

LUMI

A white wolf is the central focus, standing in a futuristic, blue-toned digital environment. The background is filled with vertical data streams, glowing particles, and a grid-like structure, creating a high-tech, cybernetic atmosphere. The wolf is looking slightly to the right of the viewer.

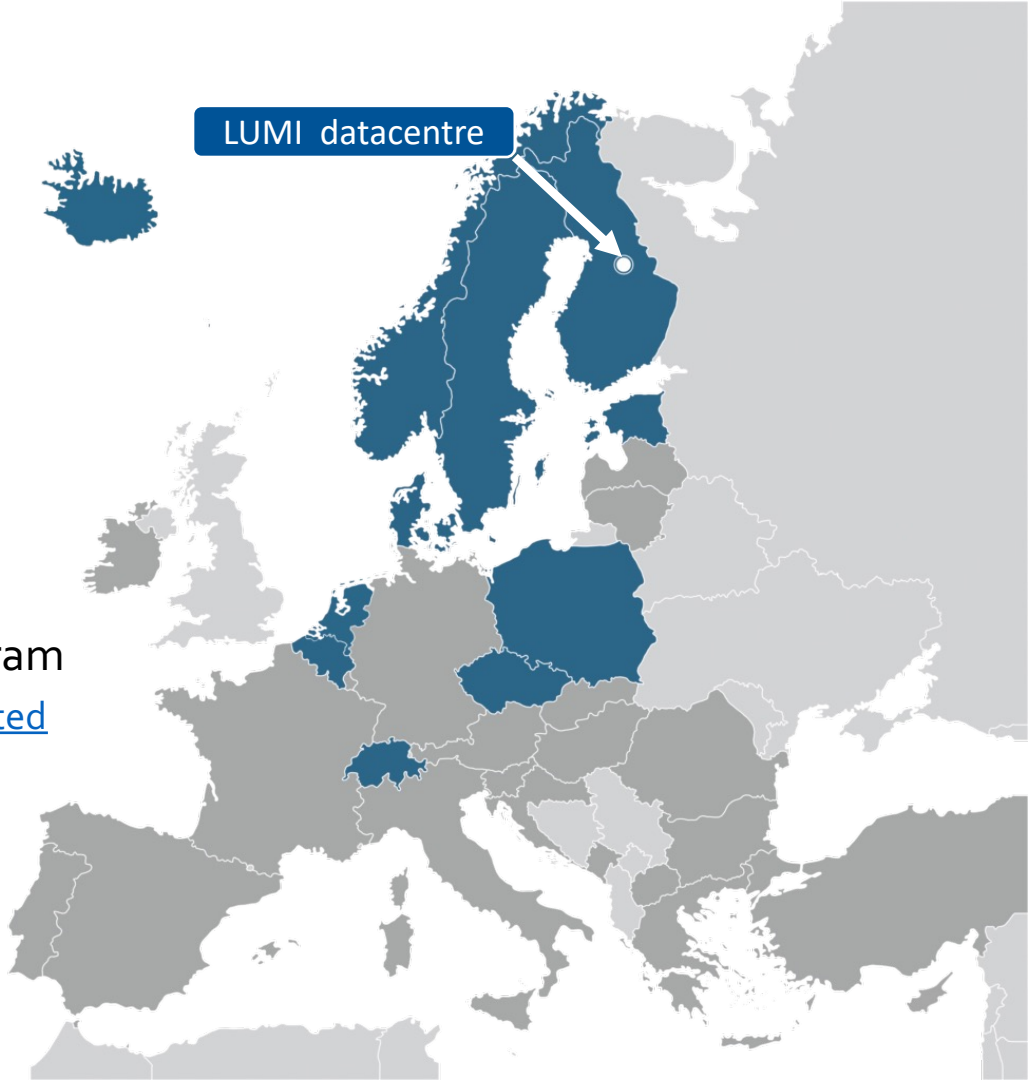
Getting Access to LUMI

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May 2024

Who pays the bills?

- EuroHPC machine so joint funding of:
 - EuroHPC JU (50%)
 - Consortium of 11 countries (The Netherlands recently joined)
- The resources of LUMI are allocated proportional to the investments
- Each LUMI consortium country sets its own policies for a national access program
 - See www.lumi-supercomputer.eu/get-started
- So LUST does not manage access to LUMI!



Projects and users

- A project
 - Corresponds to a coherent amount of work done by a single person or a collaboration between a group of users.
 - Typically a research project
 - Project for a course
 - Some projects for organisational issues, e.g., local support team project
 - The basis for most resource allocations on LUMI
 - Compute budget: CPU core-hours for LUMI-C, GPU hours for LUMI-G and visualisation nodes
 - Storage budget: Expressed in TB·hours
 - Budgets are assigned and managed by the resource allocators, not by the LUMI User Support Team
 - LUMI projects: project_465XXXXXX or project_462XXXXXX (Finland only)
 - This is the number that you should mention when contacting LUMI User Support

Projects and users (2)

- A user account
 - One physical person per account
 - Do not share accounts!
 - Some physical persons have more than one account
 - An unfortunate consequence of decisions made very early on in the project
 - Needs a project to do anything useful on LUMI
- Many-to-many mapping between projects and user accounts
 - Projects can of course have several users who collaborate
 - Users can be a member of multiple projects (and this is more common than you think)
- Resources:
 - Mostly attached to projects
 - Bare minimum for user accounts: just a fixed size home directory

Projects management

- Different systems in different countries
 - Finland: MyCSC, completely independent management
 - Other countries and EuroHPC projects are managed via puhuri
 - Web-based portal developed by the Nordic countries for project and resource allocation management (and not just for LUMI)
 - Some countries have their own front-end, other countries use a Puhuri front-end
 - Login to Puhuri via MyAccessID
 - MyAccessID is a GÉANT service that then interfaces with your institute identity provider and several alternatives
 - Always use the same credentials!
 - This is also the place for ssh key management for Puhuri projects
- Quick check of your resources on the system command line: `lumi-workspaces`

File spaces – User-specific

- Home directory: /users/<my_uid>
 - Limited in size and not extensible
 - Should be used only for very personal stuff: user-specific configuration files, etc.
 - Not meant as a way to transfer data to future projects
 - Not billed

File spaces – Project based

- All billed against the storage budget
- Permanent storage in /project/project_46YXXXXXX
 - Place for, e.g., software installations, permanent input data sets
 - Billed at 1 TB·hour per TB per hour used
- Disk-based scratch storage in /scratch/project_46YXXXXXX
 - May be erased after 90 days
 - Billed at 1 TB·hour per TB per hour used
- Flash-based scratch storage in /flash/project_46YXXXXXX
 - May be erased after 30 days
 - Billed at 10 TB·hour per TB per hour used
- Permanent object storage (LUMI-O)
 - Billed at 0.5 TB·hour per TB per hour used

File spaces - Quota

Goal	Where?	Capacity	Files	Retention
User home	/users/<username>	20 GB	100k	User lifetime
Project persistent	/project/<project>	50-500 GB	100k	Project lifetime
Project scratch	/scratch/<project>	50-500 TB	2M	90 days
Project fast scratch	/flash/<project>	2-100 TB	1M	30 days

- Flexibility in block quota (within limits) but less flexibility in file quota
 - See day 2 session: Big parallel file systems don't like small files
 - Singularity containers should be used for software installations with lots of small files
 - Quota extensions currently done by the LUMI User Support Team

File spaces – Further information

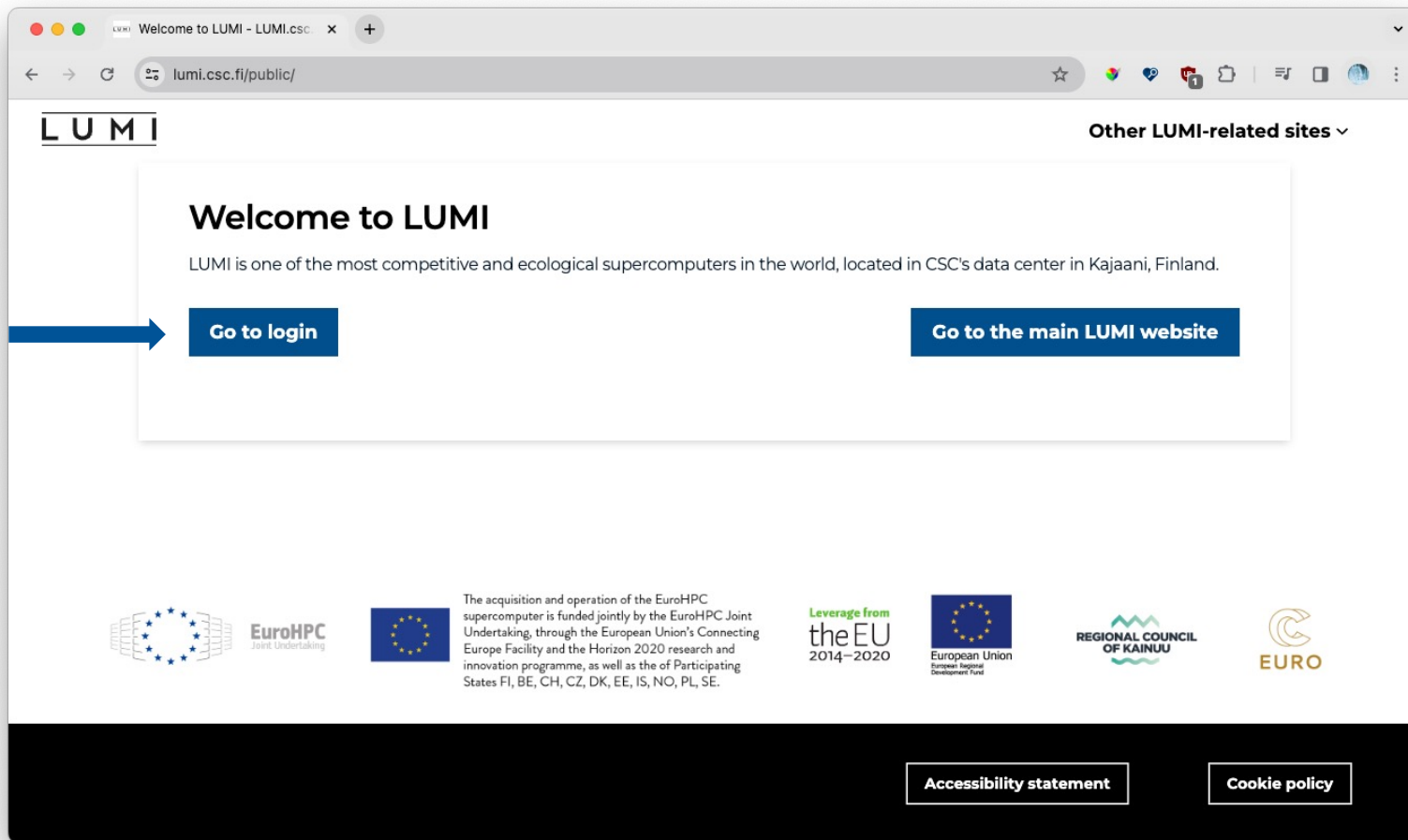
- 4 disk based file systems for /users, /project and /scratch
 - Your user home directory may be on a different file system as your /project and /scratch directory
 - And no, the LUMI User Support Team cannot change that
- /flash is also a parallel file system...
- LUMI is not a data archiving or data publishing system
 - “Permanent” = for the duration of the project
 - Data that is not needed anymore should be moved to your home institute or an archiving service
 - No backup
 - NL: [SURF Data Archive](#) and [SURF Data Repository](#)

Access

- 4 login nodes accessible via key-based ssh
 - Generic name: lumi.csc.fi
 - Specific login nodes: lumi-uano1.csc.fi, lumi-uano2.csc.fi, lumi-uano3.csc.fi, lumi-uano4.csc.fi
 - May be needed for tools for remote editing etc.
 - Key management:
 - Most users: Via MyAccessID: mms.myaccessid.org
 - Users who entered first via CSC: my.csc.fi
- Web interface via Open OnDemand: www.lumi.csc.fi
 - Own set of login nodes
 - Tools still being added
- Moderate support for GUI applications on LUMI through other technologies
 - X11 over ssh is unbearably slow for most users
 - VNC support provided via OOD or via a separate module and browser of VNC client

Open OnDemand (1)

LUMI





The screenshot shows a web browser window with the URL `lumi.csc.fi/public/`. The page features the LUMI logo in the top left and a navigation menu in the top right. The main content area contains a welcome message and two prominent blue buttons: "Go to login" and "Go to the main LUMI website". A blue arrow points from the left edge of the browser window to the "Go to login" button. The footer includes logos for EuroHPC, the European Union, Leverage from the EU, the European Union, the Regional Council of Kainuu, and EURO, along with text describing the funding sources. At the bottom right, there are links for "Accessibility statement" and "Cookie policy".


Welcome to LUMI


LUMI is one of the most competitive and ecological supercomputers in the world, located in CSC's data center in Kajaani, Finland.


[Go to login](#) [Go to the main LUMI website](#)


 EuroHPC
Joint Undertaking

 The acquisition and operation of the EuroHPC supercomputer is funded jointly by the EuroHPC Joint Undertaking, through the European Union's Connecting Europe Facility and the Horizon 2020 research and innovation programme, as well as the of Participating States FI, BE, CH, CZ, DK, EE, IS, NO, PL, SE.

 Leverage from
the EU
2014-2020

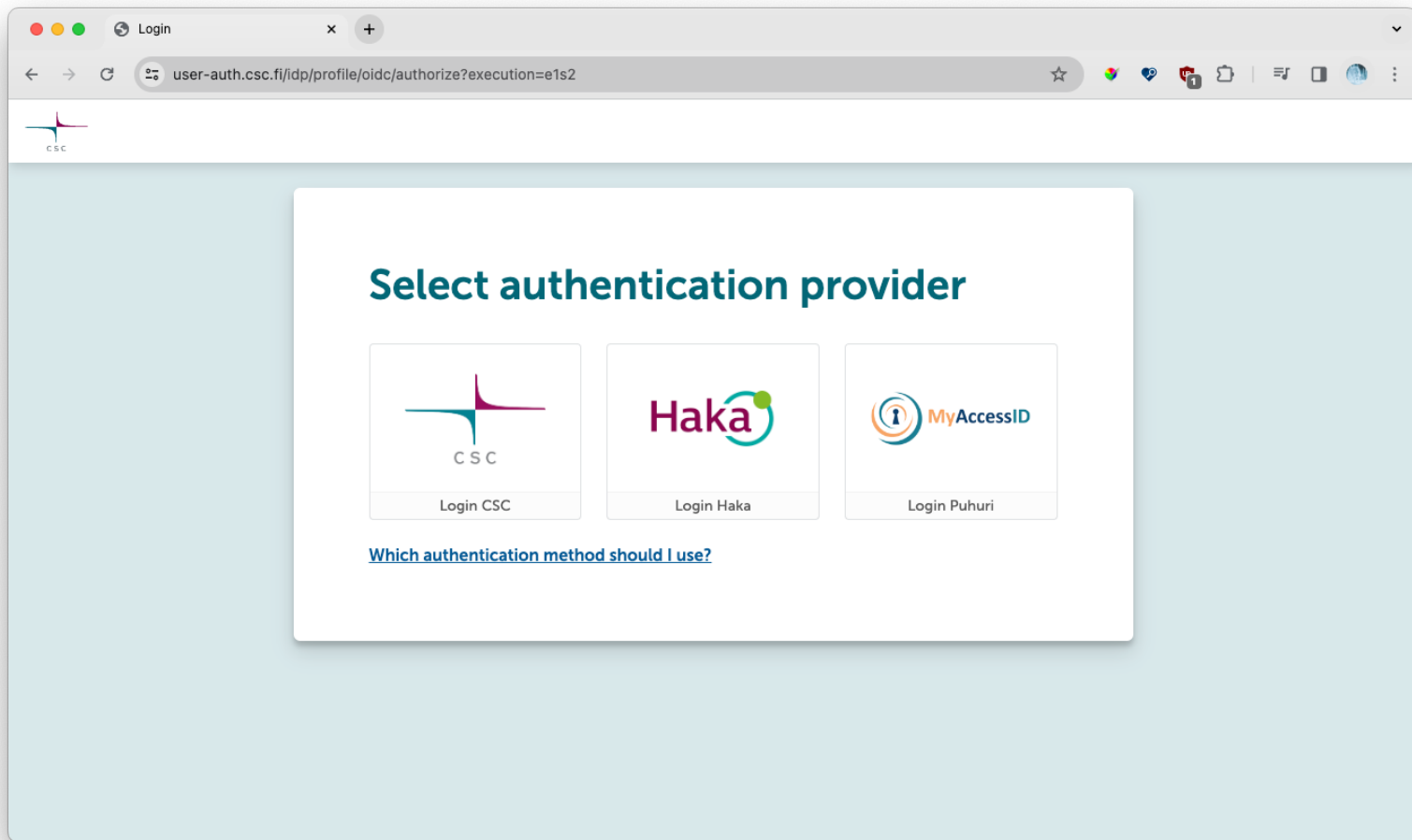
 European Union
European Regional
Development Fund

 REGIONAL COUNCIL
OF KAINUU

 EURO

[Accessibility statement](#) [Cookie policy](#)

Open OnDemand (2)



Open OnDemand (3)

LUMI

The screenshot shows a web browser window with the URL `lumi.csc.fi/pun/sys/dashboard/`. The page features a navigation bar with the LUMI logo and menu items for Files, Jobs, Apps, and Tools. A light blue notification banner at the top states: "The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app." Below this is a "Pinned Apps" section with a grid of application tiles. A blue arrow points from the "Compute node shell" tile to the "Login node shell" tile. The "Notifications" section at the bottom indicates "You have no notifications."











Dashboard - LUMI.csc.fi x +

lumi.csc.fi/pun/sys/dashboard/

LUMI Files Jobs Apps Tools

The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app.

Pinned Apps

 Home Directory	 Compute node shell	 Login node shell	 Desktop	 Active Jobs
 Jupyter	 Jupyter for courses	 Julia-Jupyter	 TensorBoard	 Visual Studio Code

Notifications

You have no notifications.

Open OnDemand (4) – Login node shell

L U M I

```
Dashboard - LUMI.csc.fi x kulust@uan09.lumi.csc ~ +
lumi.csc.fi/pun/sys/shell/ssh/default
Host: uan09.can Themes: Github

* | functional anymore. Many base libraries for 23.09 have already
* | been installed with a few more to follow, and we are now
* | porting some of the recipes for user-installable software as
* | we expect that versions before 23.09 will not be supportable
* | after the next big system update.
* |
* | You can use the lumi-workspaces command (without loading an
* | additional module) to check your quota and allocations on
* | LUMI. Also check `module help lumi-tools` for more info.
* |
* | .Notes-----
* | Make sure one of the following modules is loaded to have the
* | full LUMI experience:
* | - CrayEnv: The Cray software stack enriched with some
* |   additional tools not installed by default in the OS
* | - LUMI: The extensible LUMI software stack that you can use
* |   as a basis for additional software installs with EasyBuild
* |   and other tools.
* | - spack: If you are an experienced Spack user and know how it
* |   works. Spack is offered as-is. We do not do development or
* |   bug fixing in Spack but do offer a configuration compatible
* |   with the Cray PE.
** |-----**
** |-----**

Did you know?
*****
The preferred way to contact the LUMI User Support Team is using the forms on
https://lumi-supercomputer.eu/user-support/need-help/. Please don't recycle an
old ticket for a new request but fill in the form again. This ensures the
proper handling of your request. LUMI user support is active on workdays
from 8am till 6 pm central-European time so covers the regular 9-to-5 business
hours in all countries of EuroHPC.

There are storage quota and storage billing unit warnings:
WARNING: project_46500961 is out of storage hours

[lumi][kulust@uan09-1001 ~]$
```

- This app does not run in the context of a job,
- but on a separate set of login nodes

Open OnDemand (5)

The screenshot shows a web browser window with the URL `lumi.csc.fi/pun/sys/dashboard/`. The page features a navigation bar with the LUMI logo and menu items for Files, Jobs, Apps, and Tools. A light blue notification banner at the top states: "The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app." Below this is a "Pinned Apps" section with a grid of ten application tiles. A blue arrow points to the "Home Directory" tile. The tiles are: Home Directory (house icon), Compute node shell (terminal icon), Login node shell (terminal icon), Desktop (monitor icon), Active Jobs (clock icon), Jupyter (jupyter logo), Jupyter for courses (jupyter logo), Julia-Jupyter (Julia logo), TensorBoard (TensorBoard logo), and Visual Studio Code (VS Code logo). At the bottom, a "Notifications" section indicates "You have no notifications."











Dashboard - LUMI.csc.fi x +

lumi.csc.fi/pun/sys/dashboard/

LUMI Files Jobs Apps Tools

The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app.

Pinned Apps

 Home Directory	 Compute node shell	 Login node shell	 Desktop	 Active Jobs
 Jupyter	 Jupyter for courses	 Julia-Jupyter	 TensorBoard	 Visual Studio Code

Notifications

You have no notifications.

Open OnDemand (6) – Home Directory

LUMI

The screenshot shows the LUMI Open OnDemand web interface. At the top, there's a navigation bar with the LUMI logo and menu items: Files, Jobs, Apps, Tools. Below this is a light blue notification banner stating: "The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app." Below the banner is a toolbar with buttons: Open in Terminal, Refresh, New File, New Directory, Upload, Download, Copy/Move, and Delete. The main content area is titled "Home Directory" and shows a list of directories. A callout box is overlaid on the interface, containing the following text:

- This app does not run in the context of a job
- Can also be used for uploading and downloading data, but will fail for big transfers

The directory list below the callout shows:

<input type="checkbox"/>		container-demo		-	18-9-2023 12:53:27
<input type="checkbox"/>		course		-	17-2-2023 19:02:44
<input type="checkbox"/>		Desktop		-	11-4-2024 12:24:45
<input type="checkbox"/>		Documents		-	11-4-2024 12:24:51

Open OnDemand (7)

The screenshot shows a web browser window with the URL `lumi.csc.fi/pun/sys/dashboard/`. The page features a navigation bar with the LUMI logo and menu items for Files, Jobs, Apps, and Tools. A light blue notification banner at the top states: "The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app." Below this is a "Pinned Apps" section with a grid of ten application tiles. A blue arrow points from the "Login node shell" tile to the "Desktop" tile. The "Notifications" section at the bottom indicates "You have no notifications."











Dashboard - LUMI.csc.fi x +

lumi.csc.fi/pun/sys/dashboard/

LUMI Files Jobs Apps Tools

The web interface has been updated to release 3. MATLAB and Visit are now available in the Desktop app. Additionally, the web version of MATLAB is also available as an interactive app.

Pinned Apps

 Home Directory	 Compute node shell	 Login node shell	 Desktop	 Active Jobs
 Jupyter	 Jupyter for courses	 Julia-Jupyter	 TensorBoard	 Visual Studio Code

Notifications

You have no notifications.

Open OnDemand (8) – Desktop app

LUMI

The screenshot displays the LUMI web interface for managing interactive sessions. The browser address bar shows the URL `lumi.csc.fi/pun/sys/dashboard/batch_connect/sessions`. The left sidebar contains a menu with categories: Graphical applications (Desktop, Servers), Course environments (Jupyter for courses), and Tools (>_Compute node shell). The main content area shows session details for a job with ID `01210c84-67ed-46...`. Key information includes: Time Remaining: 28 minutes, Project: `project_465000095`, Partition: `lumid`, Cores: 4, Memory: 4096M, and GPUs (A40): 1. Below the details are two tabs: 'noVNC Connection' (selected) and 'Native Instructions'. The 'noVNC Connection' tab features two sliders: 'Compression' (set to approximately 5) and 'Image Quality' (set to approximately 5), both ranging from 0 (low) to 9 (high). A blue arrow points from the '>_Compute node shell' option in the Tools menu to the 'Launch Desktop' button. A 'View Only (Share-able Link)' button is also present. A text box on the right contains a list of bullet points.

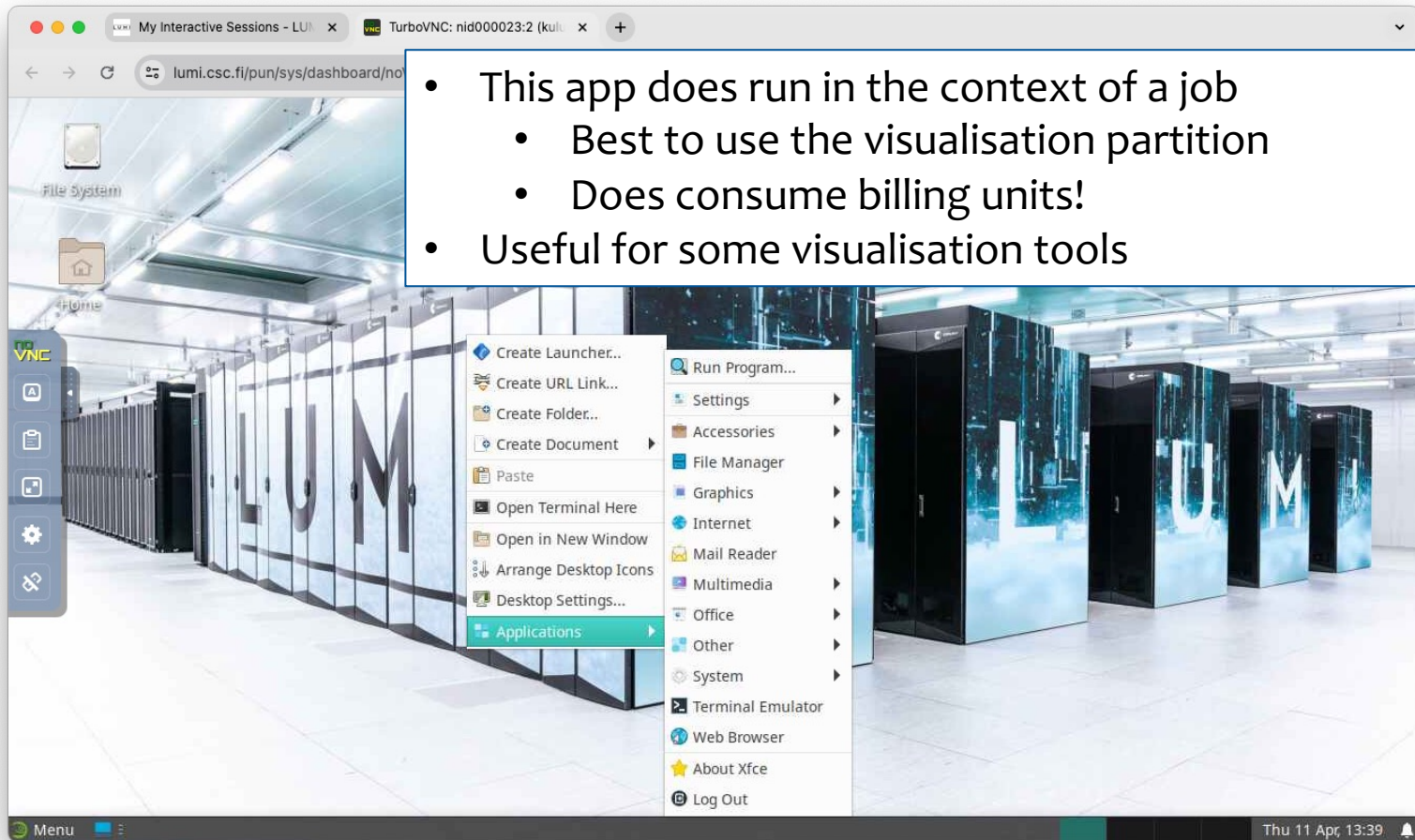
- Runs as a job
- Skipped parameters for the job
- VNC-based with a choice of connection options, including just the web browser

powered by OPEN OnDemand

LUMI web interface: **Release 3**
Based on OnDemand version: 3.1.4
Cookie policy

Open OnDemand (9) – Desktop app

LUMI



• This app does run in the context of a job

- Best to use the visualisation partition
- Does consume billing units!

• Useful for some visualisation tools

Menu Thu 11 Apr, 13:39

Data transfer

- sftp to the login nodes
 - Authentication with your ssh key
 - Can be slow on high latency connections
 - Slow connections are not the fault of LUMI but of the whole path to the machine
- Data transfer via the object storage system LUMI-O
 - Transfer to LUMI-O and then to other LUMI file systems
 - Or from the file systems of LUMI to LUMI-O and then to your home institute
 - Support for various tools including rclone and S3 commands
 - Multi-stream transfers are a way to deal with high latency
 - See the [storage section of the LUMI documentation](https://docs.lumi-supercomputer.eu/storage) at docs.lumi-supercomputer.eu and the next slides
- Unfortunately no support yet for Globus or other forms of gridFTP

What is LUMI-O?

- Object storage system, based on Ceph
 - Finnish users: similar to Allas, but less functionality at the moment
 - Specific tools to access data, not mounted as a regular file system
- Organisation:
 - Buckets: “Containers” used to store objects.
 - Flat structure: Buckets cannot contain other buckets
 - Objects: Any type of data, stored in a bucket
 - Metadata for buckets and objects
 - Bucket: e.g., access rights
 - Custom metadata possible

What is LUMI-O? (2)

- Objects can be served on the web also
 - This is how recordings of some LUST courses are served
 - But not meant as a data publishing service (e.g., no EUDAT alternative)
- Can be reached easily from outside LUMI
 - So also a mechanism for data exchange
 - Tools of object storage are more performance and more robust than sftp
- Specs:
 - Capacity: 30 PB
 - Quota: 150 TB capacity, 1K buckets and 500K objects per bucket (fixed)
 - Billed at 0.5 TB·hour per TB per hour
 - Persistent for the duration of the project

Accessing LUMI-O

- Access is based on keys
 - Generated via a web interface
 - But there may be alternatives in the future
- Tools on LUMI
 - `rclone`: Easiest tool if you want public and private data
 - `s3cmd`
 - `restic`
- Tools on remote systems (e.g., your laptop)
 - Many tools possible, though some may be a bit tricky to configure
 - Web-based tool that generates configuration scripts
- Access via the Open OnDemand web interface is work-in-progress

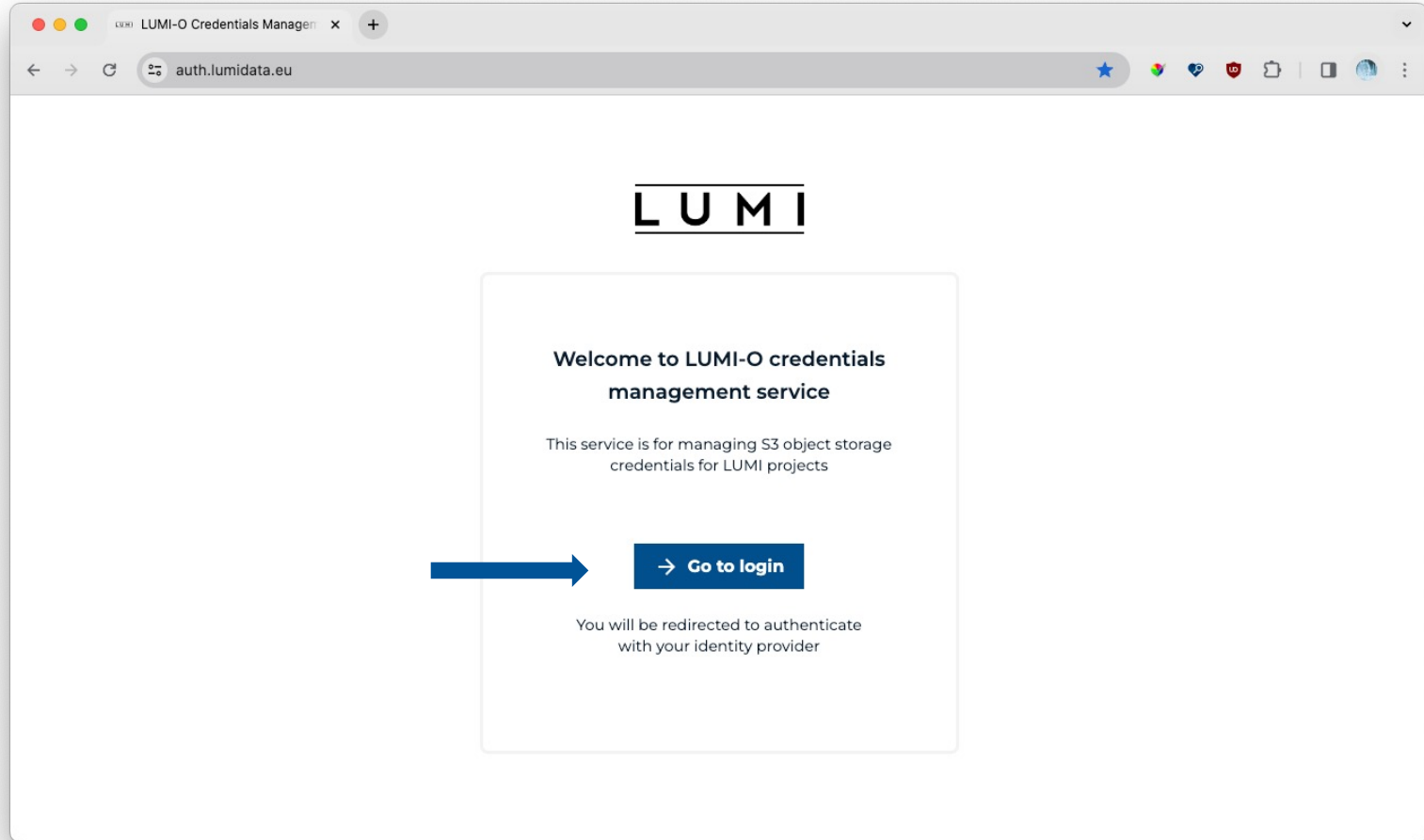
Accessing LUMI-O

Key generation

- Web interface at auth.lumidata.eu
- You'll have to select your login method in the same way as for Open OnDemand
- After a while you should see a list of projects, select the one for which you want to generate a key
 - The right column will show active keys for the project, and expired ones
- Selecting an active access key changes the right column to one where you get information about the key, can extend the key and can generate templates to configure various tools

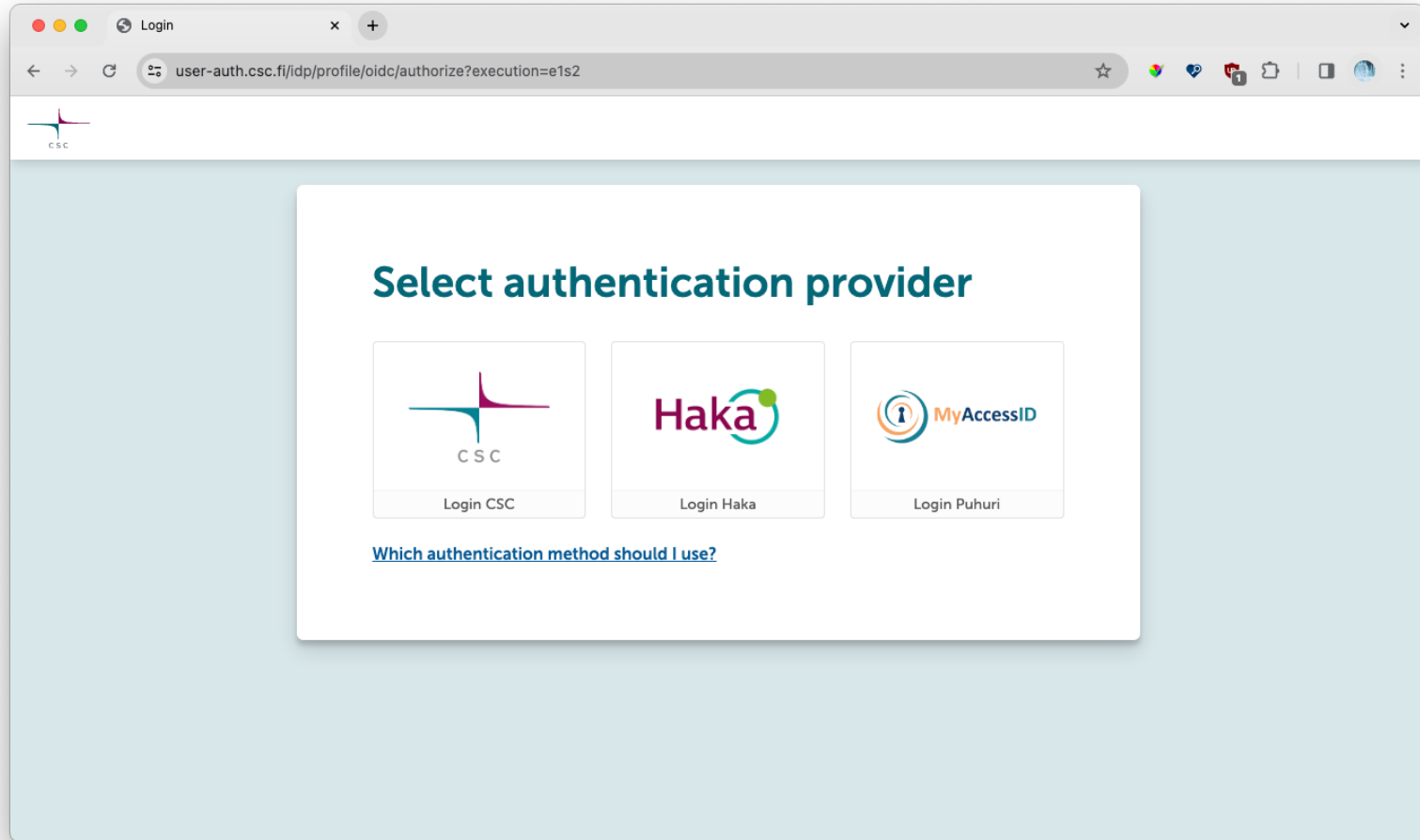
Credential mangement web interface (1)

L U M I



Credential management web interface (2)

LUMI



The screenshot shows a web browser window with the address bar containing the URL `user-auth.csc.fi/oidc/profile/oidc/authorize?execution=e1s2`. The page features a light blue background with a white central box. At the top left of the page is the CSC logo. The main heading in the white box is "Select authentication provider". Below this heading are three selectable options, each with a logo and a button:

- CSC**: The CSC logo (a stylized cross) is above the text "C S C". Below it is a button labeled "Login CSC".
- Haka**: The Haka logo (the word "Haka" in purple with a green circle) is above the text "Haka". Below it is a button labeled "Login Haka".
- MyAccessID**: The MyAccessID logo (a blue circle with an 'i' and the text "MyAccessID") is above the text "MyAccessID". Below it is a button labeled "Login Puhuri".

At the bottom of the white box, there is a blue link: [Which authentication method should I use?](#)

Credential management web interface (3)

L U M I

The screenshot shows a web browser window with the URL `auth.lumidata.eu/projects/465001102`. The page features the LUMI logo and navigation links for [Help & Support](#), [Documentation](#), and [Logout](#).

Your projects

Project number	Project description
465000095	VLAAMS SUPERCOMPUTER CENTRUM / VSC-SUPPORT
465000297	LUST Training / Detailed introduction to the LUMI-C environment and architecture (23-24 Nov 22)
465000844	VLAAMS SUPERCOMPUTER CENTRUM / VSC-2023-04-T159-KH-EASYBUILD
465000961	LUST Training / 2024-02-08 LUMI Intro
465001098	LUST Training / 2024-04-23-26 LUMI General
465001102	LUST Training / 2024-05-02-03 Supercomputing with LUMI

A blue arrow points to the project with ID 465001102.

Authentication keys

Project number: 465001102

Generate a new authentication key pair

Both fields are required. Key duration may not exceed 168 hours.

Duration (hours)*

Key description*

[Generate key](#)

Available keys

There are no keys to show.

The keys you generate will appear in this list.

A blue arrow points to the [Generate key](#) button.

Credential management web interface (4)

LUMI

The screenshot displays the LUMI-O Credentials Management web interface. The browser address bar shows the URL `auth.lumidata.eu/projects/465001102`. The page header includes the LUMI logo and navigation links for Help & Support, Documentation, and Logout.

Your projects

Project number	Project description
465000095	VLAAMS SUPERCOMPUTER CENTRUM / VSC-SUPPORT
465000297	LUST Training / Detailed introduction to the LUMI-C environment and architecture (23-24 Nov 22)
465000844	VLAAMS SUPERCOMPUTER CENTRUM / VSC-2023-04-T159-KH-EASYBUILD
465000961	LUST Training / 2024-02-08 LUMI Intro
465001098	LUST Training / 2024-04-23-26 LUMI General
465001102	LUST Training / 2024-05-02-03 Supercomputing with LUMI

Generate a new authentication key pair

Both fields are required. Key duration may not exceed 168 hours.

Duration (hours)*

Key description*

Generate key

Available keys

Access key
OGR2KN5PUPW929W9WPP4
Course demo
Expires on: Apr 18 2024 11:29:54 GMT+0200

Expired keys

The are no expired keys to show.

Credential management web interface (5)

LUMI

The screenshot shows a web browser window with the URL `auth.lumidata.eu/projects/465001102/keys/OGR2KN5PUPW929W9WPP4`. The page features the LUMI logo and navigation links for Help & Support, Documentation, and Logout. The main content is divided into two sections: 'Your projects' and 'Authentication keys'.

Your projects

Project number	Project description
465000095	VLAAMS SUPERCOMPUTER CENTRE SUPPORT
465000297	LUST Training / Detailed introductory C environment and architecture [2]
465000844	VLAAMS SUPERCOMPUTER CENTRE 04-T159-KH-EASYBUILD
465000961	LUST Training / 2024-02-08 LUMI Ir
465001098	LUST Training / 2024-04-23-26 LUMI
465001102	LUST Training / 2024-05-02-03 Supercomputing with LUMI

Authentication keys

Access key details

Access key	OGR2KN5PUPW929W9WPP4
Secret key	LyYAKH4i5oULHMBwvisOskQwdl6xkm0Jc2G8Jam9
Key description	Course demo
Project number	465001102
Project description	LUST Training / 2024-05-02-03 Supercomputing with LUMI
Key owner	kulust
Creation time	Apr 11 2024 11:29:54 GMT+0200
Expires on	Apr 18 2024 11:29:54 GMT+0200

Extend key duration

The expiry time of a key is calculated from the time of its generation and cannot be extended.

Credential management web interface (6)

L U M I

L U M I

Help & Support Documentation Logout

Your projects

Project number	Project description
46500095	VLAAMS SUPERCOMPUTER CENTI SUPPORT
46500297	LUST Training / Detailed introductory C environment and architecture (2
46500844	VLAAMS SUPERCOMPUTER CENTI 04-T159-KH-EASYBUILD
46500961	LUST Training / 2024-02-08 LUMI Ir
465001098	LUST Training / 2024-04-23-26 LUM
465001102	LUST Training / 2024-05-02-03 Sup with LUMI

Extend key duration

The expiry time of a key is calculated from the time of its generation and cannot exceed a total of 168 hours.

Extend by (hours)

Configuration templates

Select configuration format to generate (opens in a new tab)

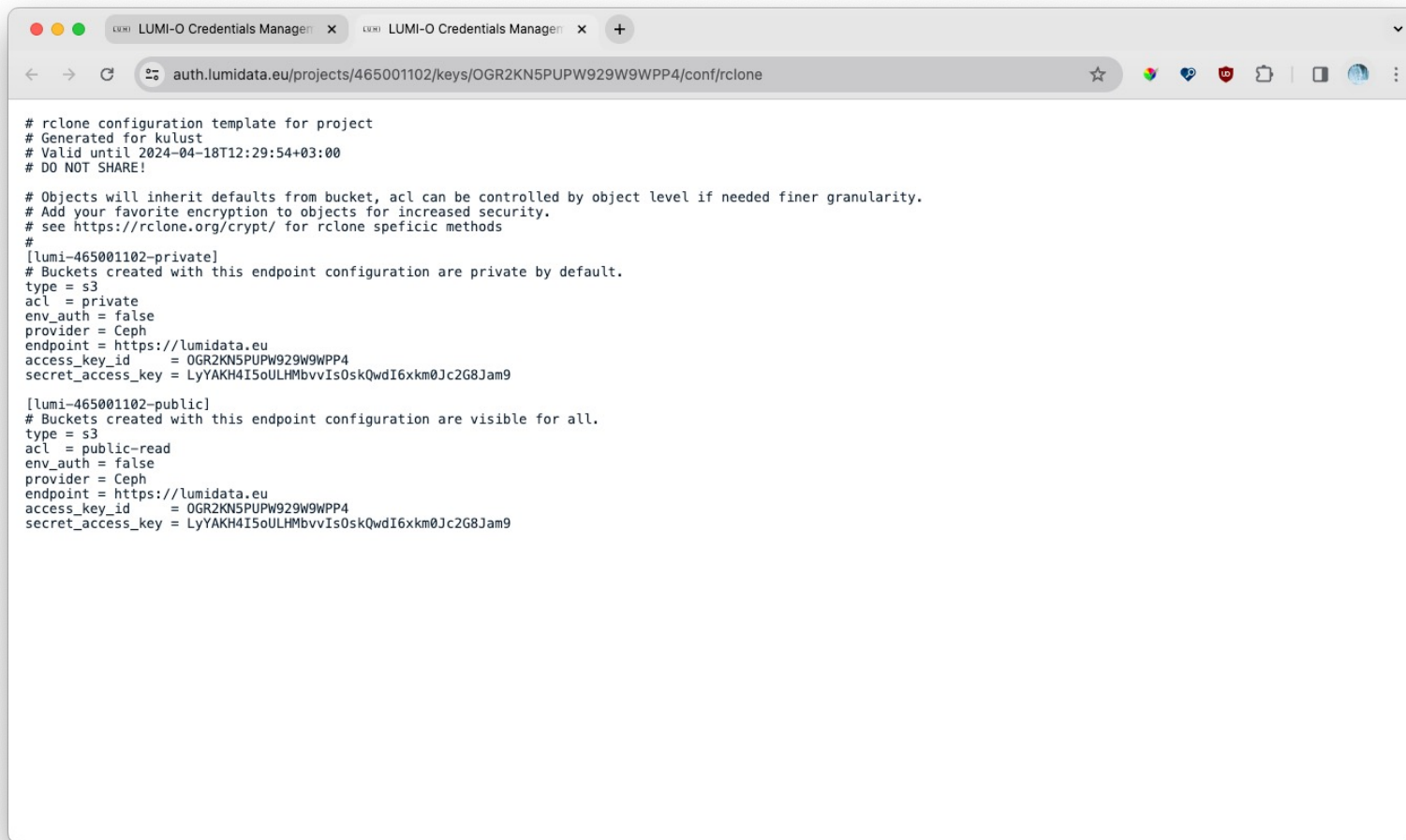
Se

- shell
- boto3
- rclone
- s3cmd
- aws

manently disable all connections where this key has been he connection

Credential mangement web interface (7)

LUMI



```
# rclone configuration template for project
# Generated for kulust
# Valid until 2024-04-18T12:29:54+03:00
# DO NOT SHARE!

# Objects will inherit defaults from bucket, acl can be controlled by object level if needed finer granularity.
# Add your favorite encryption to objects for increased security.
# see https://rclone.org/crypt/ for rclone specific methods
#
[lumi-465001102-private]
# Buckets created with this endpoint configuration are private by default.
type = s3
acl = private
env_auth = false
provider = Ceph
endpoint = https://lumidata.eu
access_key_id = OGR2KN5PUPW929W9WPP4
secret_access_key = LyYAKH4I5oULHMbvvis0skQwdI6xkm0Jc2G8Jam9

[lumi-465001102-public]
# Buckets created with this endpoint configuration are visible for all.
type = s3
acl = public-read
env_auth = false
provider = Ceph
endpoint = https://lumidata.eu
access_key_id = OGR2KN5PUPW929W9WPP4
secret_access_key = LyYAKH4I5oULHMbvvis0skQwdI6xkm0Jc2G8Jam9
```

Configuring LUMI-O tools

- On LUMI, you can use `lumio-conf` to configure `rclone` and `s3cmd`
 - Need to load the `lumio` module which also provides `rclone`, `s3cmd` and `restic`
 - Will ask for data from the “Access key details” screen
 - A future version may be more automatic
 - The `rclone` configuration differs from the one generated via the web interface
- Generate the configuration snippets via the web interface
 - E.g., for `rclone`: copy manually to `~/.config/rclone/rclone.conf`
 - Can be used to configure tools on your computer also

Rclone on LUMI-O

- The configuration contains two end points
 - With lumio-conf :
 - `lumi-o`: Buckets and objects uploaded to this endpoint will not be publicly accessible
 - `lumi-pub`: Buckets and objects uploaded to this endpoint will be publicly accessible
 - Can have both publicly accessible and not publicly accessible objects in one bucket
 - Web generator:
 - `lumi-465001102-private`: Private buckets and objects
 - `lumi-465001102-public`: Public buckets and objects
- When using the `rclone` command line tool, it is possible to throttle the speed for many commands with the `--bwlimit` command line option
 - May be needed if you upload from home over a very bandwidth-limited connection

Questions?

