The HPC Desktop: A Linux Environment for Interactive HPC

Robert Henschel

henschel@iu.edu

https://github.com/RobertHenschel/HPCDesktop/

Contents

- The HPC Desktop concept in 10 minutes or less
- Demo

- The State of HPC
- HPC Users, a big picture
- HPC Desktops
  - History, Architecture, Use Cases

My Goal For Today

Raise awareness of HPC Desktops as a way to access HPC systems.

Inspire you to offer an HPC Desktop for your users.

My View of HPC

- I am passionate about enabling broad science with HPC.

- At Indiana University for 17 years, now part time.
  - IU has seen the future of HPC use.
- Started HPC consulting 3 years ago, working for Cendio, maker of ThinLinc, a Linux remote Desktop solution.
  - Lots of customer interviews.

- Very familiar with a specific part of the HPC market.

My View of HPC

Posts | Replies | Media | Lists

Andrew Jones (hpcnotes) @hpcnotes.bsky.social · 13d
What happens when people realize that the best High Performance Computing happens when you learn to optimize not so much the performance of the computer, but the performance of the humans using the computer?

#HPC #supercomputing

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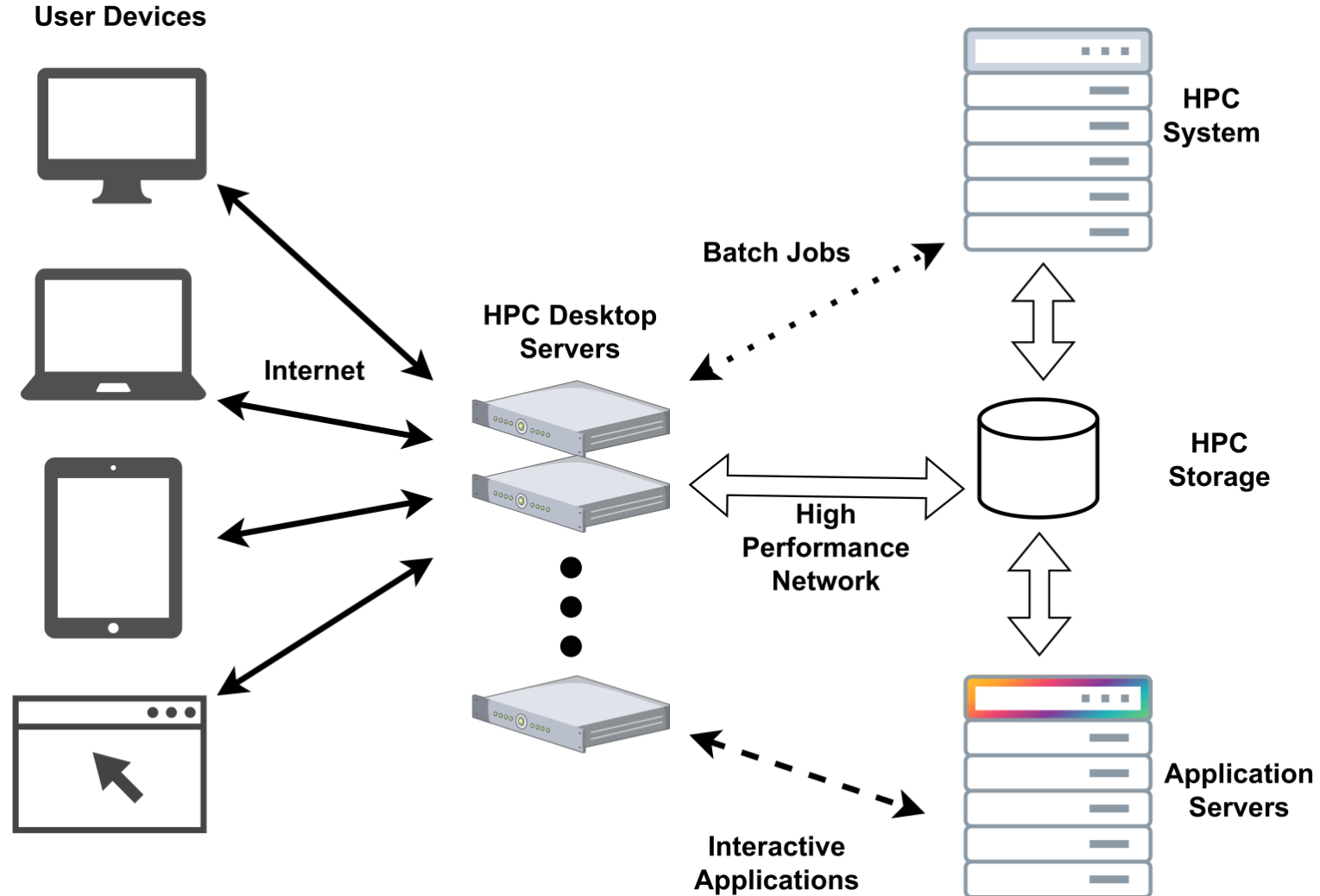
The HPC Desktop Concept in 10 Minutes or Less

HPC Desktop – Big Picture

What if you had access to a **high performance desktop from any endpoint device**? What if this desktop allowed you to **launch interactive graphical applications** like MATLAB, Jupyter Notebooks, Ansys and VS Code, as well as **compose scientific workflows**? What if this desktop had **enough performance to run the applications** and also provided **tools to quickly manage and submit jobs** to an HPC system? What if this desktop was **available to you for weeks or months**, allowing you to reconnect whenever you need it?

Interactive HPC Workshop at SC22

HPC Desktop – Architecture

User Devices

Internet

HPC Desktop Servers

Batch Jobs

HPC System

High Performance Network

HPC Storage

Interactive Applications

Application Servers

HPC Desktop – Why?

- Ease of use, convenience for end users

- Easy to deploy, versatile

- Lots of capabilities for little investment

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- Enable creativity of users
- Deploy applications in a secure environment
- Run agents

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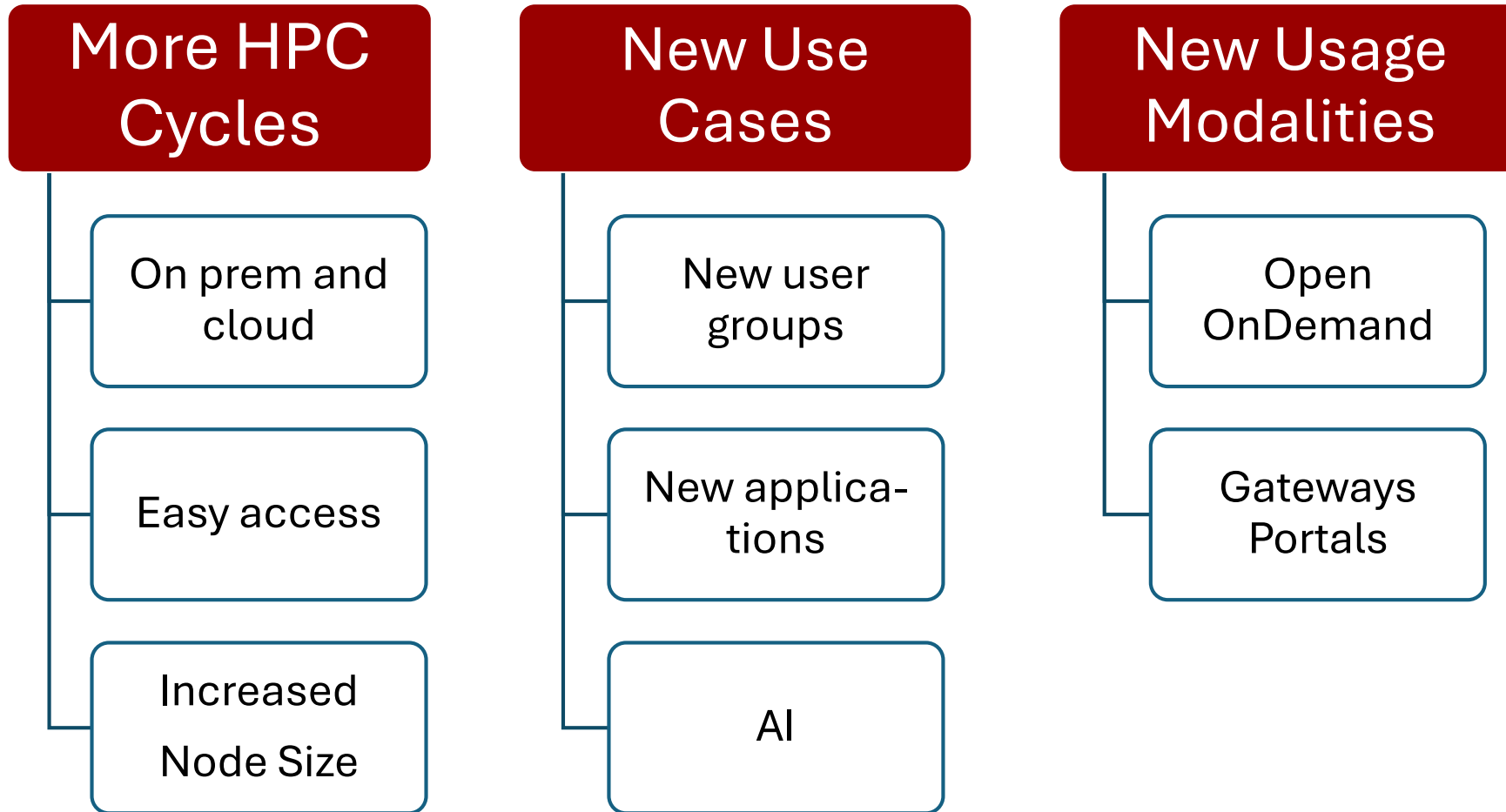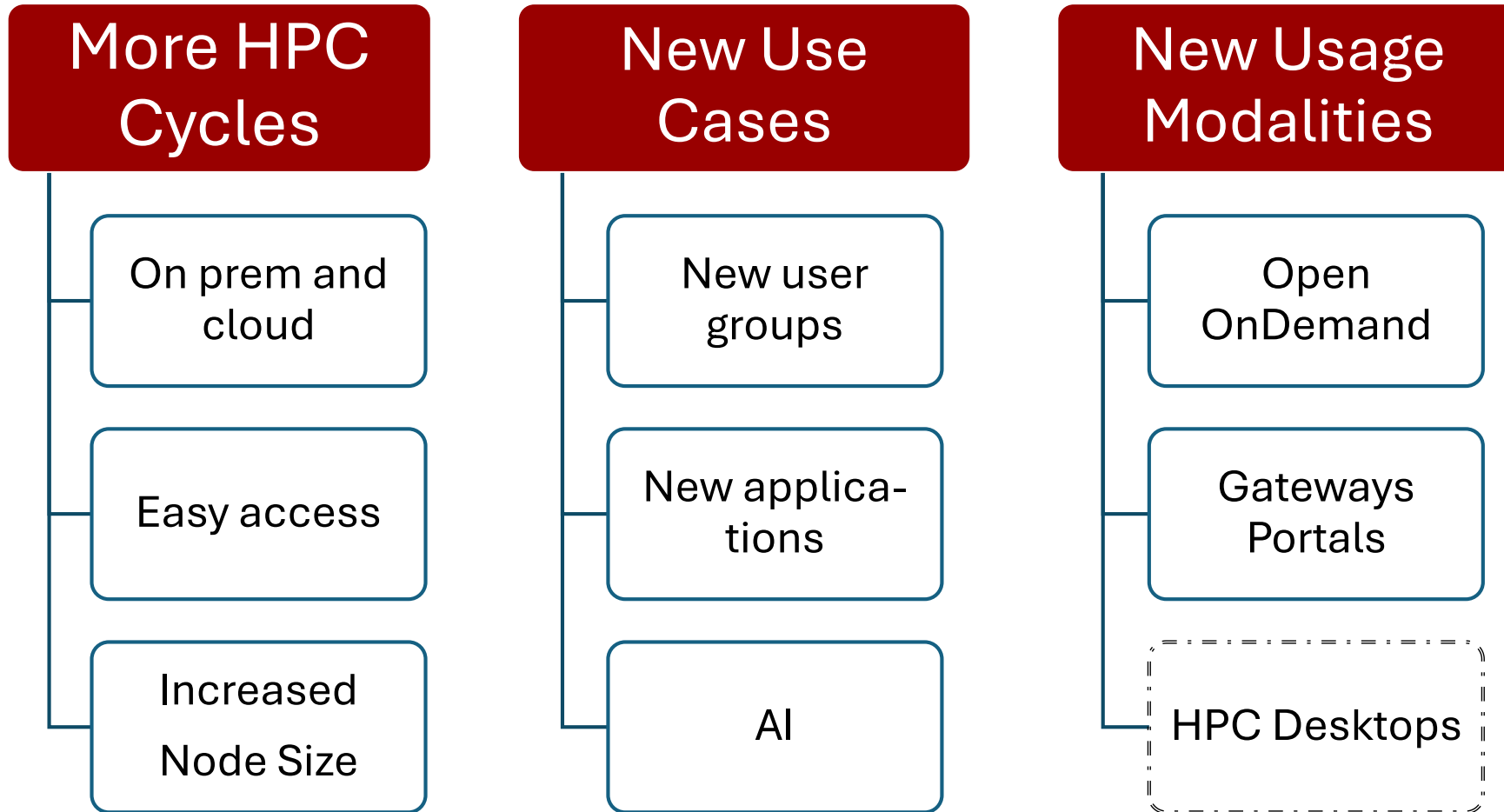- Because desktops are just a better UI than a browser. 😂
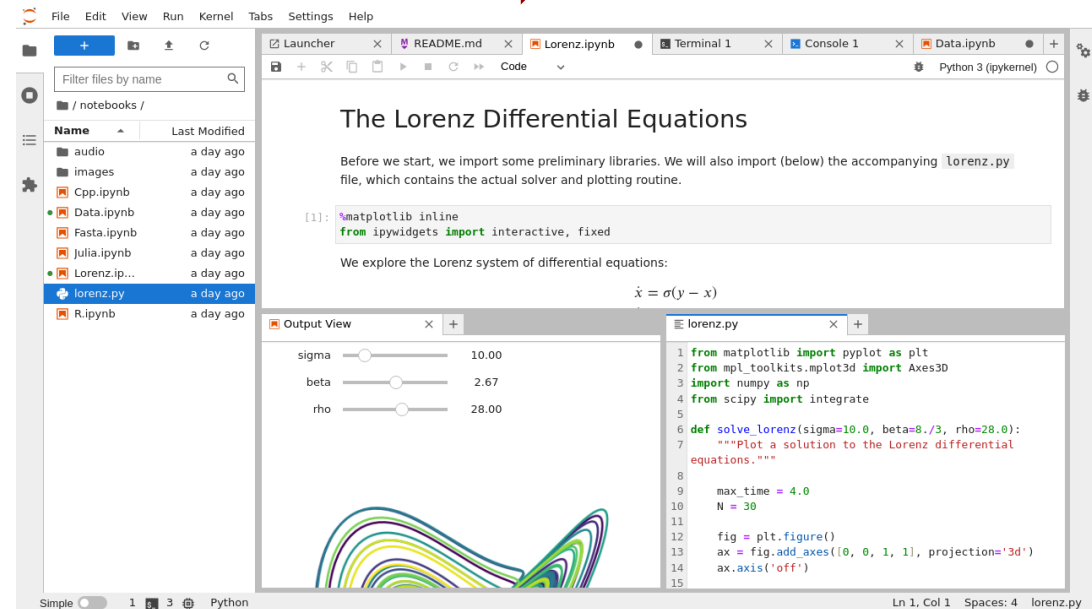
Demo

The State of HPC

The State of HPC

More HPC Cycles
- On prem and cloud
- Easy access
- Increased Node Size

New Use Cases
- New user groups
- New applications
- AI

New Usage Modalities
- Open OnDemand
- Gateways Portals

The State of HPC

More HPC Cycles	New Use Cases	New Usage Modalities
On prem and cloud	New user groups	Open OnDemand
Easy access	New applica-tions	Gateways Portals
Increased Node Size	AI	HPC Desktops

The State of HPC

Edit-Compile-Run

REPL / Notebook

File Based

Document Based
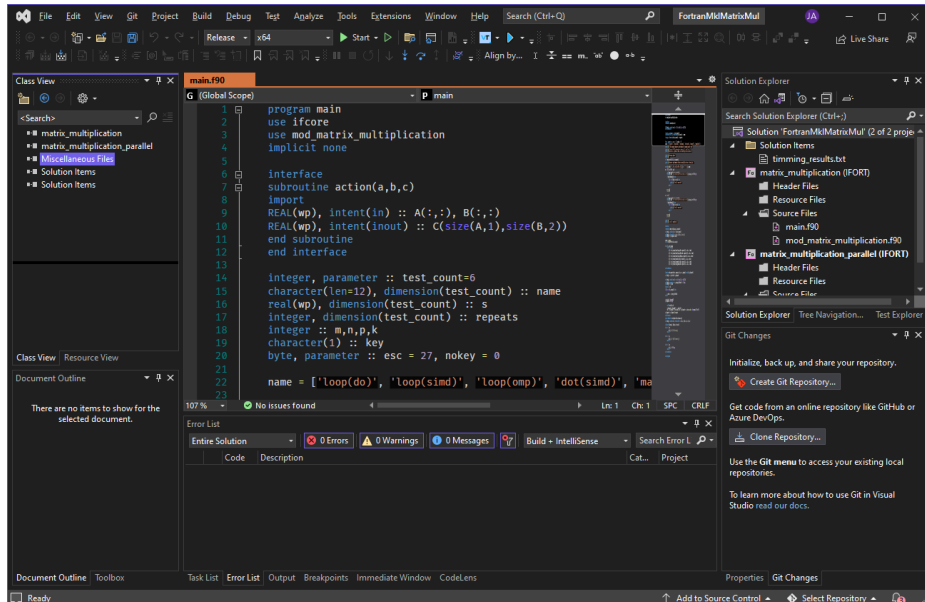
The State of HPC

- HPC systems are becoming more widely available.
- Demand is increasing from all fields of science.
- The users are more diverse and so is their skillset.
- The tools they use are more diverse.

- HPC Centers are asked to support it all. (and IU has since the early 2000s)

HPC Users, a big picture

Observations about Users

- Users don't read documentation.
- Users are annoyingly creative.
- Users utilize diverse tools, tools evolve.
- Users don't know how computers work.

Source: Matt Rocklin at HPPSS at SC24

Lessons learnt

- Be familiar, not novel.
- Invite the user to invent.
- Make it visual.
- Tell people about their usage.
- Make it useful on a laptop.

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Lessons learnt

HPC Desktop

- Be familiar, not novel. ⭐
- Invite the user to invent. ⭐
- Make it visual. ⭐
- Tell people about their usage. ⭐
- Make it useful on a laptop. ⭐

Future HPC Users

- We are hopefully heading into a future with more and more HPC user.

- There are developments on all levels to help new users:
  - SPACK, EasyBuild
  - Open OnDemand
  - Container support
  - Custom portals and gateways

- HPC Desktops are another way.

The Case for HPC Desktops

HPC Desktop – History

- Indiana University has a long history of open access to HPC
  - 2016: A PetaFLOPS Supercomputer as a Campus Resource: Innovation, Impact, and Models for Locally-Owned High Performance Computing at Colleges and Universities
  - 2019: Research Computing Desktops: Demystifying research computing for non-Linux users
  - 2022: Lightning talk at the Interactive HPC workshop at SC
  - 2024: Use Cases for HPC Desktops, at the Interactive HPC workshop at ISC
  - 2025: The Case for HPC Desktops, at the HPC Advisory Council

- Interactive and Urgent HPC: Challenges and Opportunities
  - https://arxiv.org/abs/2401.14550

SCAN ME

HPC Desktop – Use Cases

- Use Cases for High Performance Research Desktops at ISC24
    - Combined report from Indiana University, Lund University Sweden and Denmark Technical University
    - https://arxiv.org/abs/2404.03298

arXiv > cs > arXiv:2404.03298

Computer Science > Distributed, Parallel, and Cluster Computing

[Submitted on 4 Apr 2024]

Use Cases for High Performance Research Desktops

Robert Henschel, Jonas Lindemann, Anders Follin, Bernd Dammann, Cicada Dennis, Abhinav Thota

SCAN ME

HPC Desktop – Big Picture

Guiding principle for HPC Desktops:

Convenience over Efficiency

- Desktops provide an environment for light computational and data management work outside of the HPC system.

- Batch system and application servers support the desktop.

- Leverage the power of HPC infrastructure as much as possible.
  - Network, storage, applications, people, …

- Desktop customizations are key for the user experience.
  - Application menu, desktop icons, storage shortcuts, gfxLauncher
  - Policies to enable long running applications and a persistent environment.

HPC Desktops – Examples
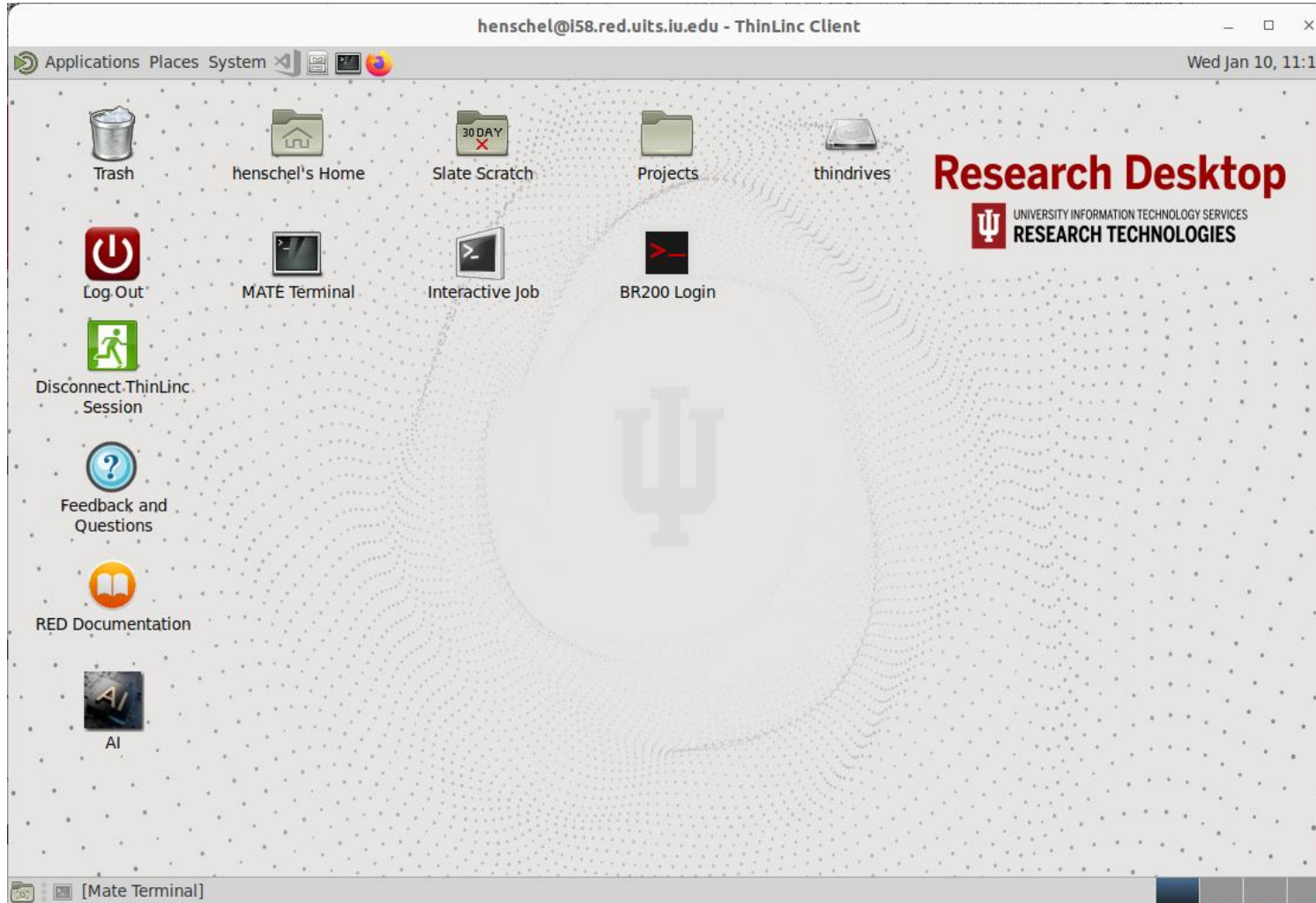
Indiana University

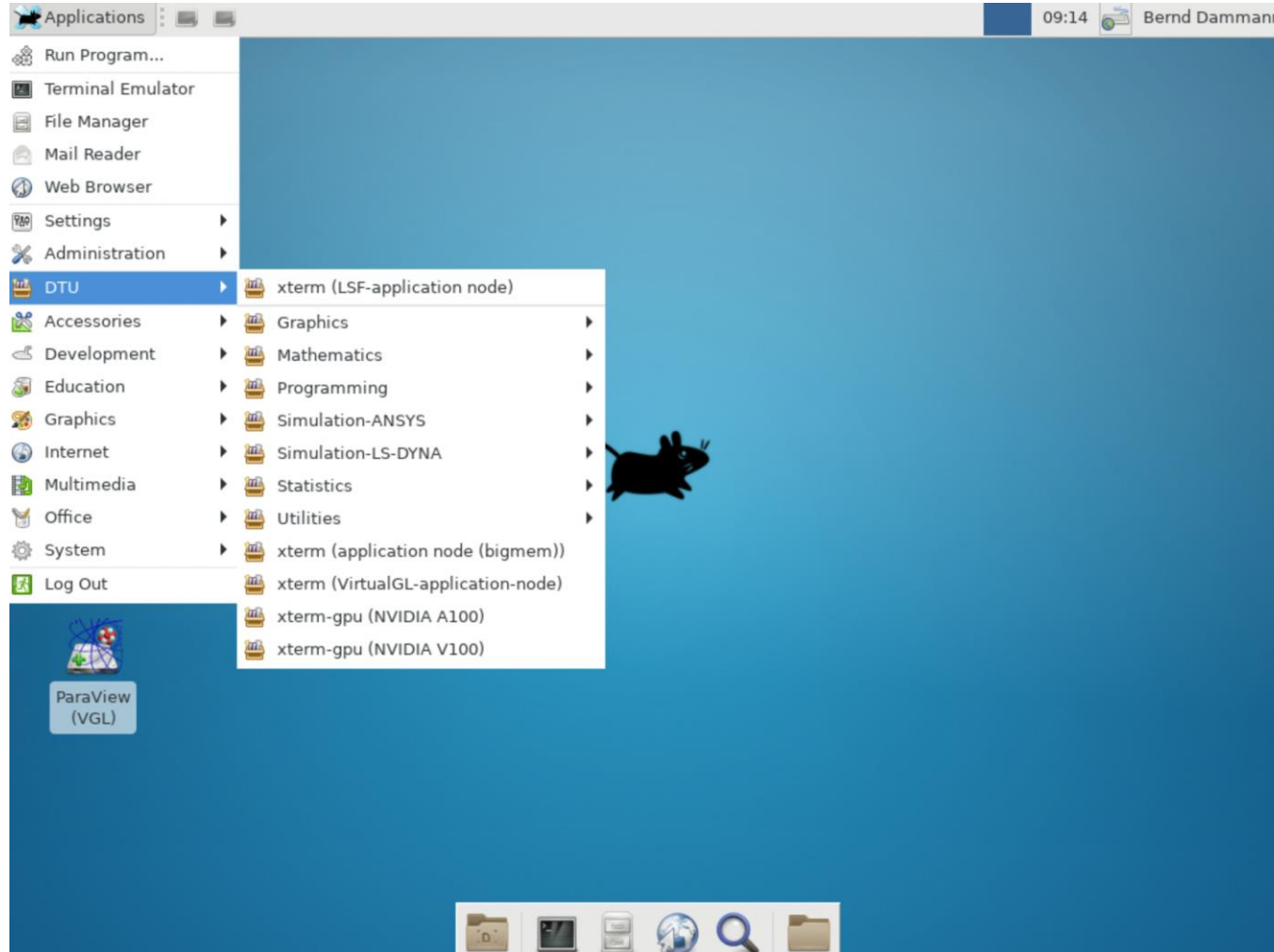# HPC Desktops – Examples
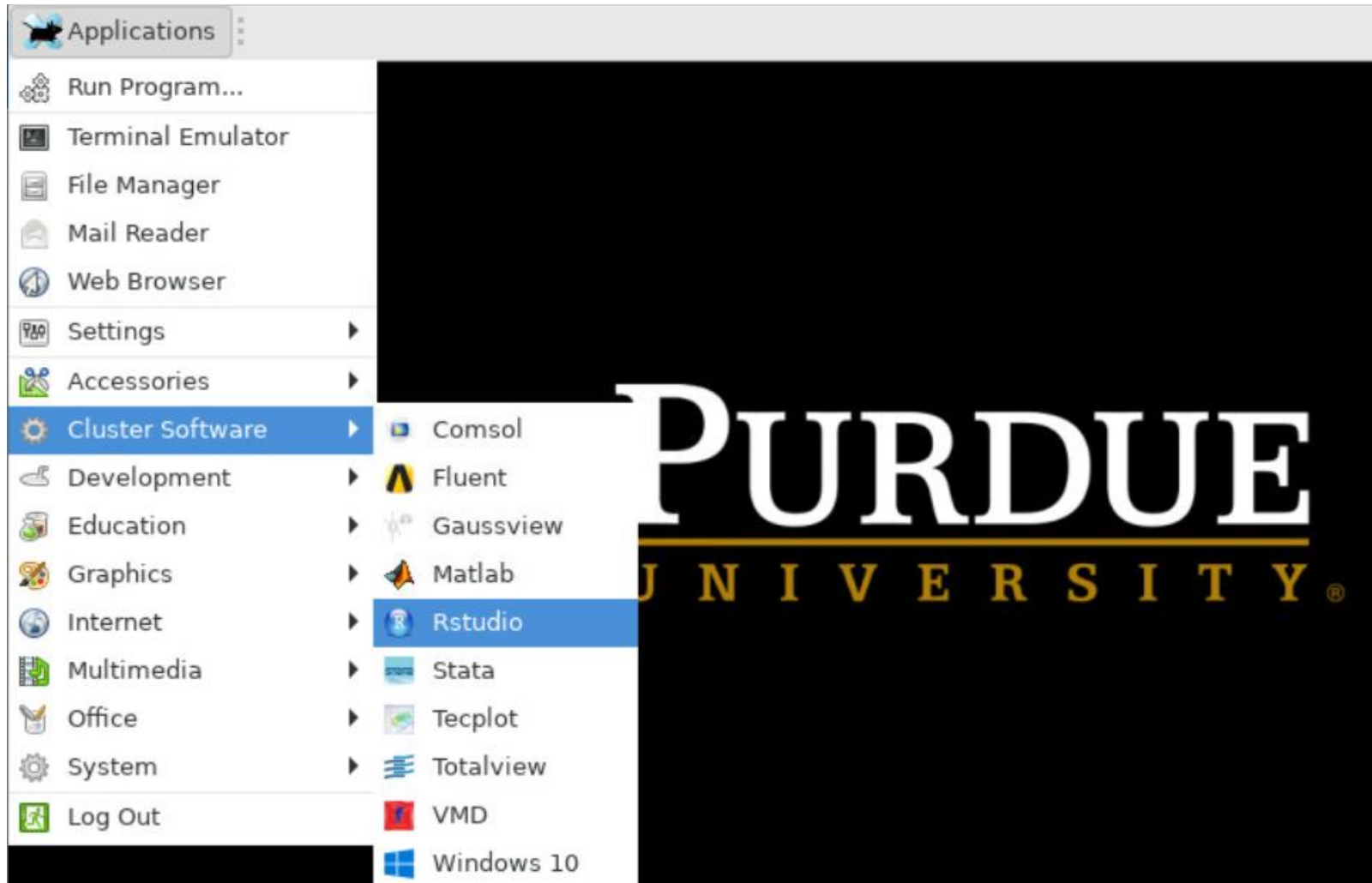
Purdue University
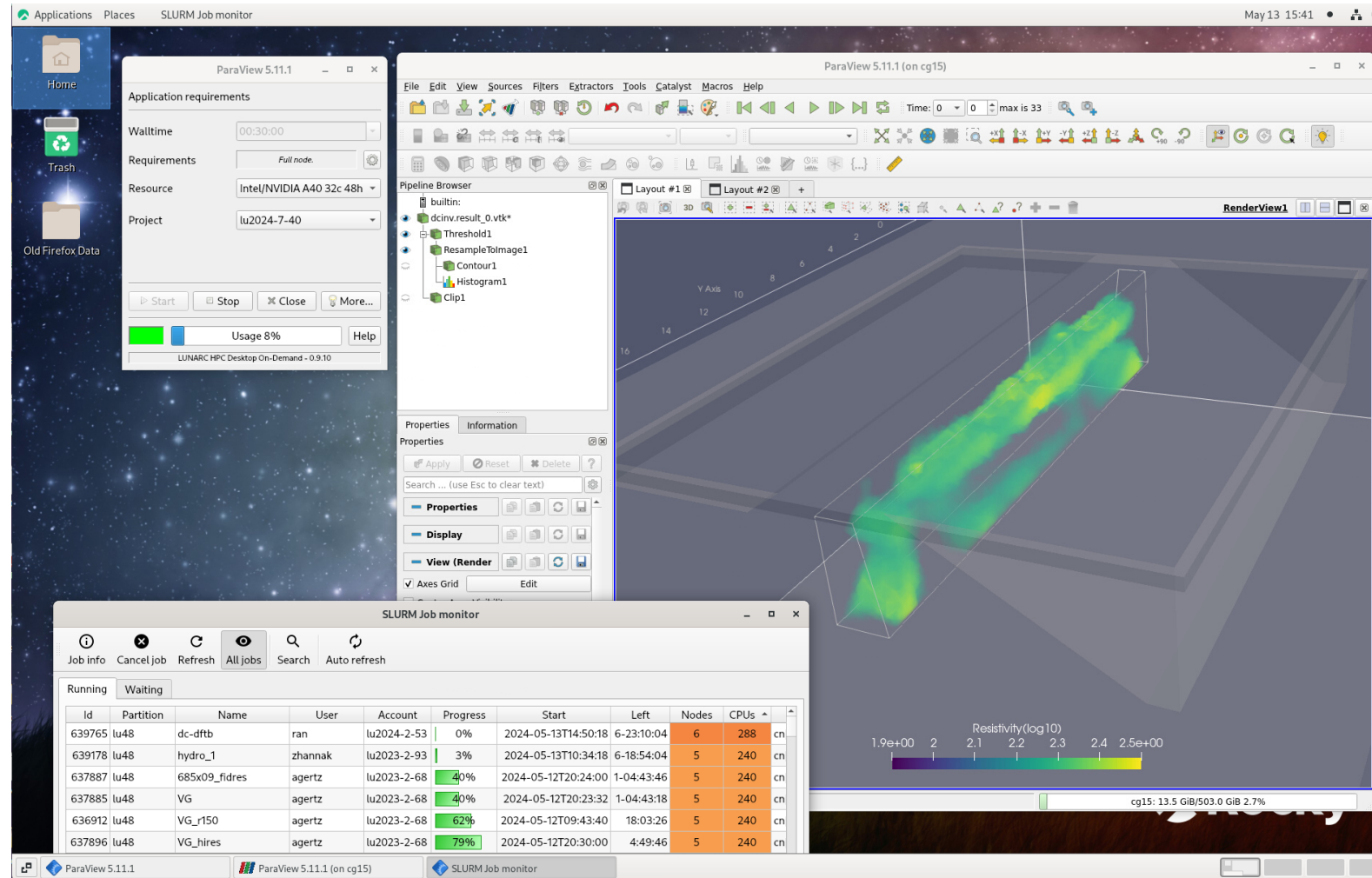
HPC Desktops – Examples
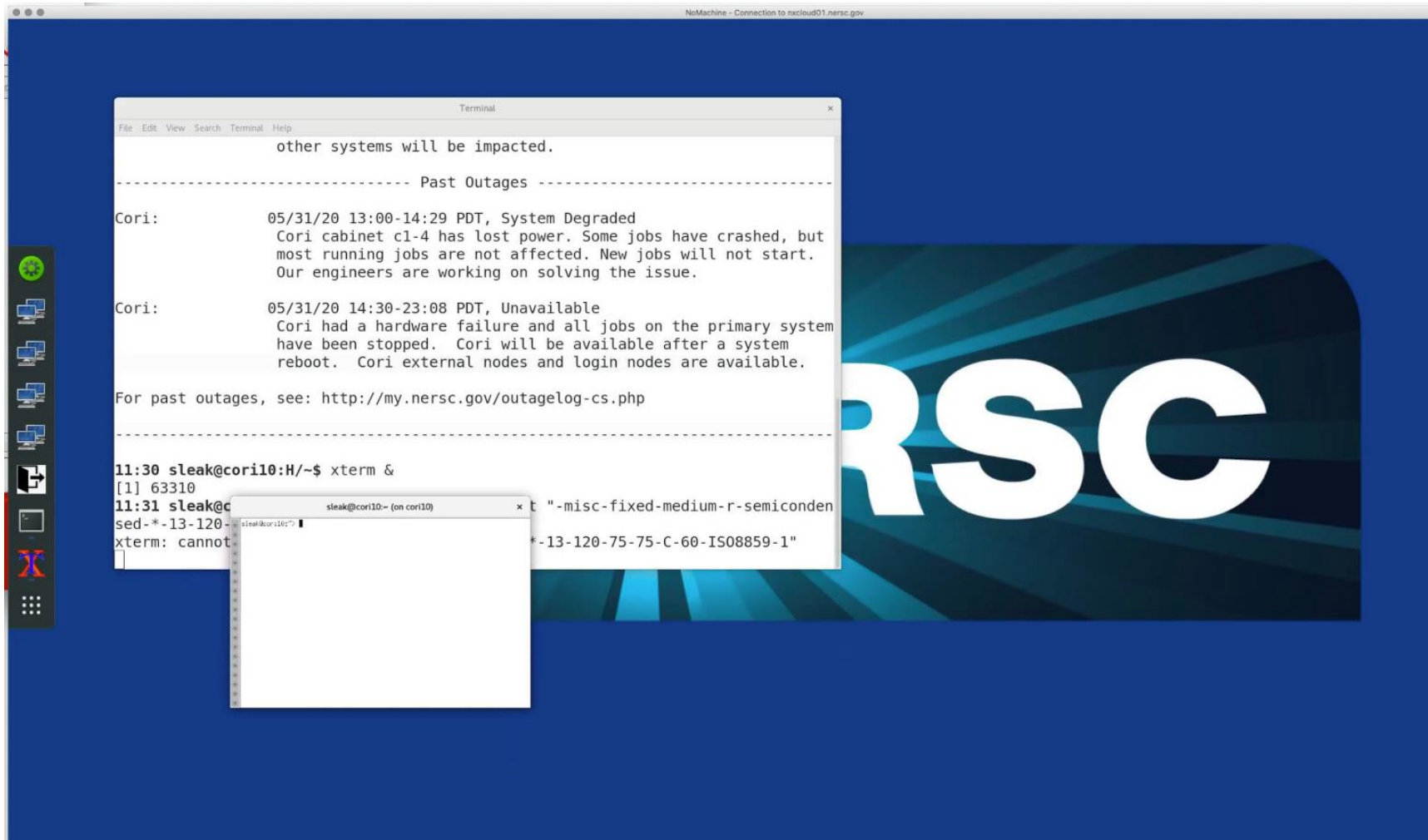
NERSC

HPC Desktops – Examples
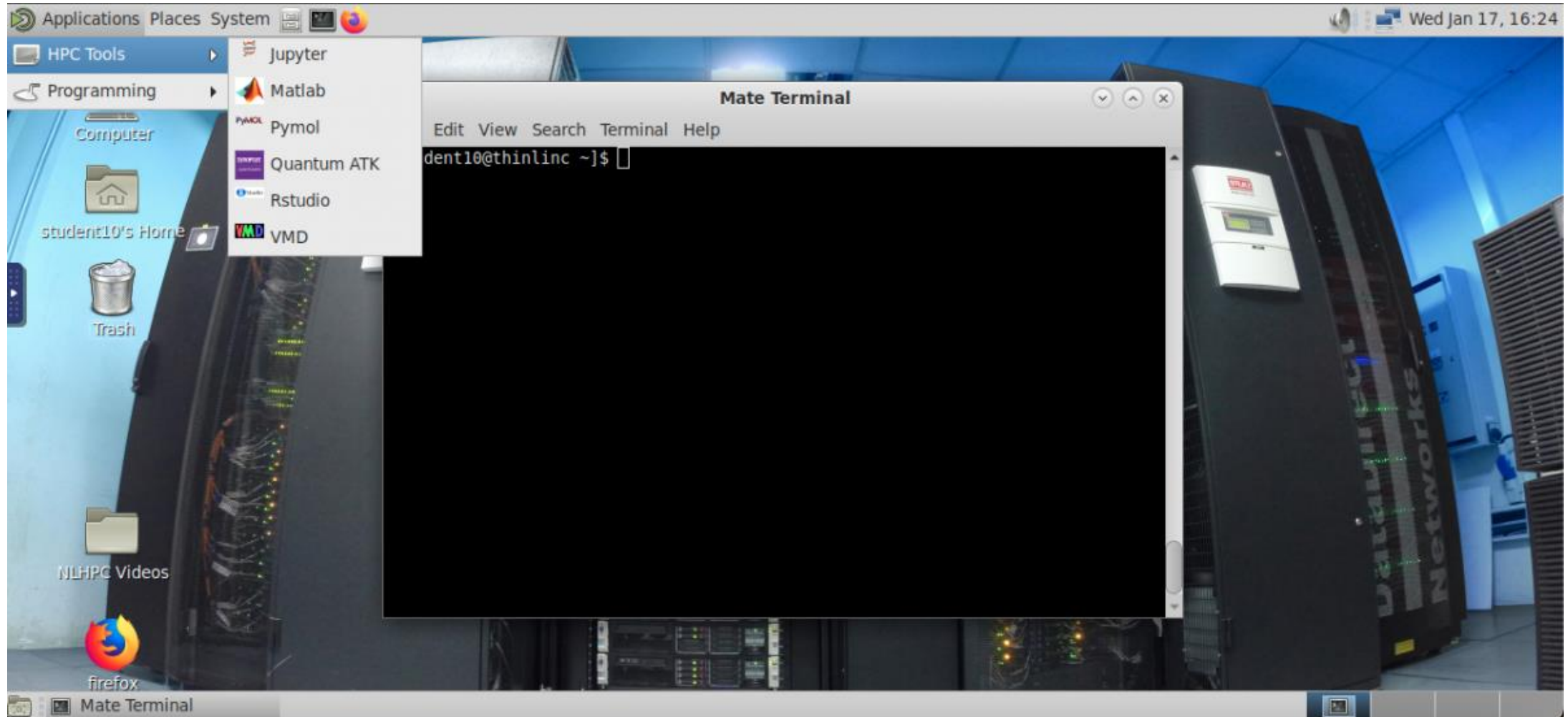

Denmark Technical University

HPC Desktops – Examples

Lund University

HPC Desktops – Examples

HPC Desktop – Use Cases

- File Manager
- Non HPC Computations
- HPC Jobs Workflow
- Client Server Applications made easy
- Teaching, Classes
- Secure Enclaves

HPC Desktop – Big Picture

- Disconnect and reconnect. Persistence like laptops!

- Help overcome the initial barrier and people will learn!

- Leveraging HPC investments to attract more users, serve a broader range of scientists.

- Onboard the next generation of HPC users.

- Easy to deploy, Desktops can be administered with shell scripts!

The Future

- It should be our goal to get more users onto HPC systems.
- An HPC Desktop is one way to do it.

- I am not advocating to ban the terminal, and I am not bashing Open OnDemand!
I am advocating for providing another solution. One that is more general purpose than OOD, and more user friendly than a terminal.

The Future

Build a community around HPC Desktops

- Interactive and Urgent HPC Workshops at ISC and SC
  - https://www.interactivehpc.com/
- HPC Desktop GitHub repository
  - https://github.com/RobertHenschel/HPCDesktop/

Experiment with new UI features

- Write small applications and desktop customization
- UI concepts that integrate an HPC system into a desktop
- Coding with AI makes this cheap, let's experiment!
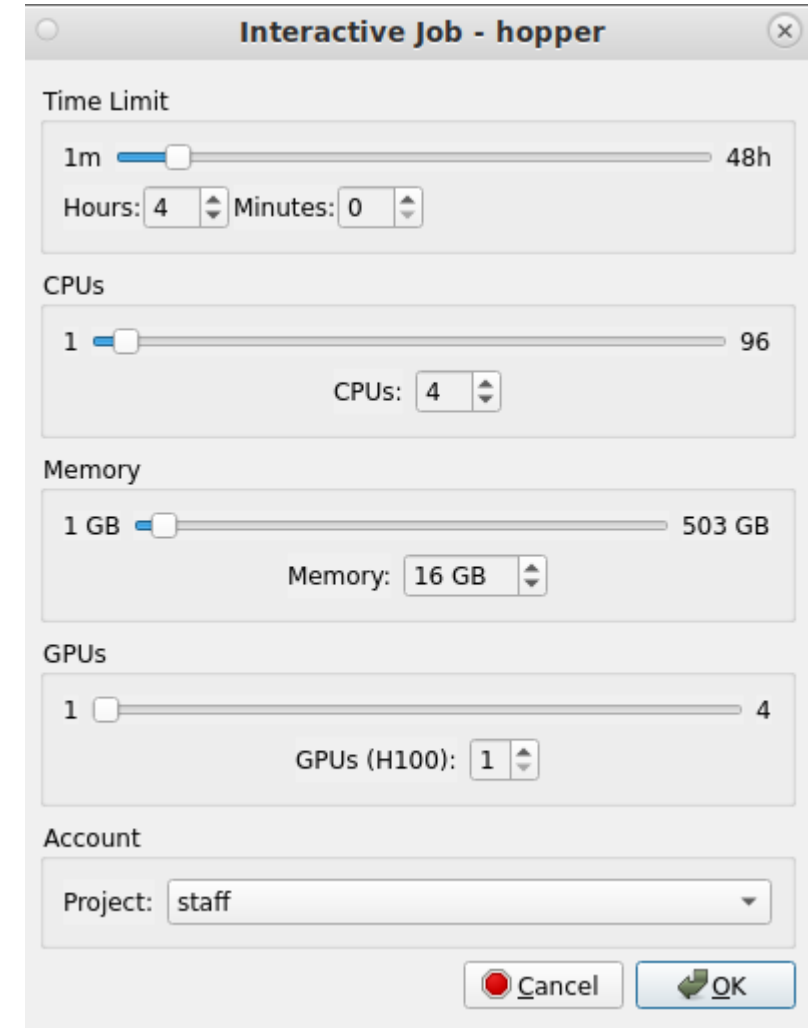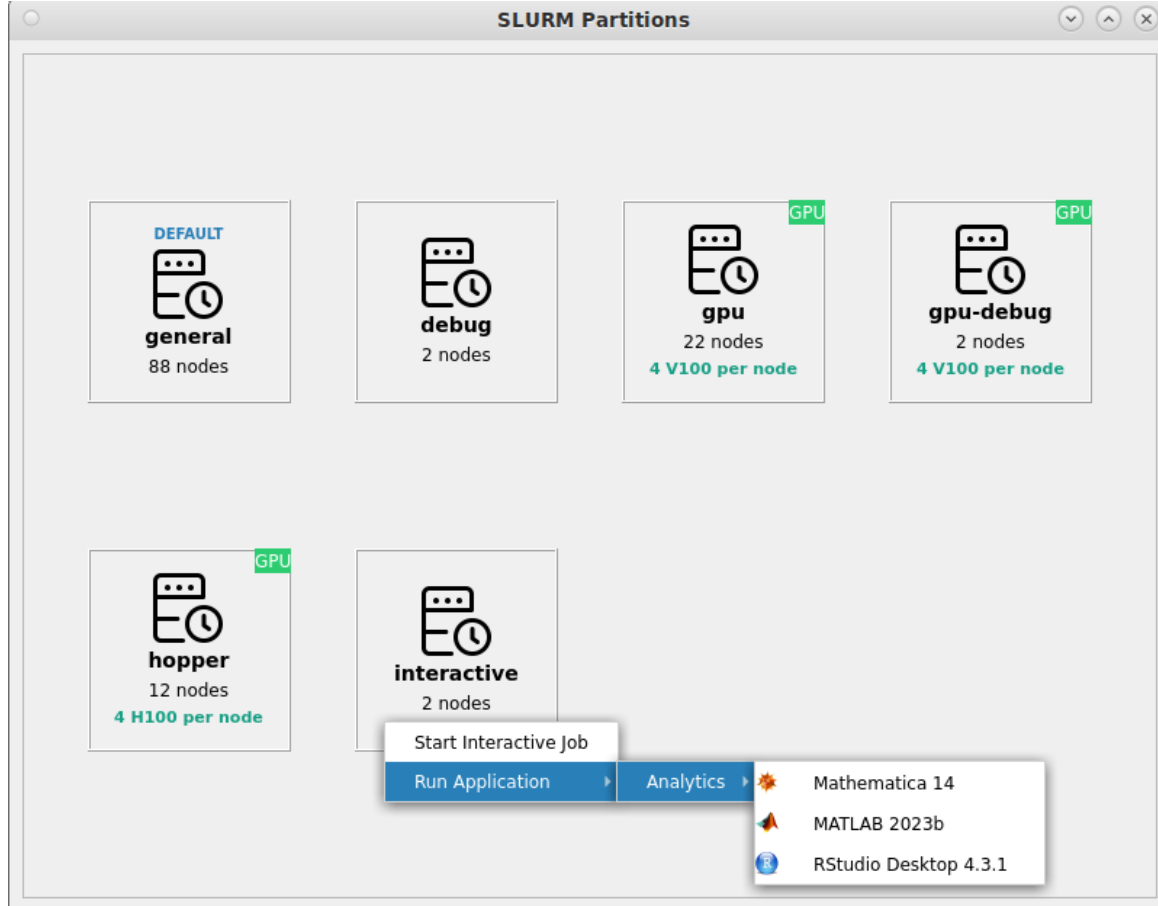
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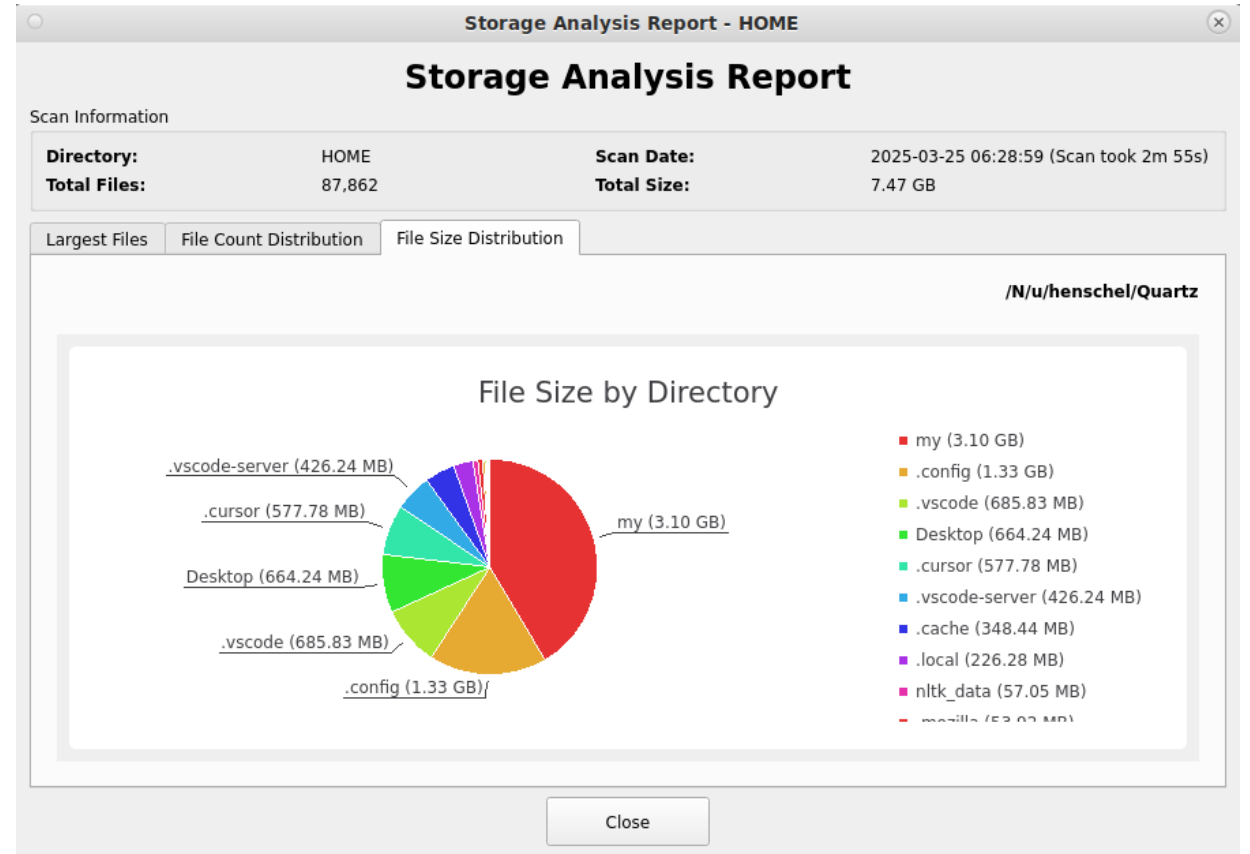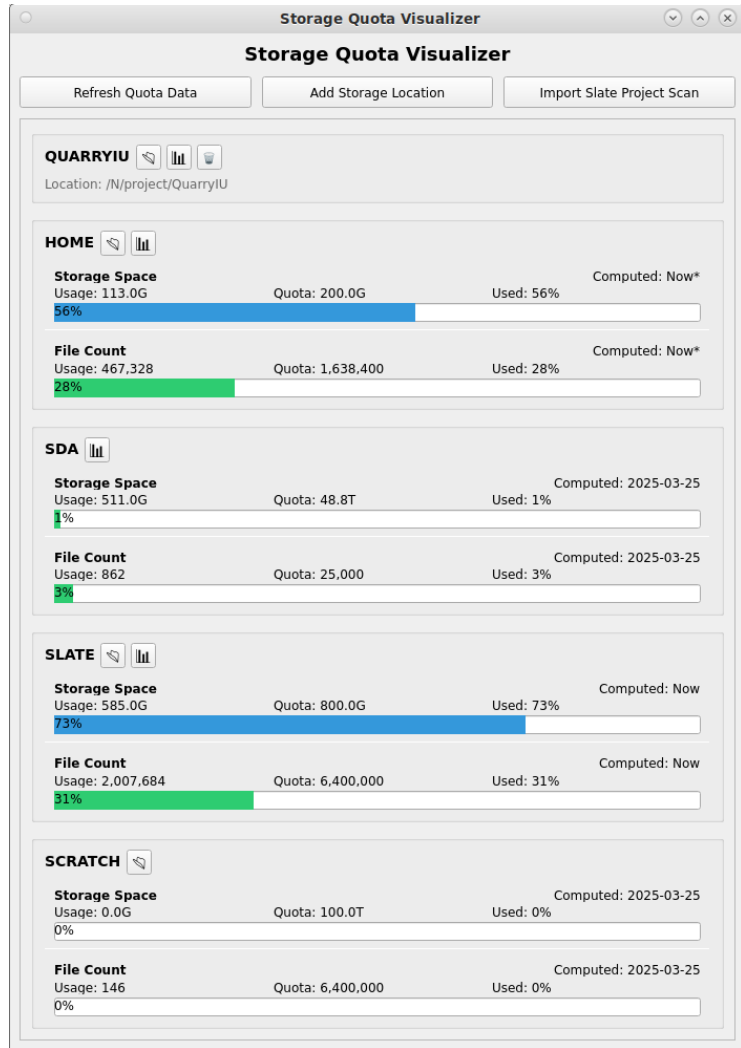SCAN ME

The Future – App Delivery Platform

- Creating native Linux applications is easy now, thanks to LLMs.
  - It starts with vibe coding, and it will only grow from there.

- HPC Desktops can serve as a powerful platform for agents

- HPC Centers can now deploy utilities and apps quickly and securely.

The Future – App Delivery Platform

The Future – App Delivery Platform

Summary

- HPC Desktops are a thing!

- Leverage HPC investments to increase user count, support more use cases, enable more science.
- Grow the next generation of HPC users.

- Join the Interactive HPC Community at ISC and SC.
  - SC25 workshop on Friday, 9 to 12:30
- Experiment with integrating an HPC system into a desktop.

Thank you!

- Find me over the next days for an HPC Desktop demo and a good discussion.

- Or reach out:
  - henschel@iu.edu
  - https://www.linkedin.com/in/roberthenschel/
  - https://bsky.app/profile/roberthenschel.bsky.social
  - https://github.com/RobertHenschel/HPCDesktop/