Rucio and CS3API

To enable data management for the ScienceMesh Cloud

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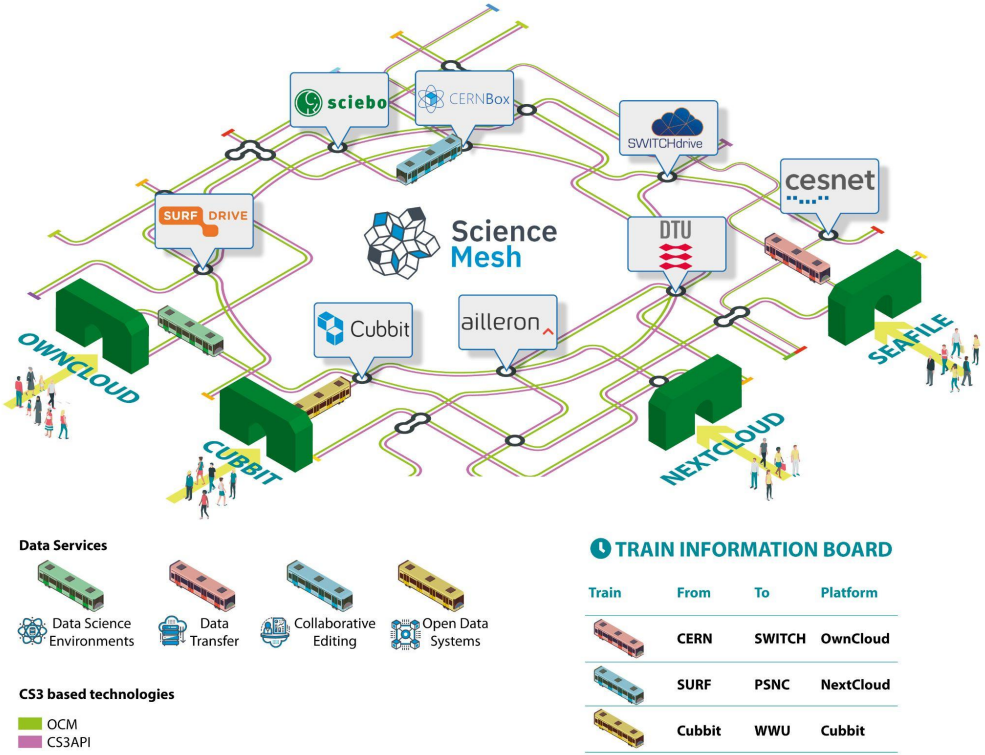
Rucio

Rucio serves the data needs of modern scientific experiments.
Large amounts of data, countless numbers of files, heterogeneous storage systems, globally distributed data centres, monitoring and analytics.

We want to use Rucio to orchestrate on demand data transfers both within the ScienceMesh and between a ScienceMesh site and a Grid Site.

CS3MESH4EOSC



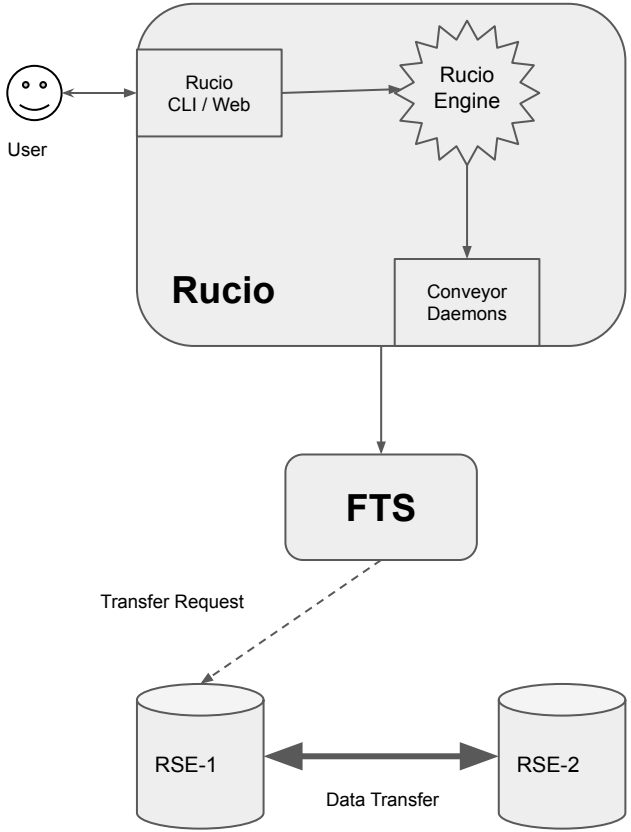
Source: https://cs3mesh4eosc.eu/science-mesh

The ScienceMesh aims to federate cloud sync and share services (CS3) between various siloed CS3 services across EU.

Data, applications, and computation are brought together to enable federated usage within and across scientific domains.

One of the requirements of CS3MESH4EOSC is on demand data transfers.

Data Transfer



Conveyor is a group of daemons to manage file transfers. E.g. submitter, poller, finisher etc.

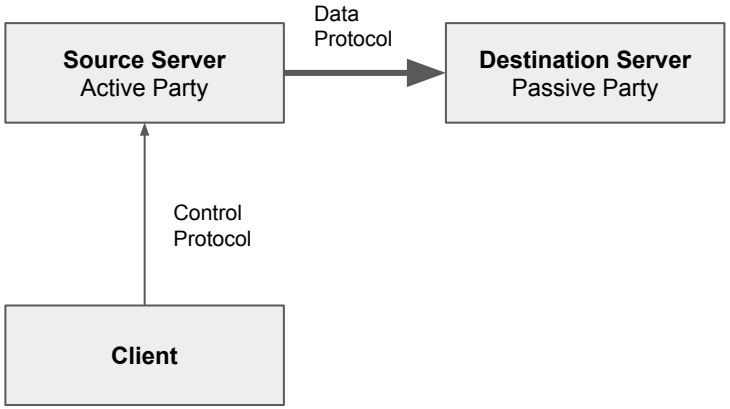
FTS3 is the service responsible for globally distributing the majority of the LHC data across the WLCG infrastructure.

RSE is the lowest addressable storage unit. And is an abstraction of storage protocols, priorities, and attributes of a storage system.

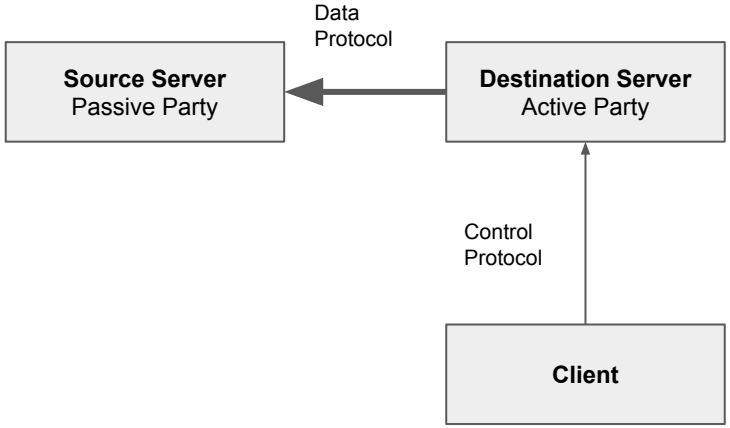
HTTP - Third Party Copy

HTTP-TPC is an extension to HTTP [RFC7231] that allows a client to request that data is copied from one server to another without the data passing through the controlling client.

The control protocol allows the client to request a file is transferred, terminate an ongoing transfer, receive progress and other diagnostic information about an on- going transfer, and learn when the transfer has finished.

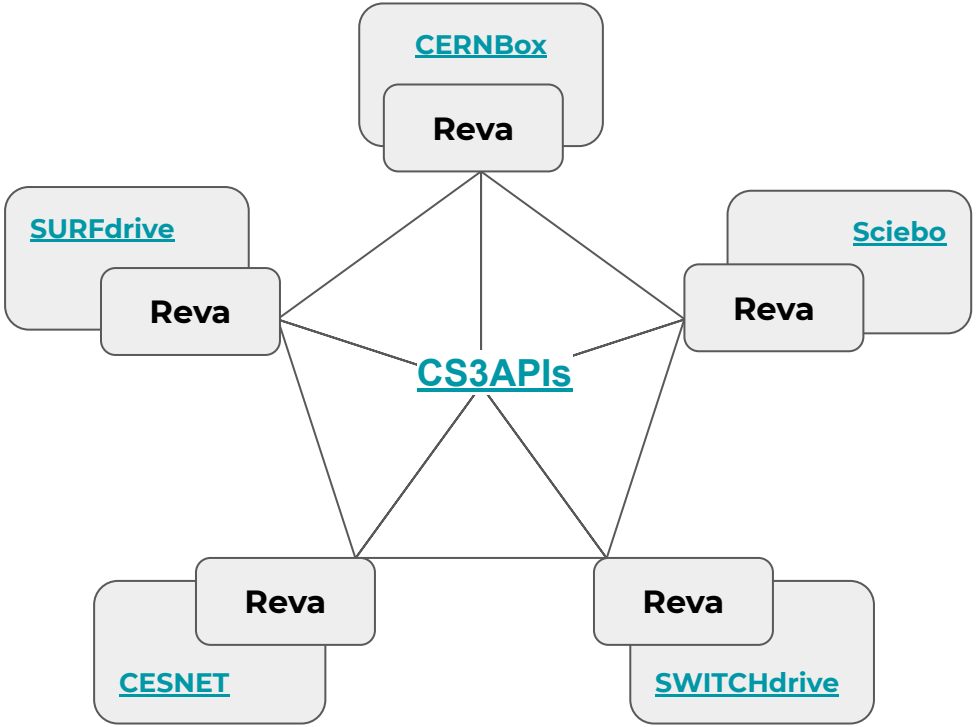


TPC - Push Mode



TPC - Pull Mode

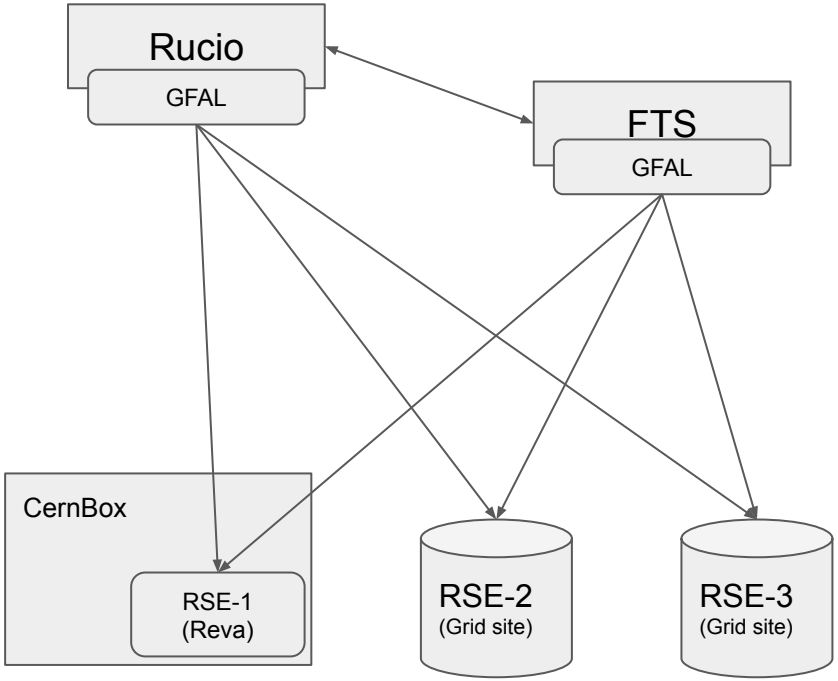
Reva and ScienceMesh



The Reva project aims to make cloud storage and application providers inter-operable through a common platform. The IOP component is deployed at each site to ensure compatibility across sites and being able to join the mesh.

CS3APIs is a set of Interfaces that allow to maximize portability of integrations across different platforms, application providers and data providers.

Reva as a RSE



GFAL-2 is a plugin based library for file manipulation supporting multiple protocols (Webdav/https, GridFTP, xroot, SRM).

Enable Reva to understand the control protocol and perform a data transfer according to the data protocol of HTTP TPC.

Extend HTTP-Plugin of the GFAL library and allow the multiplexer to use the custom flow for Science Mesh sites based on the url prefix (cs3).

Demo

We perform a HTTP TPC using the gfal-copy command.

GFAL (Grid File Access Library) is a C library providing an abstraction layer of the grid storage system complexity.
Protocol particularities within gfal are implemented using plugins.
Our example triggers the use of HTTP Plugin which uses libdavix.

```
gfal-copy -vf \
          --copy-mode=pull \
          cs3://reva:19001/remote.php/webdav/home/srcFile \
          cs3://reva2:17001/remote.php/webdav/home/dstFile
```

```
[root@1480da8e24fc build]# gfal-copy -vf --copy-mode=pull cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile
Copying 10737418240 bytes cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
event: [1629654517438] BOTH   GFAL2:CORE:COPY   LIST:ENTER
event: [1629654517438] BOTH   GFAL2:CORE:COPY   LIST:ITEM       cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
event: [1629654517438] BOTH   GFAL2:CORE:COPY   LIST:EXIT
event: [1629654517438] BOTH   http_plugin       PREPARE:ENTER   cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
event: [1629654517449] BOTH   http_plugin       PREPARE:EXIT    cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
event: [1629654517449] BOTH   http_plugin       TRANSFER:ENTER  cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
event: [1629654517449] BOTH   http_plugin       TRANSFER:TYPE   3rd pull
monitor: cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile 635102822 274255052 3175514112 5
monitor: cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile 467435520 299768217 4674355200 10
monitor: cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile 407378329 287263948 6110674944 15
monitor: cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile 379887616 297415475 7597752320 20
monitor: cs3://reva2:19001/remote.php/webdav/home/large-file cs3://reva2:17001/remote.php/webdav/home/largeFile 364234670 301622886 9105866752 25
event: [1629654552213] BOTH   http_plugin       TRANSFER:EXIT   cs3://reva2:19001/remote.php/webdav/home/large-file => cs3://reva2:17001/remote.php/webdav/home/largeFile
```

Todo

- Devising an authentication flow that allows full interoperability between WLCG sites and ScienceMesh sites.
- Retrieving storage-issued tokens from ScienceMesh sites.

Miscellaneous Info

Project Report

- **Google Summer of Code Work Product Submission**

Pull Requests

- Extending davix to communicate with a reva server via HTTP Protocol:
  - cern-fts/davix/pull/72
- Configuring the GFAL library to utilise the davix extension when requests are made to a Reva server.
  - cern-fts/gfal2/pull/7
- Implementing logic inside Reva to respond to Http TPC requests from the Reva server.
  - cs3org/reva/pull/2007

Special Mentions

I am grateful to my mentors and

- **Mihai Patrascoiu, Steve Murray, Joao Lopes** from the FTS team
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- **Mayank Sharma, Benedikt Ziemons and Thomas Beerman** from Rucio

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Thank you ☺