XNAT + Neurodesk + JupyterHub: A Powerful Platform for Neuroimaging Analysis

Presented by: An Zhao, Fang Xu, Aswin Narayanan, Steffen Bollmann, Tom Johnstone, Ryan Sullivan

Date: 30 Oct 2024

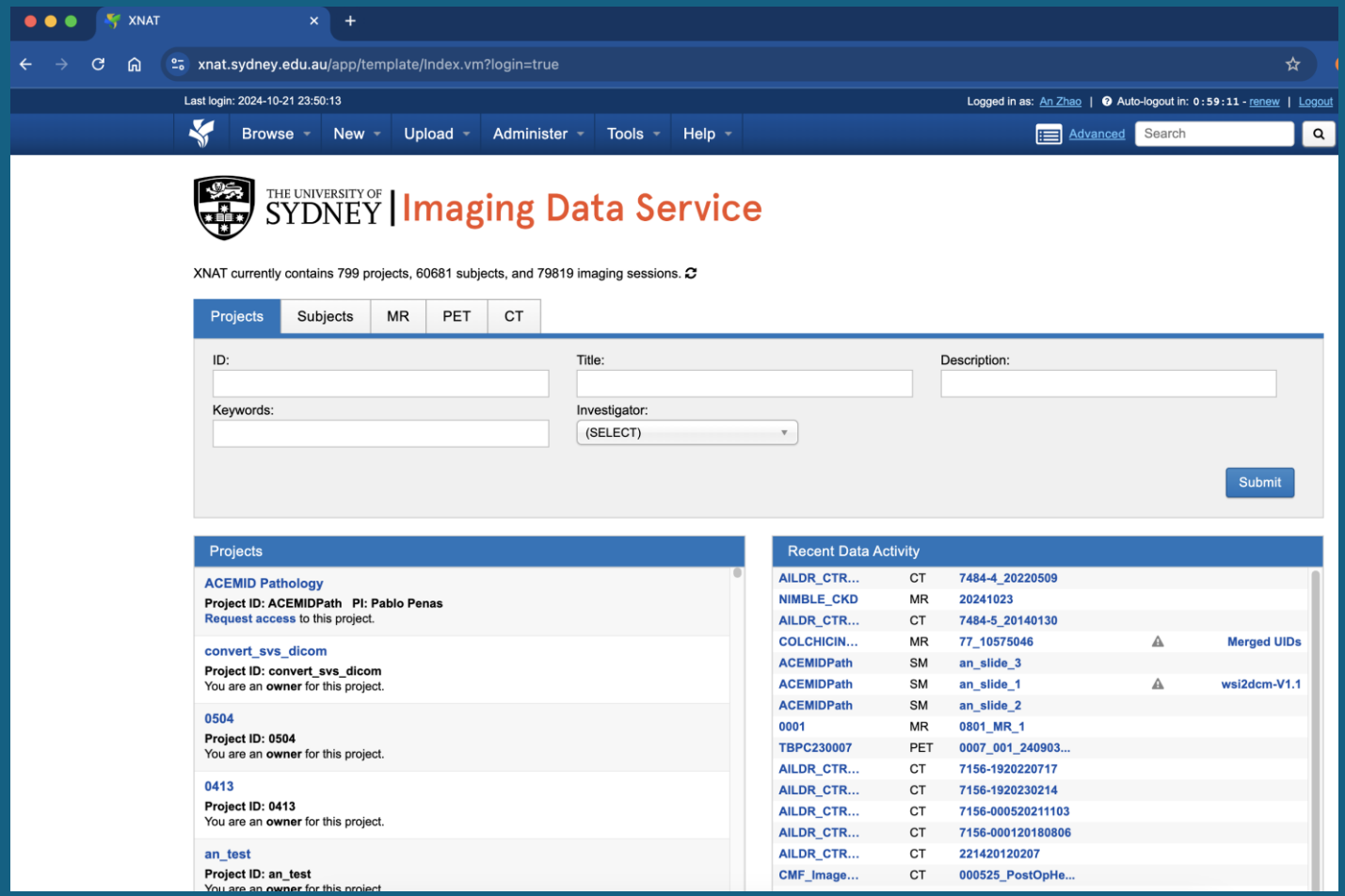
THE UNIVERSITY OF SYDNEY

Introduction to XNAT

- **What is XNAT?**
  - XNAT is an open-source imaging informatics platform developed by the Neuroinformatics Research Group at Washington University.
- **Major Features:**
  - **Data Management:** Upload, organize, and share medical imaging data.
  - **Data Processing:** Automate complex workflows with a pipeline engine.
  - **Data Security:** Robust security features to manage data access.
  - **Extensibility:** Highly customizable to fit specific research needs.

THE UNIVERSITY OF SYDNEY

XNAT Web interface



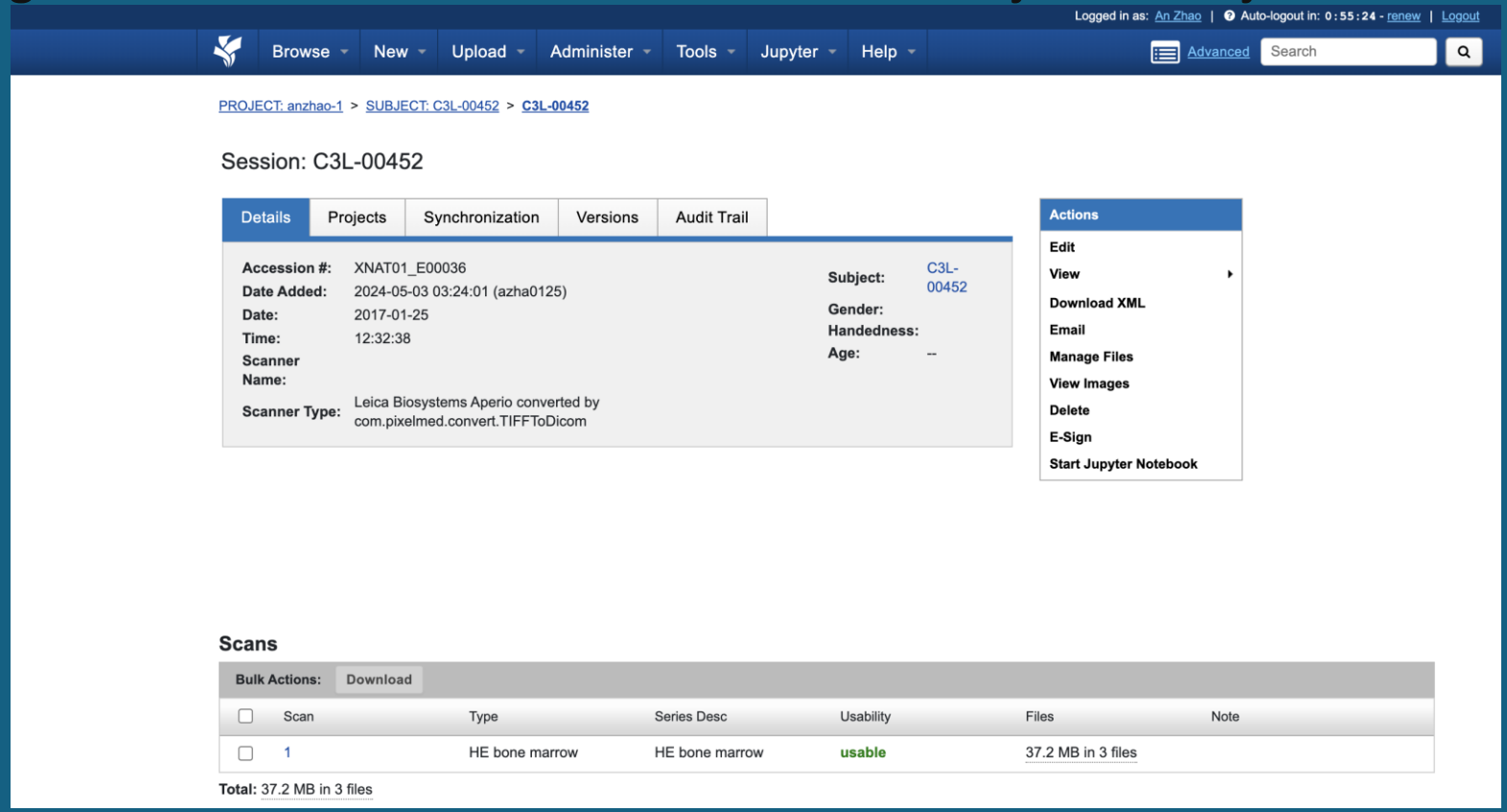
THE UNIVERSITY OF SYDNEY

AIS

CRICOS 00026A TEQSA PRV12057

XNAT Data Structure

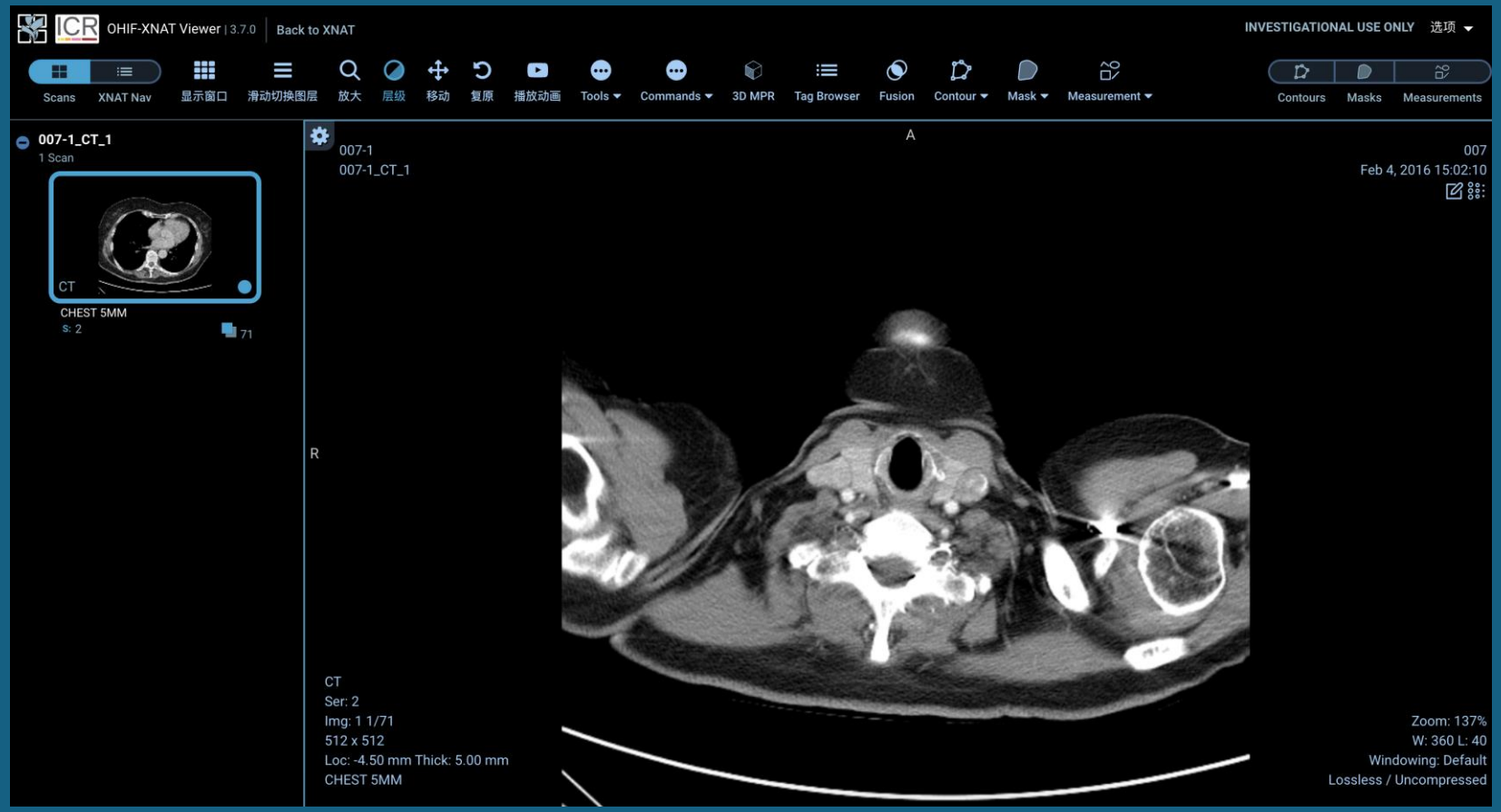
XNAT organizes the data in a hierarchical structure: Project → Subject → Session



THE UNIVERSITY OF SYDNEY

AIS

View Image Using OHIF Viewer on XNAT



THE UNIVERSITY OF SYDNEY

AIS

Overview of JupyterHub

- JupyterHub is a multi-user server for Jupyter Notebooks, designed to support many users by spawning, managing, and proxying multiple single-user Jupyter Notebook servers.

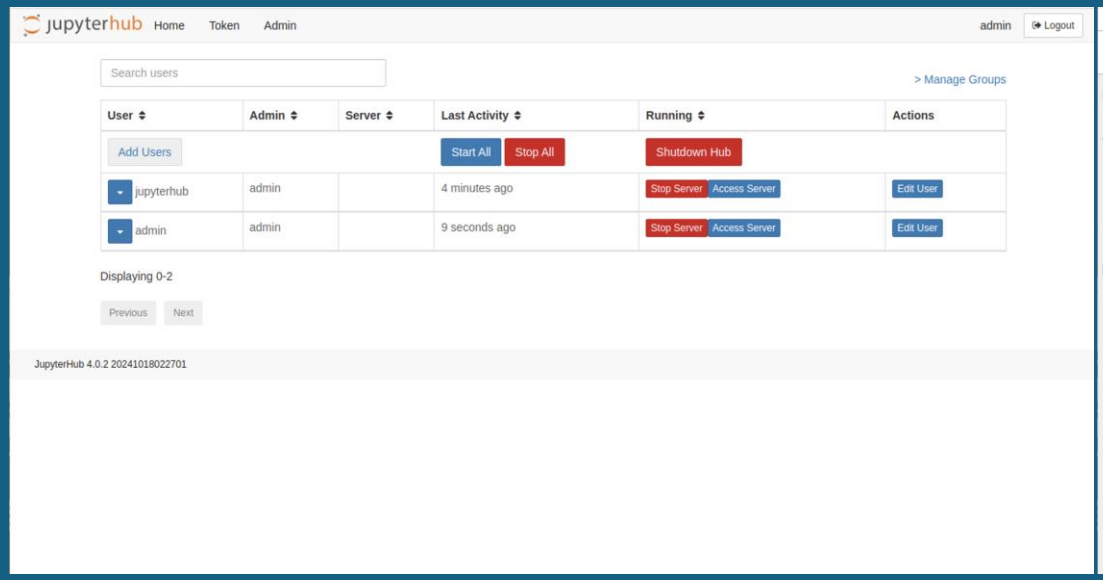
•Major Features:

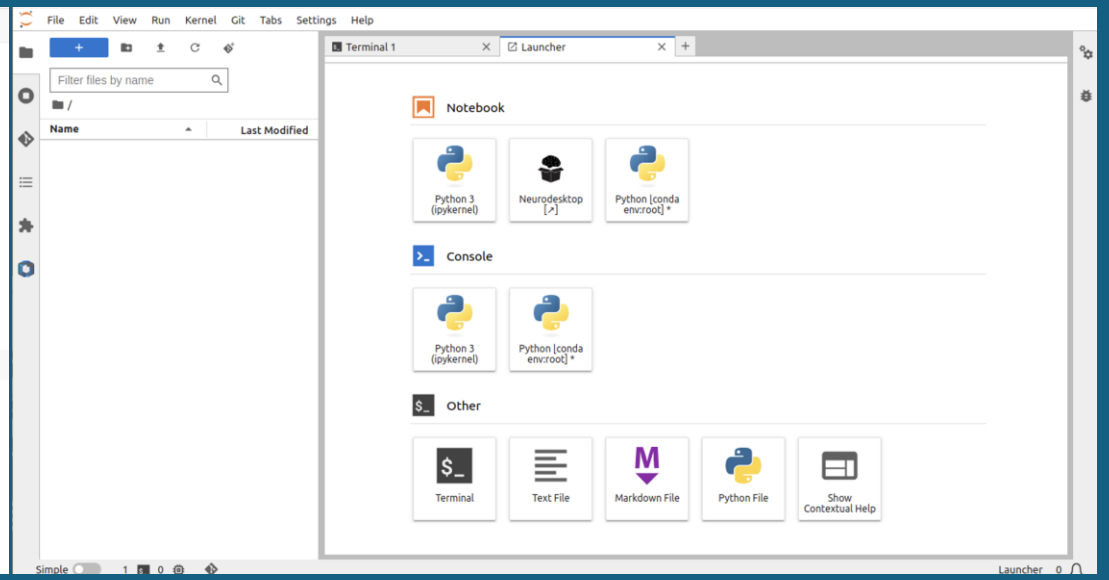
- **Multi-User Support:** JupyterHub allows multiple users to access their own jupyter Notebook servers.
- **Scalability:** JupyterHub can be deployed on a single server for small groups or scaled up using Kubernetes for large numbers of users.
- **Authentication and Security:** Includes pluggable authentication modules like OAuth and GitHub.

THE UNIVERSITY OF SYDNEY

AIS

JupyterHub Web Interface:





THE UNIVERSITY OF SYDNEY

AIS

Overview of Neurodesk

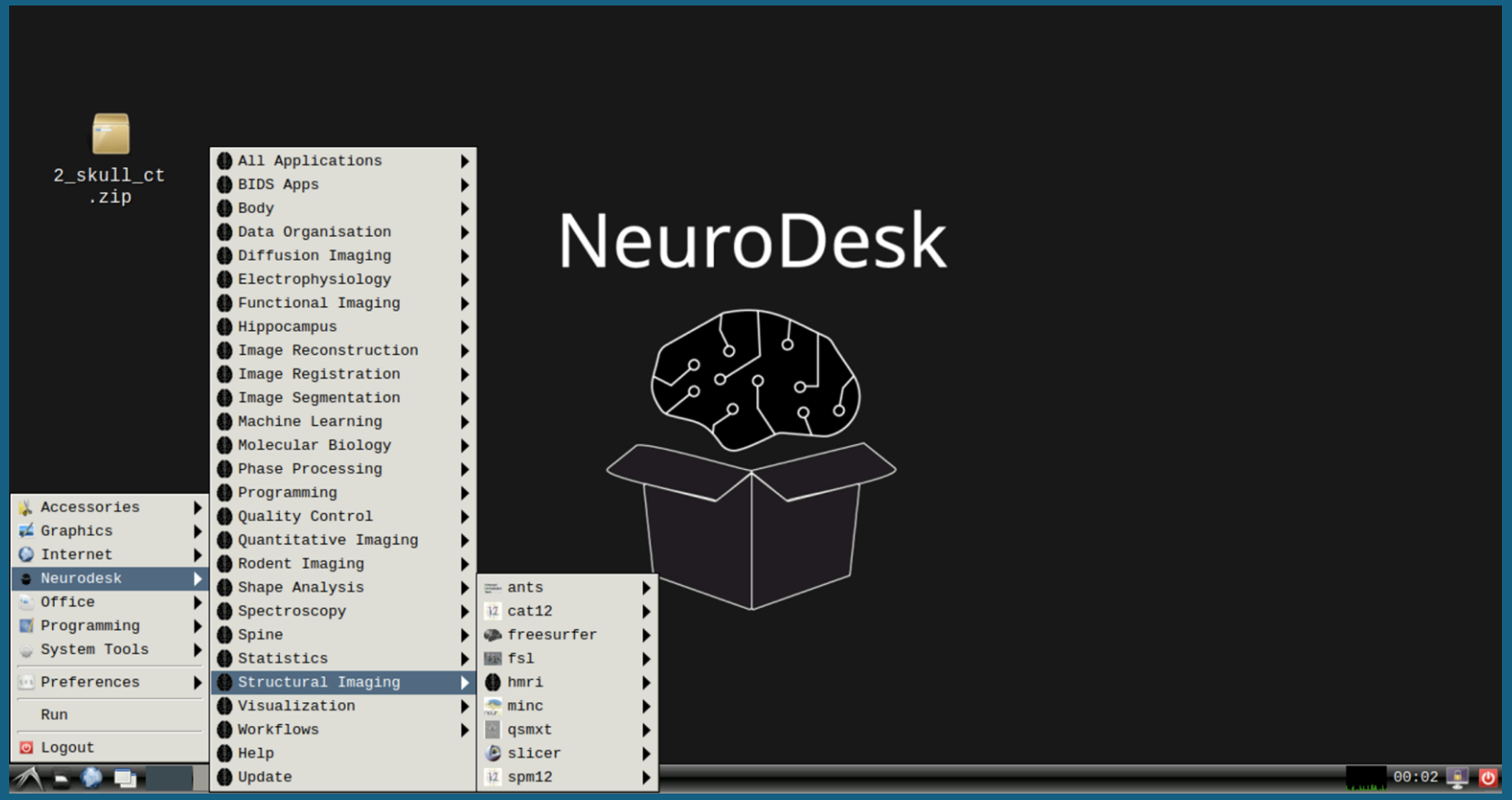
NeuroDesk: A flexible and scalable data analysis environment for reproducible neuroimaging.

Key Features:

- **Containerized Environment:** Encapsulates neuroimaging tools and dependencies.
- **Reproducibility:** By using containers, NeuroDesk ensures that the same analysis pipeline can be run with same results, regardless of the underlying hardware or software updates.
- **Cross-Platform Compatibility:** Users can run NeuroDesk on local PCs, high-performance computing (HPC) clusters, and cloud platform.

THE UNIVERSITY OF SYDNEY

Neurodesk Interface:



THE UNIVERSITY OF SYDNEY

AIS

CRICOS 00026A TEQSA PRV12057

Integrating XNAT, Neurodesk, & JupyterHub

•Why Integrate?

- Streamlined workflows
- Enhanced data management
- Improved reproducibility

•Integration Workflow:

- Data ingestion in XNAT
- Data analysis and process using Neurodesk
- Interactive visualization with JupyterHub

THE UNIVERSITY OF SYDNEY

AIS

Integration Workflow Details:

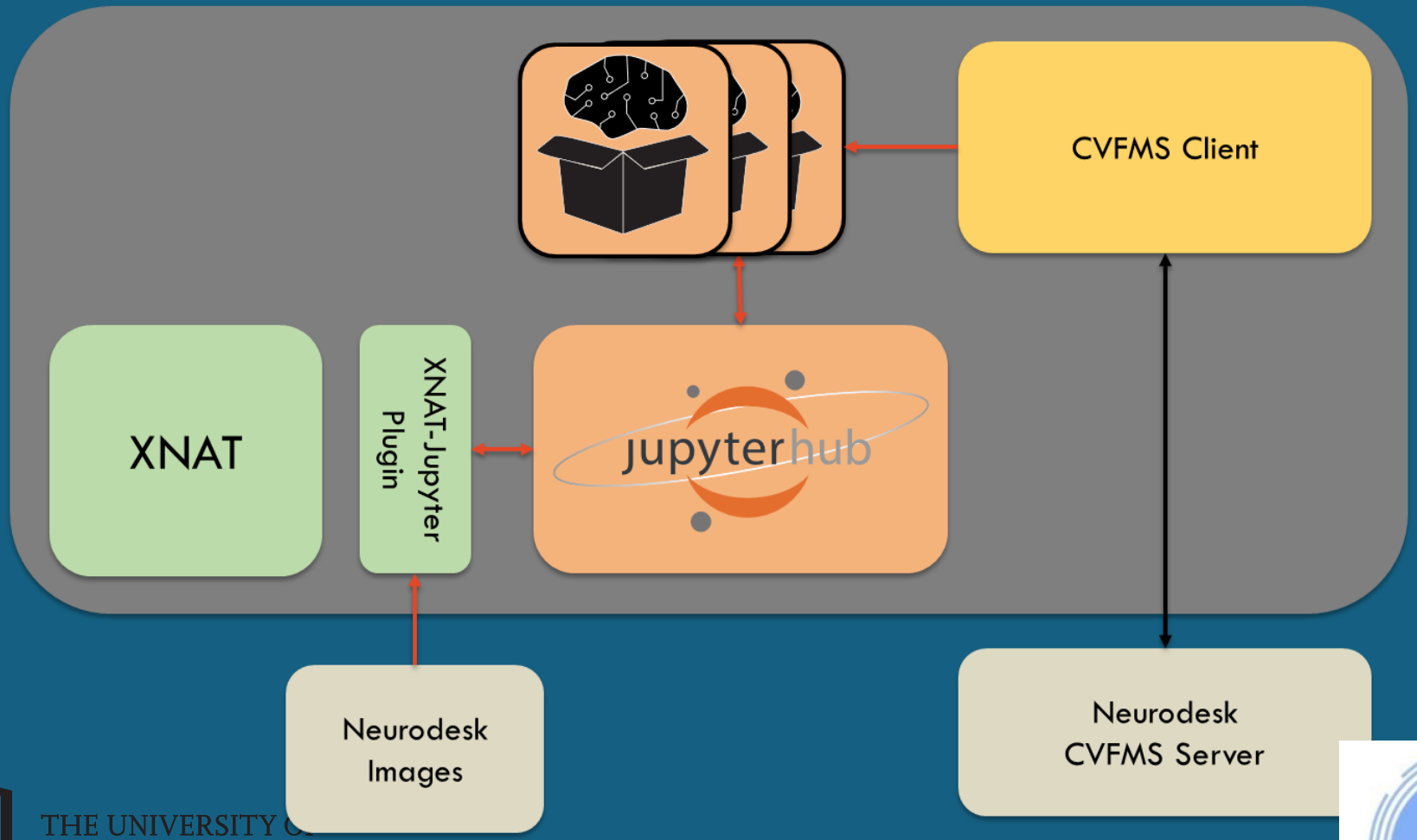
XNAT and Neurodesk: XNAT serves as a central repository for storing and managing neuroimaging data, ensuring data integrity and accessibility. XNAT can be used to manage and share the neuroimaging data that Neurodesk processes. Data from XNAT can be pulled into Neurodesk for analysis, and results can be pushed back to XNAT for storage and sharing.

Neurodesk and JupyterHub: JupyterHub provides an interactive environment for data exploration and analysis, which can be used to create and run notebooks that utilize Neurodesk for processing.

XNAT and JupyterHub: The JupyterHub plugin will connect XNAT users to JupyterHub, allowing them to spawn Jupyter notebook containers.

THE UNIVERSITY OF SYDNEY

Integration Diagram:



THE UNIVERSITY OF SYDNEY

AIS

Deploy Procedure:

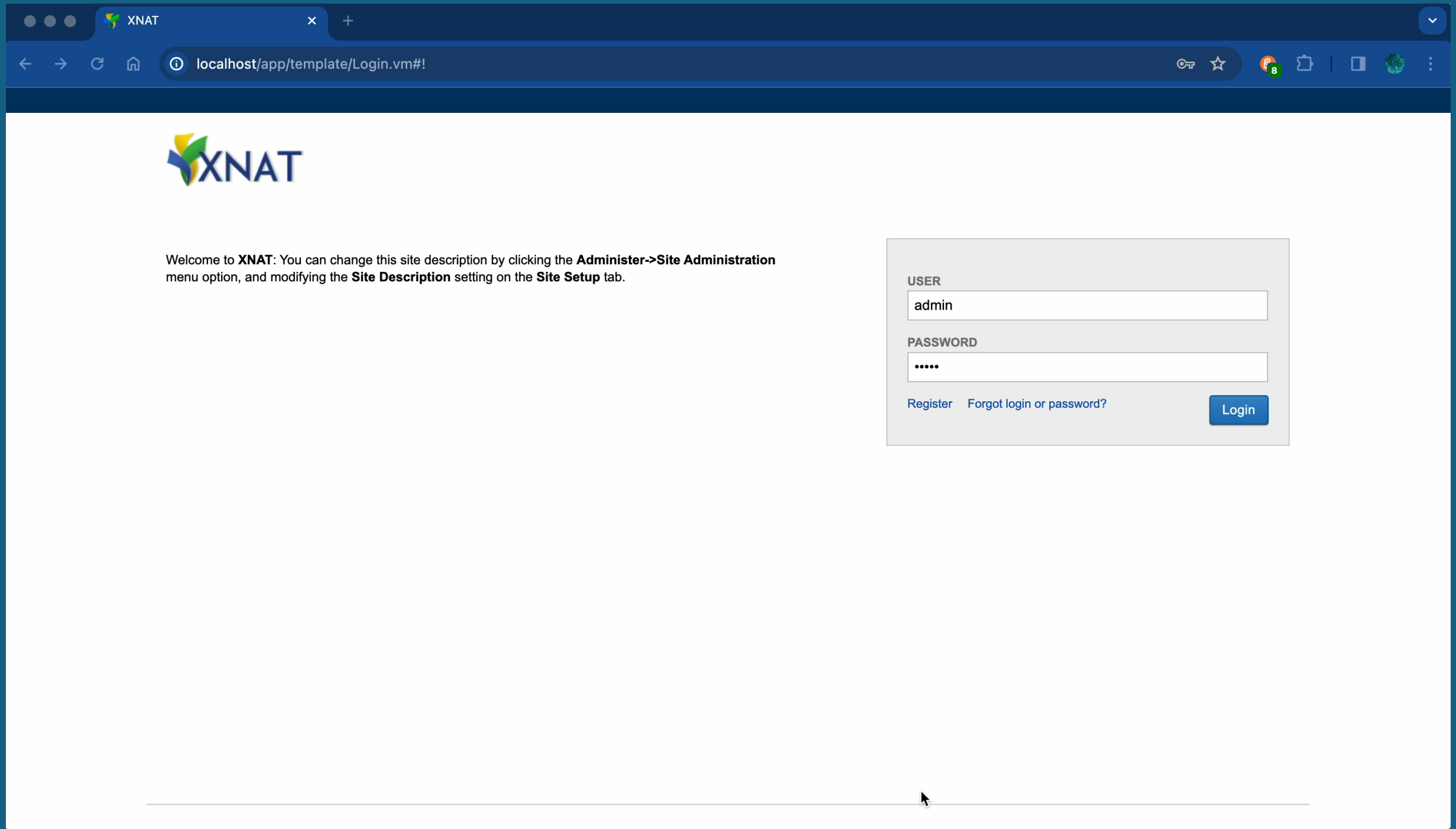
Deployed via 3 AIS Helm Charts:

- XNAT
- JupyterHub
- CVMFS

Synced with national NeuroDesk Infrastructure.

THE UNIVERSITY OF SYDNEY

Watch the following video Demo:


XNAT
localhost/app/template/Login.vm#!
XNAT
Welcome to XNAT: You can change this site description by clicking the Administer->Site Administration menu option, and modifying the Site Description setting on the Site Setup tab.
USER
admin
PASSWORD
Register
Forgot login or password?
Login

Any Questions?

THE UNIVERSITY OF SYDNEY

Thank you!

THE UNIVERSITY OF SYDNEY