

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 camera.

Getting Access to LUMI

**Dan Jonsson
Kurt Lust**

LUMI User Support Team (LUST)

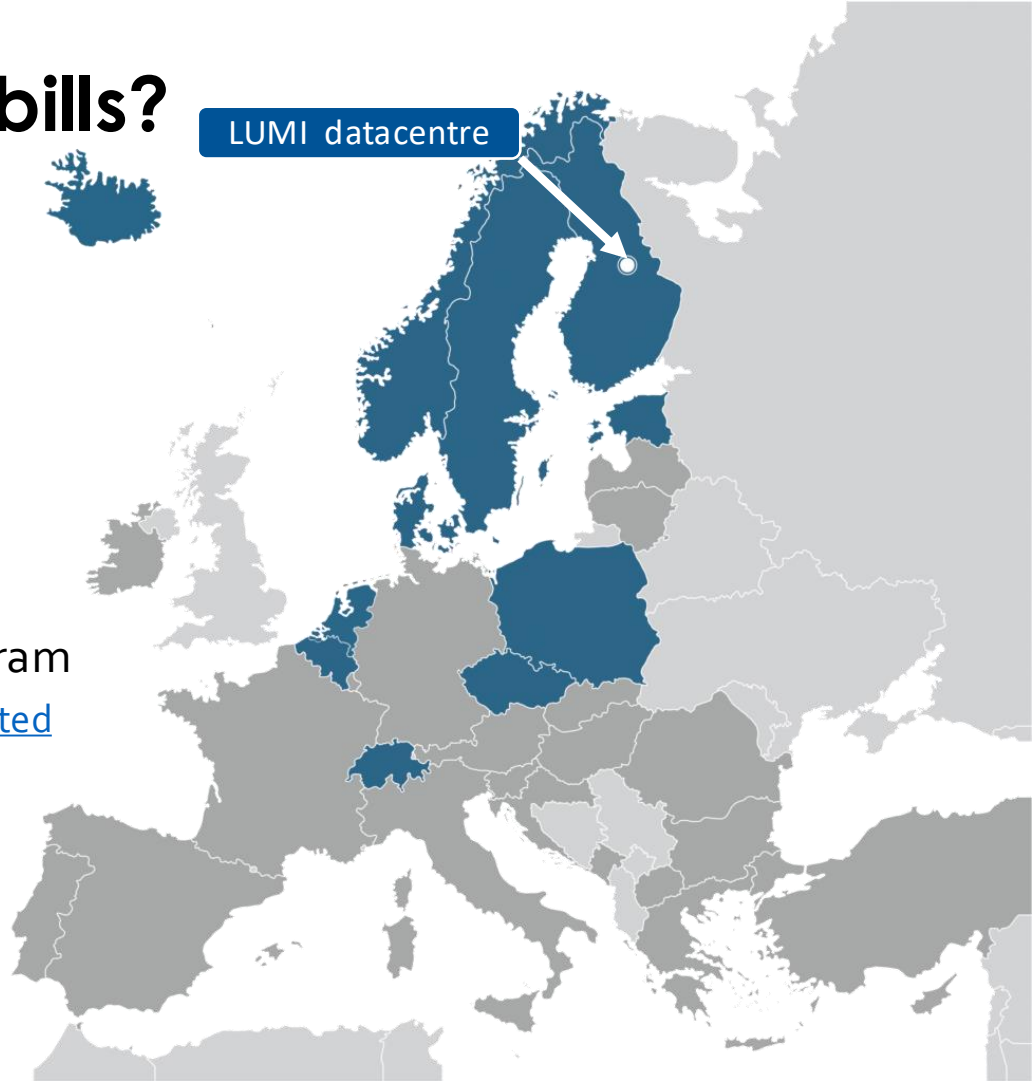
April 2026

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)

- 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)

LUMI

The image shows a browser window displaying the LUMI website. A blue box with the text "Point to www.lumi.csc.fi" has an arrow pointing to the address bar, which contains "lumi.csc.fi/public/". Another blue box with the text "Go to login" has an arrow pointing to the "Go to login" button. The website content includes the LUMI logo, a "Welcome to LUMI" heading, a paragraph about the supercomputer's location, and two buttons: "Go to login" and "Go to the main LUMI website". The footer contains logos for EuroHPC, the European Union, the Regional Council of Kainuu, and EURO, along with text about funding and links for "Accessibility statement" and "Cookie policy".

Welcome to LUMI - LUMI.csc. x +

lumi.csc.fi/public/

Point to www.lumi.csc.fi

LUMI

Other LUMI-related sites v

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)

The screenshot shows a web browser window with the following details:

- Browser title: Login
- Address bar: user-auth.csc.fi/ldap/profile/oidc/authorize?execution=e1s2
- Bookmarks: Course, mkdocs, Links, Links LUMI, Soft, tmp, LUMI tools, UA tools, Documentation, Software, Promo, Links
- Page content:
 - Header: CSC logo
 - Section: **Select authentication provider**
 - Options:
 - Haka Login (with Haka logo)
 - Login Puhuri (with Puhuri logo and @neic)
 - Login CSC (with CSC logo)
 - Link: [Which authentication method should I use?](#)

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: Files, Jobs, Apps, Tools, and a document icon. On the right side of the navigation bar, there are icons for a search, user profile, and refresh. The main content area is titled "Pinned Apps" and contains a grid of 15 application tiles. A blue arrow points to the "Compute node shell" tile. Below the grid is a "Notifications" section with the text "You have no notifications".

Dashboard - LUMI.csc.fi x +

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

LUMI Files Jobs Apps Tools

Pinned Apps

- Home Directory
- Compute node shell
- Login node shell
- Desktop
- Cloud storage configuration
- Disk quotas
- Project view
- Active Jobs
- Jupyter
- Jupyter for courses
- Julia-Jupyter
- MATLAB
- MLflow
- 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.csc

| 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.

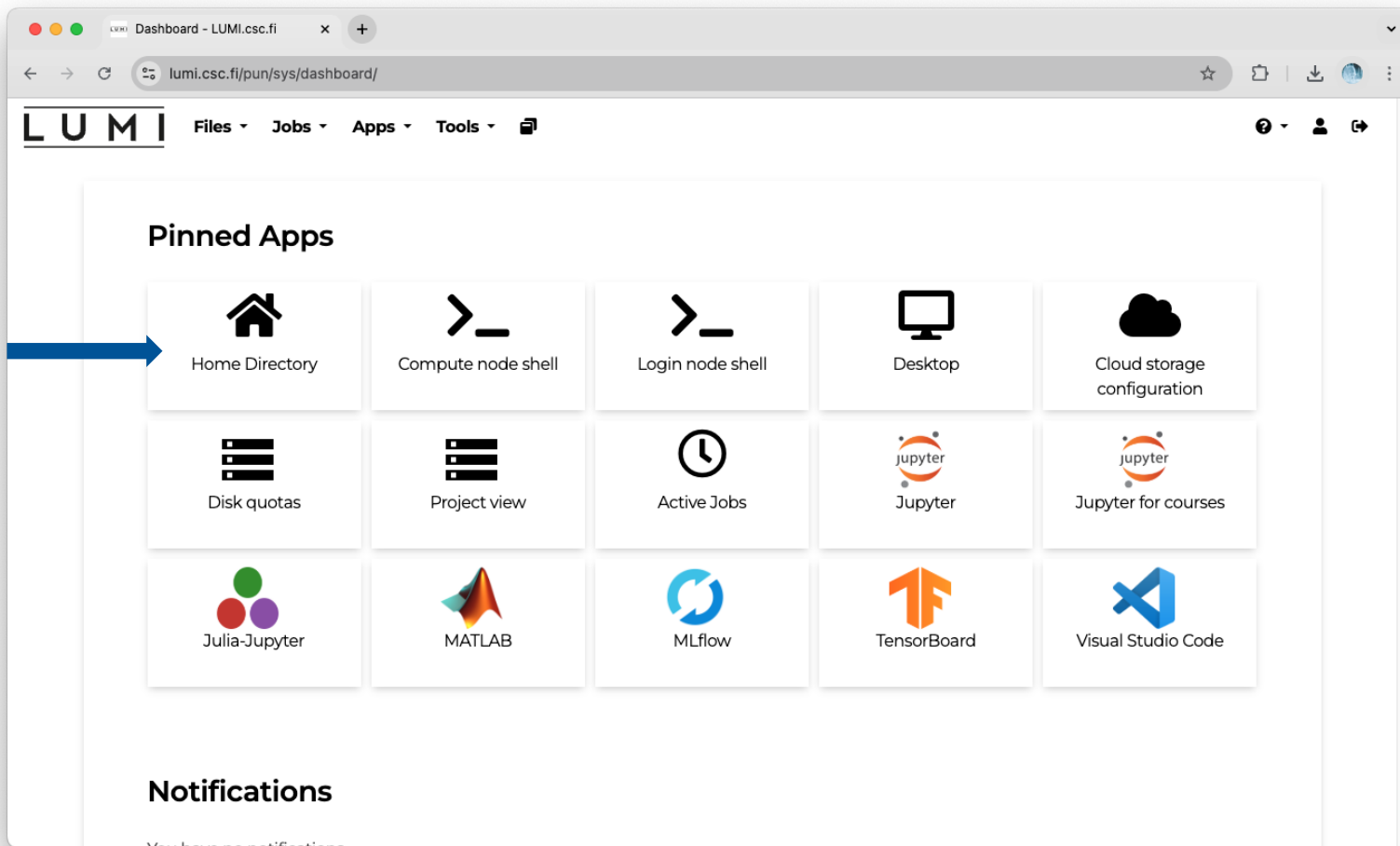
The waste heat from LUMI that can be used in Kajaani's district heating network
is equivalent to up to 20 per cent of the energy that Kajaani needs to use in
the area's district heating. This reuse of waste heat will reduce the annual
carbon dioxide footprint of Kajaani by 13,500 tons – an amount that 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)



Open OnDemand (6) – Home Directory

L U M I

Dashboard - LUMI.csc.fi

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

LUMI 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:

- Desktop
- Documents
- Downloads
- EasyBuild

	-	11-4-2024 12:24:45
	-	11-4-2024 12:24:51
	-	26-5-2023 18:20:10
	-	7-10-2024 11:08:13

- 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

Open OnDemand (7)

L U M I

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: Files, Jobs, Apps, Tools, and a document icon. On the right side of the navigation bar, there are icons for a search, user profile, and refresh. The main content area is titled "Pinned Apps" and contains a grid of 15 application tiles. A blue arrow points from the "Login node shell" tile to the "Desktop" tile. Below the grid is a "Notifications" section with the text "You have no notifications".

Dashboard - LUMI.csc.fi

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

L U M I

Files Jobs Apps Tools

Pinned Apps

- Home Directory
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- Cloud storage configuration
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- MATLAB
- MLflow
- TensorBoard
- Visual Studio Code

Notifications

You have no notifications

Open OnDemand (8) – Desktop app

L U M I

The screenshot shows the Open OnDemand web interface for creating a new Desktop session. The browser address bar shows the URL: `lumi.csc.fi/pun/sys/dashboard/batch_connect/sys/ood-vnc/default/session_contexts/new`. On the left, a sidebar menu is open, with a blue arrow pointing to the **MATLAB** option. The main content area is titled "Partition" and shows the selected partition as "lumid". Below this, the "Resources" section is visible, with the following settings:

- Number of CPU cores: 2
- Memory (GB): 2
- Number of GPUs (A40): 1
- Time: 4:00:00

Below the resources, there is a blue "Launch" button and a grey "Reset to default settings" button. A blue arrow points to the "Launch" button. A callout box on the right contains the text: "• Runs as a job". At the bottom, a note states: "*The Desktop session data for this session can be accessed under the [data root directory](#)."

Open OnDemand (9) – Desktop app

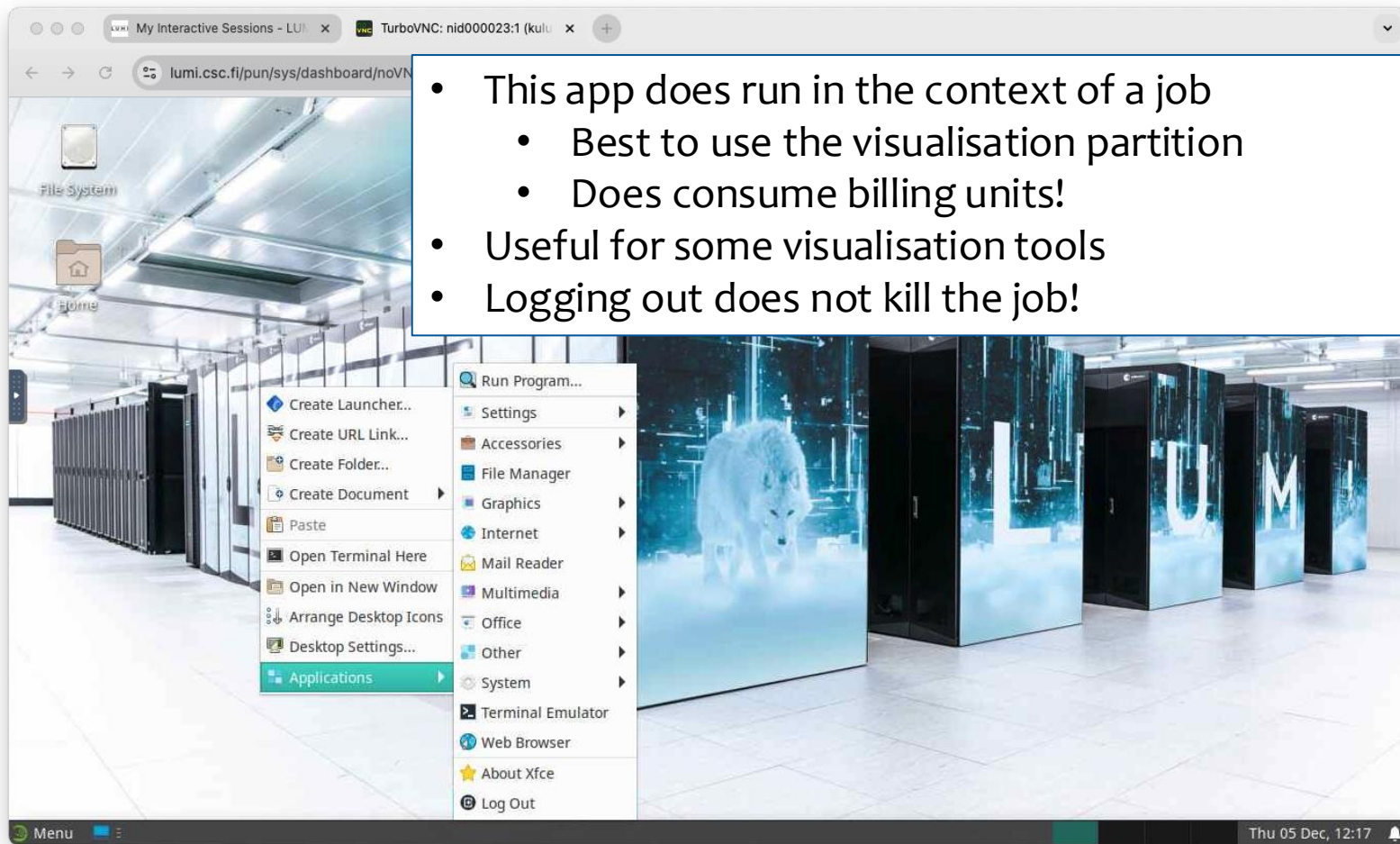
L U M I

The screenshot shows a web browser window with the URL `lumi.csc.fi/pun/sys/dashboard/batch_connect/sessions`. The page displays a session titled "Desktop (8630905)" with a status of "1 node | 4 cores | Running". A red "Cancel" button is visible with a blue arrow pointing to it. The session details include: Host: `>_nid000023`, Created at: 2024-12-05 10:13:40 UTC, Time Remaining: 3 hours and 59 minutes, Session ID: `c42cb9ed-a1c6-4c15-`, Project: `project_465001603`, Partition: `lumid`, Cores: 4, Memory: 2048M, and GPUs (A40): 1. Below the details are two tabs: "noVNC Connection" (selected) and "Native Instructions". There are two sliders: "Compression" (0 (low) to 9 (high)) and "Image Quality" (0 (low) to 9 (high)). A blue arrow points from the "Course env" option in the left sidebar to the "Launch Desktop" button. A "View Only (Share-able Link)" button is also present.

- 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 shows a desktop environment with a file manager window open on the left and an application menu open in the center. The desktop background features a server room with large digital displays showing the letters 'LUMI'. The application menu includes options like 'Run Program...', 'Settings', 'Accessories', 'File Manager', 'Graphics', 'Internet', 'Mail Reader', 'Multimedia', 'Office', 'Other', 'System', 'Terminal Emulator', 'Web Browser', 'About Xfce', and 'Log Out'. The system tray at the bottom shows the date and time as '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!

Data transfer

- 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-section-of-the-lumi-documentation) 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?

