

Architectures, plugins and pipeline



As usual

- Privacy, GDPR, ISO laws, etc
- Single project, multiple research groups
- Authentication and authorization
- Project data lifecycle
- Collaboration and cooperation
- Save results
- And so on



XNAT

- What Is XNAT ?
- XNAT is an open source imaging informatics platform developed by the **Neuroinformatics Research Group** at Washington University. XNAT was originally developed at Washington University in the Buckner Lab, which is now located at Harvard University. It facilitates common **management, productivity, and quality assurance tasks** for imaging and associated data. Thanks to its extensibility, XNAT can be used to support a wide range of imaging-based projects.

What does XNAT provide?



Full DICOM Integration and Anonymization:
Get image data in, and keep PHI out.



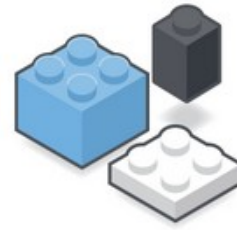
Secure Access & Permission Control:
You decide who does what with your data.



Integrated Search & Reporting: Report on your image and clinical data together.



Pipeline Processing:
Use the power of high-performance computing on your data.



Modular Extensibility:
Expand the capabilities of your XNAT to meet your needs.



Developer Community:
Benefit from an active and engaged set of XNAT power users.

First XNAT deploy @ INFN-Pisa

- VM on vmware cluster
- Running XNAT in a Dockerized Container with Configurable Dependencies
 - 1) \$ git clone <https://github.com/NrgXnat/xnat-docker-compose>
 - 2) \$ cd xnat-docker-compose
 - 3) \$ git checkout features/dependency-mgmt
- Init web application
- SSL certificate configuration
- Plugin LDAP config and install
- Container Service plugin
- OpenId connect plugin
- ...

At first sight

```
xnat:~ # docker ps -a
```

CONTAINER ID STATUS	IMAGE	COMMAND	CREATED	
PORTS				
NAMES				
f93d337e3b46 (0) 18 hours ago	xnat/hello-world:1.0	"/hello"	18 hours ago	Exited
xenodochial_engelbart				
77b06e8d56cf (0) 18 hours ago	hpc/wn-hpc2:cs7	"ls"	18 hours ago	Exited
eloquent_sammet				
ea8b7327757b About a minute	xnat-web	"wait-for-postgres.s..."	19 hours ago	Up
0.0.0.0:8000->8000/tcp, 0.0.0.0:8104->8104/tcp, 0.0.0.0:8144->8144/tcp, 8080/tcp				
xnat-web				
e5ed2a1fd3b3 19 hours	xnat-db	"docker-entrypoint.s..."	19 hours ago	Up
5432/tcp				
xnat-db				
bd67689cb90f 19 hours	traefik:latest	"/entrypoint.sh --lo..."	19 hours ago	Up
0.0.0.0:80->80/tcp, 0.0.0.0:443->443/tcp, 0.0.0.0:8080->8080/tcp				
traefik				
xnat-				

```
xnat:~ #
```

```
xnat:~ # ls xnat-docker-compose/xnat-data/plugins/
```

```
batch-launch-0.6.0.jar ldap-auth-plugin-1.1.0.jar
```

```
containers-2.1.0-fat.jar ohif-viewer-3.2.0-fat.jar
```

```
xnat:~ # ls xnat-docker-compose/xnat-data/
```

```
archive build config logs plugins tomcat webapps
```

```
xnat:~ # ls xnat-docker-compose/xnat-data/config/auth/
```

```
ldap-provider.properties
```

```
Xnat:~#xnat:~ # cat xnat-docker-compose/traefik/config/certificates.yml
```

```
tls:
```

```
certificates:
```

```
- certFile: /etc/certs/server.crt
```

```
keyFile: /etc/certs/server.key
```

```
xnat:~ #
```

```
xnat:~ # mmgetstate
```

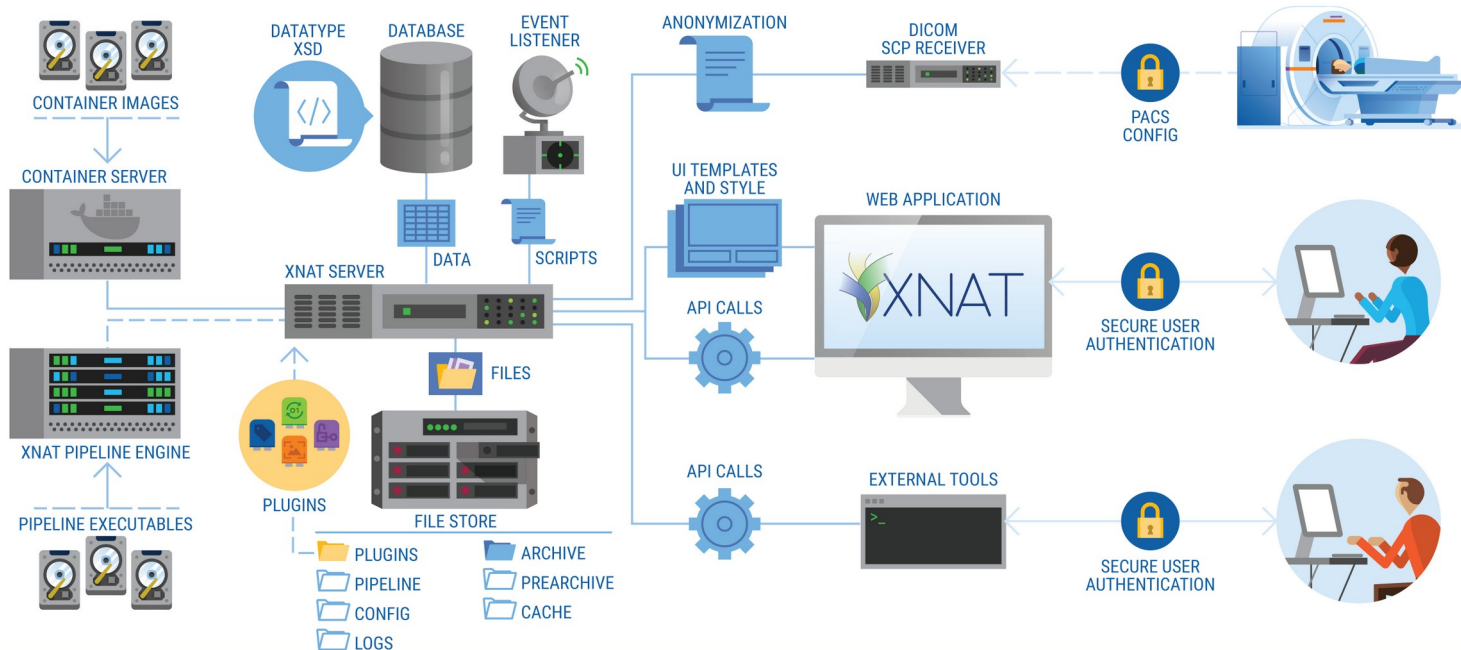
```
Node number Node name GPFS state
```

```
6 xnat active
```

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 Script 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

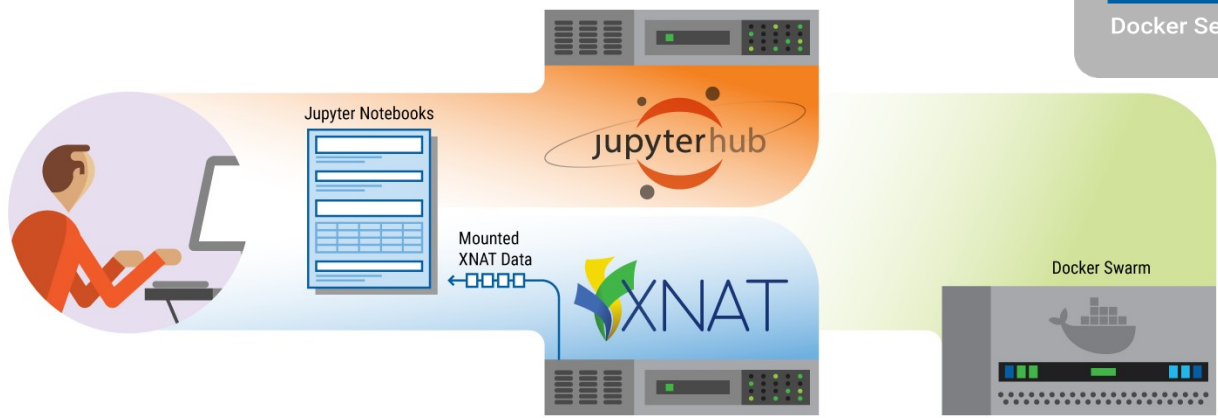
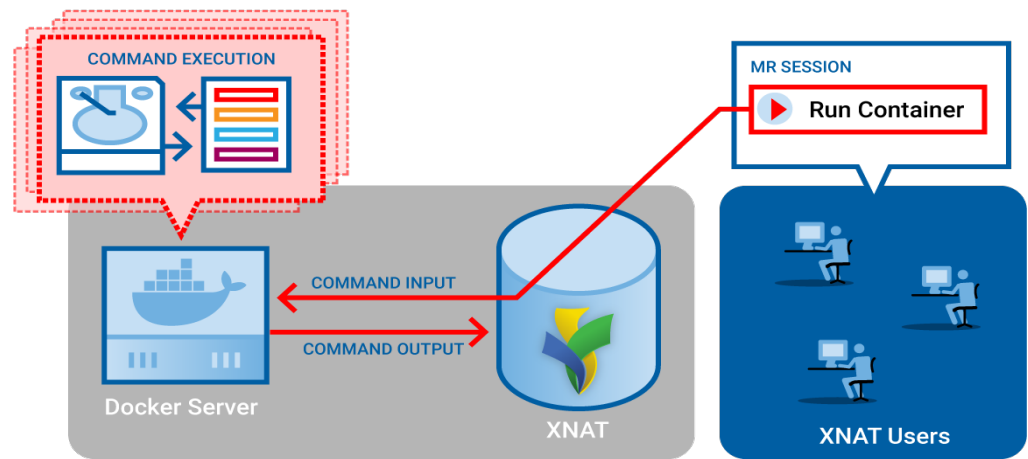
Spring Security used by default. LDAP / OpenID can be enabled by plugins.

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.

Plugin

- XNAT Desktop Client (Mac OS, Windows e Linux)
- LDAP Authentication Plugin
- OpenID Authentication Plugin
- Container Service Plugin
- JupyterHub Integration Plugin
- XNAT OHIF Viewer
- XNATpy
- XNAT ML



LDAP plugin and XNAT roles

- `ldap-provider.properties:`

`name=LDAP`

`provider.id=ldap`

`auth.method=ldap`

`visible=true`

`auto.enabled=false` → disabled by default

`auto.verified=true` → check by e-mail sent to the user

...

...

The screenshot displays the 'Edit User Info' interface for a user named 'camilla'. The interface is divided into several sections:

- User Details:** Shows fields for Username (camilla), First Name (Camilla), Last Name (Scapicchio), and Email (camilla.scapicchio@pi.infn.it). There are also checkboxes for 'Verified' and 'Enabled', both of which are currently checked.
- Actions:** A blue button labeled 'Edit' and a link labeled 'View XML'.
- Assign project membership and roles:** A table with columns for Project Label, Project ID, and Group. One entry is visible: 'Toy Platform Phantom' with Project ID 'ToyPhantom' and Group 'Owners'. An 'Add Role' button is located below the table.
- Define security settings:** This section includes 'System Roles' with a checked 'Site Manager' role. Below this are two warning messages in yellow boxes: one about granting administrative privileges and another about non-expiring passwords. At the bottom of this section is the 'Allow All Data Access' setting, which is currently set to 'Read, Edit & Delete' (indicated by a selected radio button). A 'Save' button is located to the right of this section.

A red rectangular box highlights the 'Allow All Data Access' section, including the warning message and the radio button options.

Pipeline Engine

- Java-based framework that links sequential activities, human and computer.
- Some processes are carried out automatically without any human intervention
- Pipeline Engine facilitates both fully automated and semi-automated workflows.
- The process flow is defined in an XML document called the pipeline descriptor and the executables are defined in a separate XML document called resource descriptors.



Pipeline. Yes we can.

Logged in as: Admin Admin | Auto-logout in: 0:24:20 - renew | Logout

Browse ▾ New ▾ Upload ▾ Administer ▾ Tools ▾ Help ▾

Advanced Search 🔍

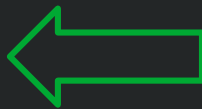
	Applies To	Generates	Description	Path
Delete	All Datatypes		Pipeline creates NIFTI files from DICOM files.	/data/xnat/pipeline/catalog/mricron/DicomToNifti.xml

Add Pipeline to Repository

```
root@1d78dd7e7a49:/usr/local/tomcat# cat /data/xnat/camilla/run_dicomtonifti.sh
#!/bin/bash

dicomtonifti_script="/data/xnat/camilla/dicomtonifti.py"
input=`find "$2" -type f | head -n1`
output=$4/`basename $input`.nii

echo $input
echo $output
python3 "$dicomtonifti_script" "$input" "$output"
```



```
<Pipeline xmlns="http://nrg.wustl.edu/pipeline" xmlns:xi="http://www.w3.org/2001/XInclu
/2001/XMLSchema-instance" xsi:schemaLocation="http://nrg.wustl.edu/pipeline ..\schema\p
tp://www.xnat.org/java/org.nrg.imagingtools.utils.FileUtils">
  <name>DicomToNifti</name>
  <location>mricron</location>
  <description>Pipeline creates NIFTI files from DICOM files.</description>
  <documentation>
    <authors>
      <author>
        <lastname>Mohana</lastname>
        <firstname>Ramaratnam</firstname>
      </author>
      <author>
        <lastname>Flavin</lastname>
        <firstname>John</firstname>
        <contact>
          <email>flavinj@mir.wustl.edu</email>
        </contact>
      </author>
    </authors>
    <version>20150114</version>
    <input-parameters>
      <parameter>
        <name>scanids</name>
        <values>
          <schemalink>xnat:imageSessionData/scans/scan/ID</schemalink>
          </values>
          <description>Scan ids of all the scans of the session</description>
        </parameter>
      <parameter>
        <name>xnat_id</name>
        <values>
          <schemalink>xnat:imageSessionData/ID</schemalink>
          </values>
          <description>XNAT ID (Accession Number) of the session</description>
        </parameter>
      <parameter>
        <name>sessionId</name>
        <values>
          <schemalink>xnat:imageSessionData/label</schemalink>
          </values>
          <description>Session label</description>
        </parameter>
    </input-parameters>
```

```
{  
  "Message": "Thanks for attention",  
  "Any question?": [  
    "Some response..."  
  ]  
}
```