Architectures, plugins and pipeline

Kickoff meeting AIM-MIA

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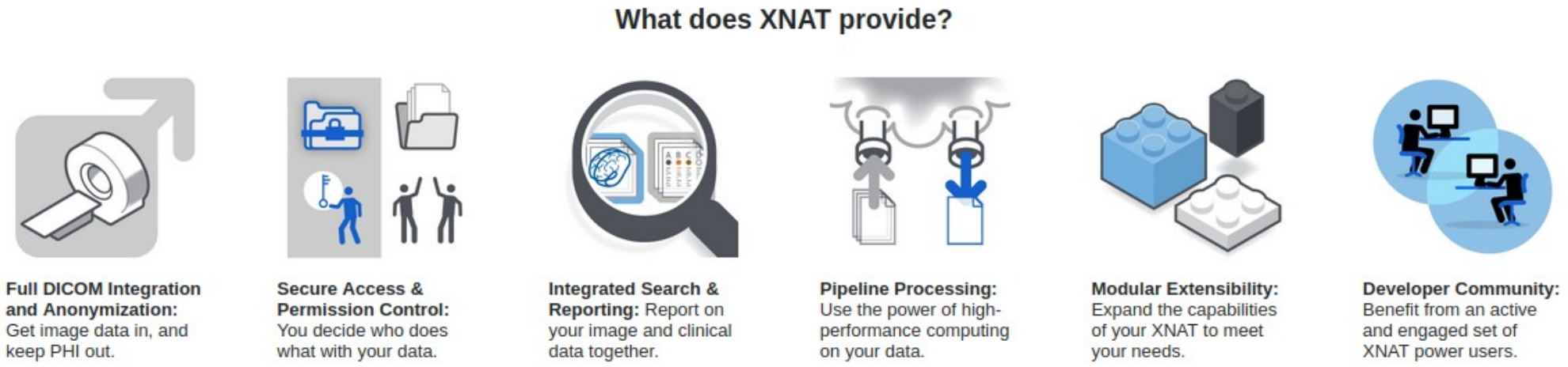
As usual

- Privacy, GDPR, ISO laws, etc
- Single project, multiple research groups
- Authentication and autorization
- 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 **N**euroinformatics **R**esearch **G**roup 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.



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

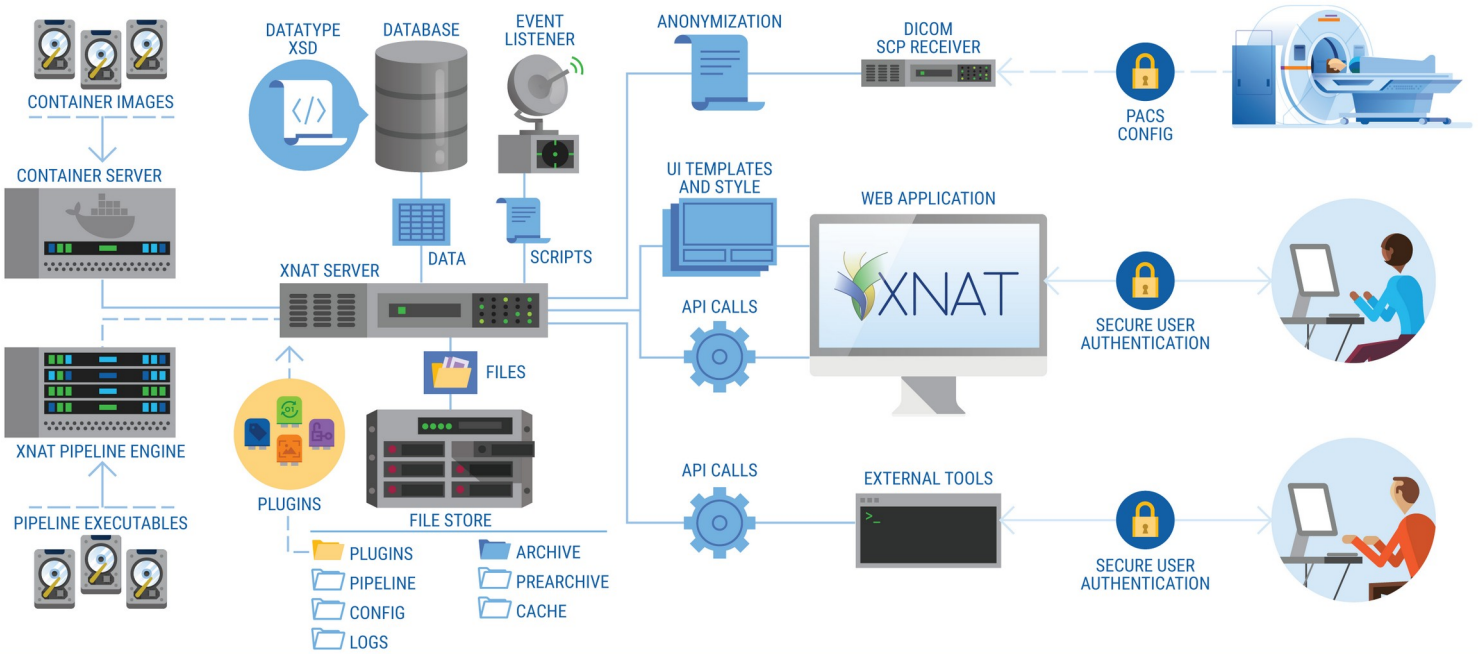
```
xnat:~ # docker ps -a
CONTAINER ID        IMAGE                  COMMAND                  CREATED
        STATUS
PORTS                                                 NAMES
f93d337e3b46        xnat/hello-world:1.0   "/hello"                 18 hours ago        Exited
(0) 18 hours ago
           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

XNAT ACADEMY

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.

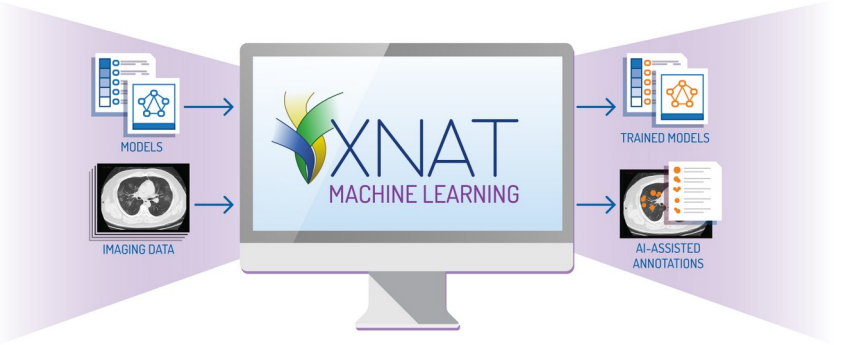
DICOM SCP RECEIVER
Allows your XNAT to be set up as a destination for PACS to send image sessions to. Requires PACS to be set up separately.

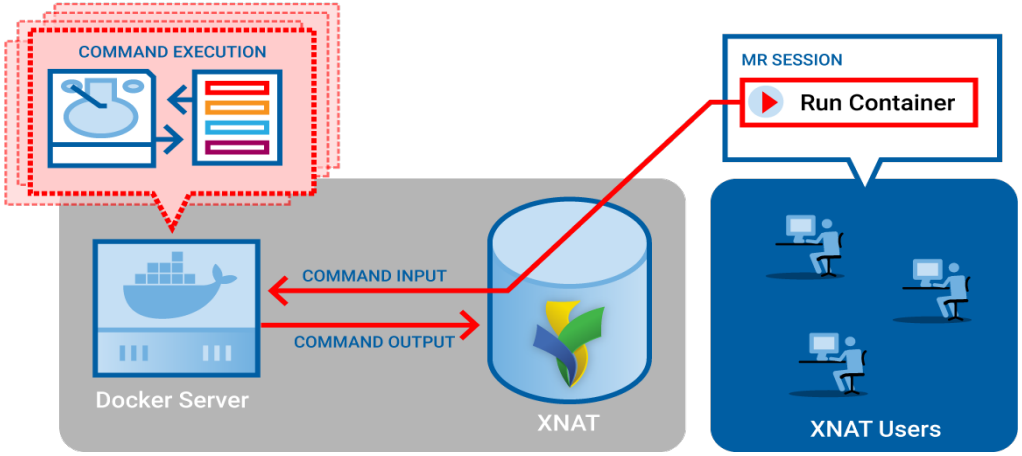
USER AUTHENTICATION
Spring Security used by default. LDAP / OpenID can be enabled by plugins.

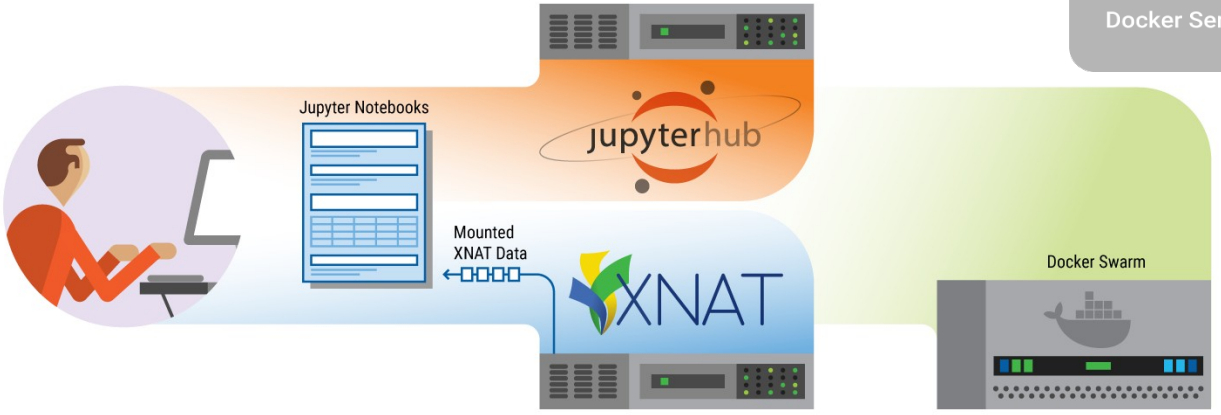
USER ACCESS
Data access in XNAT is segregated by project. Each project determines who has access to its data. User access can be enabled or disabled by site administrators as needed.

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

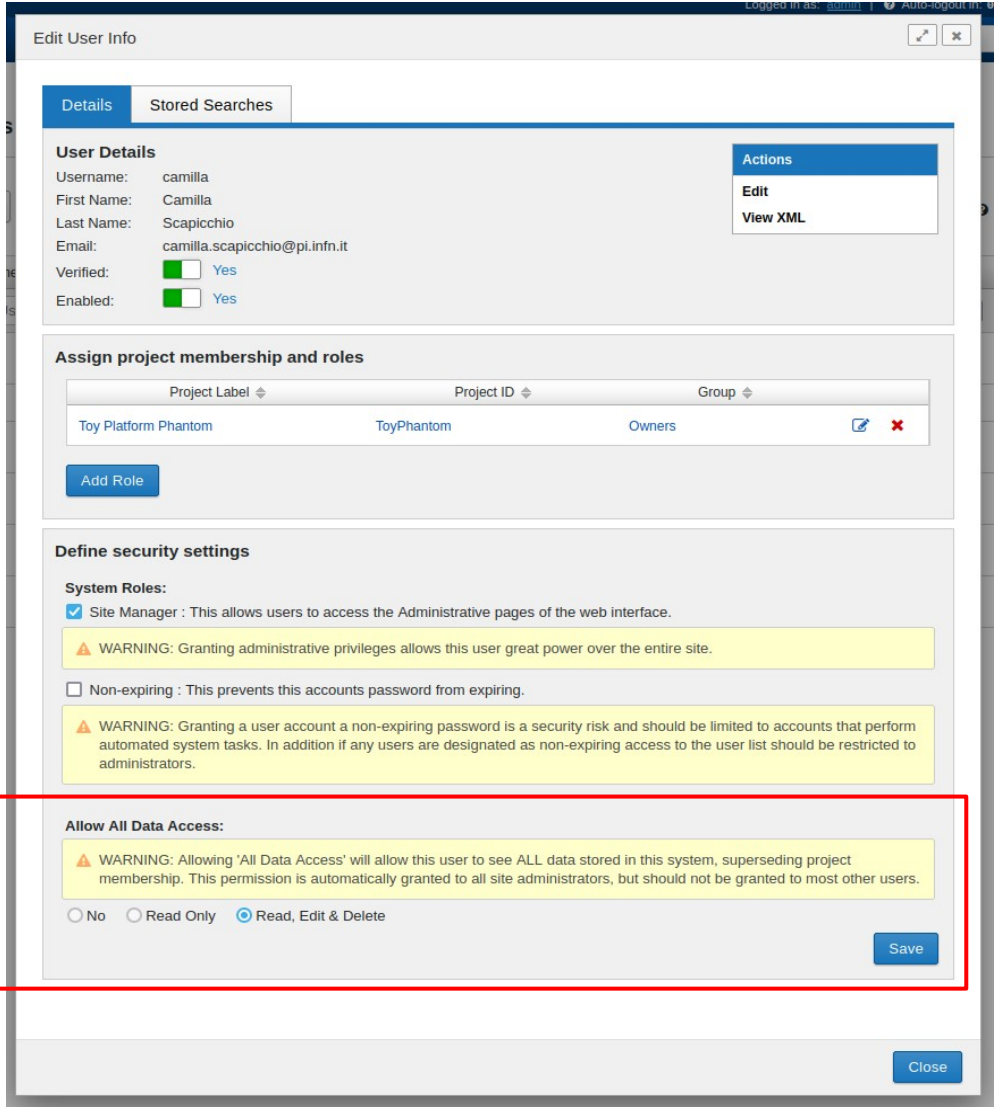
visible=true

auto.enabled=false → disabled by default

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

…

…



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 am XML document called the pipeline descriptor and the executables are defined in a separate XML document called resource descriptors.

Pipeline. Yes we can.

	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>
```

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