

Northwestern University Neuroimaging Data Archive (NUNDA) “Great Leap Forward”

Lei Wang

Feinberg School of Medicine

Departments of Psychiatry and Behavioral Sciences, Radiology



NORTHWESTERN
UNIVERSITY



People

- Washington University XNAT Team
 - Dan Marcus
 - Mohana Ramaratnam
 - Tim Olsen
- Todd Parrish / CTI (formerly known as CAMRI)
- NU XNAT Team
 - Kate Alpert
 - Alex Kogan
- NU QUEST Team
 - Bruce Foster



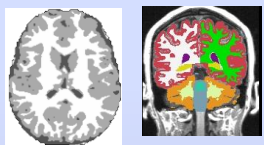
NORTHWESTERN
UNIVERSITY

<https://nunda.northwestern.edu/>

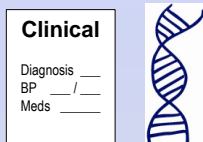
NUNDA



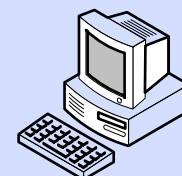
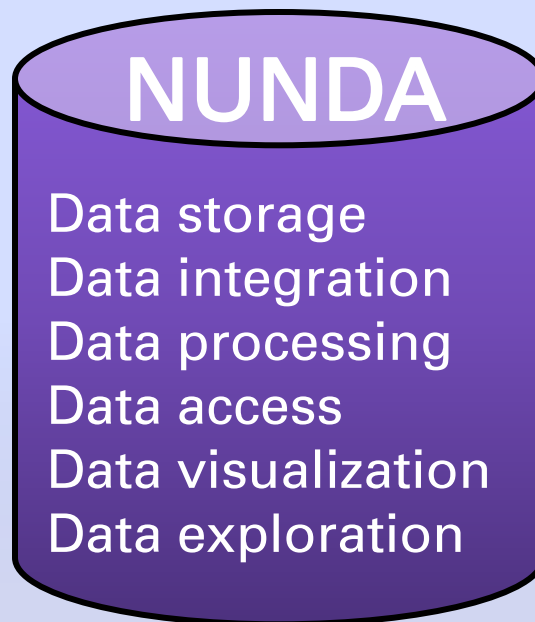
Neuroimaging



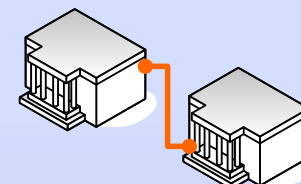
Processing & analysis



Related data



Local users



Collaborators



Community

- Archive of MR Sessions
 - Secure
 - Redundant
 - Backed up
- Pooling controls
- Common Anatomic Protocol (NUCAP)
 - T1, T2, DTI, Resting-State
- Standard processing pipeline
- Linking NUNDA with other neuroimaging centers via federated, disease-oriented databases



NORTHWESTERN
UNIVERSITY

<https://nunda.northwestern.edu/>

NUNDA

- Launched in 2009
- 35 Projects, 684 Subjects, and 935 Imaging Sessions
- 60 registered users

Search
NUNDA currently contains 35 Projects, 678 Subjects, and 927 Imaging Sessions.

Projects	Subjects	MR	PET	CT
ID	Name	Description		
Keywords	Investigator	SELECT		

Submit

Projects

Hippocampal Shape and Memory Function In Progressive Memory Loss Associated with Alzheimer Disease
Project ID: PPAADHippo PI: Lei Wang
This study compares data from structural magnetic resonance imaging (MRI) scans with behavioral data from a nonverbal memory task to properly categorize sub...

Advancing Neuroscience of Emotion and Emotional Disorder in Women over the Lifespan
Project ID: WOL PI: Jacqueline Gollan
This study uses functional Magnetic Resonance Imaging (fMRI) to investigate unique functional and structural characteristics in the brain corresponding to mo...

An fMRI Study of Affective Regulation and Attentional Control in Behavioral Activation Treatment of MDD
Project ID: Davee PI: Jacqueline Gollan
This functional Magnetic Resonance Imaging (fMRI) study investigates

Recent Data Activity

ID	Name	ARC
NUBridge	MR Test_BW_Nordahl...	ARC
NUBridge	MR Test_BW_Gilmore...	ARC
NMorphCH	MR 120208_CH7059b	ARC
WOL	MR W071	ARC
WOL	MR W068	ARC
Davee	MR D002_T3b	ARC
Davee	MR D001_T3b	ARC
Davee	MR D016_T1b	ARC
Davee	MR D015_T1b	ARC
Davee	MR D014_T1b	ARC
Davee	MR D013_T1b	ARC
Davee	MR D012_T1b_resting	ARC
Davee	MR D012_T1b	ARC
WOL	MR W072	ARC
WOL	MR W070	ARC
WOL	MR W067	ARC
WOL	MR W066	ARC
WOL	MR W065	ARC
WOL	MR W064	ARC

MR Session: 71318_3

Accession #	Subject
NUNDA_E00256	71318_3

Date Added	Gender
2010-06-08 14:37:52.0 (kalpert)	

Date	Handedness
2009-05-14	..

Time	Age
13:53:05	

Scanner	
MRC35013 SIEMENS TrioTim	

Scans

Scan	Type	Usability	Files	Note
1	localizer	usable	Show Counts	
2	t1_mpr_1mm_p2_pos50	usable	Show Counts	
3	t1_mpr_1mm_p2_pos50	usable	Show Counts	
4	t2_spc_1mm_p2	usable	Show Counts	
5	ep2d_bold_test	usable	Show Counts	
6	ep2d_bold_connect	usable	Show Counts	
7	ep2d_bold_connect	usable	Show Counts	
8	ep2d_diff_b800_35dir_2mm	usable	Show Counts	
9	ep2d_diff_b800_35dir_2mm	usable	Show Counts	
10	tse_p3_64s	usable	Show Counts	
11	MPRAGE	usable	Show Counts	

Reconstructions

ID	Type	Base Type
4DFP_NUNDA_E00256	4DFP	4DFP
FS_v4.5.0_NUNDA_E00256	FS_v4.5.0	FS
BOLD_NUNDA_E00256	BOLD	BOLD
MPRAGE_GU_n2_NUNDA_E00256	MPRAGE_GU_n2	MPRAGE
MPRAGE_GU_seq-2-11_NUNDA_E00256	MPRAGE_GU_seq-2-11	MPRAGE

Quality Control Images



NORTHWESTERN
UNIVERSITY

<https://nunda.northwestern.edu/>

NUNDA

NUNDA
Northwestern University Neuroimaging Data Archive

User: admin (Logout) (Edit) (Report a problem) Search Advanced

Home New Upload Administer Tools

Search
NUNDA currently contains 35 Projects, 684 Subjects, and 935 Imaging Sessions.

Projects Subjects MR PET CT

ID Name Description
Keywords Investigator SELECT Submit

Projects

- Neuromorphometry by Computer Algorithm NUSRG**
Project ID: NMorphCH PI: John Csernansky
Neuromorphometry by Computer Algorithm NUSRG protocol Session ids: yymmdd_CH###_##
Request access to this project.
- Ragin ACE Study**
Project ID: ACE PI: Ann Ragin
Request access to this project.
- PharmacMRI of Parkinson's disease: a pilot study of drug effects on connectivity**
Project ID: pd_pharmacomri PI: Darren Gitelman
Request access to this project.
- NUBridge: Prenatal Stress and Early Brain Development (12 & 24 months)**
Project ID: NUBridge PI: Lei Wang
Specific aims of the project are to examine the effects of prenatal exposure to stress on longitudinal developmental patterns of brain growth in early develo ...
Request access to this project.

Recent Data Activity

Subject	Modality	Session	Modality
TP	MR	24361	ARC
pd_phar...	MR	007b	ARC
pd_phar...	MR	007a	ARC
pd_phar...	MR	006a_b	ARC
pd_phar...	MR	004a_b	ARC
pd_phar...	MR	008a	ARC
pd_phar...	MR	008b	ARC
NUBridge	MR	120216_001M	MOD
NUBridge	MR	Test_BW_Nordahl...	ARC
NUBridge	MR	Test_BW_Gilmore...	ARC
NMorphCH	MR	120208_CH7059b	ARC
PPA	MR	CH15a	ARC
PPA	MR	P66a	ARC
SA	MR	SA148a	ARC
WOL	MR	W071	ARC
WOL	MR	W068	ARC
Davee	MR	D002_T3b	ARC
Davee	MR	D001_T3b	ARC
Davee	MR	D016_T1b	ARC

powered by XNAT
zotero

- Project (35)
 - Psychiatry (8)
 - Radiology (8)
 - Neurology (3)
 - Physiology (3)
 - CNADC (2)
 - CMH, MSS, Endocrinology



NORTHWESTERN
UNIVERSITY

<https://nunda.northwestern.edu/>

NUNDA

- Project
 - Subject

NUNDA - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NUNDA

Smart Bookmarks Most Visited Latest Headlines News Journals Research RSS QuickLink Inglés Blackboard Learn Northwestern Collabor...

NUNDA
Northwestern University Neuroimaging
Data Archive

User: admin (Logout) (Edit) (Report a problem) Search Advanced

Home New Upload Administrator Tools

Neuromorphometry by Computer Algorithm NUSRG

Details Access Manage Pipelines History

ID: NMorphCH
Description: Neuromorphometry by Computer Algorithm NUSRG protocol Session ids: yymmdd_CH####_##
PI: Csernansky, John
Investigators: Wang, Lei

Edit Details Delete Manage Custom Variables

Subjects MR Sessions

<< first < prev 1 2 3 next > last >> 40 1 of 3 Pgs (100 Rows) Reload Options

Subject	M/F	Hand	YOB	Group	MR Sessions
CH0090_01	M	R	1982	M2	2
CH0446_01	F	R	1986	M2	1
CH0446_02	M	R	1990	M2c	1
CH1840	M	R	1981	M2	3
CH2917	M	R	1981	M2	3
CH3098	F	R	1972	M1	4
CH3183	M	R	1978	M1	3
CH4440	M	R	1984	M1	1
CH5874	F	R	1983	M2	1
CH5994	F	R	1987	M2	1
CH7059b	M	R	1979	M2	1
CH7098a	M	R	1990	M1	1
CH7131b	F	R	1971	M2	2
CH7172a	M	R	1978	M2	3
CH7176a	F	R	1982	M1	2
CH7193b	M	L	1970	M1	3
CH7202b	F	R	1984	M2	2
CH7216a	F	R	1969	M1	1
CH7238a	M	L	1976	M1	1
CH7259b	M	R	1977	M1	3
CH7264b	M	R	1965	M1	3
CH7272b	M	L	1979	M1	2
CH7292b	M	R	1965	M2	1
CH7307a	M	R	1976	M1	3
CH7316a	F	L	1975	M1	3
CH7317b	M	R	1990	M2	1
CH7353a	F	R	1980	M1	5
CH7458a	F	R	1967	M1	2
CH7496a	M	R	1967	M2	1

http://nunda.northwestern.edu/nunda/app/t/natprojectData.ID/search_value/NMorphCH#

zotero



NORTHWESTERN
UNIVERSITY

<https://nunda.northwestern.edu/>

NUNDA

- Project
 - Subject
 - MR Session

NUNDA
Northwestern University Neuroimaging Data Archive

User: admin (Logout) (Edit) (Report a problem) Search Advanced

Home New Upload Administer Tools

PROJECT: NMorphCH > CH3098

Subject Details: CH3098

Details	
Accession #	NUNDA_S00002
Date Added	2009-04-24 00:37:38.0 (admin)
Birth year	1972
Gender	Female
Handedness	Right
Education	14
Race	Caucasian
Height (inches)	64.0
Weight (lbs)	145.0
Recruitment Source	Rehab Clinic
Group	M1

Actions

- Edit
- View XML
- Add Experiment
- Download
- Email
- Share
- Manage Files
- Delete

Experiments

Date	Experiment	Project	Label
2009-01-05	MR Session	NMorphCH	090105_CH3098
2009-02-27	MR Session	NMorphCH	090227_CH3098_fMRI
2009-08-21	MR Session	NMorphCH	090821_CH3098_NCEPTS
2011-04-14	MR Session	NMorphCH	110414_CH3098

powered by XNAT

zotero



NUNDA

Session: 110414_CH3098 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Session: 110414_CH3098 +

nunda.northwestern.edu/nunda/app/action/DisplayItemAction/search_element/xnat%3A_mrSessionData/search ☆ ↻ ↺

Smart Bookmarks Most Visited Latest Headlines News Journals Research RSS QuickLink Inglés Blackboard Learn Northwestern Collabor...

NUNDA

Northwestern University Neuroimaging Data Archive

User: admin ([Logout](#)) ([Edit](#)) ([Report a problem](#)) Search Advanced

Home New Upload Administrator Tools

PROJECT: NMorphCH > SUBJECT: CH3098 > 110414_CH3098

MR Session: 110414_CH3098

Details		Projects	
Accession #	NUNDA_E00575	Subject:	CH3098
Date Added	2011-04-14 15:31:07.0 (pvoss)	Gender:	Female
Date:	2011-04-14	Handedness:	Right
Time:	11:54:51	Age:	39.00
Operator:	Jill/Sam		
Scanner:	MEDPC SIEMENS TrioTim		
Marker:	vitamin e capsule left eye		
Stabilization:	head pads		
Receiver coil:	12 channel		

Actions

- Edit
- View
- Upload
- Download
- Email
- Share
- Launch Pipeline
- Manage Files
- Delete

Notes:

Scans

Scan	Type	Usability	Files	Note
#1	AAHScout	usable	DICOM (128 files, 14.13 Mb) SNAPSHOTS (2 files, 123 Kb)	
#2	MPRAGE	usable	DICOM (4 files, 457 Kb) SNAPSHOTS (2 files, 23 Kb)	
#3	MPRAGE	usable	DICOM (176 files, 33.63 Mb) SNAPSHOTS (2 files, 395 Kb)	
#4	MPRAGE	usable	DICOM (176 files, 33.54 Mb) SNAPSHOTS (2 files, 391 Kb)	
#5	t2_wpc_1mm_(T2-SPACE)	usable	DICOM (176 files, 33.81 Mb) SNAPSHOTS (2 files, 335 Kb)	
#6	ep2d_Test Bold	usable	DICOM (5 files, 1.86 Mb) SNAPSHOTS (2 files, 114 Kb)	
#7	ep2d_bold_nback	usable	DICOM (137 files, 51.34 Mb) SNAPSHOTS (2 files, 556 Kb)	
#8	ep2d_bold_nback	usable	DICOM (137 files, 51.26 Mb) SNAPSHOTS (2 files, 555 Kb)	
#9	ep2d_bold_nback	usable	DICOM (137 files, 51.26 Mb) SNAPSHOTS (2 files, 557 Kb)	
#10	RESTING STATE	usable	DICOM (164 files, 251.32 Mb) SNAPSHOTS (2 files, 3.09 Mb)	
#11	RESTING STATE	usable	DICOM (164 files, 251.23 Mb) SNAPSHOTS (2 files, 3.10 Mb)	
#12	DTI	usable	DICOM (35 files, 57.46 Mb) SNAPSHOTS (2 files, 4.44 Mb)	
#13	DTI	usable	DICOM (35 files, 57.44 Mb) SNAPSHOTS (2 files, 4.44 Mb)	
#14	T2-fl3d-tse_p2_64sl	usable	DICOM (64 files, 9.15 Mb) SNAPSHOTS (2 files, 84 Kb)	
#15	Bold Tobias-EP2D_emotion	usable	DICOM (400 files, 191.00 Mb) SNAPSHOTS (2 files, 944 Kb)	
#16	MPRAGE	usable	DICOM (176 files, 32.97 Mb) SNAPSHOTS (2 files, 454 Kb)	

History

powered by XNAT

- Project
 - Subject
 - MR Session
 - Scan



NUNDA

NUNDA - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Check Text Status x NUNDA

nunda.northwestern.edu/nunda/app/template/ImageUpload.vm

Smart Bookmarks Most Visited Latest Headlines News Journals Research RSS QuickLink Inglés Blackboard Learn Northwestern Collabor...

NUNDA
Northwestern University Neuroimaging Data Archive

User: admin (Logout) (Edit) (Report a problem) Search Advanced

Home New Upload Administer Tools

Launch Uploader

Option 1: Compressed upload

Raw image files can be zipped (.zip or .tar.gz) and uploaded using the form. This tool currently supports DICOM and ECAT files. Selecting 'Prearchive' will place your images into a temporary holding space. You will then have the ability to review the details and match the data to the proper subject & session id. If you are confident the data will be mapped properly, you can directly 'Archive' the files and specify whether the resulting session should go into a quarantine state.

Project SELECT

Destination ☒ Prearchive ☐ Archive in quarantine ☐ Archive no quarantine

File Browse...

Upload

Option 2: Uploader Applet

DICOM and ECAT files can be uploaded via an online upload tool.

Launch Uploader

Option 3: DICOM C-STORE Service Class User

Any DICOM C-STORE SCU, including scanner consoles or DICOM applications like OsiriX or DicomBrowser, can send files directly to this server.

DICOM C-STORE receiver (SCP) Specifications

- Host Name: nunda.northwestern.edu
- Port: 104
- AE Title: NUNDA

Start DICOM Browser

powered by XNAT

zotero

1. Data capture

- Push from CAMRI
- Web upload



NUNDA

1. Data capture
2. Quality control



NUNDA

1. Data capture
2. Quality control
3. Data exploration & download

The header indicates the type of data in the listing. Listings are available for MR, PET, analyzed data, and custom non-image types

Click 'Search' to open view custom search dialog.

Click here or on the data ID to view a detailed report. Click the ids to view details.

The columns that appear in a listing are tailored for the data type.

The screenshot displays the NUNDA web application interface. At the top, there is a navigation bar with links for 'File', 'Edit', 'Check', 'SmartB', and 'Northwestern Data Arch'. Below this is a search bar with a 'Search' button and an 'Advanced' link. The main content area is titled 'Neuromorphometry by Computer Algorithm NUSRG' and features a 'Details' tab. The details section shows the ID 'NMorphCH', a description 'Neuromorphometry by Computer Algorithm NUSRG protocol Session ids: yymmdd_CH####_##', the PI 'Cserninsky, John', and the investigator 'Wang, Lei'. There are buttons for 'Edit Details', 'Delete', and 'Manage Custom Variables'. Below the details section is a table of search results. The table has columns for 'MR ID', 'Date', 'Subject', 'Age', 'Scanner', and 'Scans'. The first five rows of the table are visible, showing data for subjects CH5994, CH3098, CH7957, CH7259b, and CH7637. The 'Scans' column contains detailed scan parameters for each subject. A 'Subjects' tab is also visible at the top of the table. A 'zotero' logo is visible in the bottom right corner of the interface.

MR ID	Date	Subject	Age	Scanner	Scans
081219_CH5994	2008-12-19	CH5994	21	MRC35013	ep2d_bold_connect(1), ep2d_diff_b800_35dir_2mm(2), EP2D_emotion(1), localizer(1), T1(2), T2(1), tse_p3_64sl(1)
090105_CH3098	2009-01-05	CH3098	37	CAMRI Trio 3T	ep2d_bold_connect(1), ep2d_bold_test(1), ep2d_diff_b800_35dir_2mm(2), EP2D_emotion(1), localizer(1), T1(2), T2(1), tse_p3(1), tse_p3_64sl(1)
090119_CH7957	2009-01-19	CH7957	35	CAMRI Trio 3T	ep2d_bold_connect(1), ep2d_bold_episodic(1), ep2d_bold_nback(2), ep2d_bold_test(1), ep2d_diff_b800_35dir_2mm(2), EP2D_emotion(1), localizer(1), MPRAGE(1), PhoenixZIPReport(1), T1(2), T2(1), tse_p3(1), tse_p3_64sl(1)
090202_CH7259b	2009-02-02	CH7259b	32	CAMRI Trio 3T	ep2d_bold_nback(7), ep2d_bold_test(1), ep2d_diff_b800_35dir_2mm(2), EP2D_emotion(2), localizer(2), T1(2), T2(1), tse_p3_64sl(2)
090223_CH7637	2009-02-23	CH7637	38	CAMRI Trio 3T	ep2d_bold_connect(2), ep2d_bold_nback(3), ep2d_bold_test(1), ep2d_diff_b800_35dir_2mm(2), EP2D_emotion(1), localizer(1), MPRAGE(1), T1(2), T2(1), tse_p3_64sl(1)



NUNDA

1. Data capture
2. Quality control
3. Data exploration & download

Session: 110414_CH3098 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Session: 110414_CH3098

nunda.northwestern.edu/nunda/app/action/DisplayItemAction/search_element/xnat%3A_mrSessionData/search

Smart Bookmarks Most Visited Latest Headlines News Journals Research RSS QuickLink Inglés Blackboard Learn Northwestern Collaborator

NUNDA

Northwestern University Neuroimaging Data Archive

User: admin ([Logout](#)) ([Edit](#)) ([Report a problem](#)) Search Advanced

Home New Upload Administer Tools

PROJECT: NMorphCH > SUBJECT: CH3098 > 110414_CH3098

MR Session: 110414_CH3098

- Projects
- Recent
- Favorite
- My projects
- Other projects
- Stored Searches
- Data

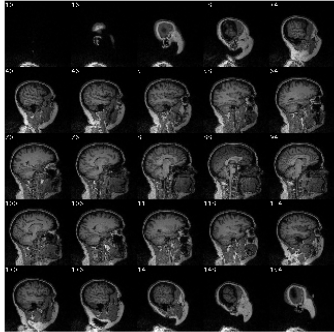
Details		Projects	
Accession #	NUNDA_E00575	Subject:	CH3098
Date Added	2011-04-14 15:31:07.0 (pvoss)	Gender:	Female
Date:	2011-04-14	Handedness:	Right
Time:	11:54:51	Age:	39.00
Operator:	Jill/Sam		
Scanner:	MEDPC SIEMENS TrioTim		
Marker:	vitamin e capsule left eye		
Stabilization:	head pads		
Receiver coil:	12 channel		

[Edit](#)
[View](#)
[Upload](#)
[Download](#)
[Email](#)
[Share](#)
[Launch Pipeline](#)
[Manage Files](#)
[Delete](#)

Notes:

Scans

Scan	Type	Usability	Files	Note
[x] 1	AAHScout	usable	DICOM (128 files, 14.13 Mb) SNAPSHOTS (2 files, 123 Kb)	
[x] 2	MPRAGE	usable	DICOM (4 files, 457 Kb) SNAPSHOTS (2 files, 23 Kb)	
[x] 3	MPRAGE	usable	DICOM (176 files, 33.63 Mb) SNAPSHOTS (2 files, 395 Kb)	



Image

Session

SESS

L&B

MAP#

AGE :

GEND

HAND

ACQ :

SCAN

STAB

REF :

INVE

The screenshot shows a Mozilla Firefox browser window with the address bar displaying "NUNDA". The page content includes a header with navigation icons (back, forward, home, search, etc.) and a main content area. The main content area has a title bar "NUNDA" with a close button. Below the title bar is a form with the following fields:

- Type: T1
- Data: RAW
- Run: 3
- View: Transverse
- Display: Stack
- ☒ radiologic
- GO

Below the form is a "Block" button. The bottom of the page features a "Session information" section with the following details:

- SESSION ID: NUNDA_E00011
- LAB ID:
- MAP#:
- AGE: 26.24
- GENDER: Female
- HANDEDNESS: Right
- ACQ. DATE: 2009-04-22
- SCANNER: CAMRI Trio 3T
- STABILIZATION:
- REF. MARKER:
- INVESTIGATOR:

The browser's status bar at the bottom shows "Done".



NUNDA Pipelines

1. Data capture
2. Quality control
3. Data exploration & download
4. Image processing pipelines

NUNDA PIPELINES

Process Your Data

NUNDA Pipelines

- Currently Available Pipelines
- The Front-End (How to Launch a Pipeline)
- The Back-End (How the Pipeline Engine Works)
- Live Demo (NUNDA Cooking Show)

Currently Available Pipelines

- Standard Structural Preprocessing (StdBuildNunda)
 - ▣ DICOM → Analyze reconstruction
 - ▣ MPRAGE averaging
- FreeSurfer Segmentation and Surface Generation (FSBuild)
- FSL Tissue Segmentation (FSLSeg)
 - ▣ Image segmentation into gray, white, CSF, tissue types
- Resting-State Preprocessing (GenericBoldPreprocessingNunda)
 - ▣ Resting-state BOLD scan preprocessing
 - ▣ Includes QC outputs

Currently Available Pipelines

- Standard Structural Preprocessing (StdBuildNunda)
 - ▣ DICOM → Analyze reconstruction (16-bit 4dint)
 - ▣ T1 MPRAGE averaging
 - Geometric distortion correction
 - Averaging multiple acquisitions
 - Gain field correction
 - ▣ T2W/TSE
 - Geometric distortion correction

Currently Available Pipelines

- Standard Structural Preprocessing (StdBuildNunda)
- FreeSurfer Segmentation and Surface Generation (FSBuild)
 - ▣ recon-all -all
 - Subcortical segmentation and volume
 - Cortical parcellation and volume, surface area, cortical thickness
 - Currently requires pre-processed MPRAGE image as input, will soon accept DICOMs

Currently Available Pipelines

- Standard Structural Preprocessing (StdBuildNunda)
- FreeSurfer Segmentation and Surface Generation (FSBuild)
- FSL G/W/CSF Tissue Segmentation (FSLSeg)
 - ▣ Segmenting MPAGE with FSL
 - Requires pre-processed MPAGE image as input
 - FSL BET – deletes non-brain tissue from input image
 - FSL FAST – corrects for spatial intensity variations – bias field or RF inhomogeneities
 - FSL FAST – segments image into gray, white, CSF, tissue types, provides volume

Currently Available Pipelines

- Standard Structural Preprocessing (StdBuildNunda)
- FreeSurfer Segmentation and Surface Generation (FSBuild)
- FSL G/W/CSF Tissue Segmentation (FSLSeg)
- Resting-State Preprocessing (GenericBoldPreprocessingNunda)
 - ▣ Pipeline to pre-process BOLD scan types
 - Frame alignment to correct for asynchronous slice acquisition
 - Correction for odd-even slice intensity differences
 - Movement correction
 - Average of all the first frames
 - Transformations to standard atlas space
 - ▣ Includes QC
 - Intensity histogram of the normalized bold image
 - Movement plot (from motion correction)

Launch Pipeline from NUNDA Web

NUNDA
Northwestern University Neuroimaging
Data Archive

User: kalpert ([Logout](#)) ([Edit](#)) ([Report a problem](#))

[Advanced](#)

[Home](#)

[New ▾](#)

[Upload ▾](#)

[Administer ▾](#)

[Tools ▾](#)

PROJECT: Test Project > SUBJECT:BP27214 > 080427_BP27214

MR Session: 080427_BP27214

Details

Projects

Accession #	NUNDA_E00900	Subject:	BP27214
Date Added	2011-11-22 18:30:44.0 (kalpert)	Gender:	
Date:	2008-04-27	Handedness:	
Time:	11:06:39	Age:	--
Operator:	JS AS		
Scanner:	MEDPC SIEMENS TrioTim		
Acquisition Site:	Washington		

Actions

- Edit**
- View** ▶
- Upload** ▶
- Download** ▶
- Email**
- Share**
- Launch Pipeline**
- Manage Files**
- Delete**

Notes:

Navigate to your MR Session page, select “Launch Pipeline” from the Actions Menu

NUNDA

nunda.northwestern.edu/nunda/app/action/XDATAActionRouter/xdataaction/Pipeline? ☆ ABP ▼

Please select a pipeline to launch for 080427_BP27214


☐ FSL_SEG
Description: Pipeline for segmenting MPRAGE data

☐ FSBuild
Description: Pipeline for running reconall -all

☐ GenericBoldPreprocessingNunda
Description: Pipeline to pre-process BOLD scan types. Includes the Functional Connectivity post-processing.

☒ StdBuildNunda
Description: Dicom to Analyze Reconstruction

Close Submit

 powered by
XNAT

Select the pipeline you wish to launch and click
“Submit”



StdBuild Pipeline: Session Parameters

Subject: BP27214

Project: Test (Alex)

***Warning: StdBuildNunda pipeline has been run already. A rerun will overwrite the following reconstructions: 4DFP_NUNDA_E00900, TSE_NUNDA_E00900, T2_NUNDA_E00900, and MPRAGE_*_NUNDA_E00900. ***

sessionId: 080427_BP27214

Min Number of Slices Needed to Reconstruct Sequence (changing this will change the sequences you can select below): 30

☐ Include localizer

(NOT ENOUGH FRAMES)

☒ Include AAScout

Check scans to reconstruct:

☒ 2 (AAScout Quality: usable)

☒ 7 (AAScout Quality: usable)

☐ Include localizer_aligned

(NOT ENOUGH FRAMES)

☒ Include t1_mpr_1mm_p2_pos50

Check scans to reconstruct:

☒ 4 (t1_mpr_1mm_p2_pos50 Quality: usable)

☒ 5 (t1_mpr_1mm_p2_pos50 Quality: usable)

☒ Include t2_spc_1mm_p2

Check scans to reconstruct:

☒ 6 (t2_spc_1mm_p2 Quality: usable)

☒ Include tse_p3

Check scans to reconstruct:

☒ 8 (tse_p3 Quality: usable)

☐ Include ep2d_bold_test

(NOT ENOUGH FRAMES)

Set session-specific parameters....

☒ **Include ep2d_diff_b800_30dir_2mm**

Check scans to reconstruct:

☒ 12 (ep2d_diff_b800_30dir_2mm Quality: usable)☒ 13 (ep2d_diff_b800_30dir_2mm Quality: usable)☒ **Include T2 star ep2d_fid**

Check scans to reconstruct:

☒ 14 (T2 star ep2d_fid Quality: usable)☒ **Include tse_p3_64sl**

Check scans to reconstruct:

☒ 15 (tse_p3_64sl Quality: usable)**MPR Process T1 Scans:** ☒ Yes ☐ No**Choose MPR Scans to Process (align using b-spline interpolation, average if more than 1):**☒ 4 (t1_mpr_1mm_p2_pos50 Quality: usable)☒ 5 (t1_mpr_1mm_p2_pos50 Quality: usable)**Parameters for MPR Processing:**Grad Unwarp? ☒ Yes ☐ NoChoose Map for Grad Unwarp (scanner gradient model): **Avanto (use for TimTrio)**Atlas (711-2B) Representative Target: ☒ TRIO_Y_NDC (for young adults) ☐ CAPIIO (for older adults)

When the process is complete, an email will be automatically sent to k-alpert@northwestern.edu

Send *additional* confirmation emails to (use spaces to separate multiple addresses)**Launch Selected**

Close

And click “Launch Selected” to launch!

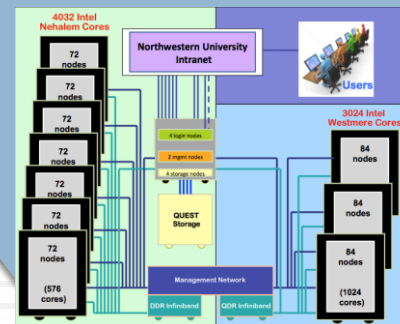
The Back-End

We harness the power of Quest, Northwestern's high performance computing cluster, to run NUNDA pipeline processes

NUNDA Server



Quest Cluster



Quest Computing Cluster

[NUI Home](#) > [Research Computing Resources](#) > [Advanced Research Computing](#) > [High Performance Computing](#) > **The Quest Cluster**

High Performance Computing System - Quest

The University's high performance computing (HPC) system is referred to as Quest. H University's secure [Data Center facilities](#), it offers a large shared computational facility.

Designed as a general use cluster, Quest supports the majority of HPC applications at Northwestern and is built to accommodate a wide variety of codes with great economy.

University researchers and educators, including postdoctoral researchers are eligible to [apply for an account](#) to [request an allocation](#) of time on Quest as computational investigators (CI's) for the purpose of research or education.

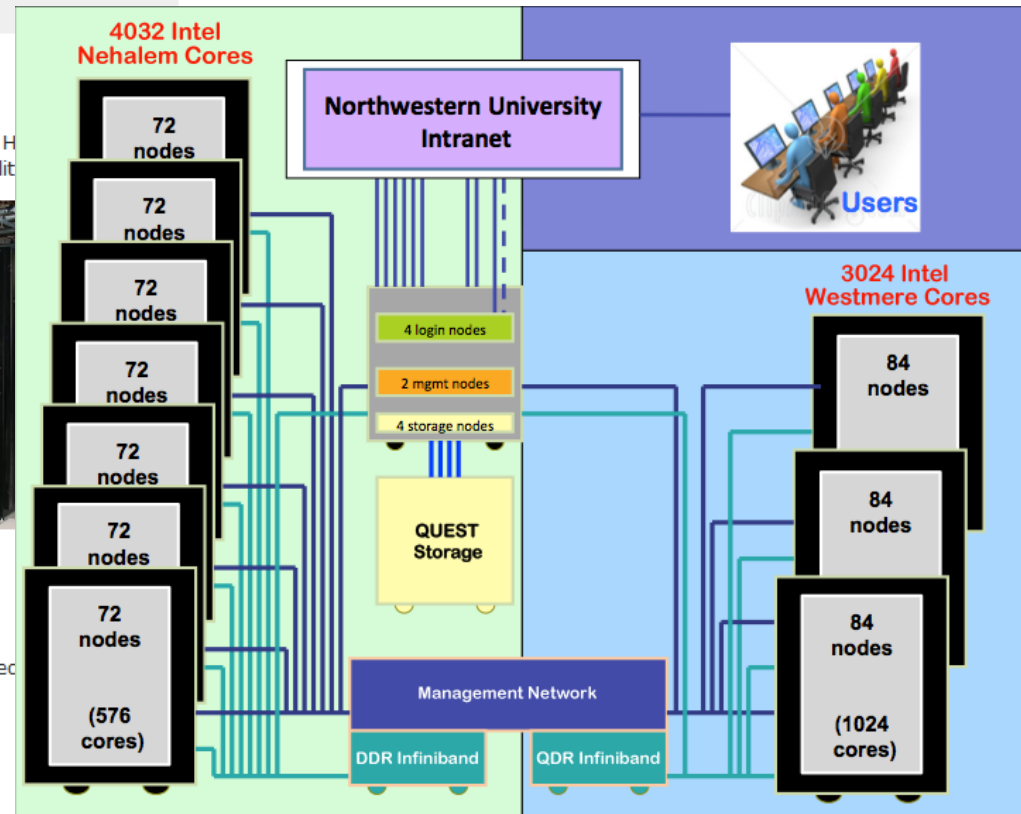
Information on the types of allocations supported by Quest, application deadlines, and required documentation can be found in the [Allocation Submission and Review Guidelines](#).



Quest Facts

Ranked among the [TOP500](#) list of the fastest computers world wide, Quest's architecture

- Vendor: IBM iDataPlex
- Parallel Filesystem: IBM GPFS
- DDN DCS 9900 storage system: 100 TB available for projects on Quest
- **Interconnect: Infiniband DDR**
 - Number of Nodes: 504 (4032 cores)
 - Processor: Intel Nehalem E5520, 64-bit, 8M Cache, 2.26 GHz, 5.86 GT/s Intel® QPI, 1066Mhz FSB
 - Memory: Per node (Per Core) 48GB's (6GB's), Type: DDR3
- **Interconnect: Infiniband QDR**
 - Number of Nodes: 252 (3024 cores)
 - Processor: Intel Westmere X5650, 64-bit, 12MB Cache, 2.66 Ghz, 6.4 GT/s Intel® QPI, 1333Mhz FSB
 - Memory: Per node (Per Core) 48GB's (6GB's), Type: QDR



XNAT Pipeline Engine



The diagram illustrates the XNAT Pipeline Engine architecture. On the left is a light blue rounded rectangle labeled 'NUNDA Server'. On the right is a large light blue circle labeled 'Quest Cluster'. Inside the 'Quest Cluster' circle is a smaller green rectangle labeled 'Pipeline Engine'.

NUNDA Server

Quest Cluster

Pipeline
Engine

- ❑ Installed and runs on Quest nodes, not on the NUNDA server
- ❑ It is a java-based engine that uses XML workflows to call local programs/scripts

XNAT Pipeline Engine

```
<?xml version="1.0" encoding="UTF-8"?>
- <Pipeline xmlns:fileUtils="http://www.xnat.org/java/org.nrg.imagingtools.utils.FileUtils"
  xmlns:nrgString="http://www.xnat.org/java/org.nrg.pipeline.utils.StringUtils"
  xsi:schemaLocation="http://nrg.wustl.edu/pipeline ../../schema/pipeline.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://nrg.wustl.edu/pipeline">
  <name>StdBuildNunda</name>
  <location>/var/lib/nunda_pipeline/catalog/build-tools</location>
  <description>Dicom to Analyze Reconstruction</description>
  - <documentation>
    - <input-parameters>
      - <parameter>
        <name>sessionId</name>
        - <values>
          <schemalink>xnat:mrSessionData.label</schemalink>
          </values>
          <description>The MRSession Label</description>
        </parameter>
      </input-parameters>
    </documentation>
    <xnatInfo appliesTo="xnat:mrSessionData"/>
    <outputFileNamePrefix>^concat(/Pipeline/parameters/parameter[name='builddir']/values/unique/text
      (),',', /Pipeline/parameters/parameter[name='sessionId']/values/unique/text
      (),',', /Pipeline/parameters/parameter[name='sessionId']/values/unique/text())^</outputFileNamePrefix>
    <loop xpath="^/Pipeline/parameters/parameter[name='allstudies']/values/list^" id="alls"/>
    <loop xpath="^/Pipeline/parameters/parameter[name='studies']/values/list^" id="studys"/>
  - <parameters>
    - <parameter>
      <name>workdir</name>
      - <values>
        <unique>^concat(/Pipeline/parameters/parameter[name='builddir']/values/unique/text
          (),',', /Pipeline/parameters/parameter[name='sessionId']/values/unique/text())^</unique>
      </values>
    </parameter>
    - <parameter>
      <name>processeddir</name>
      - <values>
        <unique>^concat(/Pipeline/parameters/parameter[name='workdir']/values/unique/text
          (),',', /PROCESSED')^</unique>
      </values>
    </parameter>
  </parameters>
</Pipeline>
```

Ins
It i
pro

al

XML Workflow Example: StdBuild

XNAT Pipeline Engine

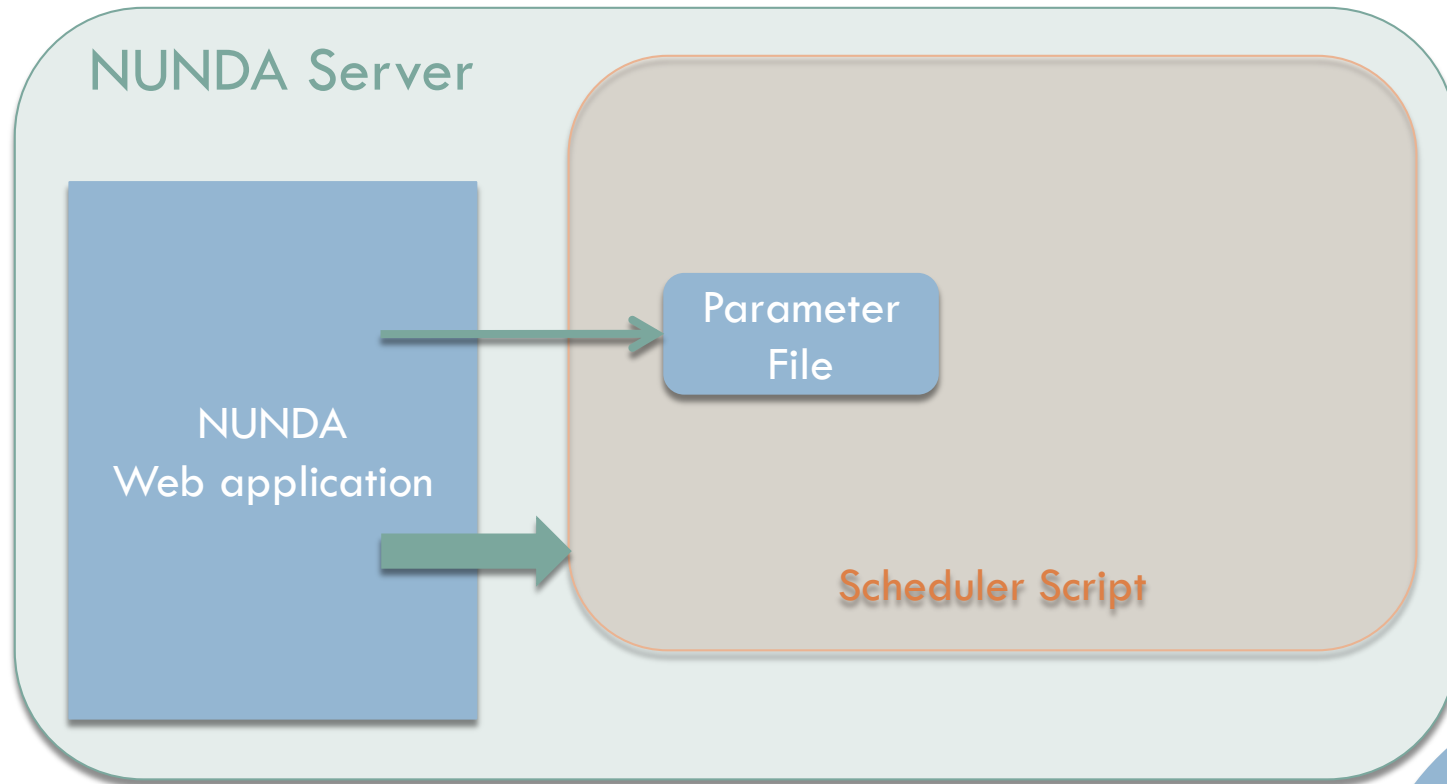


- ❑ Installed and runs on Quest nodes, not on the NUNDA server
- ❑ It is a java-based engine that uses XML workflows to call local programs/scripts
- ❑ It communicates with XNAT (NUNDA server) via the REST API

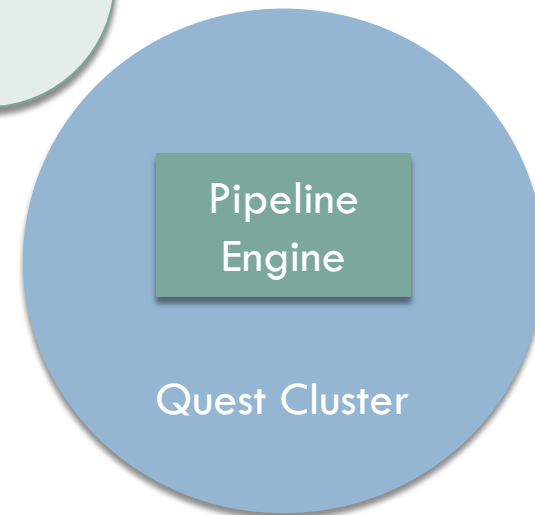
The REST (REpresentational State Transfer) API

- REST API enables a client to interact with the server in a standardized fashion
 - ▣ A client makes a request to the server, the server returns a response to the client
 - Requests can be GETs, POSTs, PUTs, DELETEs, etc.
 - ▣ Requests and responses are built around the transfer of representations of resources
 - ▣ A representation (for example, an XML document) communicates the state of a resource
 - E.g., a client GETs a resource XML, which represents an MRSession, from the server, changes the fields for scanner type and date, and then PUTs the updated resource XML back onto the server
 - A client (not on the server) is able to change the state of the MRSession resource
- This way, a client (with proper authentication!) can pull information from and push information to NUNDA → no need to run processing on the server

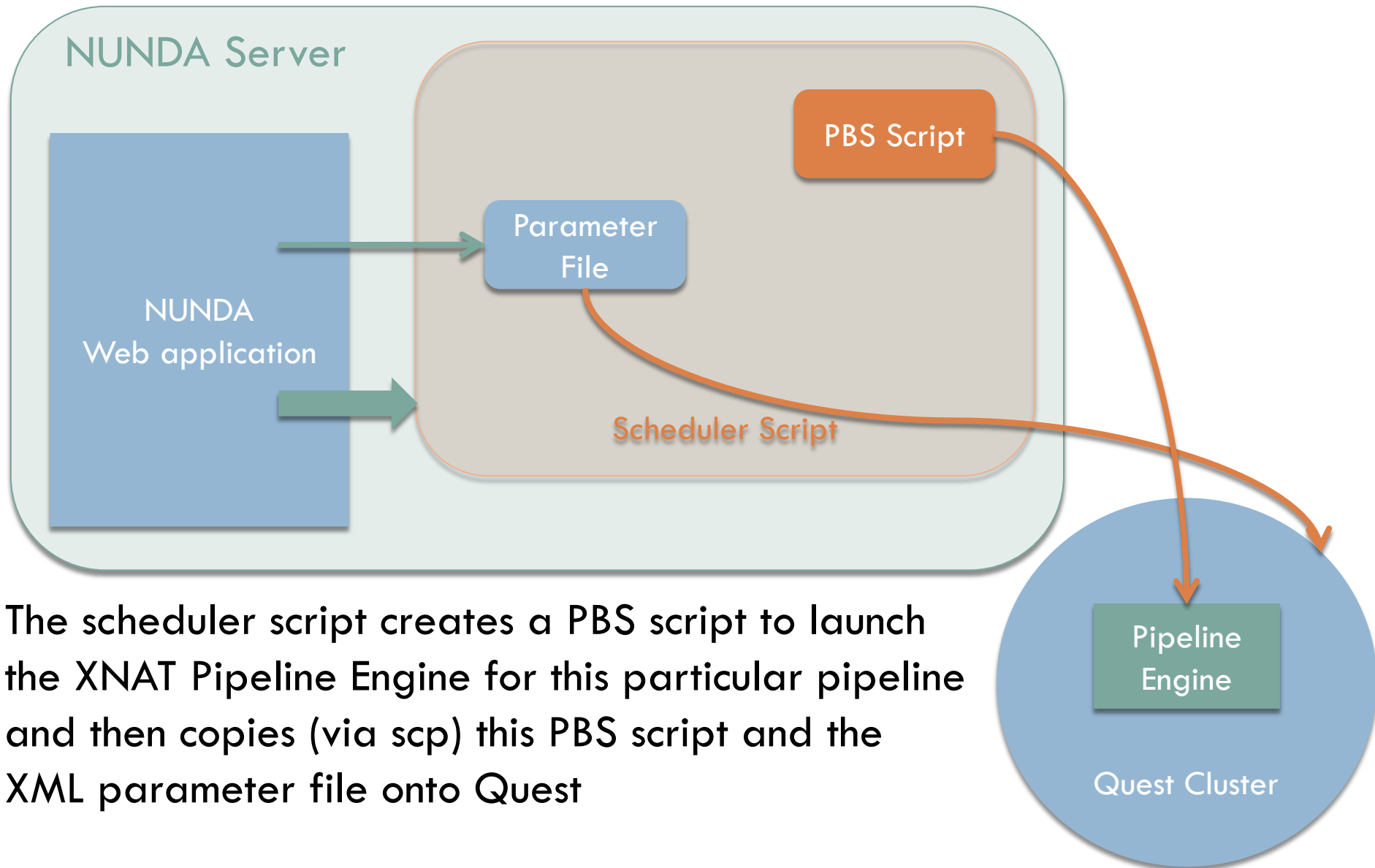
Communicating with Quest



When the user launches a pipeline, the NUNDA web application/web engine generates an XML parameter file, which stores all project and session parameters for the pipeline, and calls a scheduler script

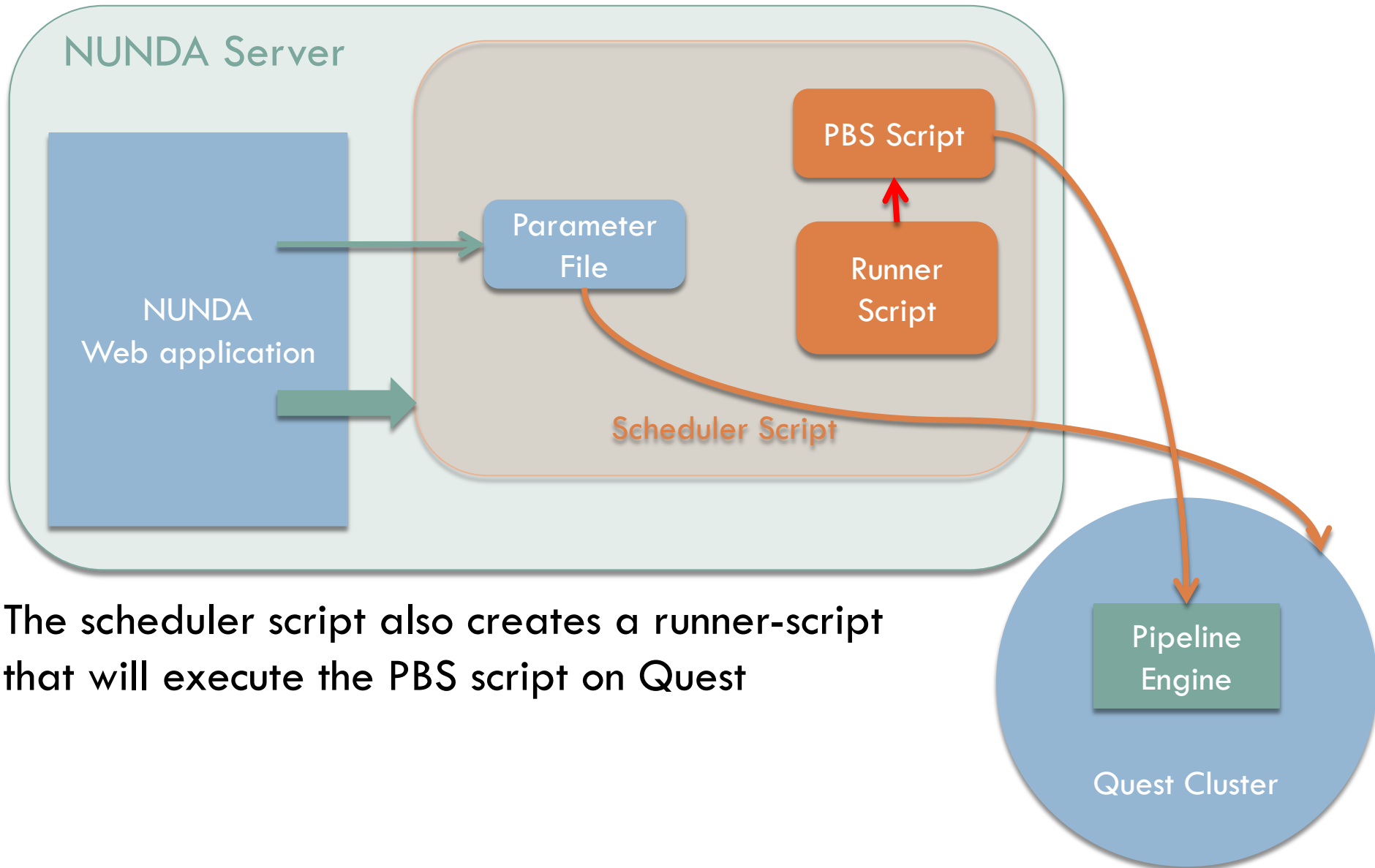


Communicating with Quest

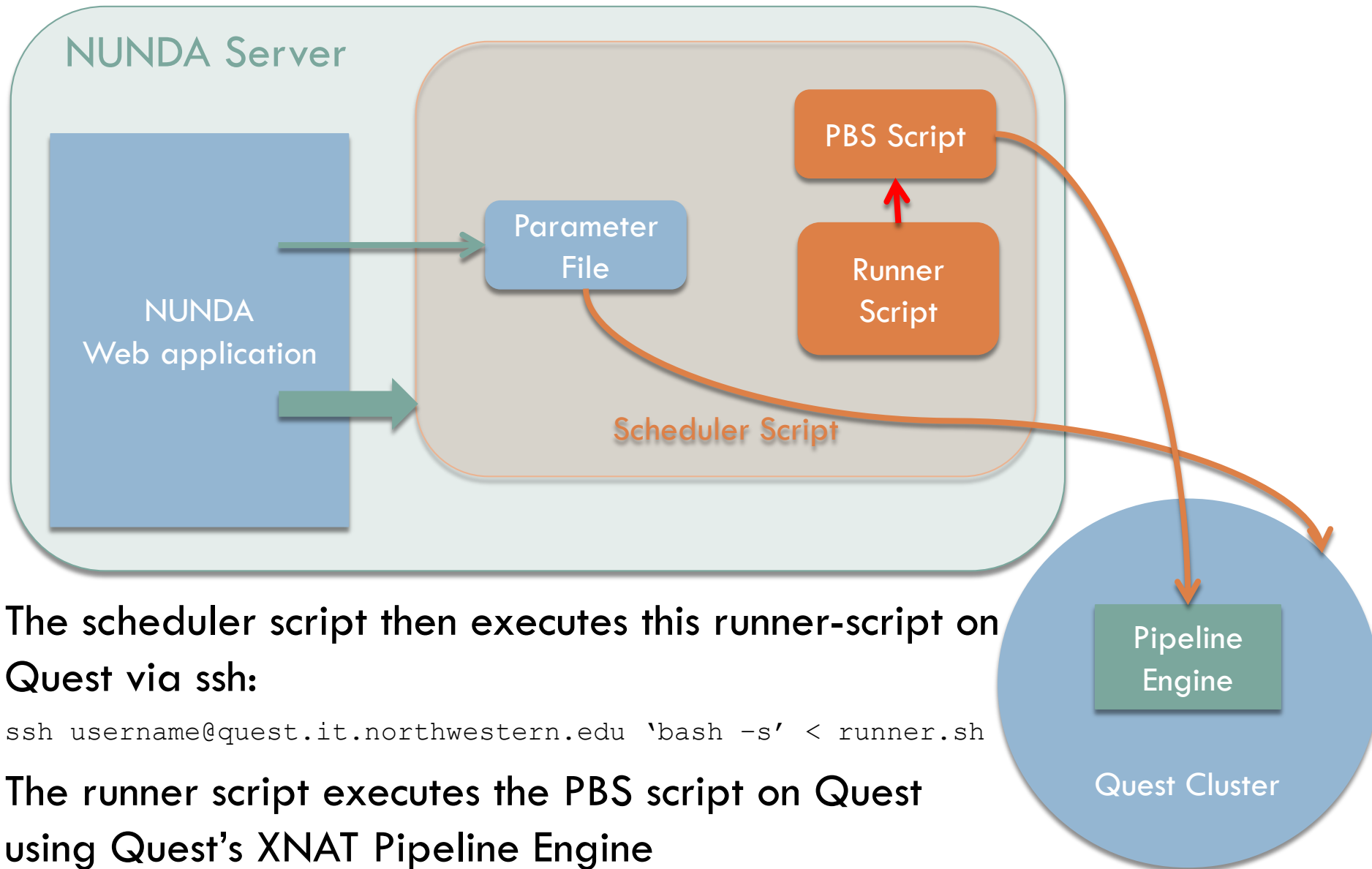


The scheduler script creates a PBS script to launch the XNAT Pipeline Engine for this particular pipeline and then copies (via scp) this PBS script and the XML parameter file onto Quest

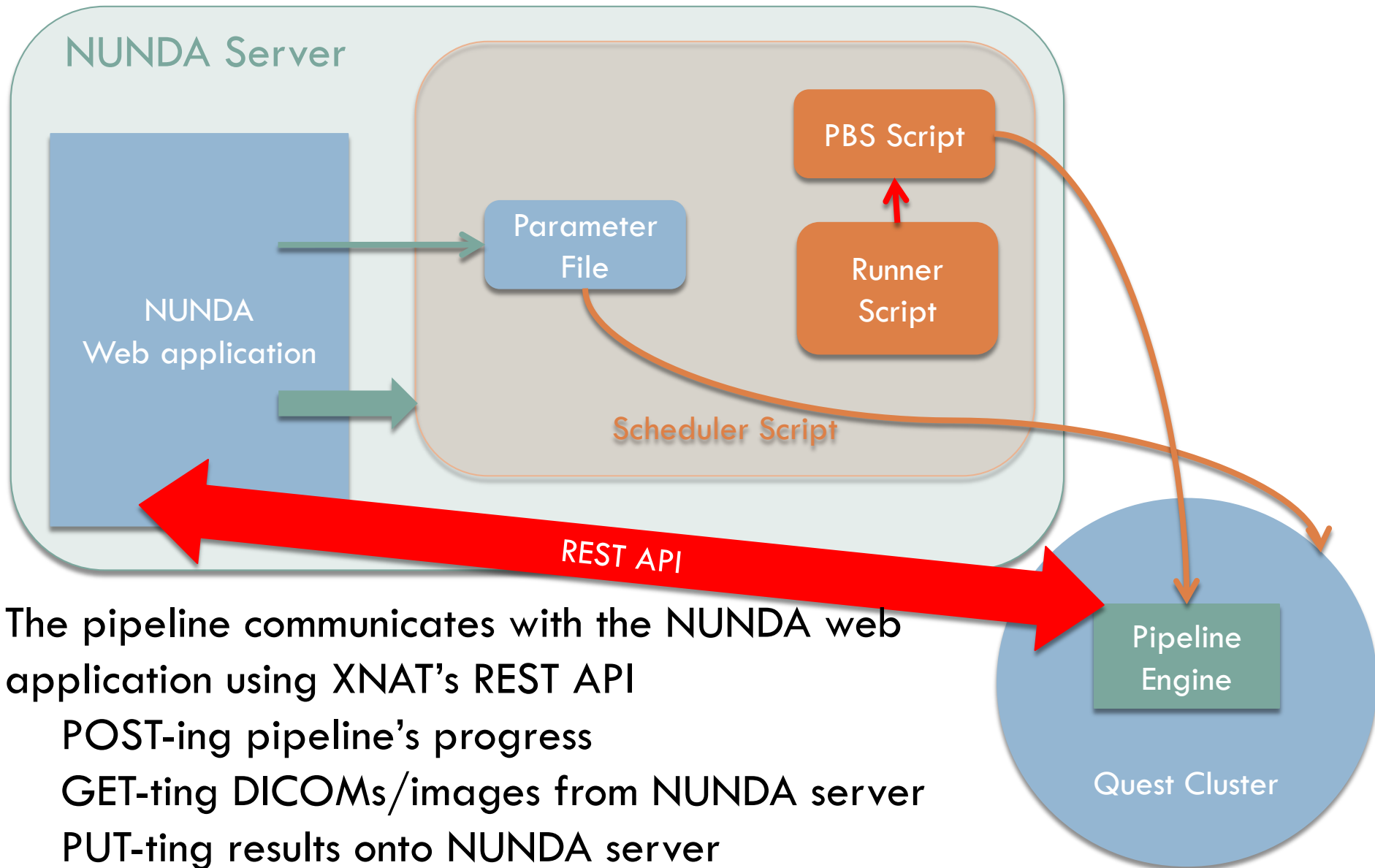
Communicating with Quest



Communicating with Quest



Communicating with Quest



How to Launch a Pipeline

Once you have MR Sessions in a project on NUNDA, you can begin running pipelines

Step 1: Add Pipeline to Your Project

NUNDA

Northwestern University Neuroimaging Data Archive

User: kalpert ([Logout](#)) ([Edit](#)) ([Report a problem](#))

[Advanced](#)

[Home](#)
[New](#)
[Upload](#)
[Administer](#)
[Tools](#)

- Projects
 - Recent
 - Favorite
 - My projects
 - Other projects
- Stored Searches
- Data

Test (Alex)

[Details](#)
[Access](#)
[Manage](#)
[Pipelines](#)
[History](#)

Pipelines for TP

			Applies To	Generates	Name	Description
	Edit	Details	MR Sessions	FSL_Segs	FSL_SEG	Pipeline for segmenting MPRAGE data
	Edit	Details	MR Sessions	Freesurfer,APARCs,ASEGs	FSBuild	Pipeline for running reconall -all
	Edit	Details	MR Sessions		GenericBoldPreprocessingNunda	Pipeline to pre-process BOLD scan types. Includes the Functional Connectivity post-pro

[Add More Pipelines](#)

[Subjects](#)

<< first < prev 1 next > last >>

20 1 of 1 Pgs (14 Rows)

Subject	M/F	Hand	YOB	Group	MR Sessions	CT Sessions
0507_5120_4	U	U			1	
090503_CH7436	U	U				
12	M	A	2009	21	5	1
24159	U	U			1	
24361	U	U			1	
71318_3	U	U			2	
BP27214	U	U			1	
CAMPY_KR7E9EE	U	U			1	

Navigate to your project page, select the “Pipelines” tab, and click “Add More Pipelines”

Test (Alex)

Details Access Manage **Pipelines** History

Additional Pipelines for TP

		Applies To	Generates	Name	Description
Add	Details	MR Sessions		StdBuildNunda.xml	Dicom to Analyze Reconstruction

Show Project Pipelines

Actions

Add ▶
Upload Images
View Prearchive
Add to Favorites
Download XML
Download Images

-Select “Add”
next to the
pipeline you
wish you add.

-Set any
project-wide
parameters for
the pipeline.

-Click “Add”

NUNDA

nunda.northwestern.edu/nunda/app/action/ManagePipeline?task=projectpipeline&templa

Add StdBuildNunda Pipeline to Project TP:

Please set the following parameters:
(If a parameter can take multiple values, please enter a comma separated list of values for that parameter.)

No Project-Wide Parameters To Set Up!

Add **Cancel**

powered by
XNAT

Step 2: Launch Pipeline on MRSession

User: kalpert ([Logout](#)) ([Edit](#)) ([Report a problem](#))

[Advanced](#)

[Home](#)

[New ▾](#)

[Upload ▾](#)

[Administer ▾](#)

[Tools ▾](#)

PROJECT: Test Project > SUBJECT:BP27214 > 080427_BP27214

MR Session: 080427_BP27214

Details

Projects

Accession #	NUNDA_E00900	Subject:	BP27214
Date Added	2011-11-22 18:30:44.0 (kalpert)	Gender:	
Date:	2008-04-27	Handedness:	
Time:	11:06:39	Age:	--
Operator:	JS AS		
Scanner:	MEDPC SIEMENS TrioTim		
Acquisition Site:	Washington		

Actions

- Edit**
- View** ▶
- Upload** ▶
- Download** ▶
- Email**
- Share**
- Launch Pipeline**
- Manage Files**
- Delete**

Notes:

Navigate to your MR Session page, select “Launch Pipeline” from the Actions Menu

Step 3: Check Pipeline Status

NUNDA
Northwestern University Neuroimaging
Data Archive

User: kalpert ([Logout](#)) ([Edit](#)) ([Report a problem](#)) [Advanced](#)

[Home](#) [New ▾](#) [Upload ▾](#) [Administer ▾](#) [Tools ▾](#)

PROJECT: Test Project > SUBJECT:BP27214 > 080427_BP27214

MR Session: 080427_BP27214

Active Processes	
StdBuildNunda:	Running 37.2549 Start Time: 2012-02-23 09:32:52.0

Details **Projects**

Accession #	NUNDA_E00900	Subject:	BP27214
Date Added	2011-11-22 18:30:44.0 (kalpert)	Gender:	
Date:	2008-04-27	Handedness:	
Time:	11:06:39	Age:	--
Operator:	JS AS		
Scanner:	MEDPC SIEMENS TrioTim		
Acquisition Site:	Washington		

Actions

- Edit**
- View** ▶
- Upload** ▶
- Download** ▶
- Email**
- Share**
- Launch Pipeline**
- Manage Files**
- Delete**

Notes:

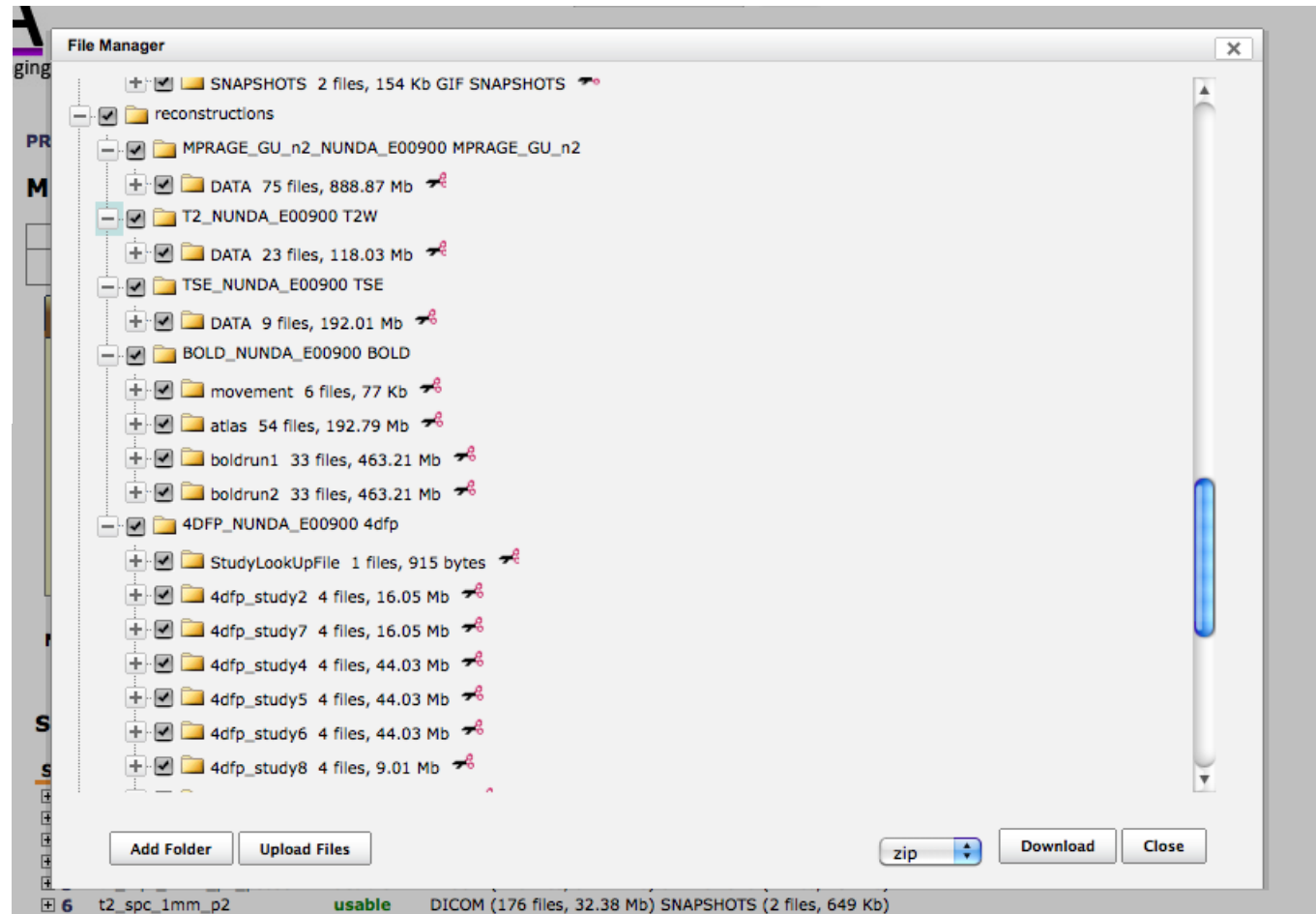
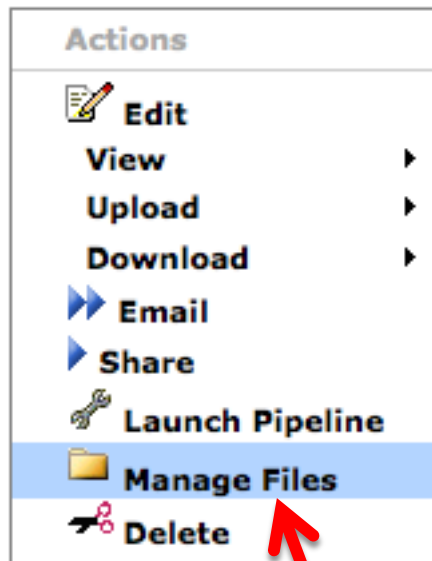
Note the pipeline is listed as a “Running” Active Process.

Step 4a: View Reconstructions

Reconstructions

ID	Type	Base Type
<input type="checkbox"/> MPRAGE_GU_n2_NUNDA_E00900	MPRAGE_GU_n2	MPRAGE
<input type="checkbox"/> T2_NUNDA_E00900	T2W	T2W
<input type="checkbox"/> TSE_NUNDA_E00900	TSE	TSE
<input type="checkbox"/> BOLD_NUNDA_E00900	BOLD	BOLD
<input checked="" type="checkbox"/> 4DFP_NUNDA_E00900	4dfp	4dfp
Files		
080427_BP27214_study2_fl3d1_2.4dfp.hdr		
080427_BP27214_study2_fl3d1_2.4dfp.ifh		
080427_BP27214_study2_fl3d1_2.4dfp.img		
080427_BP27214_study2_fl3d1_2.4dfp.img.rec		
080427_BP27214_study4_tfl3d_4.4dfp.hdr		
080427_BP27214_study4_tfl3d_4.4dfp.ifh		
080427_BP27214_study4_tfl3d_4.4dfp.img		

Once the pipeline has finished, you can check for output files under the “Reconstructions” area of the MR Session report page...



Or you can peruse the Reconstructions from the “Manage Files” section of the “Actions” menu.

Step 4b: View Assessors

Assessments

Experiment	Label	Date	Project
FSL_Seg	FSEG_NUNDA_E00900	2011-11-23	Test Project
Freesurfer	FS_v5-1-0_NUNDA_E00900	2011-11-29	Test Project
Auto QC	BOLD_QC_NUNDA_E00900	2012-01-10	Test Project

Some pipelines output Assessors in addition to Reconstructions. You'll find these under the "Assessments" area of the MR Session report page, and clicking them will take you to an Assessor report page.

NUNDA
Northwestern University Neuroimaging
Data Archive

User: kalpert ([Logout](#)) ([Edit](#)) ([Report a problem](#)) xnat:mrSessionData.ID Search [Advanced](#)

[Home](#) [New](#) [Upload](#) [Administer](#) [Tools](#)

SUBJECT:BP27214 > SESSION:080427_BP27214 > FS_v5-1-0_NUNDA_E00900

Freesurfer Analysis Details

MRSession **080427_BP27214**
 Date 2011-11-29
 Time
 Note
 ID FS_v5-1-0_NUNDA_E00900
 Project TP
 Freesurfer version freesurfer-Linux-centos4_x86_64-stable-pub-v5.1.0

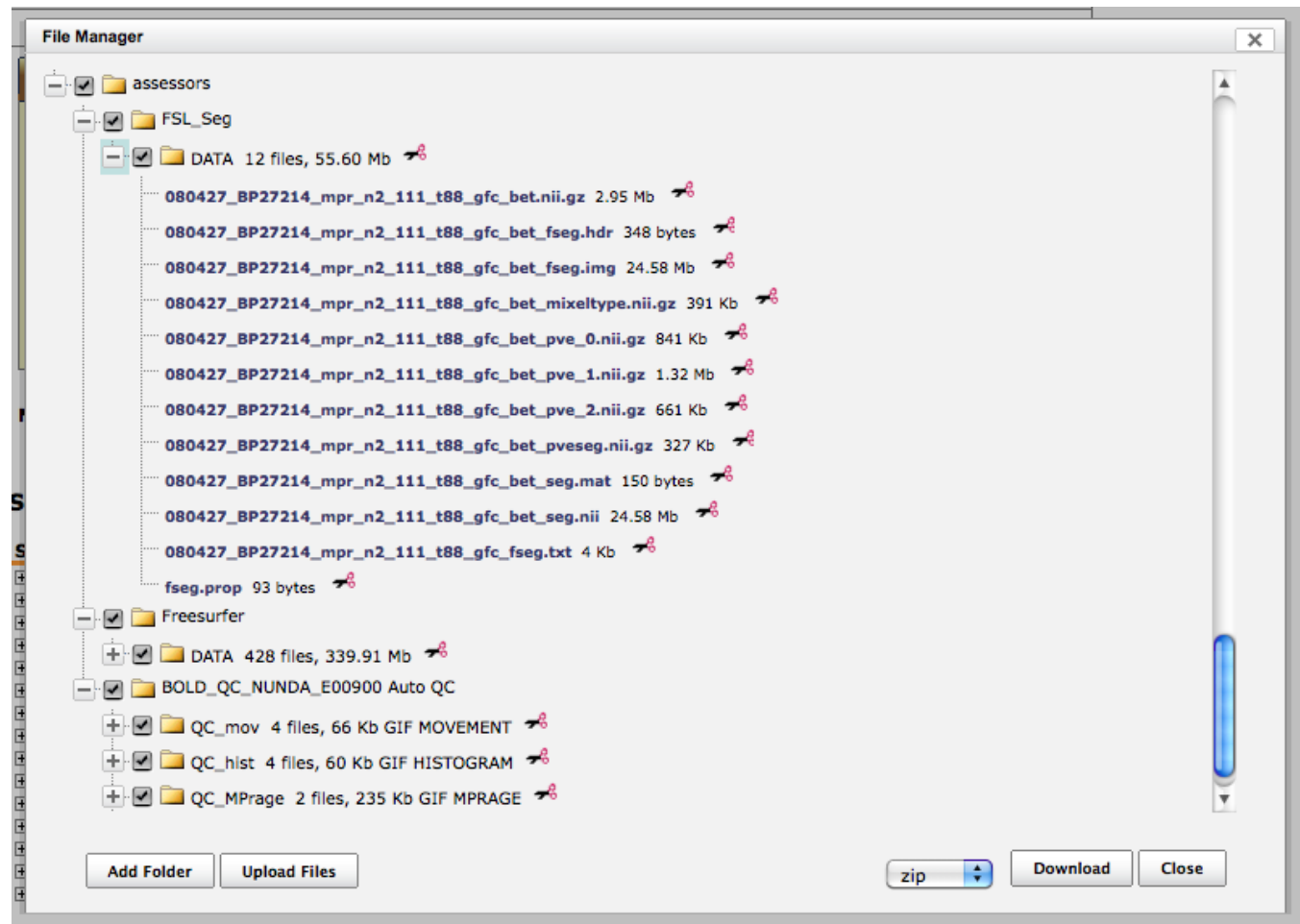
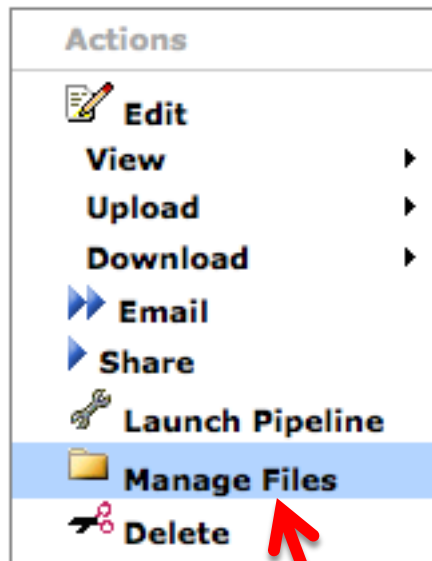
Actions

[Edit](#)
[View](#)
[Download XML](#)
[Email](#)
[Download Stat Files](#)

ASEG Measures

ICV	1426714
Left hemi. cortical gray matter vol.	244938
Right hemi. cortical gray matter vol.	243619
Total cortical gray matter vol. (based on surface-stream)	488556
Subcortical gray matter vol.	168271
Total gray matter vol.	656827
Supratentorial vol.	1024964
Left hemi. cortical white matter vol.	225002
Right hemi. cortical white matter vol.	222663
Total cortical white matter vol.	447665

Region Name	Seg Id	Hemisphere	NVoxels	Volume	Mean	Range
Left-Lateral-Ventricle	4	left	3752	3752	30.8316 +-14.1804	74 (5-79)
Left-Inf-Lat-Vent	5	left	470	470	36.2080 +-17.9742	74 (8-82)



Or you can peruse the Assessors from the “Manage Files” section of the “Actions” menu.



NUND Live Demo

Kate Alpert



Future Directions

Where we are heading with NUNDA pipeline processing

Pipeline Release Date: May 1st

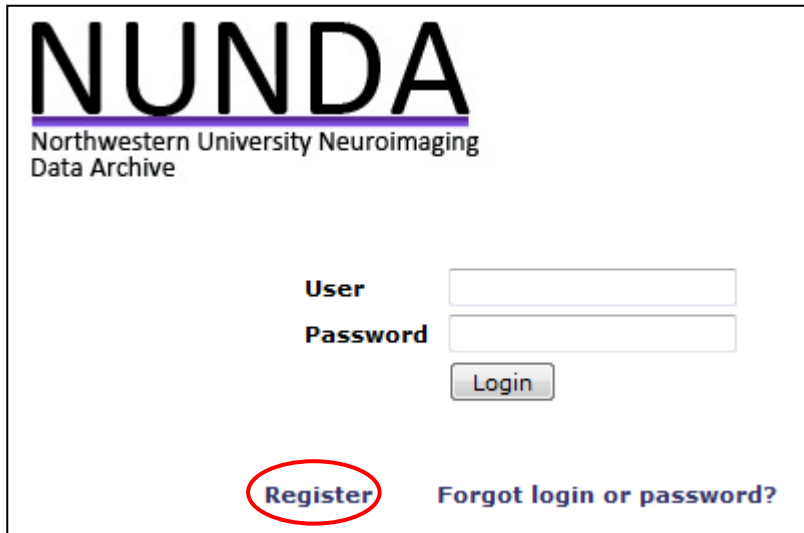
- While we have preliminary pipelines on NUNDA now, we're making some changes before we officially release the pipelines
 - ▣ Setting most preferences at the project-level as opposed to the session-level
 - ▣ Initializing the FreeSurfer Pipeline with DICOMs as well as reconstructed MPRAGE
- After we've implemented these changes, we plan to introduce the pipelines to the entire NUNDA community (Data Blitz / May 1st)

Automatic Pipeline Processing

- We are also hoping to implement an option for automatic pipeline processing by project
- NUNDA user would select “Run pipeline automatically on all sessions” within a project
 - ▣ All existing sessions and any sessions added after this point would automatically be run through the selected pipeline(s)
- Cron job would inspect the database for unprocessed sessions and shoot off pipelines as necessary
- ISSUE: we need all parameters to be set at the project level

New Pipelines

- We are excited to work with the NUNDA community to adapt processing streams into pipelines on NUNDA
- Request at NUNDA.Admin@northwestern.edu
- Register at <https://nunda.northwestern.edu/>



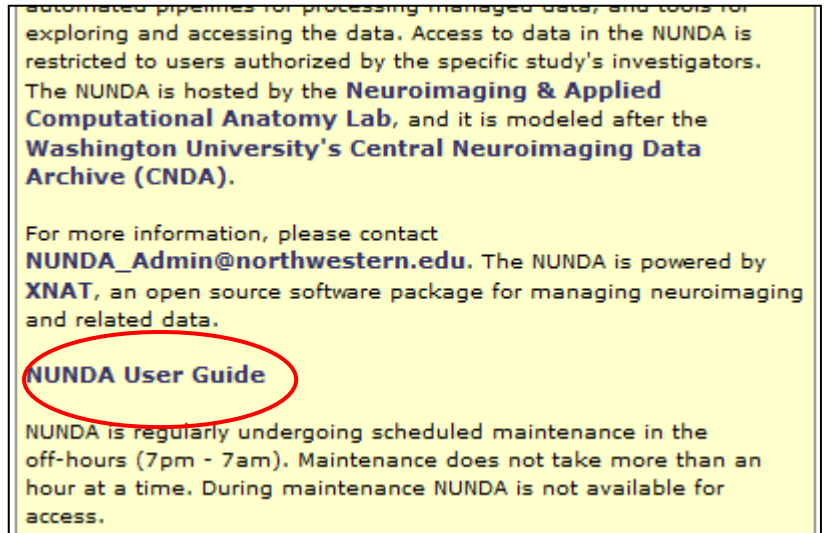
NUNDA
Northwestern University Neuroimaging
Data Archive

User

Password

Login

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



Automated pipelines for processing managed data, and tools for exploring and accessing the data. Access to data in the NUNDA is restricted to users authorized by the specific study's investigators. The NUNDA is hosted by the **Neuroimaging & Applied Computational Anatomy Lab**, and it is modeled after the **Washington University's Central Neuroimaging Data Archive (CNDA)**.

For more information, please contact NUNDA_Admin@northwestern.edu. The NUNDA is powered by **XNAT**, an open source software package for managing neuroimaging and related data.

[NUNDA User Guide](#)

NUNDA is regularly undergoing scheduled maintenance in the off-hours (7pm - 7am). Maintenance does not take more than an hour at a time. During maintenance NUNDA is not available for access.