



XNAT Admin 101 - Basic and Best Practices for XNAT Administration



ICR The Institute of
Cancer Research



Health+BioScience
IDEAS



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- Senior Director of Customer Solutions and Support
- Developed for and administered multiple XNAT systems since 2010 in Academia, Pharma and then with Radiologics, Inc.
- London is still warmer than either Glasgow or my current hometown of Philadelphia right now.
 - London 66F/18C
 - Glasgow 56F/13C
 - Philadelphia 50F/10C



XNAT Administration - Agenda

- Backend configuration
- Basic Site configuration
- Manage Notifications
- User Administration
 - Registration
 - Authentication
- Customization
 - Themes
 - Plugins

XNAT Administration - Getting Started

1. What do I do with this new shiny XNAT instance?
2. We have some boring backend configurations/optimizations to do.



XNAT Administration - Backend Items

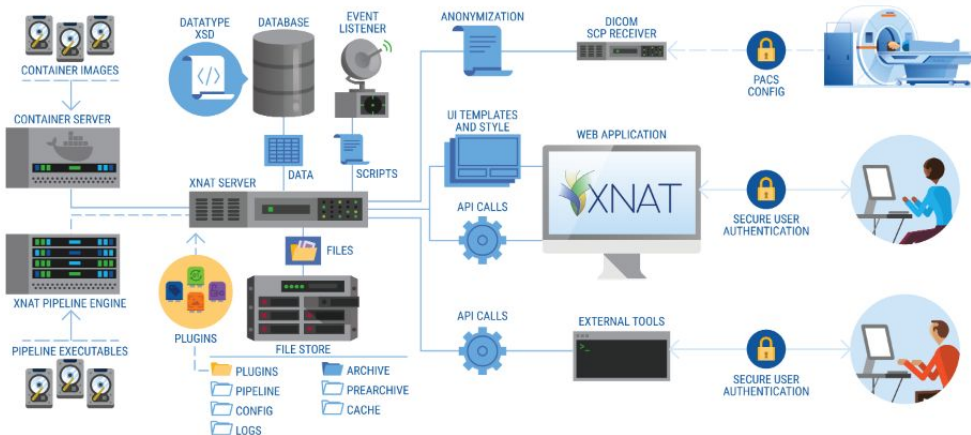
- Postgresql Optimization and configuration
- Tomcat (XNAT) configuration
- Common XNAT cron jobs

XNAT Administration - Complicated View

Understanding the Components of XNAT



FILED UNDER: GETTING STARTED



CONTAINER SERVICE

Run processing in containers where each container image controls its own environment. Enabled via plugin.

XNAT PIPELINE ENGINE

Run processing on XNAT data and return outputs to XNAT.

PLUGIN FRAMEWORK

Add data types, API, UI & features.

XNAT SERVER

Java-based web application on an Apache Tomcat server.

XNAT DATABASE

PostgreSQL used to store indexed project data according to defined XSD Schemas.

FILE STORE

All file resources are stored. Only the Archive should be backed up.

EVENT SERVICE & AUTOMATION

Script automated responses to user or system events.

ANONYMIZATION

DicomEdit scripts can be applied site-wide or on a per-project basis to remove PHI from DICOM headers.

FRONT END

UI is built in Velocity templates and delivered as HTML / CSS for use in a web browser.

API

Core data functions and commands can be accessed by external tools or scripts with proper authentication.

DICOM SCP RECEIVER

Allows your XNAT to be set up as a destination for PACS to send image sessions to. Requires PACS to be set up separately.

USER AUTHENTICATION

Spring Security used by default. LDAP / OpenID can be enabled by plugins.

USER ACCESS

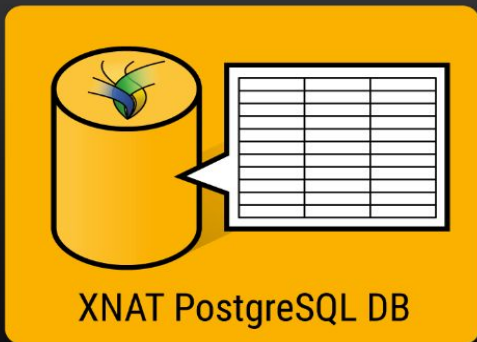
Data access in XNAT is segregated by project. Each project determines who has access to its data. User access can be enabled or disabled by site administrators as needed.

www.xnat.org | Winter 2021

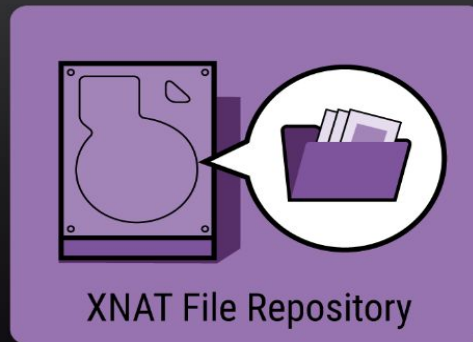
XNAT Administration - Slightly Simplified



Apache Tomcat Web Application



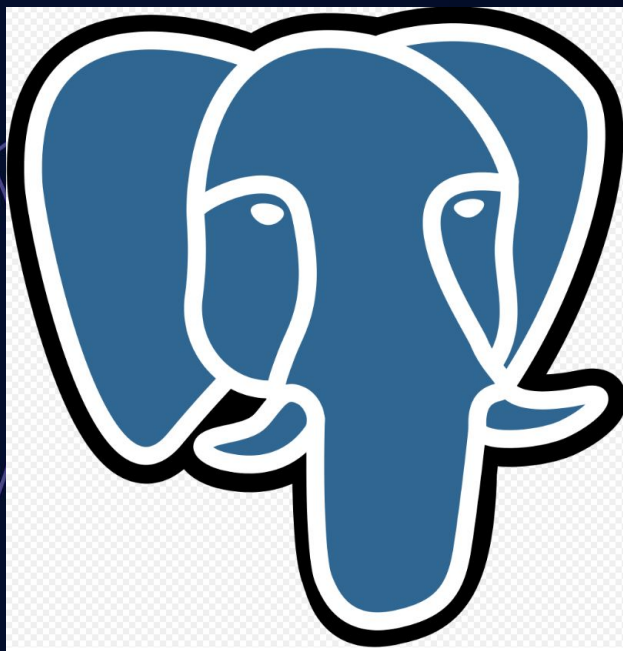
XNAT PostgreSQL DB




XNAT File Repository

Postgresql Optimization

<https://pgtune.leopard.in.ua/#/>



Home How it works 🌙



Parameters of your system

DB version	<input type="text" value="15"/>	what is this?
OS Type	<input type="text" value="Linux"/>	what is this?
DB Type	<input type="text" value="Web application"/>	what is this?
Total Memory (RAM)	<input type="text" value="32"/> <input type="text" value="GB"/>	what is this?
Number of CPUs	<input type="text" value="4"/>	what is this?
Number of Connections	<input type="text" value="100"/>	what is this?
Data Storage	<input type="text" value="SSD storage"/>	what is this?

postgresql.conf ALTER SYSTEM

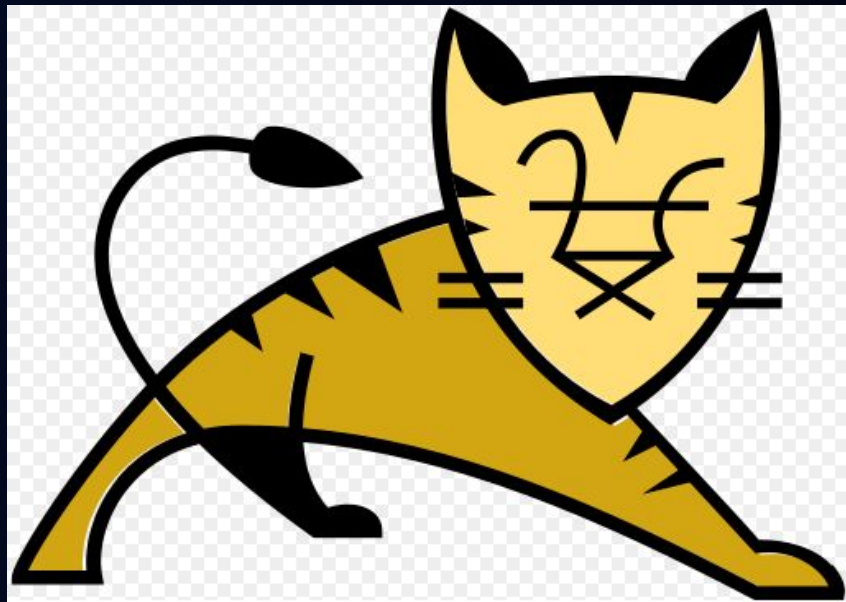
Add/modify this settings in **postgresql.conf** and restart database

```
# DB Version: 15
# OS Type: linux
# DB Type: web
# Total Memory (RAM): 32 GB
# CPUs num: 4
# Connections num: 100
# Data Storage: ssd

max_connections = 100
shared_buffers = 8GB
effective_cache_size = 24GB
maintenance_work_mem = 2GB
checkpoint_completion_target = 0.9
wal_buffers = 16MB
default_statistics_target = 100
random_page_cost = 1.1
effective_io_concurrency = 200
work_mem = 41943kB
min_wal_size = 1GB
max_wal_size = 4GB
max_worker_processes = 4
max_parallel_workers_per_gather = 2
max_parallel_workers = 4
max_parallel_maintenance_workers = 2
```


Tomcat Memory Config

```
MYMEM=$(free -m | grep Mem | awk '{print $7}')  
  
MYJAVAMEM=$(bc <<< "scale=0; ($MYMEM-1024) * .70" | cut  
-f1 -d'.')  
  
echo "CATALINA_OPTS=\"-Xmx${MYJAVAMEM}m -Xms512m  
-XX:MaxPermSize=256m \  
  
-Djavax.sql.DataSource.Factory=org.apache.commons.dbcp.Ba  
sicDataSourceFactory \  
  
-Dxnat.home=/home/xnat/  
-Djava.library.path=/usr/lib64:/usr/local/lib64/\ " " >>  
/home/xnat/tomcat/bin/setenv.sh  
  
-Xmx3096m -Xms512m  
-XX:MaxPermSize=256m
```



XNAT Filesystem Layout

Folder Name	Standard Location	Purpose
archive	/data/xnat/archive	<p>The XNAT Archive is the permanent storage location for all XNAT files, such as uploaded DICOM files or project resource files. All files in this folder are catalogued in the XNAT web application, and tracked in the XNAT audit trail.</p> <p>⚠ For any non-clinical XNAT, take steps to prevent files with personal health information (PHI) from being stored in this location.</p>
build	/data/xnat/build	<p>This path is currently unused, but is reserved for potential future enhancements to the build process.</p>
cache	/data/xnat/cache	<p>The XNAT user cache is a place where XNAT can store user-specific files. These are often temporary files.</p> <p>🕒 When users or processes mark a file for deletion, XNAT does not actually delete the file. Instead, it is sent to the cache/DELETED directory. It is a good idea to monitor usage of this folder periodically, as it can retain large amounts of unneeded data.</p>
ftp	/data/xnat/ftp	<p>This is a reserved path for the now-deprecated XNAT FTP server.</p>
prearchive	/data/xnat/prearchive	<p>The XNAT Prearchive is an interim file storage area separate from the XNAT Archive, where uploaded files can be safely reviewed for PHI. It is common for ongoing studies to upload image sessions to the Prearchive rather than directly to the archive.</p>
pipeline	/data/xnat/pipeline	<p>This is a reserved path that is used when installing the XNAT Pipeline Engine</p>

Common cron jobs

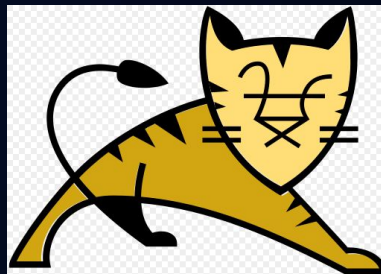
1. Security patches
2. XNAT log compression and archival.
3. Cache directory cleanout (older than x days)
4. Backing up Postgresql (pg_dump)
5. Backup the XNAT archive (rsync, zfs-snapshots etc)



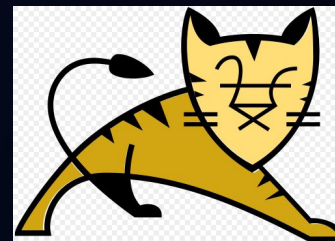
CRON JOB

Primary and Shadow Node

- Primary Tomcat node used for UI interaction.
- A 'shadow' node can be installed that point to the same filesystem and postgres.
- Shadow nodes will be used for pipeline and container rest api calls.



Primary Tomcat node
(UI)



shadow node

Deployment Strategies

- Docker compose
- Bare metal
- Hypervisor base local
 - ESXi, proxmox etc
- Hypervisor base cloud
 - aws, azure, gcp



Basic Site Configuration - Site Information

1. Set Site ID
2. Set Site Url
3. Set Site description

Site Information

Site ID

The id used to refer to this site (also used to generate database ids). The Site ID must start with a letter and contain only letters, numbers and underscores. It should be a short, one-word name or acronym which describes your site. No spaces or non-alphanumeric characters.

Site Url

The address you want visible to users in emails, and other external links. This should be a functional address (i.e. if the user pasted this address in their web browser, they should come to the site). localhost only works if the web browser is located on the same machine. You are required to guarantee that this address is functional for reaching the site.

Site Description Page Text (Markdown)

Specify a velocity template file to display on the login page

Site Login Landing

The page users will land on immediately after logging in.

Site Home

The page users will land on by clicking the XNAT logo in the menu bar.

Basic Site Configuration - Admin Information

1. Set Admin Email
2. Set Primary Username

Admin Information

Site Admin Email

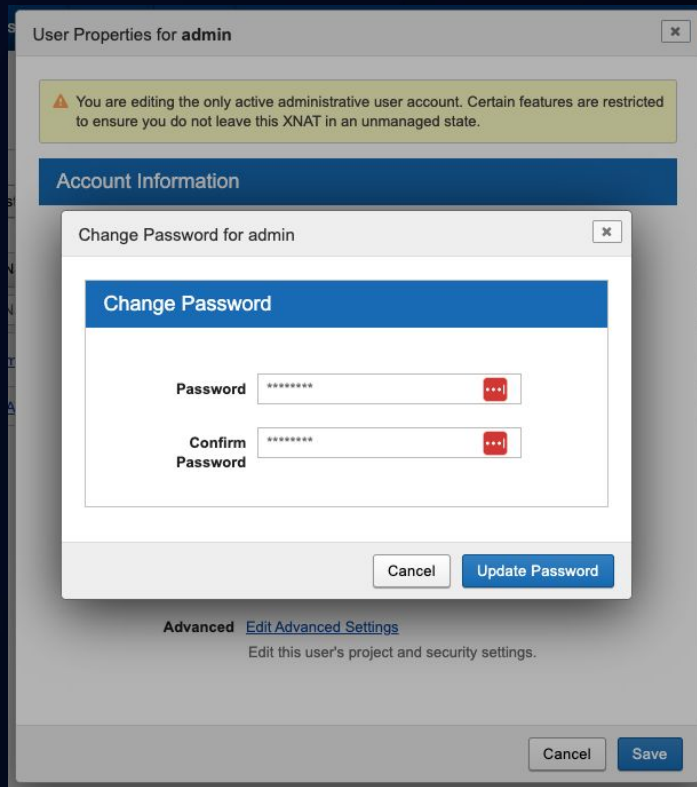
The administrative email account to receive system emails. This address will receive frequent emails on system events, such as errors, processing completion, new user registration and so on. These emails can be configured on the Notifications tab.

Primary Admin Username

This should be the login name of an enabled and valid user. The specified user must be a site administrator.

Change the Admin Password!

1. You'd be amazed....



Manage Notifications

1. Mail Server Settings
2. Notification Emails
3. Site-wide Alerts

Notification Emails

Notification Emails

i Each of these system notifications are sent to users based on various actions. Each notification email has a set of usable shortcodes, such as "USER_USERNAME". For help with system notifications, see [Notifications and Alerts in XNAT](#).

Select Email Template

Toggle which email template appears in the panel below

Verify Email Change Request

```
<p>A request was made to change the email address for the user with username
USER_USERNAME to this address. If you did not make this request, you can ignore
this email. If you made this request and wish to have this change take effect,
please log into your account and click CHANGE_EMAIL_LINK.</p>
```

Text of the message sent to a new email address for a user to verify the change made to the account's associated email. Available shortcodes:
USER_USERNAME - The username of the account.
CHANGE_EMAIL_LINK - The link to change the email address.

Discard Changes

Save

Site-wide Alerts

1. Turn on the site wide alert when scheduling any downtime for updates or maintenance.

Site-wide Alerts

i This panel can be used to create a notification banner that will be visible for all site visitors and logged-in users. You can determine whether the banner is visible only on the login page, or on all site pages.

There are three stylistic treatments:

- "message" is informational
- "alert" calls attention to critical info, such as scheduled maintenance downtime
- "error" calls attention to severe info, such as a known bug or broken functionality

Enable Alert Message On (Login and Site Header)

Alert Message

Enter your message text here. You can use HTML to enter links or add emphasis as needed.

Alert Type

Default: Alert

User Administration

1. Local users (XNAT managed authentication and authorization)
2. LDAP users (LDAP authentication with XNAT managed authorization)
3. OpenID users (OpenID authentications with XNAT managed authorization)

Manage Users

Create New User

Reload User List

Load All Users

ID	Username	Name	Email	Roles	Verified	Enabled	Active	Last Login
	<input type="text" value="Filter by Username"/>	<input type="text" value="Filter by Name"/>	<input type="text" value="Filter by Email"/>	<input type="text" value="Filter by Roles"/>	<input type="text" value="All"/>	<input type="text" value="All"/>	<input type="text" value="All"/>	<input type="text" value="All"/>
1	admin	Admin, Admin	jamesdickson@flywheel.io	ADMINISTRATOR	✓	✓		10/28/2022, 3:27:37 PM
2	guest	Guest, XNAT	jamesdickson@flywheel.io		✓	✓		
4	james	Dickson, James	jamesdickson+1@flywheel.io		✓	✓		

Registration Options

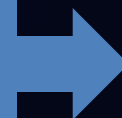
1. The user can register an account for themselves
2. A new user can be invited to join XNAT by a current user who is a project owner
3. A new user account can be created by an XNAT administrator

Customizing XNAT

1. Adding a theme.
2. Adding custom variables.
3. Creating an XNAT Plugin for a new
DataType

Customizing XNAT - Installing Data Type Plugins

- XSD Schema Entry
- XML Display Document
- UI Templates and custom scripts (optional)
- XNAT Plugin Java Class



Customizing XNAT - Rad Read Plugin

https://bitbucket.org/nrg_customizations/nrg_plugin_radread

The screenshot shows a Bitbucket repository page for 'nrg_plugin_radread'. The left sidebar contains navigation options: Source, Commits, Branches, Pull requests, Pipelines, Deployments, Issues, Wiki, Downloads, and Boards. The main content area displays the README for the 'XNAT 1.7 Rad Read Plugin'. The README includes sections for 'Building' and 'Deploying'. The 'Building' section provides a three-step process for building the plugin. The 'Deploying' section explains how to copy the plugin jar to the XNAT installation's plugins folder and restart the Tomcat server. On the right side of the repository page, there is a summary of repository statistics: Last updated (2019-02-08), Open pull requests (0), Branches (1), Watchers (1), and Forks (0). Below these statistics, there is a section for '0 builds' and a message indicating that the user does not have a build tool set up yet, with a recommendation to use Bitbucket Pipelines.

Source

README.md

XNAT 1.7 Rad Read Plugin

This is the XNAT 1.7 Rad Read Plugin. It adds the Radiological Assessment data type.

Building

To build the XNAT 1.7 Rad Read plugin:

1. If you haven't already, clone this repository and cd to the newly cloned folder.
2. Build the plugin: `./gradlew jar` (on Windows, you can use the batch file: `gradlew.bat jar`). This should build the plugin in the file `build/libs/xnat-radread-plugin-1.0.0.jar` (the version may differ based on updates to the code).
3. Copy the plugin jar to your plugins folder: `cp build/libs/xnat-radread-plugin-1.0.0.jar /data/xnat/home/plugins`

Deploying

Deploying your XNAT plugin just requires copying it to the **plugins** folder for your XNAT installation. The location of the **plugins** folder varies based on how and where you have installed your XNAT. If you are running a virtual machine created through the [XNAT Vagrant project](#), you can copy the plugin to the appropriate configuration folder and then copy it within the VM from `/vagrant` to `/data/xnat/home/plugins`.

You can also set up a share for your Vagrant configuration that actually creates the VM's **plugins** folder as a share with your host machine. This allows you to deploy the plugin by copying it into the shared local folder, where it will then appear on the VM in the linked shared folder.

Once you've copied the plugin jar into your XNAT's **plugins** folder, you need to restart the Tomcat server. Your new plugin will be available and the data type will be enabled in your XNAT as soon as the restart and initialization process is completed.

Last updated
2019-02-08

Open pull requests	Branches
0	1
Watchers	Forks
1	0

Version control system
Git

Access level
Write

Fork of
[mfmcay/nrg_webapp_radread_p...](#)

0 builds

It looks like you don't have a build tool set up yet.

Rapidly build, test, and deploy your code using Bitbucket Pipelines.

Your plan already includes build

Customizing XNAT - Building a Data Type Plugin

1. Checkout the plugin.

- `git clone https://bitbucket.org/nrg_customizations/nrg_plugin_radread`

2. Build the plugin.

- `./gradlew jar`

Customizing XNAT - Plugin Installation Process

1. Shut down the Apache Tomcat Server
 - `systemctl stop tomcat`
2. Copy the Plugin jar file into XNAT's Plugin directory
 - `cp build/libs/*.jar /home/xnat/plugins/`
3. Start up the Apache Tomcat Server
 - `systemctl start tomcat`

Configuring a new Data Type

1. Click Administrator-> Data Type menu.
2. Choose Setup Additional Data Type
3. Select new data type.
4. Insert singular/plural name
5. Click next, next, next

The screenshot shows the XNAT Administrator interface with the 'Setup Additional Data Type' configuration screen. The table below lists the existing data types and their configurations.

Element	Singular	Plural	Code	Accessible	Secured	Searchable	Browseable	Sequence
xnat:projectData	Project	Projects		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0
xnat:subjectData	Subject	Subjects		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0
xnat:investigatorData				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1
xnat:mrSessionData	MR Session	MR Sessions	MR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1
icr:roiCollectionData	ROI Collection	ROI Collections	ROIC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
ml:model	Model	Models	MDL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
ml:trainConfig	Training Configuration	Training Configurations	TRC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
ml:trainSession	Training Run	Training Runs	TRR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
sets:collection	Dataset Collection	Dataset Collections		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
sets:definition	Dataset Definition	Dataset Definitions		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
wmh:wmhData	WMH	WMHs		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
xnat:crSessionData	CR Session	CR Sessions	CR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
xnat:ctSessionData	CT Session	CT Sessions	CT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
xnat:petSessionData	PET Session	PET Sessions	PET	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
xnat:petmrSessionData	PET MR Session	PET MR Sessions	PETMR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
xsync:xsyncAssessorData	XSync Assessor Data	XSync Assessor Data		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
val:protocolData	Protocol Validation	Protocol Validations	PVAL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
xnat:pVisitData	Visit	Visits	V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
xnat:qcAssessmentData	Auto QC	Auto QCs	QC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
xnat:qcManualAssessorData	Manual QC	Manual QCs	MQC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3

Enabling Rad Reads

The easiest way for users to add a new Rad Read assessor to an image session in your XNAT is if you give them a link in the Actions menu of that image session report page. To add this action, do the following for **each image session data type** you want to add this functionality to:

1. In the top navigation of your XNAT, go to Administer > Data Types.
2. Click on the image session xsiType link for the data type you want to modify; for example, **xnat:mrSessionData**.
3. Click "Edit" in the summary dialog that opens for that data type.

In the "Available Report Actions" table in the edit data type dialog, insert this information to configure the Actions Menu link: 1. Name: **XDATScreen_edit_rad_radiologyReadData** 1. Display Name: **Add Radiology Read**
1. Popup: **never** 1. Secure Access: **edit**

Plugin Administration

1. Removing a plugin usually results in the datatype being hidden.
2. Recommend versioning data types.

List of Installed Plugins	
Plugin Info	Plugin JSON
<input type="text" value="Filter by Plugin Info"/>	
Plugin Name: XNAT 1.7 White Matter Hypointensities Plugin Plugin ID: nrg_plugin_wmh Plugin Version: 1.0.2 Plugin Class: org.nrg.xnat.wmh.WhiteMatterHypointensitiesPlugin Description: This is the XNAT 1.7 White Matter Hypointensities Plugin.	View JSON
Plugin Name: XNAT Machine Learning Development Plugin Plugin ID: xnatMIPlugin Plugin Version: 1.0.2 Plugin Class: org.nrg.xnatx.plugins.ml.XnatMIPlugin Description:	View JSON

Theme support

<https://wiki.xnat.org/documentation/xnat-administration/working-with-ui-themes>

Theme Management

i For help with themes, see [Working with UI Themes in XNAT](#)

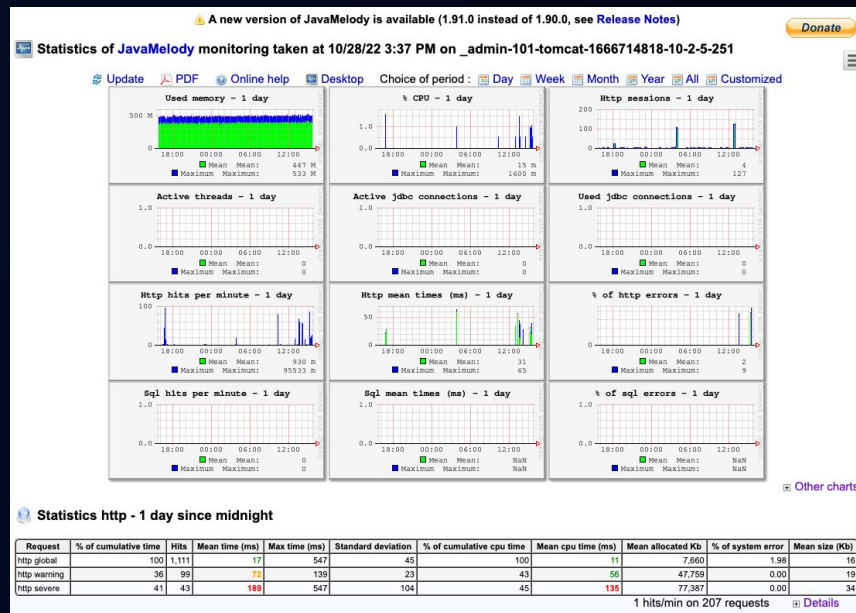
Select Theme
Select a new global theme from those available on the system.

Upload Theme
Upload a zipped theme package for selection above.

Monitoring

Probably the least know page in XNAT.

<https://admin-101.workshop.xnat.org/monitoring>



Logging

<https://admin-101.workshop.xnat.org/xapi/swagger-ui.html#/logging-api/downloadLogFilesUsingPOST>



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