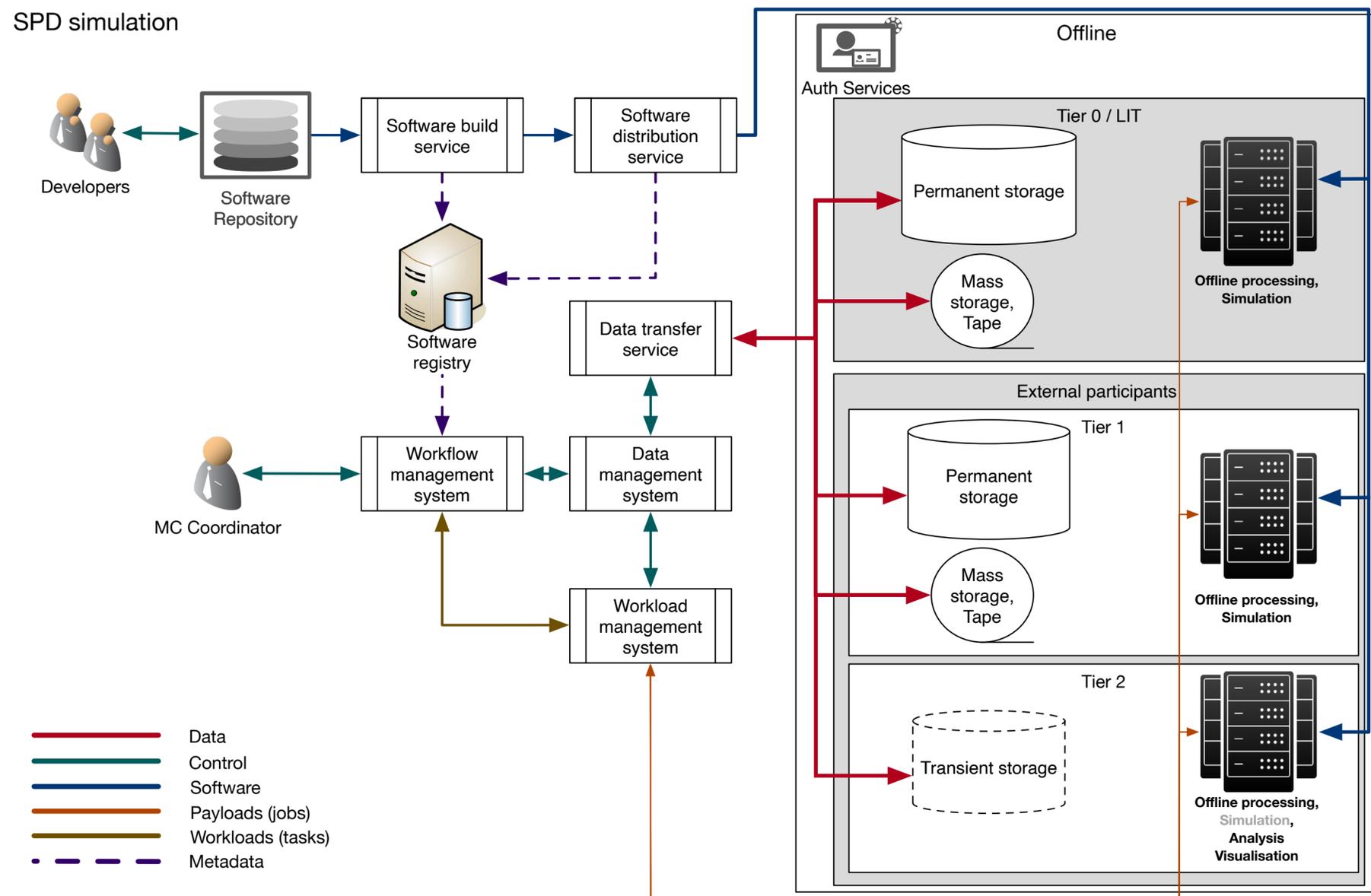


Status of the offline computing

Artem Petrosyan (MLIT JINR)
VII SPD Collaboration Meeting, Almaty, Kazakhstan
May 23, 2024

Computing system components

- IAM — an entry point to all members of the computing services of the collaboration: stores user profiles, their roles and rights to perform certain actions
- CRIC information system — the main integration component of the computing system: contains info about all computing and storage resources, access protocols, entry points, and many other things in one place and distributes this info via API to all other components mentioned below
- PanDA WFMS/WMS — manages data processing at the highest level of chains of tasks and datasets or periods and campaigns, finds the best computing resource for task to be executed on, manages individual jobs (usually 1 job means 1 input file) processing
- Rucio DMS — responsible for data management, including data catalog, data integrity and data lifetime management strategies
- FTS DTS — enables massive data transfers



Identity and Access Management service (IAM)

- The INDIGO Identity and Access Management Service provides a layer where identities, enrollment, group membership and other attributes and authorization policies on distributed resources can be managed in an homogeneous way, supporting identity federations and other authentication mechanisms (X.509 certificates and social logins).
- The IAM service has been successfully integrated with many off-the-shelf components like Openstack, Kubernetes, Atlassian JIRA and Confluence, Grafana and with key Grid computing middleware services (FTS, dCache, StoRM).
- Deployment and tuning of the SPD IAM was performed in April 2024
 - IAM service comes to replace VOMS service, which will be phased out
 - All user records were transferred from VOMS to IAM
 - IAM service implements OIDC (Open ID Connect) authentication mechanism, now users can use middleware services without having to generate X.509 user proxy certificates every day
 - IAM keeps the possibility to generate proxy for the services which have not yet migrated to OIDC
 - SSO authentication mechanism configuration is now ongoing, once done IAM will be fully integrated into security perimeter of the Institute
 - We plan to integrate IAM with JINR HR database to enable “auto registration” for members of the SPD collaboration

Identity and Access Management service (IAM)



INDIGO - DataCloud

Welcome to **indigo-dc**

Sign in with your indigo-dc credentials

Sign in

[Forgot your password?](#)

Or sign in with

Your X.509 certificate

JINR SSO

Your institutional account

Not a member?

Apply for an account

You have been successfully authenticated as
CN=Artem Petrosyan,OU=jinr.ru,OU=users,O=RDIG,C=RU

Users						
Search..						Show all
Pic	Name ^	Active	E-mail	Created	Groups	Actions
	Admin User	●	admin@iam.test	5 days ago		
	Aleksandr Vladimirovich	●	baranov@jinr.ru	2 days ago	spd.nica.jinr/VO-Admin spd.nica.jinr	
	Alexey Konak	●	konak@jinr.ru	2 days ago	spd.nica.jinr/production spd.nica.jinr	
	Alexey Zhemchugov	●	zhemchugov@jinr.ru	2 days ago	spd.nica.jinr spd.nica.jinr/VO-Admin	
	Andrey Kiryanov	●	Kiryanov_AK@pnpi.nrcki.ru	2 days ago	spd.nica.jinr spd.nica.jinr/production	
	Andrey Zarochentsev	●	andrey.zar@gmail.com	2 days ago	spd.nica.jinr	
	Artem Ivanov	●	arivanov@jinr.ru	2 days ago	spd.nica.jinr	
	Artem Petrosyan	●	artem.petrosyan@jinr.ru	2 days ago	spd.nica.jinr/production spd.nica.jinr spd.nica.jinr/pilot spd.nica.jinr/VO-Admin	
	Danila Oleynik	●	danila@jinr.ru	2 days ago	spd.nica.jinr spd.nica.jinr/production spd.nica.jinr/VO-Admin	
	Dzmitry Yermak	●	dmierk@hep.by	2 days ago	spd.nica.jinr	

1 2

[+ Add User](#)

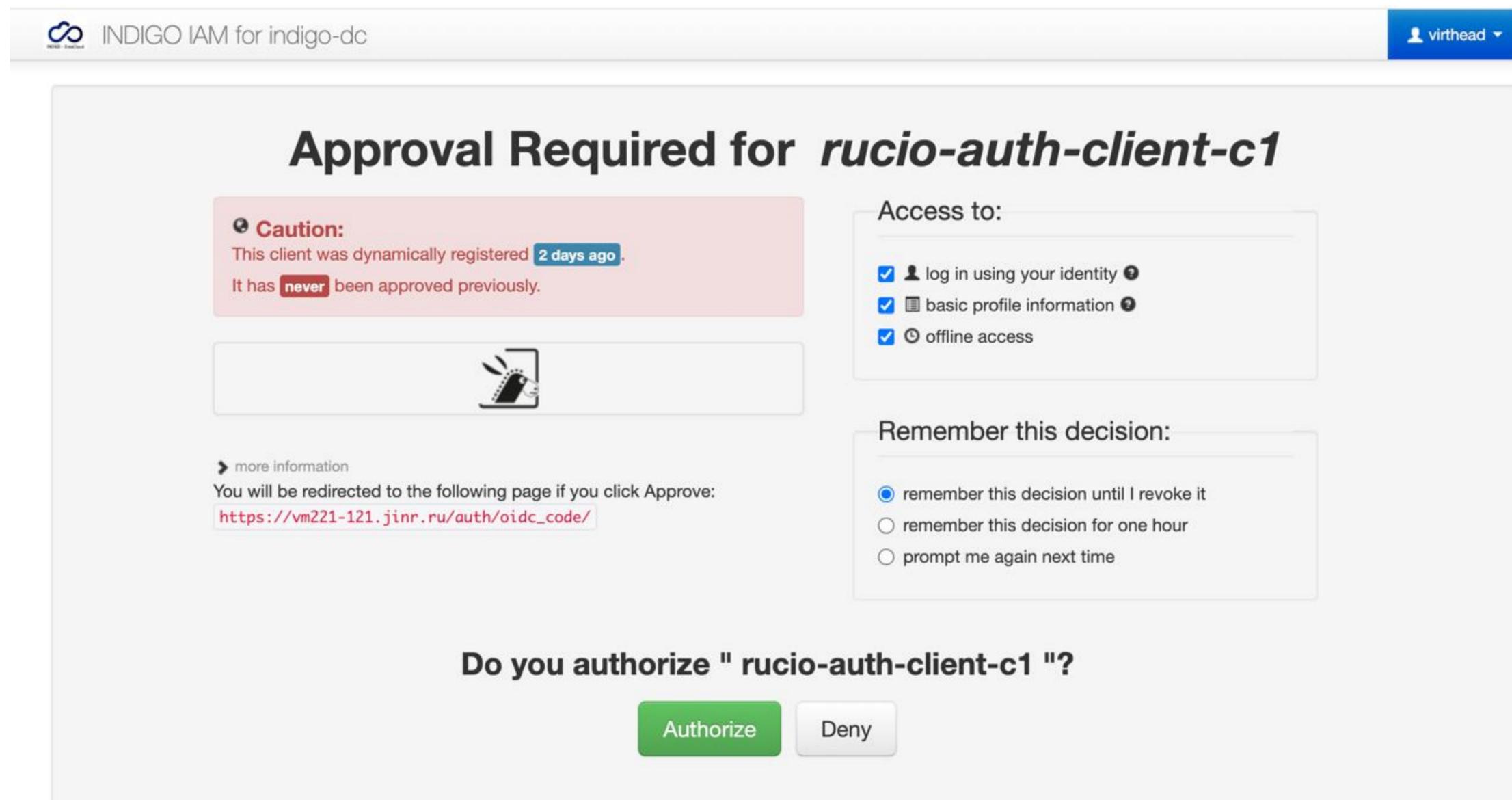
Identity and Access Management service (IAM)

RUCIO

SCIENTIFIC DATA MANAGEMENT

Please copy-paste the following code to the open terminal session with Rucio Client in order to get your access token:

```
zapkH7z29HFAr9bSUMgUiq1mux8o88VaT0XegU4dwuhgSsxQ9H
```



INDIGO IAM for indigo-dc virthead

Approval Required for *rucio-auth-client-c1*

Caution:
 This client was dynamically registered 2 days ago.
 It has never been approved previously.



➤ more information
 You will be redirected to the following page if you click Approve:
https://vm221-121.jinr.ru/auth/oidc_code/

Access to:

- log in using your identity
- basic profile information
- offline access

Remember this decision:

- remember this decision until I revoke it
- remember this decision for one hour
- prompt me again next time

Do you authorize " rucio-auth-client-c1 "?

Authorize
Deny

Files Transfer Service (FTS)

- A FTS service was deployed in December 2023 in LIT
- Several connectivity and performance tests between EOS instances at JINR and PNPI were performed during winter (more details in report of Andrey Kiryanov)
- We plan to use FTS service to organize data replication between data centers of our collaboration and to work with tape robots
- FTS can be used as directly via either command line tools or via API
- We expect that most of the transfers through FTS will be managed by Rucio data management service
- FTS supports OIDC authentication, migration to this authentication mechanism is in our nearest plan

Job id	Submit time	Job state	V0	Source SE	Destination SE
acf75c80-a2f5-11ee-af19-02009f5ddd7a	2023-12-25T07:17:35Z	FINISHED	spd.nic:	https://mss3.pnpi.nw.ru	https://eos.jinr.ru
102814e4-a2f5-11ee-af19-02009f5ddd7a	2023-12-25T07:13:12Z	FINISHED	spd.nic:	https://eos.jinr.ru	https://mss3.pnpi.nw.ru
a2ceb844-a2f4-11ee-af19-02009f5ddd7a	2023-12-25T07:10:08Z	FAILED	spd.nic:	https://eos.jinr.ru	https://mss3.pnpi.nw.ru
7d1979d6-a2f4-11ee-af19-02009f5ddd7a	2023-12-25T07:09:05Z	FAILED	spd.nic:	https://eos.jinr.ru	https://mss3.pnpi.nw.ru

Data Management Service (Rucio)

- Storage of JINR and PNPI were defined in Rucio
- SSO, IAM integration is done: users can log in using any preferable authentication method
- Definitions of rules, deletion and replication were performed
- Rucio command line and API client was deployed on CVMFS, now available to all users who work on luxi.jinr.ru
 - Users can use either voms-proxy-init or OIDC to authenticate
- Web UI is also available, integrated with JINR SSO and SPD IAM service
- Naming convention for production datasets to be stored in Rucio was defined

Rucio Web UI Examples

Rucio UI - Select Login Method

Welcome to Rucio UI

Choose Login Method

X509 Certificate

Rucio Userpass

JINR SSO

SPD IAM

Optionally specify Rucio account name ...

File Replica States

Show 10 entries

Filename
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10c
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000006.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000007.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000008.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000009.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000010.root

Rucio UI Monitoring Data Transfers (R2D2) Reports Admin

pattern OR name OR rule id Search

You are here: Search

Data pattern jeditest:* Search

Show 100 entries

DID
jeditest:jeditest.000001.simu.509
jeditest:jeditest.000001.simu.516
jeditest:jeditest.000001.simu.P.508
jeditest:jeditest.000001.simu.P.515
jeditest:jeditest.000001.simu.S.507
jeditest:jeditest.000001.simu.S.514
jeditest:jeditest.000002.reco.555
jeditest:jeditest.000002.reco.587
jeditest:jeditest.000002.reco.592
jeditest:jeditest.000002.simu.523
jeditest:jeditest.000002.simu.599
jeditest:jeditest.000002.simu.P.522
jeditest:jeditest.000002.simu.P.598
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000006.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000007.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000008.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000009.root
jeditest:s.jeditest.ba77c6a9-72e3-4643-8a4a-2f10ddb18149.000010.root

JINR_SPD_LOCALGROUPDISK

Rucio Command Line Client Usage Example

```
(1.31.7) lxui02:~ > rucio -a=virthead -S=OIDC --oidc-scope="openid profile offline_access" whoami
```

Please use your internet browser, go to:

https://vm221-121.jinr.ru/auth/oidc_redirect?jGZBdw9Dr9RpAIUhnBRPoV2

and authenticate with your Identity Provider.

Copy paste the code from the browser to the terminal and press enter:

```
1gbcRwo7V9DXJGBjIGPUuuqCTb7qIxwtwF5Rjw1vvUJt2NS9eB
```

```
status      : ACTIVE
account_type : USER
deleted_at  : None
updated_at  : 2023-12-08T08:33:48
account     : virthead
email      : artem.petrosyan@jinr.ru
suspended_at : None
created_at  : 2023-12-08T08:33:48
```

```
(1.31.7) lxui02:~ > rucio list-dids jeditest:*
```

SCOPE:NAME	[DID TYPE]
jeditest:jeditest.000001.simu.S.507	DIDType.DATASET
jeditest:jeditest.000002.simu.523	DIDType.DATASET
jeditest:jeditest.000001.simu.P.515	DIDType.DATASET
jeditest:jeditest.000001.simu.P.508	DIDType.DATASET
jeditest:jeditest.000001.simu.509	DIDType.DATASET
jeditest:jeditest.000002.simu.S.521	DIDType.DATASET
jeditest:jeditest.000001.simu.516	DIDType.DATASET
jeditest:jeditest.000002.reco.592	DIDType.DATASET
jeditest:jeditest.000002.reco.587	DIDType.DATASET
jeditest:jeditest.000001.simu.S.514	DIDType.DATASET
jeditest:jeditest.000002.reco.555	DIDType.DATASET
jeditest:jeditest.000002.simu.P.522	DIDType.DATASET

```
(1.31.7) lxui02:~ > rucio list-files jeditest:jeditest.000002.reco.587
```

SCOPE:NAME	GUID	ADLER32	FILESIZE	EVENTS
jeditest:r.jeditest.000002.reco.000019.root	C40C1058-463A-40C7-94D9-C3499E54C60C	ad:6b533501	264.000 B	
jeditest:r.jeditest.000002.reco.000026.root	81A095F5-8F57-4718-AD07-57EB6667C558	ad:b59f339e	264.000 B	
jeditest:r.jeditest.000002.reco.000021.root	E0F43754-3202-46AA-9D1C-3971257FB8FA	ad:1aec36cc	264.000 B	
jeditest:r.jeditest.000002.reco.000016.root	DD4F1D88-0B8D-4B47-8A3F-14A46F375015	ad:7ecf37a7	264.000 B	
jeditest:r.jeditest.000002.reco.000022.root	68037608-39E5-4950-80B8-A4437FE06D3B	ad:6c1d3761	264.000 B	
jeditest:r.jeditest.000002.reco.000017.root	591A393D-659B-499B-B55C-BFAB0EBDA247	ad:066e3658	264.000 B	
jeditest:r.jeditest.000002.reco.000023.root	C9C527FB-DEDD-43F1-B96D-3C12D5A3E374	ad:13fe321a	264.000 B	
jeditest:r.jeditest.000002.reco.000018.root	DEC7A499-59E8-4800-BFE9-613528BB57F1	ad:24f636ce	264.000 B	
jeditest:r.jeditest.000002.reco.000024.root	4DD72B12-5458-4BBD-8F4F-2A1866F933F5	ad:f6aa344b	264.000 B	

```
Total files : 9
Total size : 2.376 kB
```

```
(1.31.7) lxui02:~ > rucio list-file-replicas jeditest:jeditest.000002.reco.587 --pfns
```

```
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/22/51/r.jeditest.000002.reco.000016.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/54/a6/r.jeditest.000002.reco.000017.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/64/dd/r.jeditest.000002.reco.000018.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/3c/7e/r.jeditest.000002.reco.000019.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/ca/8d/r.jeditest.000002.reco.000021.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/01/5b/r.jeditest.000002.reco.000022.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/f5/3f/r.jeditest.000002.reco.000023.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/77/c9/r.jeditest.000002.reco.000024.root
root://eos.jinr.ru:1094//eos/nica/spd/localgroupdisk/rucio/jeditest/be/1a/r.jeditest.000002.reco.000026.root
```

Then files can be downloaded by any suitable command, for example: `rucio download`, `xrdcp`, or `eos cp`

Datasets naming convention

- Discussed during October and November 2023
- In order to ease metadata catalog navigation, data filtration, identification, etc., we propose the following naming convention for datasets (a set of files which represents results of organized calculations)
- Dataset name example:
2025.MC.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	[<u>DatasetUID</u>]	unique ID of the dataset	636763fd78df7d
7	[Version]	for reprocessing	0

Workflow Management System (PanDA)

- Successfully generated several samples of full chain MC (simu and reco) productions
 - Results stored on EOS
 - Metadata and data available through Rucio Web UI or using Rucio command line client
- Generation of larger samples in order to get more statistics is now on the way
- Ready to start sending jobs not only to JINR, but also to PNPI
- Since we now have running tasks it's time to deploy monitoring to allow users to check progress of running jobs, for the central production development of the production system interface can be also started
- PanDA also can work using JSON Web Tokens instead of X.509 certificates, we plan to migrate it to OIDC as well
- Now we run task by task, but PanDA allows to define whole pipeline for the process, there is an activity in this direction, as a result we expect to have a SPD MC process, which consists of several calculation steps, to be defined in one step

How do we now see central production process

- Physics coordinators prepare ideas of physical processes for which some amount of data needs to be generated and send a request to the production manager
- Production manager, should be a member of physics community of the experiment,
 - Prepares applied software, places all necessary scripts to the CVMFS in the prod folder, from which executables will be accessible by the middleware services
 - Runs some tests to check that everything seems to work as expected
 - Prepares a workflow and submits it to PanDA
 - Once the workflow is done, production manager will be informed by PanDA via email
 - Checks that results look the way how they expected to look like
 - Informs other members of physics community that data is ready and can be accessed via running command in Rucio client, for example `rucio list-dids generalprod:2025.MC.250LT.minbias`
 - During the process communicates with the offline computing system support in case of any problem
- At the moment we expect that users will only lookup and download data from Rucio, submission to PanDA at the moment is available only for production managers only

Central Database Server

- In order to optimize support efforts and concentrate services by their purpose, we initiated a dedicated DB server for our middleware services
- At the moment we have to support at least two RDBMS: Postgres and MySQL
 - Postgres
 - DBs of Rucio and Online Filter services already deployed there
 - PanDA DB will be deployed next
 - MySQL
 - IAM and CRIC DBs migration is planned after PanDA migration

Virtual Machines Operations

- JINR Certification Authority (CA)
 - All our machines already migrated from the Russian Data-Intensive Grid (RDIG) CA host certificates to the JINR CA host certificates, we expect, that, at some point, certificate will be issued automatically at the VM initiation or at the first boot, it will dramatically reduce support of certificates operations
- CentOS 7 phase out
 - CentOS 7 life cycle is over, there are 3 services which have to be migrated to AlmaLinux 9
 - For PanDA the process will be accompanied by a database migration to the central DB server
 - Harvester re-generates the DB on the first start and reads configuration from CRIC, so, the service will be simply deployed and configured at the new machine
 - CRIC — we invited author of the system, Alexey Anisenkov, he visited LIT in February, we agreed to discuss a detailed development plan and his level of involvement during the summer, at the moment there is no CRIC version for Alma 9. Possibility of migration to Postgres will be one of the topics to discuss.

Plans

- In terms of the whole system operation we are going to concentrate our efforts on the load increase (more jobs, more files, more transfers, more automation) and adopt our services to this load step by step via identifying and getting rid of bottle necks
- Generate several billions of events through the system during the rest of the year, but we also need someone to make a physics review of the generated files, and someone for a honorary role of the production manager
- Infrastructure support
 - Finish migration from CentOS 7 to AlmaLinux 9
 - Move all databases to the central DB server
 - Organize DB backups to the tapes
- Development
 - Switch all services communication from X.509 to OIDC through IAM
 - Place PanDA client to the CVMFS to allow production managers to manage their tasks through PanDA via lxui.jinr.ru
 - Deploy monitoring tools
 - Start developing virtual control room for the production managers

Thank you!