

LUMI

A white wolf is the central focus, standing in a snowy, digital landscape. The background is a dark blue space filled with white, pixelated particles and vertical light streaks, creating a futuristic, high-tech atmosphere. The wolf is looking directly at the viewer with a calm expression.

Getting Access to LUMI

Kurt Lust
LUMI User Support Team (LUST)
University of Antwerp

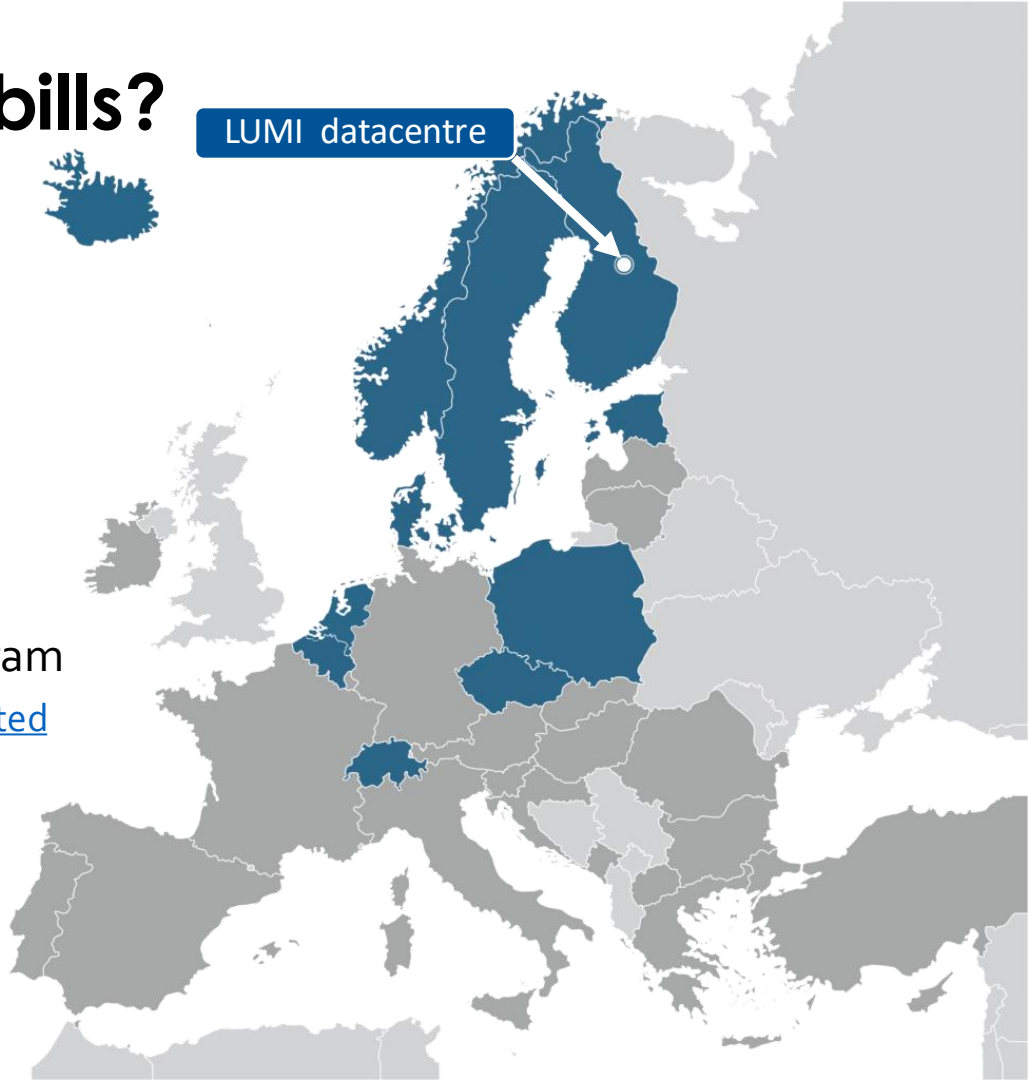
October 2025

EuroHPC supercomputers

- 5 petascale supercomputers: Meluxina, VEGA, Karolina, Discoverer, Deucalion
- 3 pre-exascale computers: LUMI, Leonardo and MareNostrum5
- One exascale computer operational: Jupiter, a second under procurement: Alice Recoque
- 2 new mid-range systems coming up: Arrhenius and Daedalus
- Future: “AI-optimised” supercomputers
- All are a joint investment of EuroHPC with one or more countries

LUMI: Who pays the bills?

- EuroHPC machine so joint funding of:
 - EuroHPC JU (50%)
 - Consortium of 11 countries (The Netherlands joined after the start)
- 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 (1)

- All billed against the storage budget
- Permanent storage in /project/project_46YXXXXXX
 - For historical reasons, also appears as /projappl/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, but this is not active
 - Billed at 1 TB·hour per TB per hour used

File spaces – Project based (2)

L U M I

- Flash-based scratch storage in /flash/project_46YXXXXXX
 - May be erased after 30 days, but this is not active
 - Billed at 3 TB·hour per TB per hour used
- Permanent object storage (LUMI-O)
 - Billed at 0.25 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 (not active)
Project fast scratch	/flash/<project>	2-100 TB	1M	30 days (not active)

- 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. Repeat: NO BACKUP.

- 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 login node
 - Simple GUI environment via the “Desktop” app, based on VNC
- Little support for GUI applications on LUMI through other technologies
 - X11 over ssh is unbearably slow for most users
 - Additional primitive VNC support outside of OOD (lumi-vnc module)

Open OnDemand (1)

L U M I

The screenshot shows a web browser window with the address bar displaying `lumi.csc.fi/public/`. A blue callout box with the text "Point to www.lumi.csc.fi" has an arrow pointing to the address bar. The website header includes the "L U M I" logo and a link for "Other LUMI-related sites". The main content area features a "Welcome to LUMI" heading, a descriptive paragraph, and two buttons: "Go to login" (highlighted with a blue arrow) and "Go to the main LUMI website". The footer contains logos for EuroHPC, the European Union, and the Regional Council of Kainuu, along with text about funding. At the bottom right, there are links for "Accessibility statement" and "Cookie policy".

Welcome to LUMI - LUMI.csc.fi x +

lumi.csc.fi/public/ Point to www.lumi.csc.fi

L U M I Other LUMI-related sites

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.

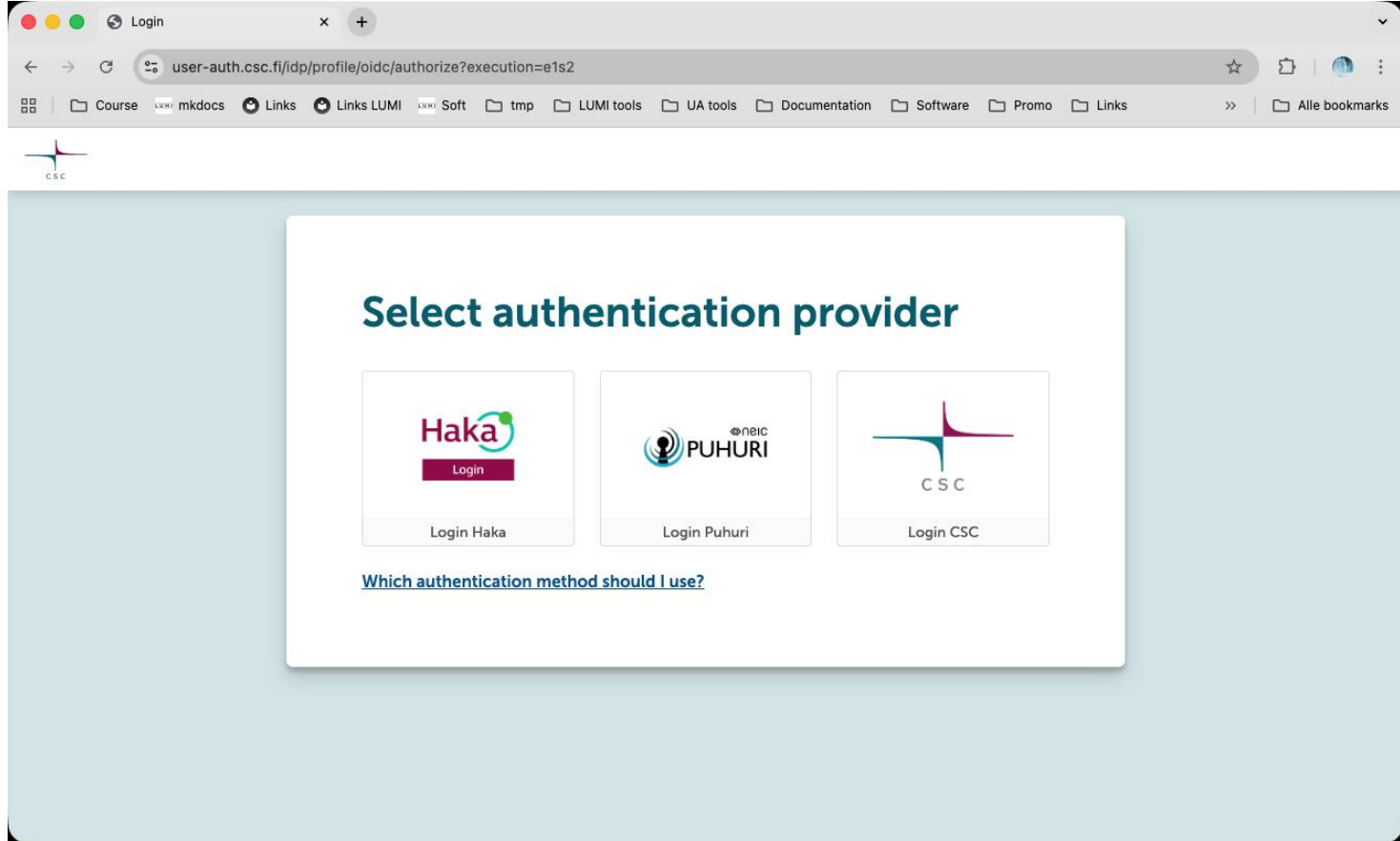
Go to login Go to the main LUMI website

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

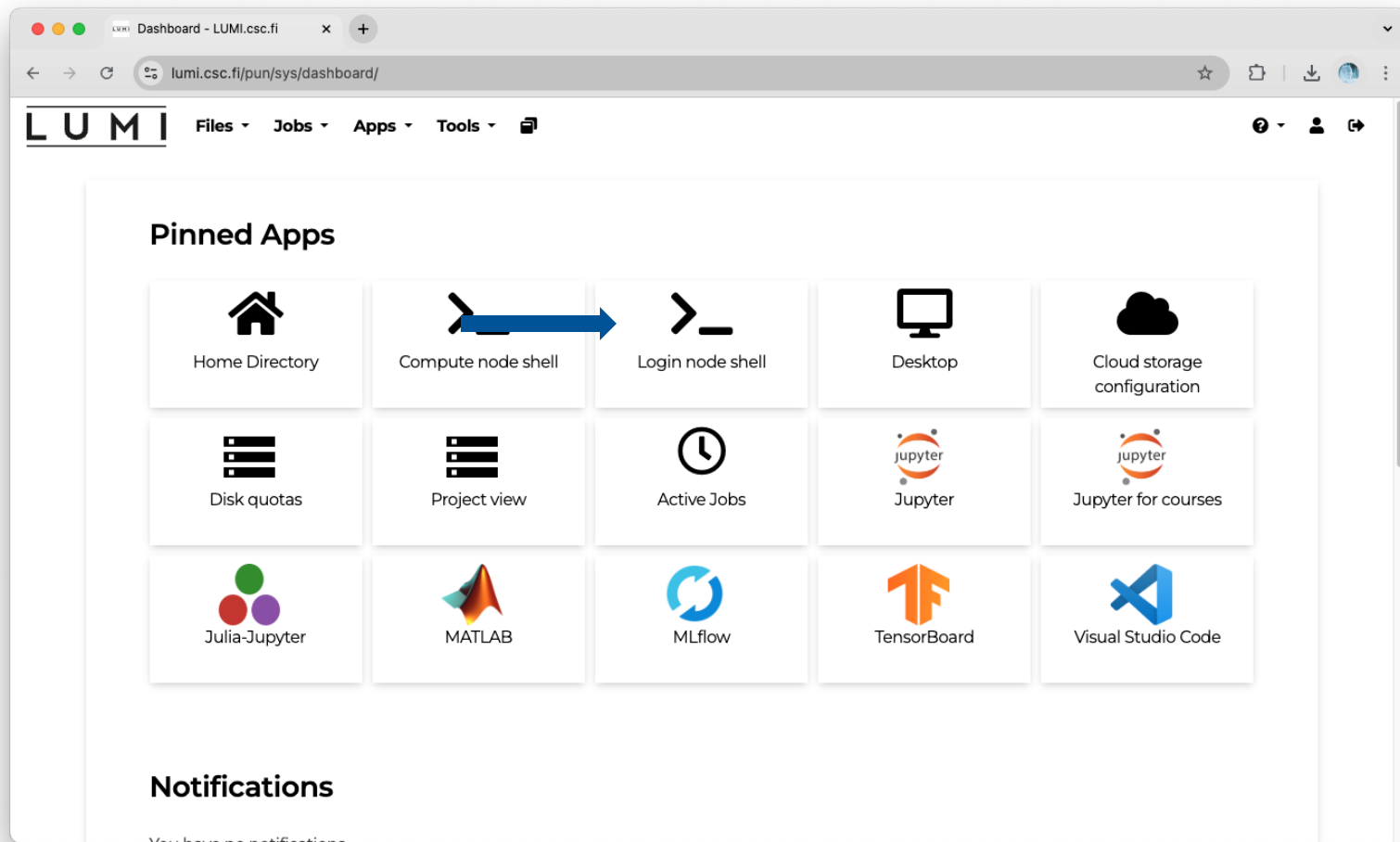
Open OnDemand (2)

LUMI



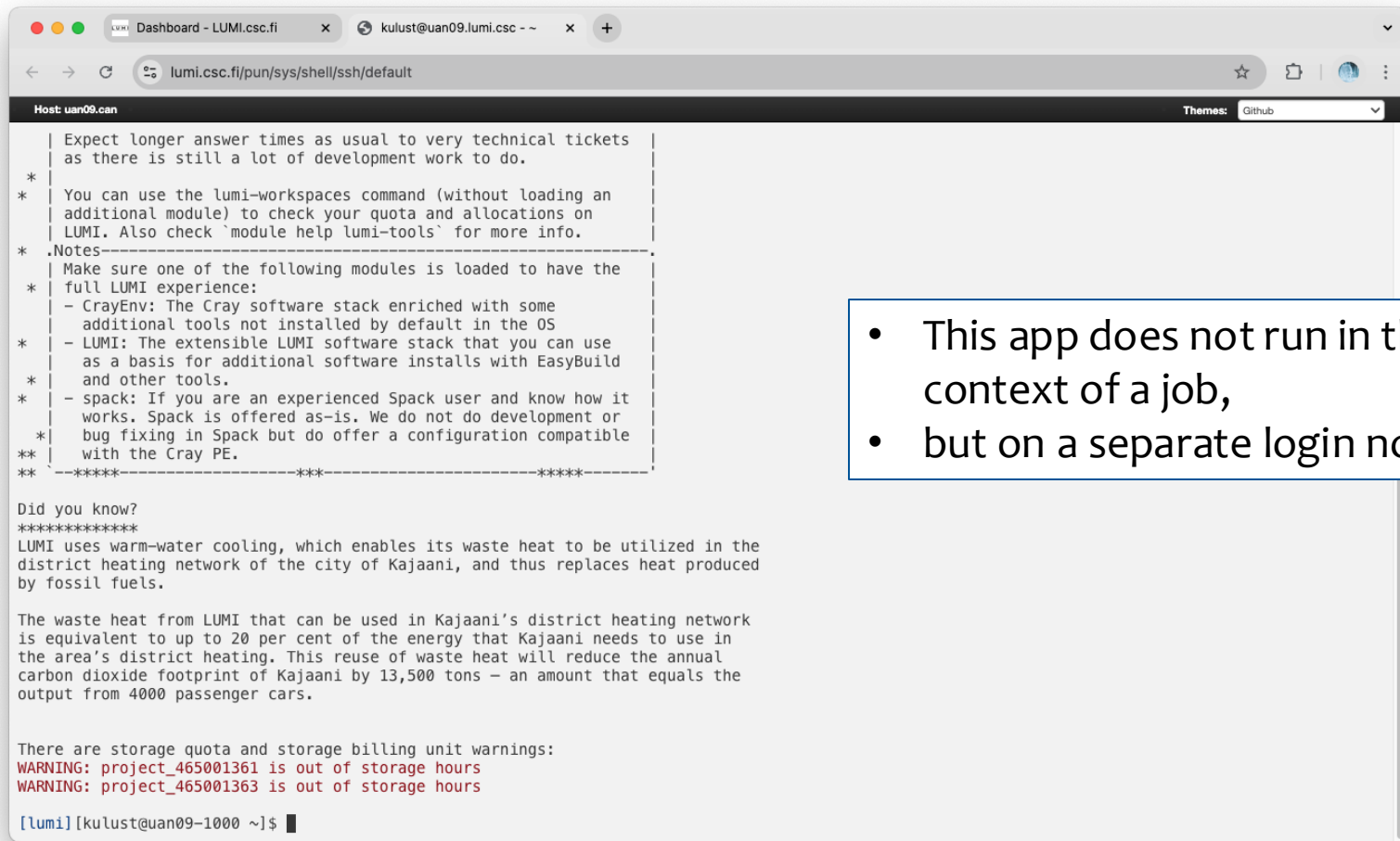
Open OnDemand (3)

L U M I



Open OnDemand (4) – Login node shell

L U M I

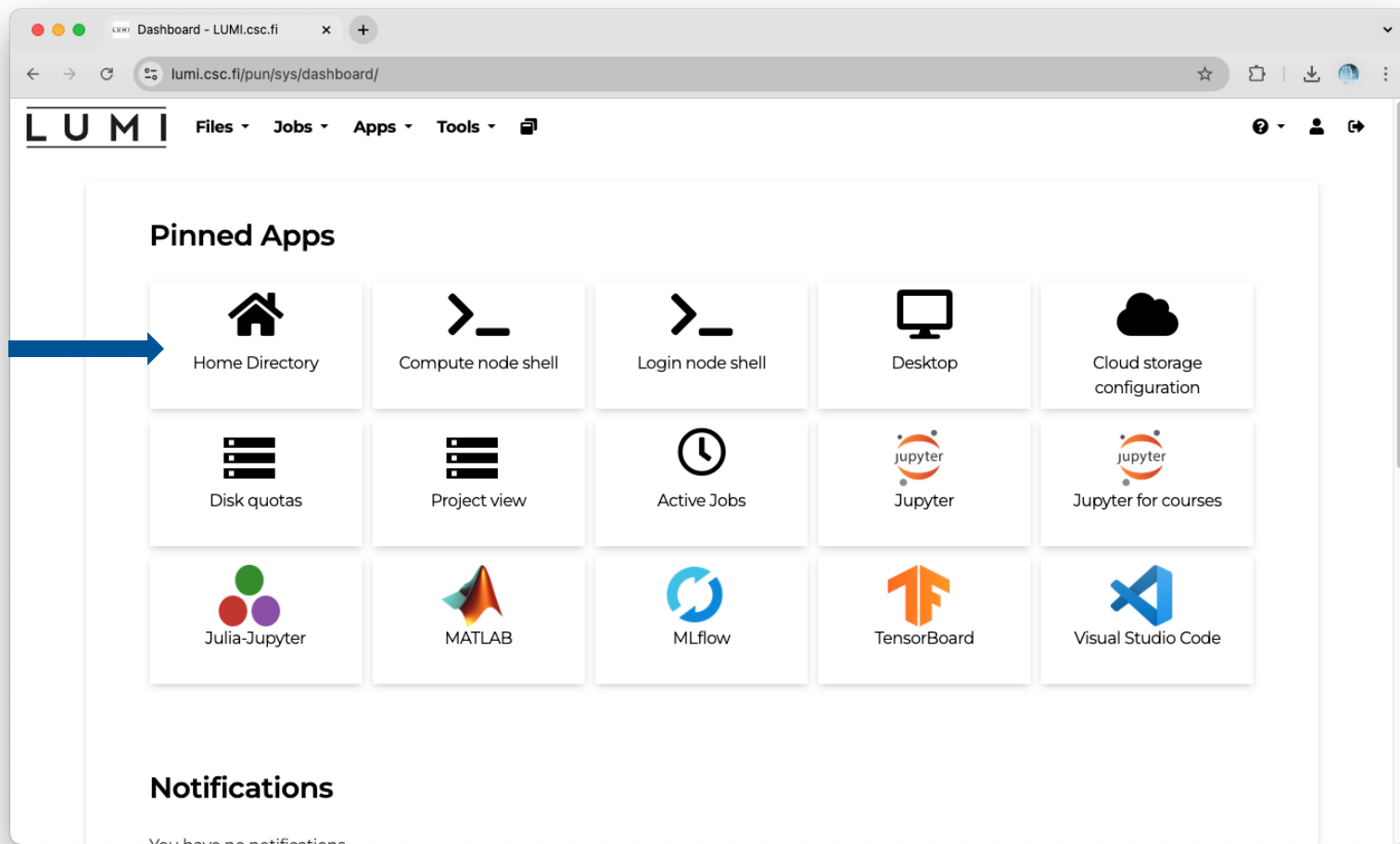


```
Host: uan09.can
Expect longer answer times as usual to very technical tickets
as there is still a lot of development work to do.
*
* You can use the lumi-workspaces command (without loading an
additional module) to check your quota and allocations on
LUMI. Also check 'module help lumi-tools' for 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?
*****
LUMI uses warm-water cooling, which enables its waste heat to be utilized in the
district heating network of the city of Kajaani, and thus replaces heat produced
by fossil fuels.
The waste heat from LUMI that can be used in Kajaani's district heating network
is equivalent to up to 20 per cent of the energy that Kajaani needs to use in
the area's district heating. This reuse of waste heat will reduce the annual
carbon dioxide footprint of Kajaani by 13,500 tons – an amount that equals the
output from 4000 passenger cars.
There are storage quota and storage billing unit warnings:
WARNING: project_465001361 is out of storage hours
WARNING: project_465001363 is out of storage hours
[lumi][kulust@uan09-1000 ~]$
```

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

Open OnDemand (5)

L U M I



Open OnDemand (6) – Home Directory

L U M I

Dashboard - LUMI.csc.fi

lumi.csc.fi/pun/sys/dashboard/files/fs/users/kulust

L U M I Files ▾ Jobs ▾ Apps ▾ Tools ▾

Open in Terminal Refresh New File New Directory Upload Download Copy/Move Delete

Home Directory

- /projappl/project_465001603
- /projappl/project_465000095
- /projappl/project_465000844
- /projappl/project_465001361
- /projappl/project_465001362
- /projappl/project_465001363
- /scratch/project_465001603
- /scratch/project_465000095
- /scratch/project_465000844
- /scratch/project_465001361
- /scratch/project_465001362
- /scratch/project_465001363
- /flash/project_465001603

/ users / kulust / Change directory Copy path

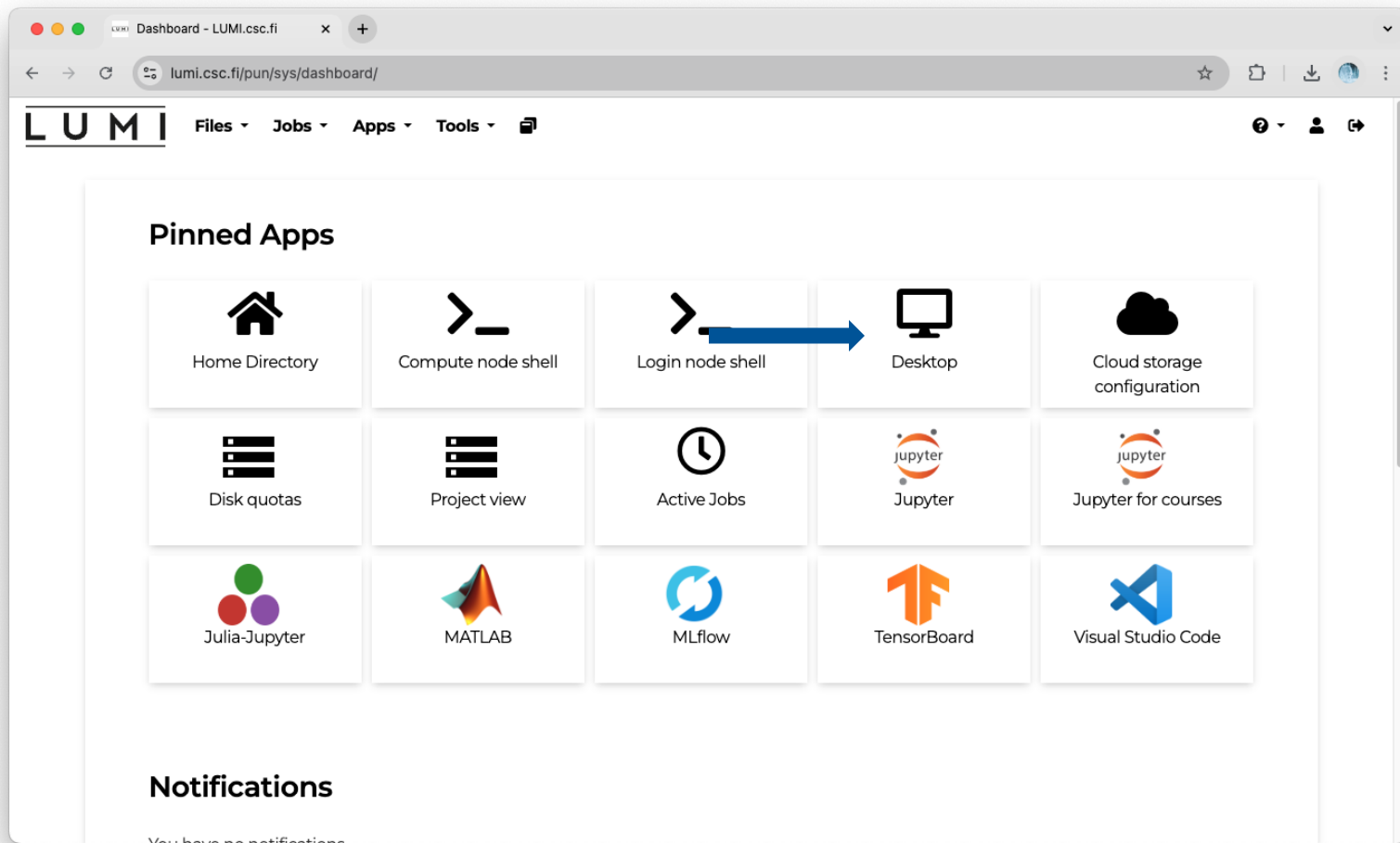
Show Owner/Mode Show Dotfiles Filter:

- 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

☐	Desktop	-	11-4-2024 12:24:45
☐	Documents	-	11-4-2024 12:24:51
☐	Downloads	-	26-5-2023 18:20:10
☐	EasyBuild	-	7-10-2024 11:08:13

Open OnDemand (7)

L U M I



Open OnDemand (8) – Desktop app

L U M I

The screenshot shows the Open OnDemand web interface in a browser window. The address bar displays the URL: `lumi.csc.fi/pun/sys/dashboard/batch_connect/sys/ood-vnc/default/session_contexts/new`. The interface is divided into a left sidebar and a main configuration area.

Left Sidebar:

- MATLAB (highlighted with a blue arrow pointing to the Partition field)
- TensorBoard
- Jupyter
- Tools
- >_Compute node shell
- Course environments
- Jupyter for courses

Main Configuration Area:

- Partition:** A text input field containing the value `lumid`.
- Resources:**
 - Number of CPU cores:** A text input field containing the value `2`. Below it, a note states: "SMT is enabled for the selected partition. 2 threads per core will be allocated."
 - Memory (GB):** A text input field containing the value `2`.
 - Number of GPUs (A40):** A text input field containing the value `1`.
 - Time:** A text input field containing the value `4:00:00`. Below it, a note states: "d-hh:mm:ss, or hh:mm:ss".
- Buttons:** At the bottom, there are two buttons: a blue "Launch" button (highlighted with a blue arrow) and a grey "Reset to default settings" button.

Annotation: A blue-bordered box on the right side of the interface contains the text:

- Runs as a job

Footer: A note at the bottom states: "*The Desktop session data for this session can be accessed under the [data root directory](#)."

Open OnDemand (9) – Desktop app

L U M I

The screenshot displays the Open OnDemand web interface in a browser window. The address bar shows the URL `lumi.csc.fi/pun/sys/dashboard/batch_connect/sessions`. The left sidebar contains a menu with categories: Apps, Editors, Graphical applications, Servers, and Tools. Under 'Apps', 'Desktop' is selected. Under 'Tools', 'Course env' is highlighted with a blue arrow pointing to the 'Launch Desktop' button. The main panel shows details for a desktop session named 'Desktop (8630905)' with 1 node, 4 cores, and a 'Running' status. It includes fields for Host, Created at, Time Remaining, Session ID, Project, Partition, Cores, Memory, and GPUs. A 'Cancel' button is visible next to the Host field. Below the session details, there are sliders for 'Compression' and 'Image Quality', both set to 0 (low) to 9 (high). A 'Launch Desktop' button is at the bottom left, and a 'View Only (Share-able Link)' button is at the bottom right. A blue arrow points from the 'Launch Desktop' button to a text box on the right.

Apps

Editors

- Visual Studio Code

Graphical applications

- Desktop

Servers

- MLflow
- Julia-Jupyter
- MATLAB
- TensorBoard
- Jupyter

Tools

- Compute node shell
- Course env
- Jupyter for courses

Desktop (8630905) 1 node | 4 cores | Running

Host: >_nid000023

Created at: 2024-12-05 10:13:40 UTC

Time Remaining: 3 hours and 59 minutes

Session ID: c42cb9ed-a1c6-4c15-

If you run into issues, please include [output.log](#)

Project: project_465001603

Partition: lumid

Cores: 4

Memory: 2048M

GPUs (A40): 1

noVNC Connection Native Instructions

Compression 0 (low) to 9 (high)

Image Quality 0 (low) to 9 (high)

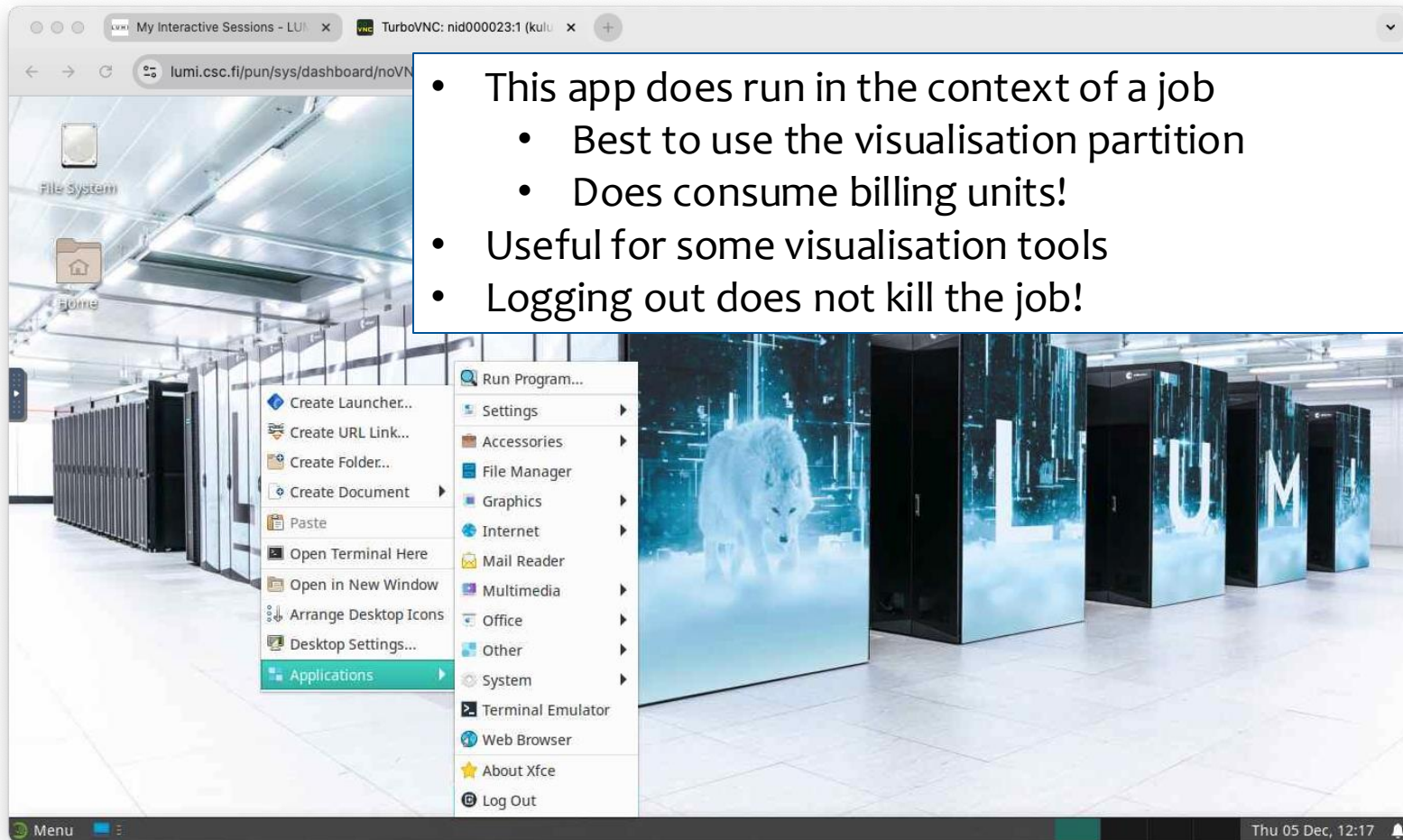
Launch Desktop

View Only (Share-able Link)

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

Open OnDemand (10) – Desktop app

L U M I



The screenshot displays a desktop environment within a TurboVNC session. The desktop background is a server room with large server racks. On the left, there are icons for 'File System' and 'Home'. A context menu is open, showing various actions like 'Create Launcher...', 'Create URL Link...', 'Create Folder...', 'Create Document', 'Paste', 'Open Terminal Here', 'Open in New Window', 'Arrange Desktop Icons', and 'Desktop Settings...'. Below these, there is a section for 'Applications' with a list of programs including 'Run Program...', 'Settings', 'Accessories', 'File Manager', 'Graphics', 'Internet', 'Mail Reader', 'Multimedia', 'Office', 'Other', 'System', 'Terminal Emulator', 'Web Browser', 'About Xfce', and 'Log Out'. The bottom of the screen shows a taskbar with a 'Menu' button and a system clock indicating 'Thu 05 Dec, 12:17'.

- 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
- Logging out does not kill the job!

- sftp or rsync over ssh 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 presentation on day 2 of this course
- Unfortunately no support yet for Globus or other forms of gridFTP

Questions?