solution with other components will be of interest:



*) See https://ceph.io/en/news/blog/2025/enhancing-ceph-multitenancy-with-iam-accounts/

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Thank you