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`eric.pauli.petteri.banzuzi@cern.ch`

Improving the Rucio CLI experience with Rich

Eric Banzuzi

Supervisor(s): Dimitrios Christidis and Mario Lassnig

EP-ADP

CERN, CH-1211 Geneva, Switzerland

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Abstract

This report covers my contribution to the Rucio project over the period I stayed at CERN. Rucio is an open-source, exabyte-scale, distributed data management originally developed for the ATLAS experiment at the Large Hadron Collider, and has since been adopted by other scientific communities. The main objective of my work was to improve the usability, functionality, and visual appearance of the command-line interface, using the Rich library for beautiful text formatting and display. The enhancements focused on making the command outputs more structured and visually appealing to make the system more user friendly.

Acknowledgement

I would like to express my gratitude to my supervisors, Dimitrios Christidis and Mario Lassnig, who guided me throughout this internship. I would also like to thank CERN for this unique opportunity and unforgettable experience that has taught me so much, and the whole Rucio team for helping me during my stay.

1 Introduction

Managing large volumes of data efficiently in a scalable manner is essential to support modern scientific projects. Scientific instruments such as ATLAS are generating unprecedented volumes of data that needs to be handled to allow proper workflows for researchers. Rucio [1] is a Python-based open-source, exabyte-scale, distributed data management system originally developed for the needs of the ATLAS high-energy physics experiment [2, 3], one of the four major experiments at the Large Hadron Collider (LHC). Within ATLAS, Rucio is responsible for detector data, simulation data, as well as user data, and provides a unified interface across heterogeneous storage and network infrastructures. Since its launch, the software tool has been continuously extended to support other LHC experiments and other scientific communities (experiments). Today, Rucio is the software of choice for many scientific communities to manage their data across geographically-dispersed and heterogeneous storages. People from many different communities participate and contribute to the Rucio project.

As a data management system, Rucio incorporates existing tools, services and storage systems to allow users to manage and follow their data. It makes use of FTS to coordinate file transfers between data centres over several protocols (e.g. XrootD, S3, WebDAV) and provides an interface which allows users to interact with the different types of storage backends in a unified way. Rucio uses of a rule-based system for managing data lifetime, where the rules define what data is replicated, deleted, or archived for safe long term storage. This allows it to offer an automated dataflow that ensures data accessibility, scalability and reliability.

In the following part of the report, I will give a brief overview of the structure and components of Rucio. This will be followed by an explanation of my project and project objectives as a summer student. Next, I will give a detailed description of the work done for improving the Rucio command-line interface. Lastly, some conclusions and final notes are offered, summarizing my time at CERN and outlining future directions.

1.1 Overview of Rucio components

Rucio has a distributed system architecture and can be decomposed into four main layers, shown in Figure 1:

- The *clients* layer consists of components that the user can interact with, such as the command line clients (CLI), Python clients, and the web user interface (UI) and configuration.
- The *server* layer is a passive layer that performs authentication, forwards the queries to the core, and provides a common API for interaction with clients and the web UI.

- The *core* layer consists of the abstractions of all Rucio concepts.
- The *daemons* layer performs all the continuous and asynchronous tasks in the background.

The work in this report is done on the *clients* layer.

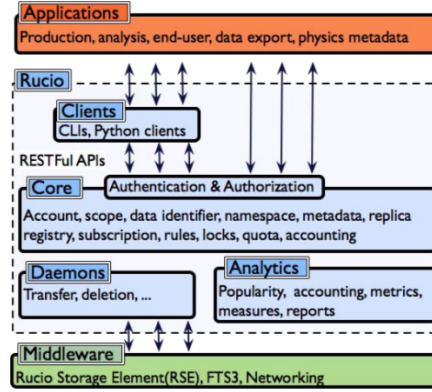


Figure 1: High-level Rucio component overview [6].

1.2 Development workflow

The development of Rucio happens on GitHub [6] using Agile and DevOps methodologies. Each new development to Rucio is viewed as a *feature* or a *patch*, depending on the level of changes done on the code base. Patches include bugfixes and minor changes to the code, and are included in patches/minor releases that are usually released every two weeks. Features include major developments or potentially disruptive changes, and are included in feature releases made approximately every 4 months. Prior to any new development, an issue tracking the planned change is created to give the entire developer community the chance to discuss the issue and point out possible implications. Developers contribute to Rucio by making their own fork of the repository, where they make the modifications to the code and submit them as a pull request to the main Rucio repository. All pull requests are automatically tested by the Github CI tool and need to be approved by another person.

2 Summer student project

As my summer student project, I focused on enhancing the Rucio command-line client interface (CLI), which is the main interface for users to interact with the data management system. With the current CLI, the output from the commands is very simplistic, making it harder for the users to see what

they were looking for. The main aim for my project was to improve the CLI's usability, functionality, and make it more visually appealing. This makes it easier for researchers to use the tool to manage their data effectively, and have a nicer experience while using Rucio.

3 Rich

The enhancements were developed using the Rich library [5], a popular Python library known for its rich text and beautiful formatting in the terminal. Rich makes it easy to add color and style to terminal output to make CLIs visually appealing. The library provides various functionalities that one can include in their terminal outputs, an overview of most of the features can be seen in Figure 2. The library offers several renderable objects, such as tables, trees, markdown, logging, tracebacks, progress bars and spinners, that can be easily customized using different styles and highlighting. For Rucio, the most interesting renderable widgets are the table, tree, logging, tracebacks, progress bars and spinners.

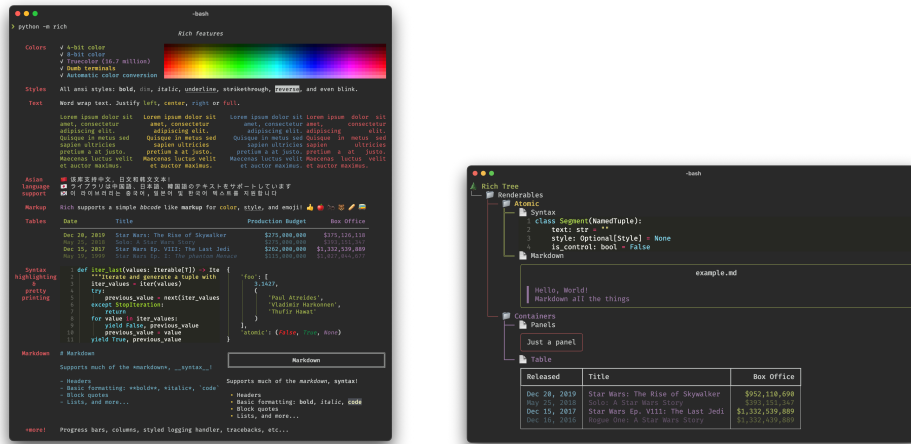


Figure 2: Rich library properties. [5]

4 Rucio command-line interface

Many of the Rucio commands are displayed or can be displayed in a table. Currently, the CLI uses the tabulate library, which is simplistic and limited when it comes to the display of wide tables. My contribution was in reformatting the command-line command outputs to be more visually appealing using the features of Rich library. As Rucio has many commands with similar outputs, I will go over a subpart of the commands and describe the main design choices behind the new command-line client in this section.

The changes for each unshown command can be seen in Appendix A. The new CLI is implemented as an opt-in option through the Rucio configuration file before eventually replacing the old CLI. The changes made to the new CLI are documented in GitHub issue [#6987](#) and its corresponding pull request [#7012](#).

4.1 CLI styles

A nice feature in Rich library is the ease of making use of colors to enhance the visual appearance of CLIs. For Rucio, the colors are mainly used to highlight different Rucio constant values that are used in the software tool. An overview of the chosen color palette can be seen in Figure 3. For different states, the idea was to highlight them with semantic colors to indicate and draw attention on whether something is positive, negative or neutral. For other types, such as DID types, the goal was to implement a coloring scheme that makes types easily distinguishable without imposing too many emotional connotations. These styles are used in all commands to highlight the corresponding keywords.

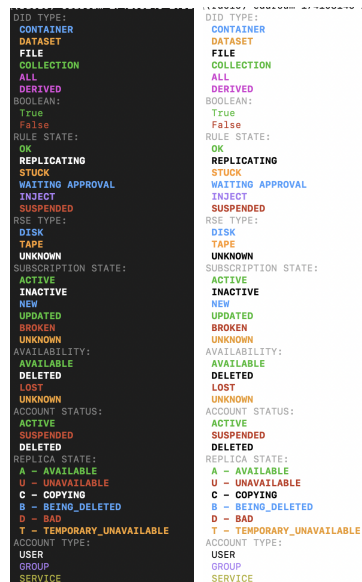


Figure 3: Used color palette for the Rucio constants in the new CLI on a default MacOS terminal. Colors might change depending on used terminal emulator.

During the color selection an attempt was made to choose colors that look good on the two most common terminal types, black and white. For users running Rucio on custom terminals, the coloring styles may cause minor issues.

4.2 Key-Value tables

The simplest tables in Rucio are two column tables without a header that show key-value pairs. Many of the Rucio commands are represented this way: `rucio whoami`, `rucio get-metadata`, `rucio stat`, `rucio list-rse-attributes`, `rucio rule-info` and `rucio-admin subscription list`. Some of the commands have an equivalent in the `rucio-admin` executable. A comparison of the new and old versions of some of the simple table commands are shown in Figures 4, 5 and 6. The keys of the left column are alphabetically sorted and left aligned in the Rich version. In commands that allow querying multiple tables simultaneously, the queried DID is displayed before the table as seen in Figure 6.

<pre> account ebanzuzi account_type USER created_at 2024-06-12T13:24:53 deleted_at email eric.pauli.petteri.banzuzi@cern.ch status ACTIVE suspended_at updated_at 2024-06-12T13:24:53 </pre>	<pre> status : ACTIVE account : ebanzuzi email : eric.pauli.petteri.banzuzi@cern.ch deleted_at : None updated_at : 2024-06-12T13:24:53 account_type : USER suspended_at : None created_at : 2024-06-12T13:24:53 </pre>
(a) New	(b) Old

Figure 4: Comparison of `rucio whoami` in the old and new CLI.

<pre> account mlassnig bytes 94834717 expired_at 1 length 1 monotonic False name user.mlassnig.pilot.test.single.hits.container open True scope user.mlassnig type CONTAINER </pre>	<pre> account: mlassnig bytes: 94834717 expired_at: None length: 1 monotonic: False name: user.mlassnig.pilot.test.single.hits.container open: True scope: user.mlassnig type: CONTAINER </pre>
(a) New	(b) Old

Figure 5: Comparison of `rucio stat` in the old and new CLI.

<pre> DID: user.mlassnig:user.mlassnig.pilot.test.single.hits.container access_cnt 1 accessed_at 2022-09-22 22:07:11 account mlassnig adler32 None availability AVAILABLE bytes None campaign None closed_at None complete None constituent None created_at 2020-06-23 08:44:51 datatype None deleted_at None did_type CONTAINER eol_at None events None expired_at None guid None hidden False is_archive True is_new True is_open 1 length 1 lumblocknr None md5 None monotonic False name user.mlassnig.pilot.test.single.hits.container obsolete False panda_id None phys_group None prod_step None project None provenance None purge_replicas True run_number None scope user.mlassnig stream_name None suppressed False task_id None transient None updated_at 2022-10-27 12:15:54 version None </pre>	<pre> access_cnt: 1 accessed_at: 2022-09-22 22:07:11 account: mlassnig adler32: None availability: AVAILABLE bytes: None campaign: None closed_at: None complete: None constituent: None created_at: 2020-06-23 08:44:51 datatype: None deleted_at: None did_type: CONTAINER eol_at: None events: None expired_at: None guid: None hidden: False is_archive: None is_new: True is_open: 1 length: 1 lumblocknr: None md5: None monotonic: False name: user.mlassnig.pilot.test.single.hits.container obsolete: False panda_id: None phys_group: None prod_step: None project: None provenance: None purge_replicas: True run_number: None scope: user.mlassnig stream_name: None suppressed: False task_id: None transient: None updated_at: 2022-10-27 12:15:54 version: None </pre>
(a) New	(b) Old

Figure 6: Comparison of `rucio get-metadata` in the old and new CLI.

The exact number of entries in a queried table is often unknown beforehand, unlike in the simple key-value pair tables. To enhance readability of longer and large tables, I implemented alternating row colors in the table through dimming. Below is a list of comparisons of the new and old commands with more complex tables or involving multiple tables. The table format remains consistent across all commands.

```
rucio list-dids
```

[illegible]

(b) Old

[illegible]

(b) Old

Here the example shows `--no-pager` option to show Rich's ability to fit the table in the current terminal. The links for URLs are highlighted in blue. However, different terminals may display blue differently.

[illegible]

(b) Old

[illegible]

The content is now put in a more concise table format and usage per account is printed in its own table for each source, separate by a subheader highlighted in cyan.

SOURCE	USED	FILES	FREE	TOTAL	UPDATED AT
custodial	259,261 GB				2024-02-21 00:40:17
expired	6,110 PB				2024-08-06 06:10:03
min_free_space	300,000 TB				2020-10-27 13:09:24
objects	1,000 GB				2024-08-06 10:11:03
persistent	19,822 PB				2024-08-06 09:56:08
ruclio	29,435 PB	88874312			2024-08-06 10:35:36
storage	29,384 PB		2,267 PB	31,651 PB	2024-08-06 16:28:39
temporary	3,474 PB				2024-08-06 09:56:08
unavailable	54,842 TB				2024-08-06 12:29:57

USAGE PER ACCOUNT:
source: ruclio

ACCOUNT	USED	PERCENTAGE %
panda	17,383 PB	59.86
cinadim	4,792 PB	16.16
prodsys	1,159 PB	3.94
root	70,292 TB	6.25
pilot	41,215 TB	9.24
young	2,798 TB	0.81
desalvato	1,246 TB	0.0
deserudg	1,127 TB	0.0
ruth	34,053 GB	0.0
coba	21,314 GB	0.0
jipthones	3,499 GB	0.0
ganapati	3,452 GB	0.0
roehrig	1,893 GB	0.0
dhayden	966 GB	0.6
akubuge	390,708 MB	0.0
disouth	369,834 MB	0.0
phys-gener	-2,428 MB	-0.0
rustem	-110,212 MB	-0.0
whopkins	-766,088 MB	-0.0
blumen	-11,710 GB	-0.0

(b) Old

[illegible]

The content is now put in a more concise table format. The actions are sorted in descending time due to the pager by default approach.

(b) Old

The state is highlighted with the CLI styles defined above for Rucio constants.

(b) Old

rucio-admin rse info

The JSON for domains in protocols is shown in as a tree for a better look.

<pre> Settings: availability: 7 availability_delete: True availability_read: True availability_write: True credentials: None delete_protocol: 1 deterministic: True domains: [{"lan": "wan"}] id: a97b618f9d964dfb4189a3e7c7bb61 key_class: Hash read_protocol: 1 rse: CERN-PROD_DATADISK rse_type: DISK sign_url: None staging_area: False third_party_copy_read_protocol: 1 third_party_copy_write_protocol: 1 verify_checksum: True volatile: False write_protocol: 1 Attributes: CERN: True CERN-PROD_DATADISK: True available_for_multihop: True browser_enabled: True cloud: CERN datapolicyanalysis: True datapolicyanalysis: True datapolicythrottle: False datapolicythrottle: False datapolicythrottleoutput: False enable_suspicious_file_recovery: True freespace: 9560 fts: https://fts3-atlas.cern.ch:8446 fts_instance: /eos/atlas physgroup: CERN-PROD site: ATLASDATADISK space_token: root://eosatlas.cern.ch:/eos/atlas/proc/accounting srf_url: 0 tier: 229600 tombstone_delay: 1209600 type: DATADISK </pre>	<pre> Settings: availability: 7 availability_delete: True availability_read: True availability_write: True credentials: None delete_protocol: 1 deterministic: True domains: [{"lan": "wan"}] id: a97b618f9d964dfb4189a3e7c7bb61 key_class: Hash read_protocol: 1 rse: CERN-PROD_DATADISK rse_type: DISK sign_url: None staging_area: False third_party_copy_read_protocol: 1 third_party_copy_write_protocol: 1 verify_checksum: True volatile: False write_protocol: 1 Attributes: CERN: True CERN-PROD_DATADISK: True available_for_multihop: True browser_enabled: True cloud: CERN datapolicyanalysis: True datapolicyanalysis: True datapolicythrottle: False datapolicythrottle: False datapolicythrottleoutput: False enable_suspicious_file_recovery: True freespace: 9560 fts: https://fts3-atlas.cern.ch:8446 fts_instance: /eos/atlas physgroup: CERN-PROD site: ATLASDATADISK space_token: root://eosatlas.cern.ch:/eos/atlas/proc/accounting srf_url: 0 tier: 229600 tombstone_delay: 1209600 type: DATADISK </pre>
(a) New	(b) Old

Figure 13: The first part of the rucio-admin rse info command.

<pre> Protocols: domains: [{"lan": ("read": 2, "write": 2, "delete": 2), "wan": ("read": 2, "write": 2, "delete": 2, "third_party_copy_read": 1, "third_party_copy_write": 1)}] extended_attributes: None hostname: eosatlas.cern.ch impl: rucio.rse.protocol.gfal.Default port: 443 prefix: /eos/atlas/atlasdatadisk/rucio/ scheme: gfal root: domains: [{"lan": ("read": 1, "write": 1, "delete": 1), "wan": ("read": 1, "write": 1, "delete": 1, "third_party_copy_read": 2, "third_party_copy_write": 2)}] extended_attributes: None hostname: eosatlas.cern.ch impl: rucio.rse.protocol.gfal.Default port: 443 prefix: /eos/atlas/atlasdatadisk/rucio/ scheme: root </pre>
(a) Old

Figure 14: The second part of the old rucio-admin rse info command.

Protocols:					
davs					
domains					
lan					
read: 2					
write: 2					
delete: 2					
nqn					
read: 2					
write: 2					
delete: 2					
third_party_copy_read: 1					
third_party_copy_write: 1					
extended_attributes					
hostname					
eosatlas.cern.ch					
impl					
rucio.rse.protocols.gfal.Default					
port					
443					
prefix					
/eos/atlas/atlasdatadisk/rucio/					
scheme					
davs					
root					
domains					
lan					
read: 1					
write: 1					
delete: 1					
nqn					
read: 1					
write: 1					
delete: 1					
third_party_copy_read: 2					
third_party_copy_write: 2					
extended_attributes					
hostname					
eosatlas.cern.ch					
impl					
rucio.rse.protocols.gfal.Default					
port					
1094					
prefix					
/eos/atlas/atlasdatadisk/rucio/					
scheme					
root					
Usage:					
SOURCE	USED	FILES	FREE	TOTAL	UPDATED AT
custodial	259.261 GB	8466	0.0 B	259.261 GB	2024-02-21 08:48:17
replica	130 MB	148723	0.0 B	130 MB	2024-02-21 08:48:17
min_free_space	300.000 TB	0	0.0 B	300.000 TB	2020-10-27 13:09:24
persistent	19.822 PB	72988161	0.0 B	19.822 PB	2024-08-06 09:56:58
storage	29.396 PB	66031473	2.255 PB	31.651 PB	2024-08-06 11:28:39
unavailable	54.777 TB	27130	0.0 B	54.777 TB	2024-08-06 13:29:57

(b) Old

Figure 15: The second part of the new rucio-admin rse info command.

RSE limits:	
MinFreeSpace	30000000000000 B

(a) New

RSE limits:	
MinFreeSpace:	30000000000000 B

(b) Old

Figure 16: The third of the old rucio-admin rse info command.

rucio list-account-usage

The numerical values (data units) are right aligned in the column, which was not done before.

RSE	USAGE	LIMIT	QUOTA LEFT
ADLT2_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
BEIJING-LQ2-EOS_SCRATCHDISK	0.000 B	7.500 TB	7.500 TB
BNL-OSQ2_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
BNLHPC_SCRATCHDISK	0.000 B	15.000 TB	15.000 TB
CA-SFU-T2_SCRATCHDISK	0.000 B	48.000 TB	48.000 TB
CA-VICTORIA-WESTGRID-T2_SCRATCHDISK	0.000 B	24.000 TB	24.000 TB
CA-WATERLOO-T2_SCRATCHDISK	0.000 B	15.000 TB	15.000 TB
CERN-PROD_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
CSCS-LQ2_SCRATCHDISK	0.000 B	19.200 TB	19.200 TB
CYFRONET-LQ2-EOS_SCRATCHDISK	0.000 B	30.000 TB	30.000 TB
DESY-HH_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
DESY-ZN_SCRATCHDISK	0.000 B	15.000 TB	15.000 TB
EELA-UTFSM_SCRATCHDISK	0.000 B	7.600 TB	7.600 TB
FMPH-UNIBA_SCRATCHDISK	0.000 B	16.493 TB	16.493 TB
FRESNO-AWS_SCRATCHDISK	0.000 B	5.000 TB	5.000 TB
FZK-LQ2_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
GOGRID_SCRATCHDISK	0.000 B	45.493 TB	45.493 TB
GRIF_SCRATCHDISK	0.000 B	45.000 TB	45.000 TB
HK-LQ2_SCRATCHDISK	0.000 B	32.985 TB	32.985 TB
IFPAE-GENOVA_SCRATCHDISK	0.000 B	29.637 TB	29.637 TB
IFAE_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
IFIC-LQ2_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
IN2P3-CC_SCRATCHDISK	0.000 B	49.800 TB	49.800 TB
IN2P3-CPM_SCRATCHDISK	0.000 B	9.664 TB	9.664 TB
IN2P3-LAPP-DKACHE_SCRATCHDISK	0.000 B	15.000 TB	15.000 TB
IN2P3-LPC_SCRATCHDISK	0.000 B	15.833 TB	15.833 TB
INFN-FRASCATI_SCRATCHDISK	0.000 B	13.194 TB	13.194 TB
INFN-GENOVA_SCRATCHDISK	0.000 B	2.639 TB	2.639 TB
INFN-LECCE_SCRATCHDISK	0.000 B	5.236 TB	5.236 TB
INFN-MILANO-ATLAS_SCRATCHDISK	0.000 B	2.723 TB	2.723 TB
INFN-NAPOLI-ATLAS_SCRATCHDISK	0.000 B	23.090 TB	23.090 TB
INFN-ROMA1_SCRATCHDISK	0.000 B	26.388 TB	26.388 TB
INFN-ROMA3_SCRATCHDISK	0.000 B	1.812 TB	1.812 TB
INFN-TI_SCRATCHDISK	0.000 B	50.000 TB	50.000 TB
JINR-LQ2_SCRATCHDISK	0.000 B	15.036 TB	15.036 TB

RSE EXPRESSION	USAGE	LIMIT	QUOTA LEFT
type=SCRATCHDISK	0.000 B	200.000 TB	200.000 TB

(a) New

RSE EXPRESSION	USAGE	LIMIT	QUOTA LEFT
type=SCRATCHDISK	0.000 B	200.000 TB	200.000 TB

(b) Old

As shown earlier, the JSON is shown as a tree, and the content is put in a table.

(b) Old

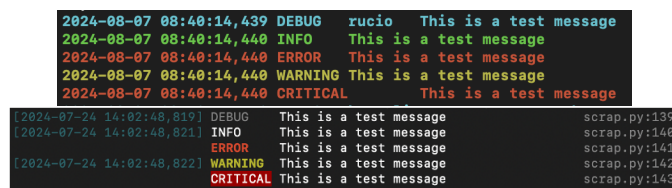
The same applies to all other one column tables: `rucio-admin account list` and `rucio list-rses / rucio-admin rse list`.

(b) Old

[illegible]

(b) Old

Rich also offers a nice way to display logging messages and caught exceptions through the RichHandler widget. This feature was implemented into the Rucio command-line interface. The styles of the logger are shown in Figure 24. In addition, a comparison of the old and new way of logging and displaying an exception is shown in Figure 25. The previous logger used an excessive amount of colors and displayed exceptions in a less clear manner. Rich logging allows to easily highlight the logging time, level, message and file where the logger is called in different colors. Moreover, the exception traceback block clearly highlights the part of the code in which the error occurs.



13

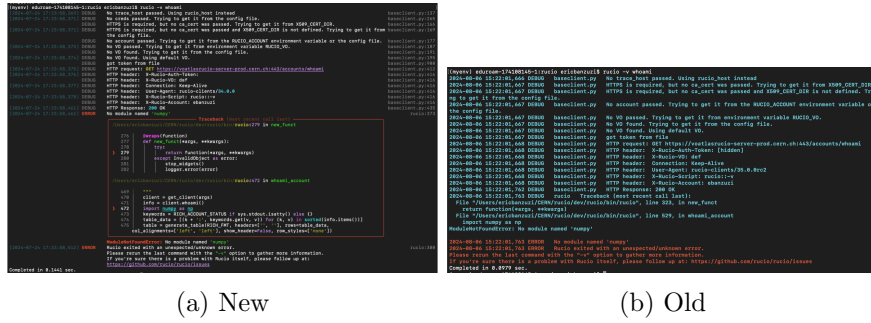


Figure 25: Catching an unexpected exception in Rucio CLI.

4.5 Spinners

Many commands in Rucio take a few seconds to complete. Unlike the old CLI, the new CLI displays a spinner as a sign to show the users that it is working on a task. This is also a common feature in many other well known CLIs. An example of the spinner is shown in iFigure 26. The spinner is not shown on the simplest and instant commands: `rucio whoami`, `rucio rule-info`, `rucio-admin rse get-distance`, `rucio list-identities`, `rucio-admin account info`, `rucio-admin rse get-attribute`, `rucio list-rse-attributes`.



Figure 26: A status spinner for working tasks.

4.6 Pager output

Another addition to the command-line interface is that it now displays outputs in a pager ¹, similarly to e.g. Git and systemd. The default pager used for the CLI is `$PAGER=less -FRSXMK`, which makes the output unwrapped, using colors and automatically exits the pager if the output of the command fits the current terminal size. The user can still get the command output to be displayed without a pager by including the `--no-pager` argument in their command, e.g. by writing `rucio --no-pager whoami`. A comparison of the pager and non-pager outputs is shown in Figure 27. The non-pager output wraps the table entries to fit the current terminal with the assumption of a minimum terminal width of 80 character. A good property of the pager usage is that it allows the user to scroll the vertically and horizontally and use many functionalities offered by less, such as search patterns.

¹Pager is a computer program used to view (but not modify) the contents of a text file moving down the file one line or one screen at a time.

IDDP	NAME	FILETYPE	ADDRESS	URL	REPLICA	SCOPE	NAME	FILETYPE	ADDRESS	URL	REPLICA
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	OL-SCS2_ATLAS_LOCALGROUPDISK1	https://atlas-localgroupdisk1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	OL-SCS2_ATLAS_LOCALGROUPDISK1	https://atlas-localgroupdisk1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_PERF-MON01	https://perf-mon01.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_PERF-MON01	https://perf-mon01.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	UK-NORTHGRID-LANCIP-CEPH-DATASITE1	https://data1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	UK-NORTHGRID-LANCIP-CEPH-DATASITE1	https://data1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	INFA-RDML_CALIBR01S	https://calib-01s.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	UK-NORTHGRID-LANCIP-CEPH-DATASITE1	https://data1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	UK-NORTHGRID-LANCIP-CEPH-DATASITE1	https://data1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1
ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	https://t2t2s1.cern.ch/ncis/ncis_137af/HTS-8622893_000001_pool.root.1	ncis_137af	HTS-8622893_000001_pool.root.1	94.83 MB	5000074	CEIN-PROD_T2T2S1	

Figure 27: Command `rucio list-file-replicas` with and without a pager. If the command is ran with `--no-pager`, the PFN links are hyperlinks in case the terminal emulator supports OSC 8. A list of such terminals can be found in [4].

In the old CLI, the commands `rucio-admin data import` and `rucio-admin data export` display multiple print statements showing what the program is doing. In the Rich version, this is simplified to be done with a spinner and a success/failure message as shown in Figures 28 and 29.

Figure 28: Old rucio-admin data import and export commands on iTerm2.

Figure 29: New rucio-admin data import and export commands on iTerm2.

During my stay, I also explored some features of Rich that may be used in the future. As of now, there are still uncertainties on how to improve these parts of the CLI so these were left unmodified.

4.8.1 Tree for list-content

I explored how a tree structure would look in the list-content command. This was done by recursively going until the leafs of the tree (file level) from a given DID. An example of such a tree is in Figure 30. This feature was scrapped so the coloring scheme is still from the feature exploration stage.



Figure 30: A tree listing DID content from high level to bottom.

4.8.2 Text outputs

Another experiment that I did was customizing some of the commands with plain output text or without any output. For these commands, I tried to see whether it would be beneficial to highlight parts of it or add some text output to make the execution of the command clearer for the user. Some examples of highlighting text are shown below:

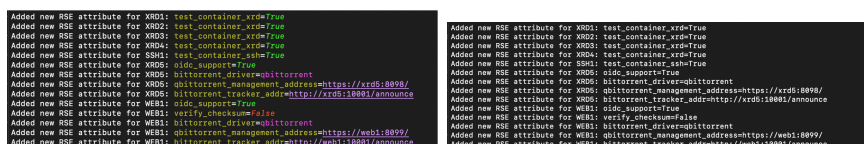


Figure 31: Command `rucio-admin rse set-attribute`. This feature makes the key-value pairs clearly highlighted and easier to see as key-value pairs.



Figure 32: Commands for adding a DID, scope, RSE and distance between RSEs. The idea behind these was to highlight what was done more clearly.

5 Other work on Rucio

During my stay, I had the chance to contribute to other areas within Rucio. The contributions were mainly minor bug fixes and structural changes to familiarize more with the Rucio development process. These were some of the issues I worked on and their descriptions:

- [#6964](#) Moving the configuration check for registering bittorrent metadata to the caller function.

- [#6973](#) Unifying the logic of two methods `perm_add_did` and `perm_add_dids` for permission checking. Before the scope was not properly checked when adding dids in bulk.
- [#6990](#) Renaming an ambiguous function for more accurate description of its functionality.
- [#7018](#) Adding overload type annotations for cache operations in `core/config.py`.
- [#6717](#) Standardizing the SQLAlchemy model names of single entities to be in singular form.

6 Conclusions and future work

Throughout this project, large enhancements were made to the CLI with Rich. These improvements were done by introducing Rich tables, trees, logging, tracebacks, text formatting, and spinners together with pager outputs. These improvements were designed to enhance the user experience and provide a visually appealing interface.

Now, the CLI will enter the first phase, an experiment phase, and will be available as an opt-in option through the configuration file until power users can test it and provide additional feedback. This is to avoid change aversion, the negative reaction users often have to changes in a product, and to introduce the changes smoothly into Rucio. After proper testing and feedback, the CLI enters a second phase, where it will be introduced as the default option during a major release. However, in this second phase the feature is included as an opt-out feature in case some major issue cannot be quickly addressed. After the Rucio community feels ready, the CLI will enter the final third phase in which the original tabulate-based implementation will be removed entirely. This consideration and planning is key for both user experience design and release engineering procedures.

In the future, we want to further improve the interface by adding Rich progress bars for download and upload commands. Additionally, we plan to introduce options for JSON and CSV outputs. Another potential idea is to reformat the text output commands to be more informative and to use Rich highlighting.

References

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A Rucio command-line outputs

`rucio rule-info`

<pre> account activity child_rule_id comments copies created_at did_type eol_at error expires_at grouping id ignore_account_limit ignore_availability locked locks_ok_cnt locks_replicating_cnt locks_stuck_cnt meta name notification priority purge_replicas rse_expression scope source_replica_expression split_container state stuck_at subscription_id updated_at weight </pre>	<pre> ddmadmin Express 1 2023-02-14 10:02:47 DATASET bb82172ff9cc4e8b8b531fa83c04be07 False False False 1 0 0 user.mlassnig.pilot.test.single.hits NO 3 False BNL-OSG2_TEST user.mlassnig False OK 2023-05-16 14:53:36 </pre>	<pre> Id: Account: Scope: Name: RSE Expression: Copies: State: Locks OK/REPLICATING/STUCK: Grouping: Expires at: Locked: Weight: Created at: Updated at: Error: Subscription Id: Source replica expression: Activity: Comment: Ignore Quota: Ignore Availability: Purge replicas: Notification: End of life: Child Rule Id: </pre> <pre> bb82172ff9cc4e8b8b531fa83c04be07 ddmadmin user.mlassnig user.mlassnig.pilot.test.single.hits BNL-OSG2_TEST 1 OK 1/0/0 DATASET None False None 2023-02-14 10:02:47 2023-05-16 14:53:36 None None None None None None None None None None None None None None None None </pre>
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(a) New

(b) Old

rucio-admin account list-attributes

Key	Value
sign-gcs	True

(a) New

Key	Value
sign-gcs	True

(b) Old

rucio-admin rse get-distance

```
((base_clone) eduroam-174108145-1:rucio ericbanzuzi$ rucio-admin rse get-distance DESY-ZN_DATADISK CERN-PROD_DET-FWD
Distance information from DESY-ZN_DATADISK to CERN-PROD_DET-FWD: distance=10
```

(a) Old

```
((myenv) eduroam-174108145-1:rucio ericbanzuzi$ rucio-admin rse get-distance DESY-ZN_DATADISK CERN-PROD_DET-FWD)
```

SOURCE	DESTINATION	DISTANCE
DESY-ZN_DATADISK	CERN-PROD_DET-FWD	10

(b) New

rucio list-dataset-replicas

RSE	FOUND	TOTAL
UKI-NORTHGRID-LIV-HEP_DATADISK	1	1
UKI-LT2-QMUL_SCRATCHDISK	1	1
IN2P3-CC_DATADISK	1	1
SWT2_CP8_SCRATCHDISK	1	1
UKI-SCOTGRID-GLASSOW-CEPH_LOCALGROUPDISK	1	1
CERN-PROD_PHYS-TOP	1	1
CA-SFU-T2_SCRATCHDISK	1	1
SLACKRD_LOCALGROUPDISK	1	1
OU_OSCER_ATLAS_DATADISK	1	1
LRZ-LMU_DATADISK	1	1
NCG-INGRID-PT_LOCALGROUPDISK	1	1
DESY-ZN_DATADISK	1	1
MW2_UC_LOCALGROUPDISK	1	1
IN2P3-CC_LOCALGROUPDISK-MW	1	1
CERN-PROD_PHYS-HI	1	1
FZK-LCG2_DATATAPE	1	1
NDGF-T1_SCRATCHDISK	1	1
ITAE_SCRATCHDISK	1	1
IN2P3-CPPM_SCRATCHDISK	1	1
UNI-FREIBURG_LOCALGROUPDISK	1	1
BNLHPC_DATADISK	1	1
CERN-PROD_GROUPTAPE	1	1
TRIUMF-LCG2_DATADISK	1	1
CYFRONET-LCG2-EOS_PHYS-HI	1	1
DESY-HH_LOCALGROUPDISK	1	1
CA-VICTORIA-WESTGRID-T2_DATADISK	1	1
RRC-KI-T1_DATATAPE	1	1
INFN-ROMA1_CALIBDISK	1	1
INFN-BOLOGNA-T3_LOCALGROUPDISK	1	1
PIC_MCTAPE	1	1
CYFRONET-LCG2-EOS_DATADISK	1	1
IEPSAS-KOSICE_LOCALGROUPDISK	1	1
SARA-MATRIX_DATADISK	1	1
HA-LCG2_DATADISK	1	1
IN2P3-CC_LOCALGROUPTAPE	1	1
CERN-PROD_PERF-IDTRACKING	1	1
UKI-SOUTHGRID-RAL_PP_SCRATCHDISK	1	1
WPPUL_SCRATCHDISK	1	1

(a) New

```
((base_clone) eduroam-174108145-1:rucio ericbanzuzi$ rucio list-dataset-replicas user.mlassnig:user.mlassnig.pilot.test.single.hits)
```

RSE	FOUND	TOTAL
UKI-NORTHGRID-LIV-HEP_DATADISK	1	1
UKI-LT2-QMUL_SCRATCHDISK	1	1
IN2P3-CC_DATADISK	1	1
SWT2_CP8_SCRATCHDISK	1	1
UKI-SCOTGRID-GLASSOW-CEPH_LOCALGROUPDISK	1	1
CERN-PROD_PHYS-TOP	1	1
CA-SFU-T2_SCRATCHDISK	1	1
SLACKRD_LOCALGROUPDISK	1	1
OU_OSCER_ATLAS_DATADISK	1	1
LRZ-LMU_DATADISK	1	1
NCG-INGRID-PT_LOCALGROUPDISK	1	1
DESY-ZN_DATADISK	1	1
MW2_UC_LOCALGROUPDISK	1	1
IN2P3-CC_LOCALGROUPDISK-MW	1	1
CERN-PROD_PHYS-HI	1	1
FZK-LCG2_DATATAPE	1	1
NDGF-T1_SCRATCHDISK	1	1
ITAE_SCRATCHDISK	1	1
IN2P3-CPPM_SCRATCHDISK	1	1
UNI-FREIBURG_LOCALGROUPDISK	1	1
BNLHPC_DATADISK	1	1
CERN-PROD_GROUPTAPE	1	1
TRIUMF-LCG2_DATADISK	1	1
CYFRONET-LCG2-EOS_PHYS-HI	1	1
DESY-HH_LOCALGROUPDISK	1	1
CA-VICTORIA-WESTGRID-T2_DATADISK	1	1
RRC-KI-T1_DATATAPE	1	1
INFN-ROMA1_CALIBDISK	1	1
INFN-BOLOGNA-T3_LOCALGROUPDISK	1	1
PIC_MCTAPE	1	1
CYFRONET-LCG2-EOS_DATADISK	1	1
IEPSAS-KOSICE_LOCALGROUPDISK	1	1
SARA-MATRIX_DATADISK	1	1
HA-LCG2_DATADISK	1	1
IN2P3-CC_LOCALGROUPTAPE	1	1

(b) Old

rucio list-account-limits

(myenv) eduroam-174108145-1:rucio erichanzuzi\$ rucio list-account-limits ebanzuzi		(base_clone) eduroam-174108145-1:rucio erichanzuzi\$ rucio list-account-limits ebanzuzi	
RSE	LIMIT	RSE	LIMIT
AGLT2_SCRATCHDISK	50.000 TB	AGLT2_SCRATCHDISK	50.000 TB
BEIJING-LCG2-EOS_SCRATCHDISK	7.500 TB	BEIJING-LCG2-EOS_SCRATCHDISK	7.500 TB
BNL-OSG2_SCRATCHDISK	50.000 TB	BNL-OSG2_SCRATCHDISK	50.000 TB
BNLHPC_SCRATCHDISK	15.000 TB	BNLHPC_SCRATCHDISK	15.000 TB
CA-SFU-T2_SCRATCHDISK	40.000 TB	CA-SFU-T2_SCRATCHDISK	40.000 TB
CA-VICTORIA-WESTGRID-T2_SCRATCHDISK	24.000 TB	CA-SFU-T2_SCRATCHDISK	40.000 TB
CA-WATERLOO-T2_SCRATCHDISK	15.000 TB	CA-VICTORIA-WESTGRID-T2_SCRATCHDISK	24.000 TB
CERN-PROD_SCRATCHDISK	50.000 TB	CA-WATERLOO-T2_SCRATCHDISK	15.000 TB
CSCS-LCG2_SCRATCHDISK	19.200 TB	CERN-PROD_SCRATCHDISK	50.000 TB
CYFRONET-LCG2-EOS_SCRATCHDISK	30.000 TB	CSCS-LCG2_SCRATCHDISK	19.200 TB
DESY-HH_SCRATCHDISK	50.000 TB	CYFRONET-LCG2-EOS_SCRATCHDISK	30.000 TB
DESY-ZN_SCRATCHDISK	15.000 TB	DESY-HH_SCRATCHDISK	50.000 TB
EELA-UTFSM_SCRATCHDISK	7.600 TB	DESY-ZN_SCRATCHDISK	15.000 TB
FAPRI-UNIBA_SCRATCHDISK	14.493 TB	EELA-UTFSM_SCRATCHDISK	7.600 TB
FZK-LCG2_SCRATCHDISK	50.000 TB	FAPRI-UNIBA_SCRATCHDISK	14.493 TB
GOGRID_SCRATCHDISK	45.493 TB	FZK-LCG2_SCRATCHDISK	50.000 TB
GRIF_SCRATCHDISK	45.000 TB	GOGRID_SCRATCHDISK	45.493 TB
HK-LCG2_SCRATCHDISK	32.985 TB	GRIF_SCRATCHDISK	45.000 TB
IERSAS-KOSICE_SCRATCHDISK	29.973 TB	HK-LCG2_SCRATCHDISK	32.985 TB
IFAB_SCRATCHDISK	50.000 TB	IERSAS-KOSICE_SCRATCHDISK	29.973 TB
IFIC-LCG2_SCRATCHDISK	50.000 TB	IFAB_SCRATCHDISK	50.000 TB
IN2P3-CC_SCRATCHDISK	49.800 TB	IFIC-LCG2_SCRATCHDISK	50.000 TB
IN2P3-CPM_SCRATCHDISK	9.664 TB	IN2P3-CC_SCRATCHDISK	49.800 TB
IN2P3-LAPP-DCACHE_SCRATCHDISK	15.000 TB	IN2P3-CPM_SCRATCHDISK	9.664 TB
IN2P3-LPC_SCRATCHDISK	15.833 TB	IN2P3-LAPP-DCACHE_SCRATCHDISK	15.000 TB
INFN-FRASCATI_SCRATCHDISK	13.194 TB	IN2P3-LPC_SCRATCHDISK	15.833 TB
INFN-GENOVA_SCRATCHDISK	2.639 TB	INFN-FRASCATI_SCRATCHDISK	13.194 TB
INFN-LEGE_SCRATCHDISK	5.236 TB	INFN-GENOVA_SCRATCHDISK	2.639 TB
INFN-MILANO-ATLAS_SCRATCHDISK	7.731 TB	INFN-LEGE_SCRATCHDISK	5.236 TB
INFN-NAPOLI-ATLAS_SCRATCHDISK	23.090 TB	INFN-MILANO-ATLAS_SCRATCHDISK	7.731 TB

RSE	EXPRESSION	LIMIT
	type=SCRATCHDISK	200.000 TB

(a) New

RSE	EXPRESSION	LIMIT
	type=SCRATCHDISK	200.000 TB

(b) Old

rucio list-rses / rucio-admin rse list

RSE	RSE
AGLT2_CALIBDISK	AGLT2_CALIBDISK
AGLT2_DATADISK	AGLT2_DATADISK
AGLT2_LOCALGROUPDISK	AGLT2_LOCALGROUPDISK
AGLT2_SCRATCHDISK	AGLT2_SCRATCHDISK
AGLT2_VP_DISK	AGLT2_VP_DISK
BEIJING-LCG2-EOS_DATADISK	BEIJING-LCG2-EOS_DATADISK
BEIJING-LCG2-EOS_LOCALGROUPDISK	BEIJING-LCG2-EOS_LOCALGROUPDISK
BEIJING-LCG2-EOS_SCRATCHDISK	BEIJING-LCG2-EOS_SCRATCHDISK
BNL-ATLAS_VP_DISK	BNL-ATLAS_VP_DISK
BNL-OSG2_DATADISK	BNL-OSG2_DATADISK
BNL-OSG2_DATATAPE	BNL-OSG2_DATATAPE
BNL-OSG2_DET-SLHC	BNL-OSG2_DET-SLHC
BNL-OSG2_GROUPTAPE	BNL-OSG2_GROUPTAPE
BNL-OSG2_LOCALGROUPDISK	BNL-OSG2_LOCALGROUPDISK
BNL-OSG2_MOTAPE	BNL-OSG2_MOTAPE
BNL-OSG2_PHYS-HI	BNL-OSG2_PHYS-HI
BNL-OSG2_SCRATCHDISK	BNL-OSG2_SCRATCHDISK
BNL-OSG2_TAPE-TEST	BNL-OSG2_TAPE-TEST
BNL-OSG2_TEST	BNL-OSG2_TEST
BNLHPC_DATADISK	BNLHPC_DATADISK
BNLHPC_SCRATCHDISK	BNLHPC_SCRATCHDISK
CA-SFU-T2_DATADISK	CA-SFU-T2_DATADISK
CA-SFU-T2_LOCALGROUPDISK	CA-SFU-T2_LOCALGROUPDISK
CA-SFU-T2_SCRATCHDISK	CA-SFU-T2_SCRATCHDISK
CA-TRIUMF-DISKLESS-XCACHE	CA-TRIUMF-DISKLESS-XCACHE
CA-VICTORIA-WESTGRID-T2_DATADISK	CA-VICTORIA-WESTGRID-T2_DATADISK
CA-VICTORIA-WESTGRID-T2_LOCALGROUPDISK	CA-VICTORIA-WESTGRID-T2_LOCALGROUPDISK
CA-VICTORIA-WESTGRID-T2_SCRATCHDISK	CA-VICTORIA-WESTGRID-T2_SCRATCHDISK
CA-WATERLOO-T2_DATADISK	CA-WATERLOO-T2_DATADISK
CA-WATERLOO-T2_LOCALGROUPDISK	CA-WATERLOO-T2_LOCALGROUPDISK
CA-WATERLOO-T2_SCRATCHDISK	CA-WATERLOO-T2_SCRATCHDISK
CERN-PROD_DAQ	CERN-PROD_DAQ
CERN-PROD_DATADISK	CERN-PROD_DATADISK
CERN-PROD_DATAPREP	CERN-PROD_DATAPREP
CERN-PROD_DATATAPE	CERN-PROD_DATATAPE
CERN-PROD_DERIVED	CERN-PROD_DERIVED
CERN-PROD_DET-FWD	CERN-PROD_DET-FWD
CERN-PROD_DET-IBL	CERN-PROD_DET-IBL
CERN-PROD_DET-INDET	CERN-PROD_DET-INDET
CERN-PROD_DET-LARG	CERN-PROD_DET-LARG

(a) New

(b) Old

```
rucio list-content
```

```
(myenv) eudora@-174188145-1:~$ rucio ericanbazuizi$ rucio list-content
```

SCOPE:NAME	[OID TYPE]
data22:DAOD_JETM1.34182787...000001.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000002.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000003.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000004.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000005.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000006.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000007.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000008.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000009.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000010.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000011.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000012.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000013.pool.root.1	FILE

```
(base_clone) eudora@-174188145-1:~$ rucio ericanbazuizi$ rucio list-content
```

SCOPE:NAME	[OID TYPE]
data22:DAOD_JETM1.34182787...000001.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000002.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000003.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000004.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000005.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000006.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000007.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000008.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000009.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000010.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000011.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000012.pool.root.1	FILE
data22:DAOD_JETM1.34182787...000013.pool.root.1	FILE

(a) New

(b) Old

```
rucio-admin account list
```

ACCOUNT	
aaбарis	(base_clone) eduroam-174198145-i.ru
aaбелел	abaris
aaбелелаз	ababel
aaбелелаз	ababelaz
aaбелбул	ababcihu
aaбелбул	ababulho
aaбелбул	ababulho
aaбар	abac
aaбарма	abackma
aaб	abad
aaбеллот	abaeliot
aaбард	abagard
aaбарул	abagrawl
aaбарта	abagrawa
aaбикот	abaiot
aaбикгал	abakigal
aaбикхо	abakimov
aaбайхан	abaiyhan
aaбайкекс	abaikeks
aaбонси	abafonsi
aaбонси	abafonsi
aaбайхер	abaihehr
aaбалведо	abalvedo
aaамблир	abamblir
aaаньяна	abanyana
aaандрез	abandrez
aaантоннов	abantonov
aaпетерс	abapeters
aaарон	abarcon
aaашах	abashah
aaасил	abasil
aaатaylor	abattaylor
aaавед	abaved
aaавите	abavite
aaавилин	abavilin
aaазкил	abazkil
aaаз	abaz
aaаbas	ababas
aaабраму	ababramu
aaабдас	ababdasa

(a) New

(b) Old