

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

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

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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.



XNAT Web interface

The screenshot shows the XNAT web interface. At the top, there is a navigation bar with the XNAT logo, a search bar, and a user profile section indicating the user is logged in as 'An Zhao' with an auto-logout timer of 0:59:11. Below the navigation bar, the main header features the University of Sydney logo and the text 'Imaging Data Service'. A status message indicates that XNAT currently contains 799 projects, 60681 subjects, and 79819 imaging sessions. The interface is divided into two main sections: a search form and a project listing. The search form includes fields for ID, Title, Description, Keywords, and Investigator, along with a 'Submit' button. The project listing section is split into two columns: 'Projects' and 'Recent Data Activity'. The 'Projects' column lists several projects, including 'ACEMID Pathology', 'convert_svs_dicom', '0504', '0413', and 'an_test', each with its Project ID and a note about ownership. The 'Recent Data Activity' column displays a table of recent data entries with columns for modality, session ID, and subject ID.

Modality	Session ID	Subject ID
CT	7484-4_20220509	
MR	20241023	
CT	7484-5_20140130	
MR	77_10575046	Merged UIDs
SM	an_slide_3	
SM	an_slide_1	wsidcm-V1.1
SM	an_slide_2	
MR	0801_MR_1	
PET	0007_001_240903...	
CT	7156-1920220717	
CT	7156-1920230214	
CT	7156-000520211103	
CT	7156-000120180806	
CT	221420120207	
CT	000525_PostOpHe...	



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XNAT Data Structure

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

The screenshot displays the XNAT web interface for session C3L-00452. The breadcrumb trail is PROJECT: anzhao-1 > SUBJECT: C3L-00452 > C3L-00452. The session title is "Session: C3L-00452".

Navigation tabs include: Details (selected), Projects, Synchronization, Versions, and Audit Trail. An Actions menu is open, listing: Edit, View, Download XML, Email, Manage Files, View Images, Delete, E-Sign, and Start Jupyter Notebook.

Session Details:

Accession #:	XNAT01_E00036	Subject:	C3L-00452
Date Added:	2024-05-03 03:24:01 (azha0125)	Gender:	
Date:	2017-01-25	Handedness:	
Time:	12:32:38	Age:	--
Scanner Name:			
Scanner Type:	Leica Biosystems Aperio converted by com.pixelmed.convert.TIFFToDicom		

Scans section:

Bulk Actions: Download

<input type="checkbox"/>	Scan	Type	Series Desc	Usability	Files	Note
<input type="checkbox"/>	1	HE bone marrow	HE bone marrow	usable	37.2 MB in 3 files	

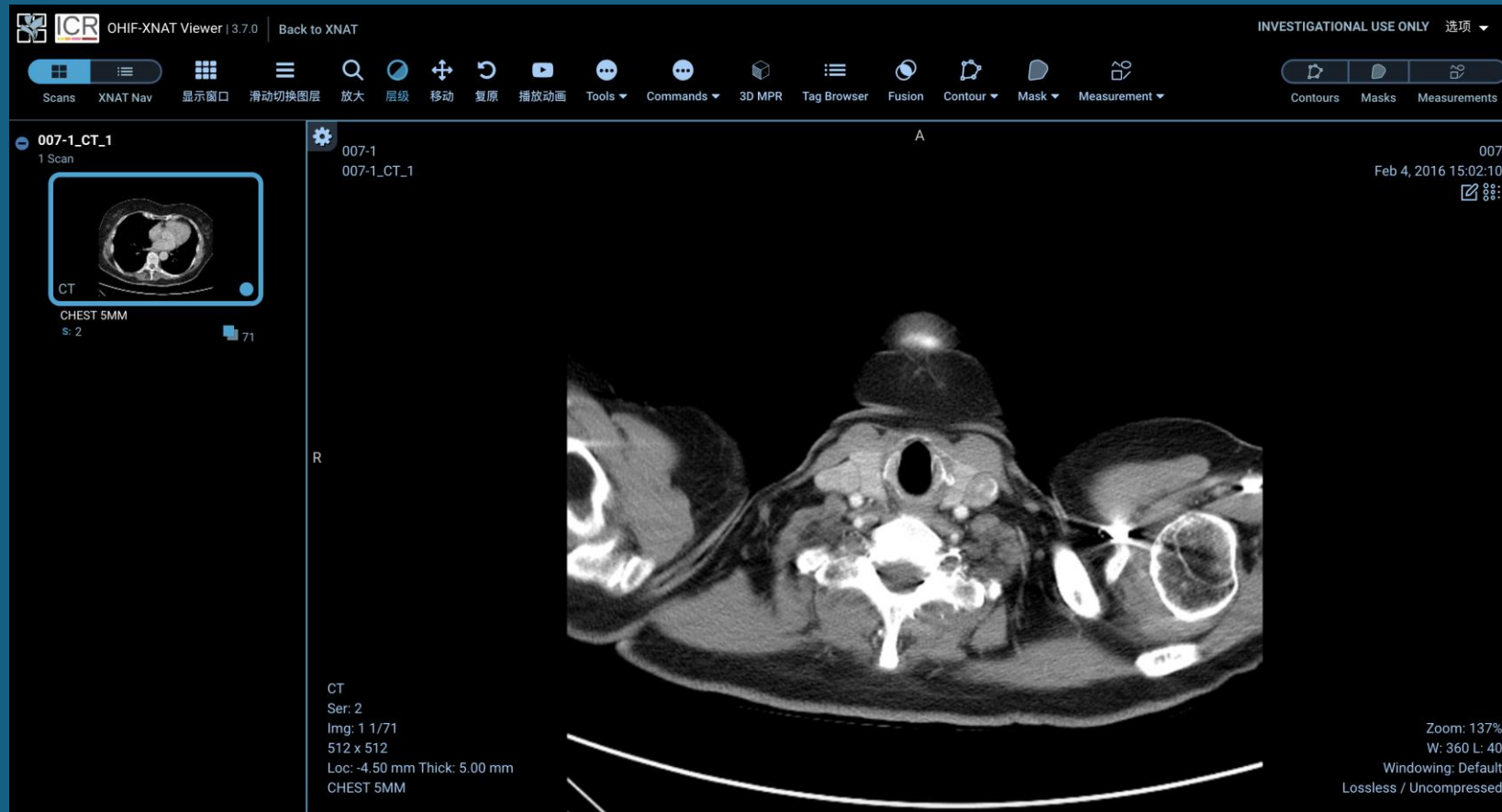
Total: 37.2 MB in 3 files



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View Image Using OHIF Viewer on XNAT



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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.



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JupyterHub Web Interface:

The screenshot shows the JupyterHub admin interface. At the top, there are navigation links for Home, Token, Admin, and a user profile for 'admin' with a Logout button. A search bar for users is present. Below it is a table with columns for User, Admin, Server, Last Activity, Running, and Actions. The table lists two users: 'jupyterhub' and 'admin'. The 'jupyterhub' user has a last activity of '4 minutes ago' and a 'Running' status with buttons for 'Stop Server' and 'Access Server'. The 'admin' user has a last activity of '9 seconds ago' and similar 'Stop Server' and 'Access Server' buttons. There are also buttons for 'Start All', 'Stop All', and 'Shutdown Hub'. At the bottom, it says 'Displaying 0-2' with 'Previous' and 'Next' buttons. The footer shows 'JupyterHub 4.0.2 20241018022701'.

User	Admin	Server	Last Activity	Running	Actions
Add Users			Start All Stop All	Shutdown Hub	
jupyterhub	admin		4 minutes ago	Stop Server Access Server	Edit User
admin	admin		9 seconds ago	Stop Server Access Server	Edit User

The screenshot shows the JupyterHub Launcher interface. It features a file browser on the left with a search bar and columns for Name and Last Modified. The main area is divided into sections: 'Notebook' with options for Python 3 (pykernel), Neurodesktop, and Python [conda envroot]; 'Console' with options for Python 3 (pykernel) and Python [conda envroot]; and 'Other' with options for Terminal, Text File, Markdown File, Python File, and Show Contextual Help.



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Overview of Neurodesk

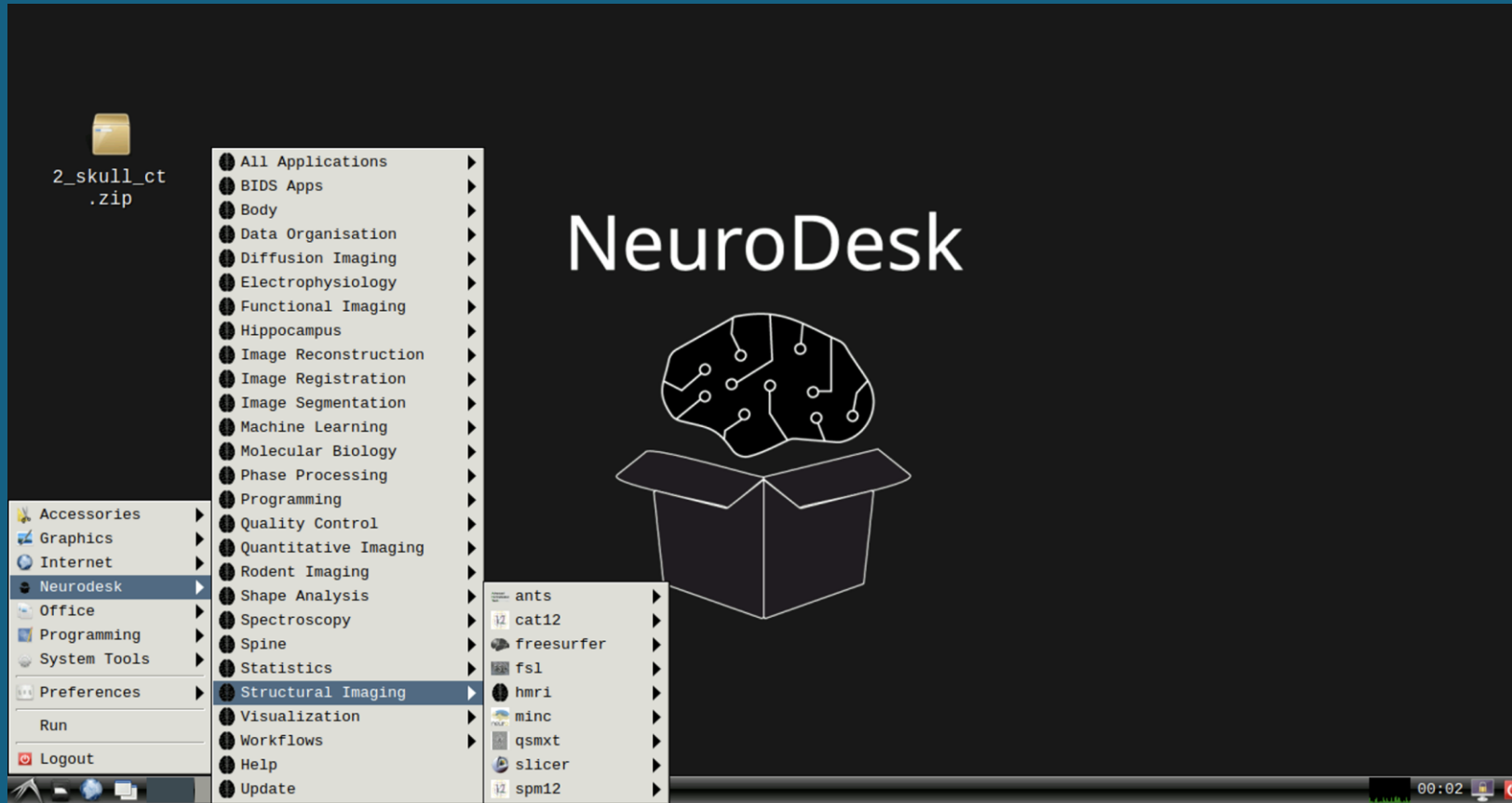
NeuroDesk: A flexible and scalable data analysis environment for reproducible neuroimaging.

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.



Neurodesk Interface:



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



Integration Workflow Details:

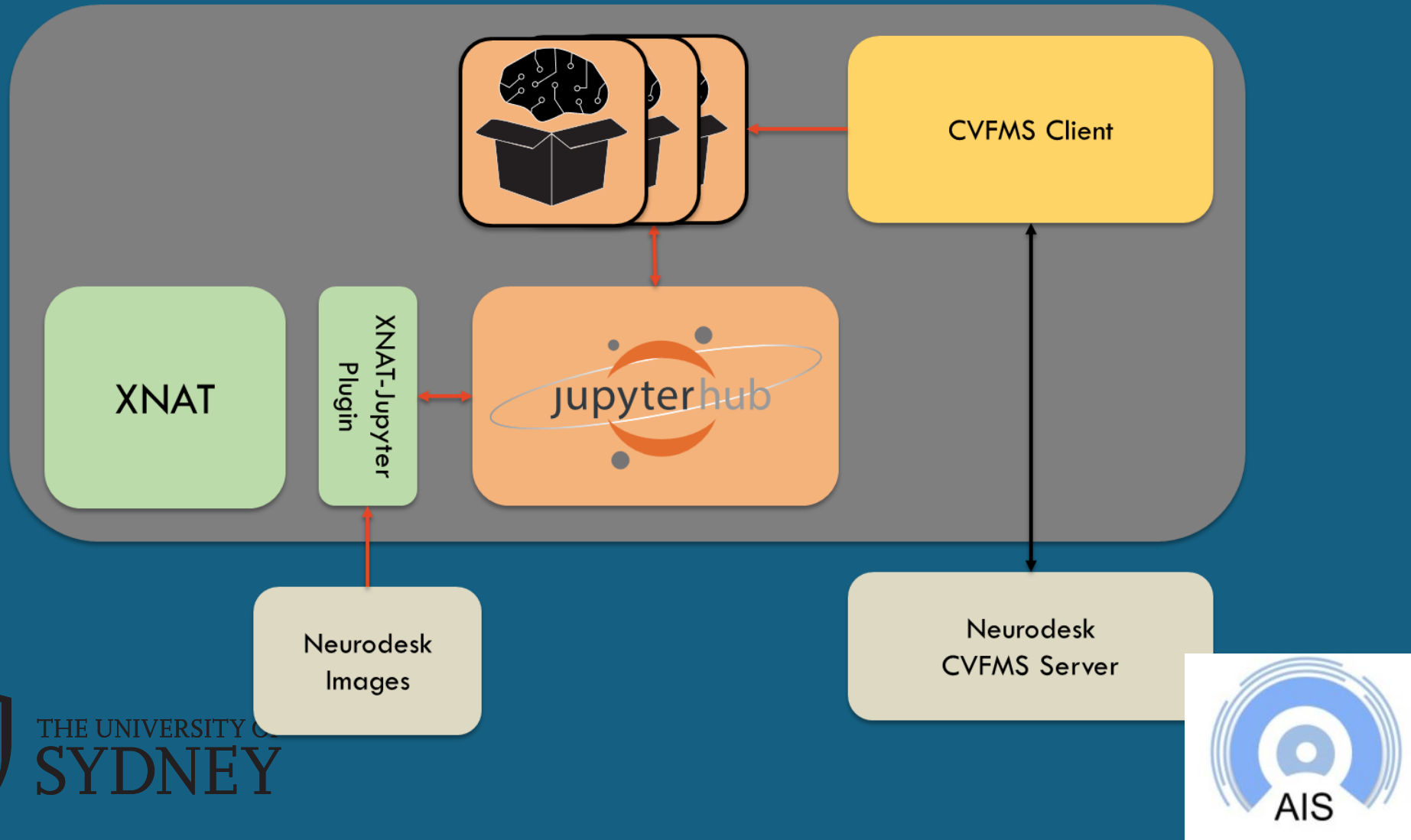
XNAT and Neurodesk: XNAT serves as a central repository for storing and managing neuroimaging data, ensuring data integrity and accessibility. XNAT can be used to manage and share the neuroimaging data that Neurodesk processes. Data from XNAT can be pulled into Neurodesk for analysis, and results can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



Integration Diagram:



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Deploy Procedure:

Deployed via 3 AIS Helm Charts:

- XNAT
- JupyterHub
- CVMFS

Synced with national NeuroDesk Infrastructure.



Watch the following video Demo:





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

PASSWORD

[Register](#) [Forgot login or password?](#)

Any Questions?



Thank you!

