



The first experience of using Rucio to manage SPD data

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About Rucio

Rucio is an open-source software framework that provides functionality for data management and access in a distributed storage environment. Rucio also provides protection against data loss and speed up access to data through a controlled number of replicas.

Currently, the Rucio system can be used to:

- organize data in a hierarchical structure for easy navigation and management;
- unified interaction of a heterogeneous network and storage infrastructure;
- distribute data for storage;
- adaptive data replication and recovery;
- automated data transfer between storages;
- data lifecycle management;
- storage and management of metadata;
- provides metrics for monitoring data usage, system performance and the status of various components.

Current status [1]

At the moment, the required set of system components of two Rucio-servers are deployed in docker containers based on JINR cloud computing infrastructure:

- A test Rucio-server with a host certificate issued by Russian Data-Intensive Grid CA is located at <https://vm221-121.jinr.ru/> .

This server was used to development, test and debug. Also, testing and debugging of interaction with PanDA was carried out with this server as a part of production data generation. Also data replication to remote storage was tested.

- A production Rucio-server with a host certificate issued by JINR Grid CA is located at <https://spd-rucio.jinr.ru/> .

The main Rucio-server which will soon be tested and will used for the needs of the SPD collaboration.

Current status [2]

It is planned to have two copies of important data – at JINR and somewhere else. For this both servers have registered JINR and PNPI storages under EOS. JINR storage is used for uploading data, PNPI storage – for storing replicas.

For convenient work with large amounts of data, the following naming scheme is used (for example: 2050.DATA.250LT.minbias.27189.RAW.636763fd78df7d.0.)

Grouping tier	Field	Description	Example
0	[YEAR]	Main Scope - the year of data production	2050
1	[MC DATA]	Real data or simulated data	DATA
2	[energy][polarization]		250LT
3	[desc]	Short name of physics aim	minbias
4	[RunNumber]	Run number for DATA, ID for MC	27189
5	[data type]	EVGEN, SIMUL, RECO....	RAW
6	[DatasetUID]	unique ID of the dataset	636763fd78df7d
7	[Version]	for reprocessing	0

Integration with JINR SSO and SPD IAM [1]

The JINR SSO system allows JINR users to have one account on all services included in the JINR system.

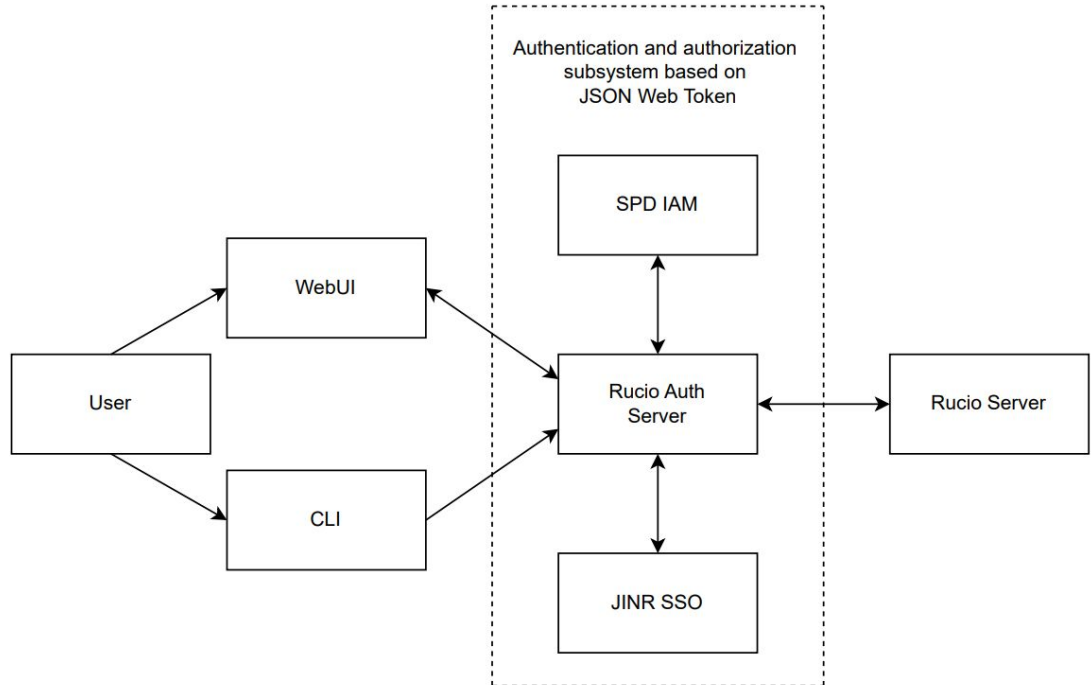
SPD IAM is used to authenticate users in Rucio using JSON Web Tokens as well as automate the registration of new users in Rucio.

There are two ways to interact with rucio-server:

- by using rucio-client;
- web interface of rucio-server.

Implementation with two Identity Providers (IdP):

- SPD IAM;
- JINR SSO.



Integration with JINR SSO and SPD IAM [2]



SCIENTIFIC DATA MANAGEMENT

Welcome to Rucio UI

Choose Login Method

X509 Certificate

Rucio Userpass

JINR SSO

SPD IAM

Optionally specify Rucio account name ...

JINR Single Sign-On

Reminder: you have agreed to comply with the JINR computing rules

Sign in with a JINR account

User name:

Password:

[Sign in](#)

[Recovery password](#)

[How to get SSO login for user.](#)
[Registration SSO service and application.](#)



INDIGO - DataCloud

Welcome to **indigo-dc**

Sign in with your indigo-dc credentials

[Sign in](#)

[Forgot your password?](#)

Or sign in with

[JINR SSO](#)

[Your institutional account](#)

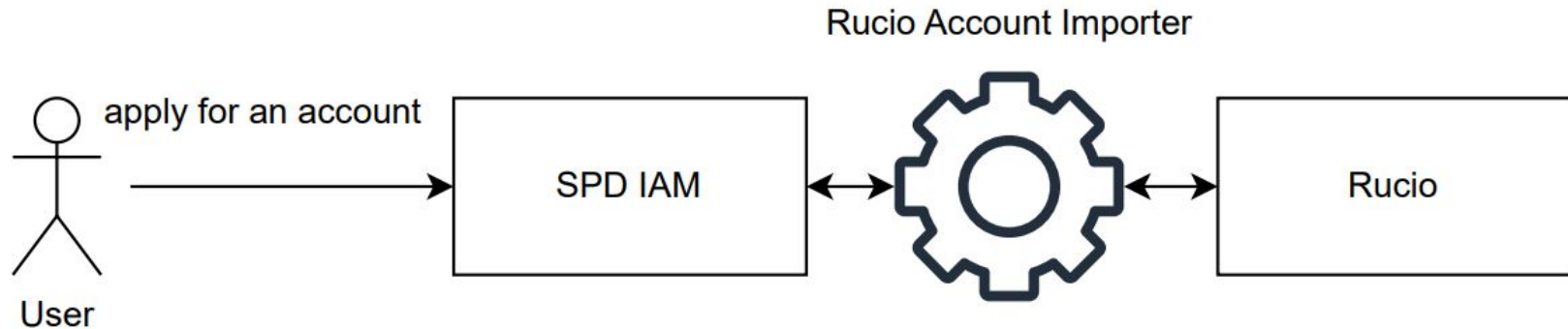
Not a member?

[Apply for an account](#)

Automation of user registration [1]

In Rucio, there is no way for the user to request registration. According to this, a registration is carried out manually by the administrator. In addition, the administrator adds identities necessary for authentication to user's Rucio account.

To avoid manual registration of users by the administrator of Rucio, a scheme was developed:



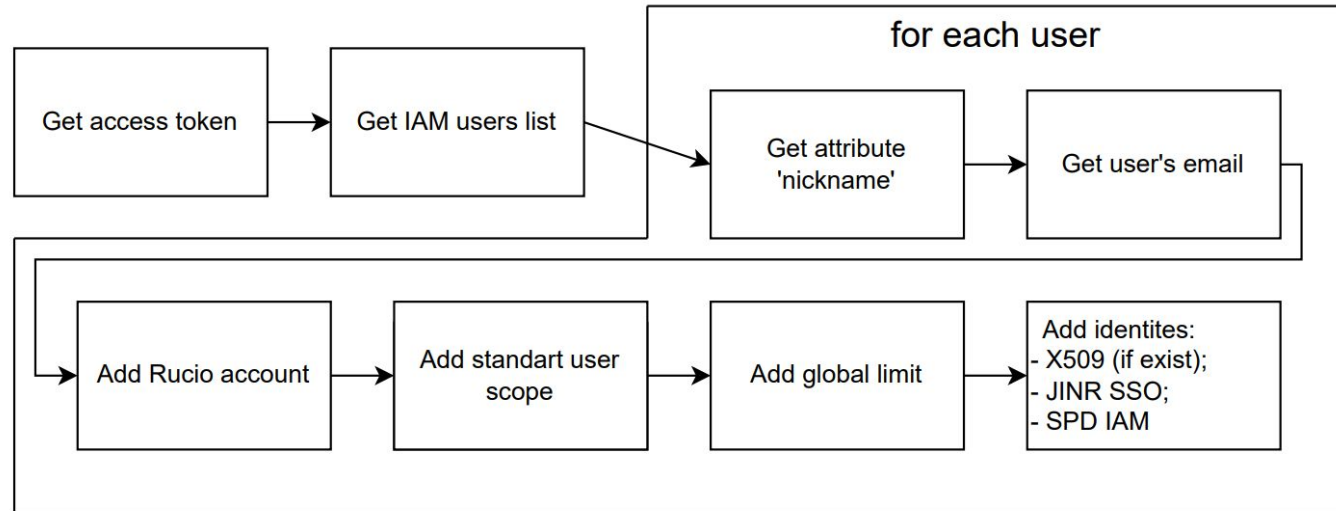
The Rucio Account Importer was implemented to import accounts and their user identification information from SPD IAM to Rucio.

Automation of user registration [2]

The Rucio Account Importer is set to run once a day in cron. The utility adds new accounts and updates the identity information of existing Rucio accounts if new IDs appear (for example, the user add his certificate to the SPD IAM.)

Used tools:

- IAM account API;
- SCIM API;
- Rucio API.



All information can be found at

https://git.jinr.ru/spd/spd-dc/rucio/ddm-utils/-/tree/dev/rucio_account_importer

Stats about SPD data

Currently, Rucio is used for mass production of SPD. During production, we tested interaction of PanDA and Rucio in various forms as well as different data organisation.

The following statistic were collected from files and datasets obtained during data generation.

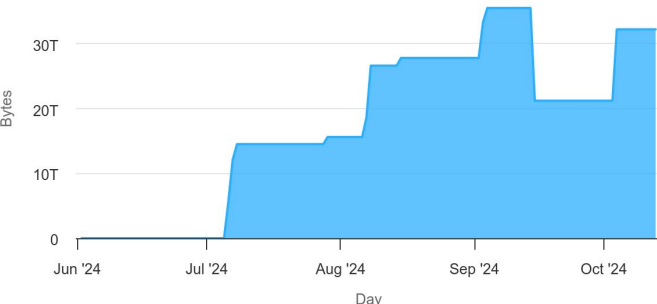
scope name	jeditest	archive	2024
total files	24302	7018	27444
files under rules	861	7018	27444
total datasets	278	551	8
size	~ 13 TB	~ 7 TB	~ 20 TB

Production data generation

The scope jeditest was used to test the interaction of PanDA and Rucio.

Scopes 2024 and archive are significant data that appeared after the production.

JINR_SPD_LOCALGROUPDISK



Name	Account	RSE Expression	Creation Date	Remaining Lifetime	State	Locks OK	Locks Replicating	Locks Stuck
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.log	panda	JINR_SPD_LOCALGROUPDISK	2024-08-07T07:55:11.000Z	-	OK	5006	0	0
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.P	panda	JINR_SPD_LOCALGROUPDISK	2024-08-07T07:55:12.000Z	-	OK	5000	0	0
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.S	panda	JINR_SPD_LOCALGROUPDISK	2024-08-07T07:55:12.000Z	-	OK	5000	0	0
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.1.R	panda	JINR_SPD_LOCALGROUPDISK	2024-08-15T09:07:38.000Z	-	OK	1426	0	0
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0	panda	JINR_SPD_LOCALGROUPDISK	2024-09-26T11:43:57.000Z	-	OK	23	0	0
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.1.log	panda	JINR_SPD_LOCALGROUPDISK	2024-09-26T11:44:52.000Z	-	OK	1451	0	0
2024:2024.MC.27GeV.test-minbias.00001.RECO.2.log	panda	JINR_SPD_LOCALGROUPDISK	2024-10-02T12:36:46.000Z	-	OK	4785	0	0
2024:2024.MC.27GeV.test-minbias.00001.RECO.2.R	panda	JINR_SPD_LOCALGROUPDISK	2024-10-02T12:36:46.000Z	-	OK	4753	0	0

Replication to PNPI storage

It is planned to have two copies of important data – origin data at JINR and replicas at PNPI.

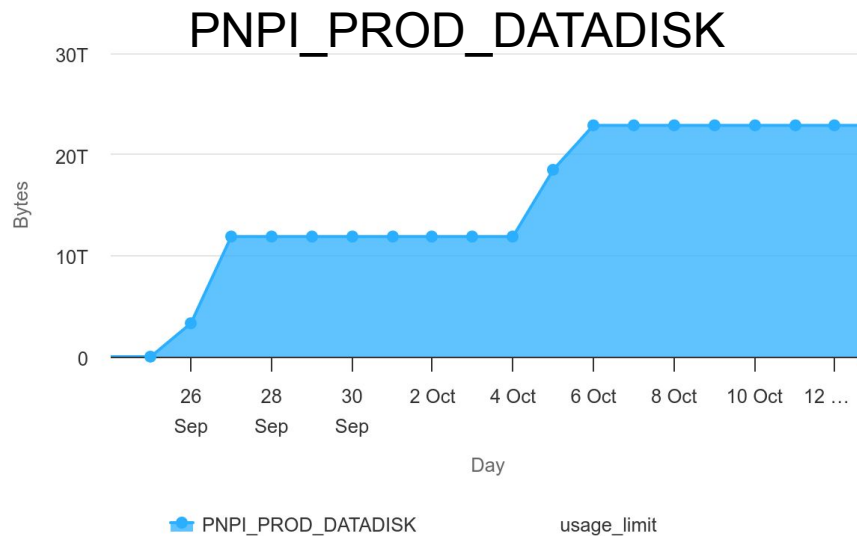
Two stages of replication:

- creates replication rules manually (after the first round of production data generation);
- replication rules were created by subscription (during the second round of production data generation).

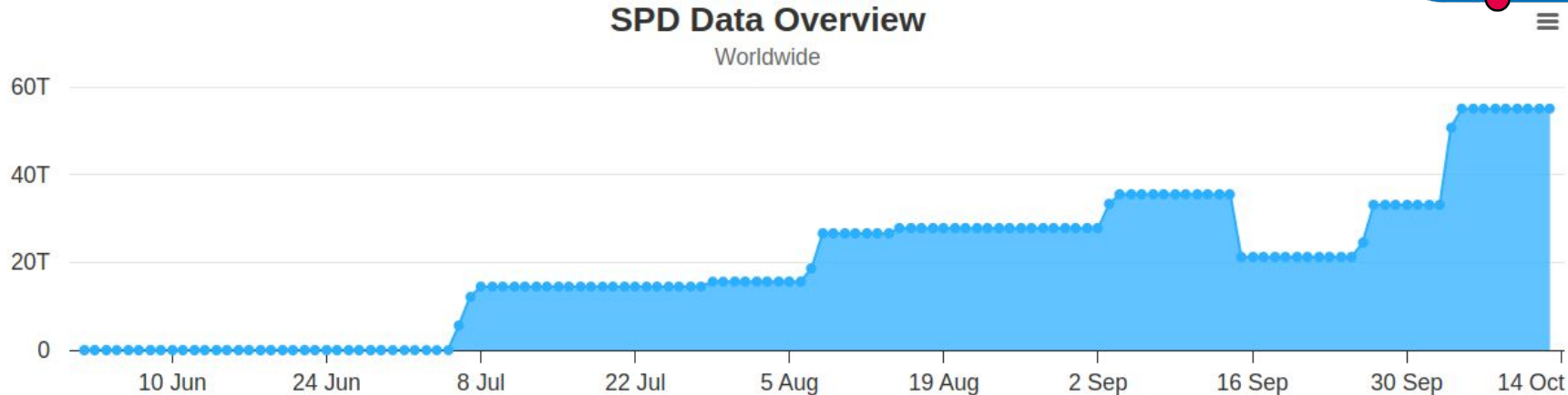
Name	Account	RSE Expression	Creation Date	Remaining Lifetime	State	Locks OK	Locks Replicating	Locks Stuck
2024:2024.MC.27GeV.test-minbias.00001.RECO.2.R	panda	PNPI_PROD_DATADISK	2024-10-02T12:39:47.000Z	-	STUCK	4741	0	12
2024:2024.MC.27GeV.test-minbias.00001.RECO.2.log	panda	PNPI_PROD_DATADISK	2024-10-02T12:39:46.000Z	-	STUCK	4769	0	16
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0	panda	PNPI_PROD_DATADISK	2024-09-26T12:41:18.000Z	-	SUSPENDED	8	0	15
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.1.log	panda	PNPI_PROD_DATADISK	2024-09-26T12:40:58.000Z	-	SUSPENDED	1429	0	22
2024:2024.MC.27GeV.test-minbias.00001.RECO.6f25043e-689f-40f7-951f-ba6e0c9f4d14.1.R	panda	PNPI_PROD_DATADISK	2024-09-26T12:40:38.000Z	-	SUSPENDED	537	0	889
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.S	panda	PNPI_PROD_DATADISK	2024-09-26T12:39:55.000Z	-	SUSPENDED	4982	0	18
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.P	panda	PNPI_PROD_DATADISK	2024-09-26T12:39:10.000Z	-	SUSPENDED	4977	0	23
2024:2024.MC.27GeV.test-minbias.00001.SIMUL.6f25043e-689f-40f7-951f-ba6e0c9f4d14.0.log	panda	PNPI_PROD_DATADISK	2024-09-26T12:36:57.000Z	-	SUSPENDED	4987	0	19

Results of replication

- 20 TB in the form of replicas is stored on the remote storage;
- identified bad files;
- tested the FTS;
- 112 MiB/s approximate transmission speed



SPD data management



- At the moment, the files and datasets in scopes 2024 are stored indefinitely. Original files are stored in JINR storage, replicas – in PNPI storage.
- Scope archive is stored indefinitely only in JINR storage.
- Files and datasets in the scope jeditest were uploaded to the JINR storage and stored there. After the expiration of the lifetime in the specified lifetime model this data were deleted automatically. The file deletion rate in the current configuration is approximately 16 files per second.

Future plans

- Monitoring system – implementation of a monitoring system to monitor the state of the system and its performance, as well as user activity and storages status.
- Naming convention – implementation of naming convention in Rucio.
- Lifetime model – reviewing and adding a model to manage the lifetime of different data.
- User policy – dividing users into groups and reviewing the allowed actions for these groups.
- Testing production rucio-server – full testing of basic functionality such as authentication, data upload and download, replication, adding rules by user and automatically with subscription, etc.
- Production data generating – testing and debugging of interaction with PanDA with production server as a part of production data generation.
- Switching from the test server to production – enter to operation mode.

Thank you for your attention!