



Roadmap

Looking toward the XNAT future



Presenter: Kate Alpert, Flywheel

- Sr Director of XNAT Product and Engineering at Flywheel
- Has worked with XNAT since 2008, first at Northwestern University - customizing for targeted data science workflows; later with Radiologics, Inc. and Flywheel on core application
- Bummed that London precip is not currently in her preferred frozen form 



Agenda

What will we cover in this talk?

- Review the XNAT roadmap
 - Near-term focus
 - Features
 - NFRs
 - Over the next 4 years of the R01
 - Architecture
 - Integrations
 - Apps
- Hear from you!
 - Interactive discussion
 - Feedback form

XNAT & eXtensibility

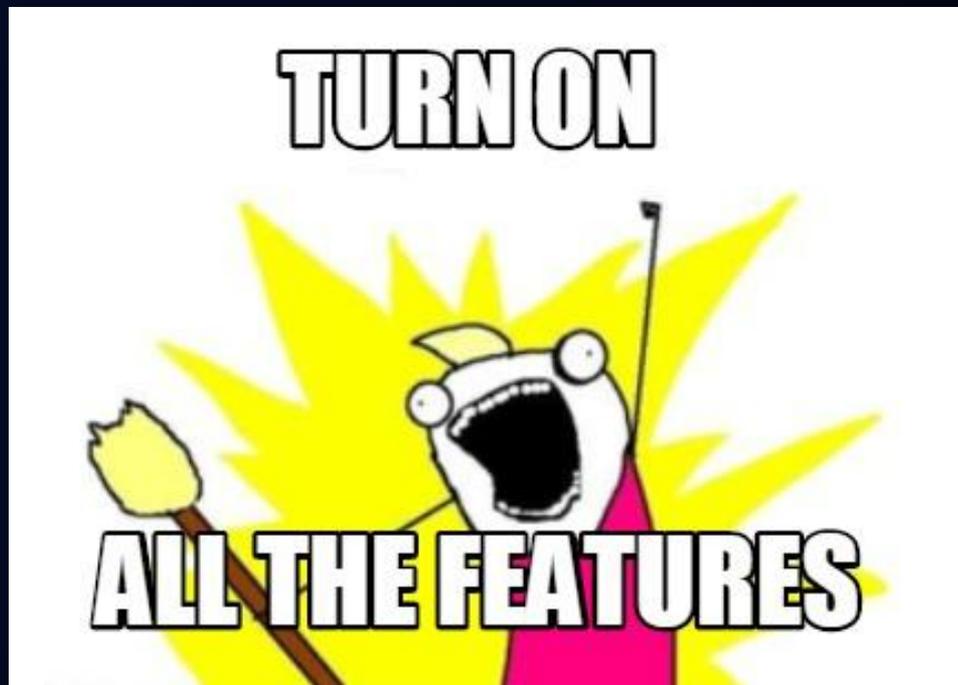
A bit of history

XNAT: eXtensible [Neuro]imaging Archive Toolkit

- Through v1.6,
 - Customizations required developers to fork XNAT core and/or the pipeline engine and struggle through a potentially complex, manual merge process to upgrade
 - User-facing customizations available around naming, default searches, custom variables, permissions, etc.
- As of v1.7,
 - Spring integration supports plugin injection, allowing developers to maintain isolated repositories for their customizations thereby reducing burden of updating core (but plugins are not aware of one another)
 - Container service offers end-users the ability to dynamically configure processing launch UI from json configuration and leverage any published container image for processing
- As of v1.8,
 - Event service facilitates user-configured actions in response to application events (e.g., creating a project, archiving a session, etc.)

Features

⚠ Day 3 emerging feature demo teasers ahead!



Coming soon!

Custom forms MVP

- WYSIWYG form builder from form.io
 - (json also supported)
- Dynamically-typed data collection
 - No more xml modifications or clunky custom variables
 - Still must “hang” on an existing data type
 - Fully dynamic data type management is in the works
- Federation-ready

The screenshot shows the XNAT web interface. At the top, there's a navigation bar with tabs for 'Projects', 'Subjects', 'MR', 'PET', and 'CT'. A status message indicates 'XNAT currently contains 1 projects, 0 subjects, and 0 imaging sessions'. A dropdown menu is open, showing options like 'XNAT Tools', 'XNAT Desktop Client', 'DICOM Browser', 'Command Prompt Tools', 'Custom Forms', 'Manage Custom Forms', and 'Migrate Custom Variables'. The main content area features a form with fields for 'ID', 'Title', 'Description', 'Keywords', and 'Investigator'. A 'Submit' button is located at the bottom right of the form. Below the form, there are two panels: 'Projects' and 'Recent Data Activity'. The 'Projects' panel shows a 'Teaser' for a project with ID 'teaser' and the note 'You are an owner for this project.' The 'Recent Data Activity' panel is currently empty.

Coming soon!

Jupyter notebook integration MVP (IC3R @ WUSTL with support from Flywheel)

- Launch and manage notebooks straight from XNAT, stage data, do science!
 - xnatpy (Erasmus MC)
- Leverage notebooks to quickly prototype custom UI

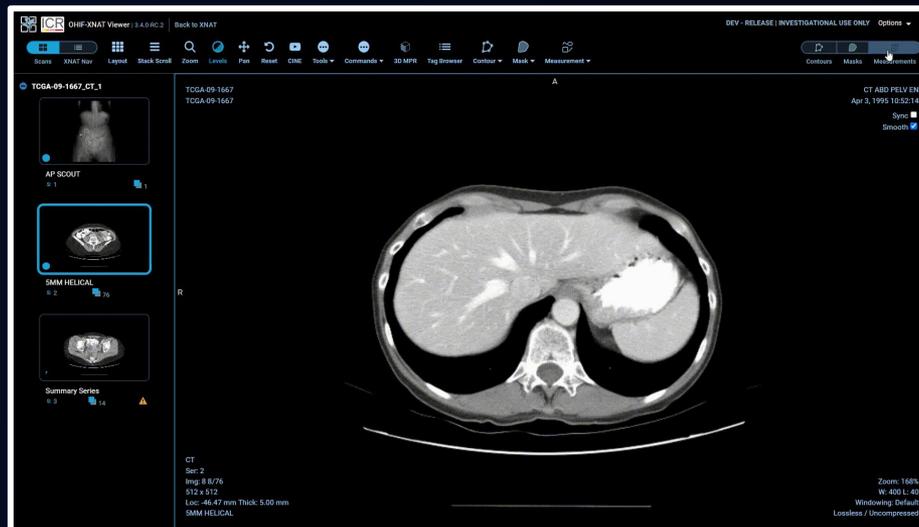
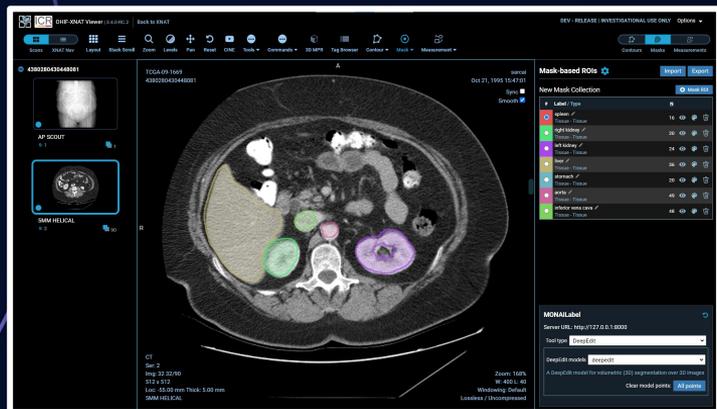
The screenshot displays the XNAT web interface for the C4KC-KITS project. The top navigation bar includes options like 'Browse', 'New', 'Upload', 'Administer', 'Tools', 'Jupyter', and 'Help'. The main content area shows the project details for 'C4KC-KITS', including a description of the 2019 Kidney and Kidney Tumor Segmentation Challenge and a list of actions such as 'Add', 'Download XML', and 'Upload Images'. Below the details is a 'Subjects' section with a table listing 25 subjects (KITS-00000 to KITS-00025) with columns for Subject, M/F, Hand, YOB, and CT Sessions.

Subject	M/F	Hand	YOB	CT Sessions
KITS-00000	U			1
KITS-00001	U			1
KITS-00002	U			1
KITS-00003	U			1
KITS-00004	U			1
KITS-00005	U			1
KITS-00006	U			1
KITS-00007	U			1
KITS-00008	U			1
KITS-00009	U			1
KITS-00010	U			1
KITS-00011	U			1
KITS-00012	U			1
KITS-00013	U			1
KITS-00014	U			1
KITS-00015	U			1
KITS-00016	U			1
KITS-00017	U			1
KITS-00018	U			1
KITS-00019	U			1
KITS-00020	U			1
KITS-00021	U			1
KITS-00022	U			1
KITS-00024	U			1
KITS-00025	U			1

Coming soon!

Viewer enhancements (ICR/NCITA team with support from Flywheel)

- Measurement service
- MONAI Label integration
- Metadata crawler performance optimizations



Coming soon(ish)!

Viewer enhancements cont'd (ICR/NCITA team with support from Flywheel)

- More activities in 3D
- In-viewer forms
- Microscopy support

The screenshot displays a medical imaging viewer interface. On the left, there are two CT scan views: a coronal slice (labeled 'S' and 'PL') and a sagittal slice (labeled 'S' and 'R'). The coronal slice shows a hip joint with a red circle highlighting a specific area. The sagittal slice shows the spine and pelvis. On the right, there is a 3D model of a pelvis with segmented parts in different colors: yellow for the hip (left), magenta for the hip (right), cyan for the proximal femur (left), red for the proximal femur (right), and green for the sacrum. Below the 3D model is a 'Quality Assurance' section for 'hipct_CT_1: scan 17'. It includes a 'RATING' section with radio buttons for 'Pass' (selected) and 'Needs review', and a 'COMMENTS' section. A 'Submit' button is visible. Below the 'COMMENTS' section is a 'HISTORY' section with a list of actions and dates.

Label		
Hip (left)	<input type="checkbox"/>	<input type="checkbox"/>
Hip (right)	<input type="checkbox"/>	<input type="checkbox"/>
Proximal femur (left)	<input type="checkbox"/>	<input type="checkbox"/>
Proximal femur (right)	<input type="checkbox"/>	<input type="checkbox"/>
Sacrum	<input type="checkbox"/>	<input type="checkbox"/>

Quality Assurance

hipct_CT_1: scan 17

RATING

Pass

Needs review

COMMENTS

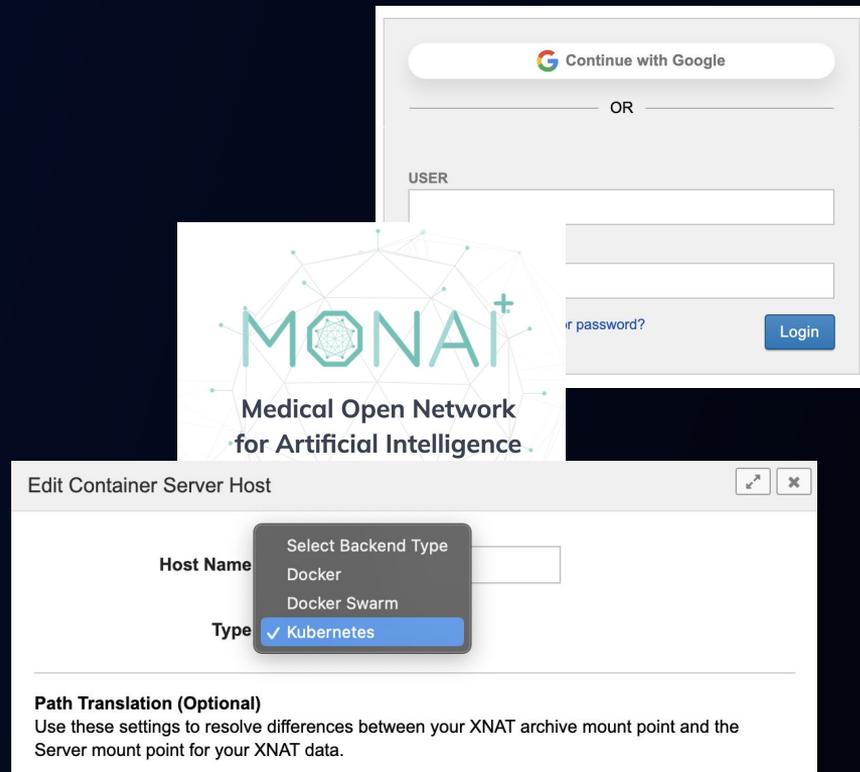
HISTORY

- admin set status to **Pass** on 12/10/2020, 4:20:08 AM
Seg looks great!
- admin set status to **Needs review** on 1/13/2021, 9:44:14 AM
I am concerned about the accuracy of the L proximal femur segmentation, see Coronal slice 247.
- kate set status to **Pass** on 1/20/2021, 2:00:37 PM
test
- kate set status to **Pass** on 5/3/2021, 1:06:23 PM
margin on slice 23
- admin set status to **Pass** on 5/18/2021, 1:06:39 PM

Coming soon!

...and more

- Unified OpenID plugin
 - Integrating AIS core, PKCE support, and streamlined UI customization
- MONAI template container for use with XNAT-ML (IC3R @ WUSTL)
 - “Pick your framework”
- Additional k8s feature support in CS
 - PVC, images labels -> node constraints, in-app management
- Anonymization profiles in DicomEdit
 - Imports, conditional blocks, federation-ready



Nonfunctional Requirements



Coming soon(ish)!

Nonfunctional requirements

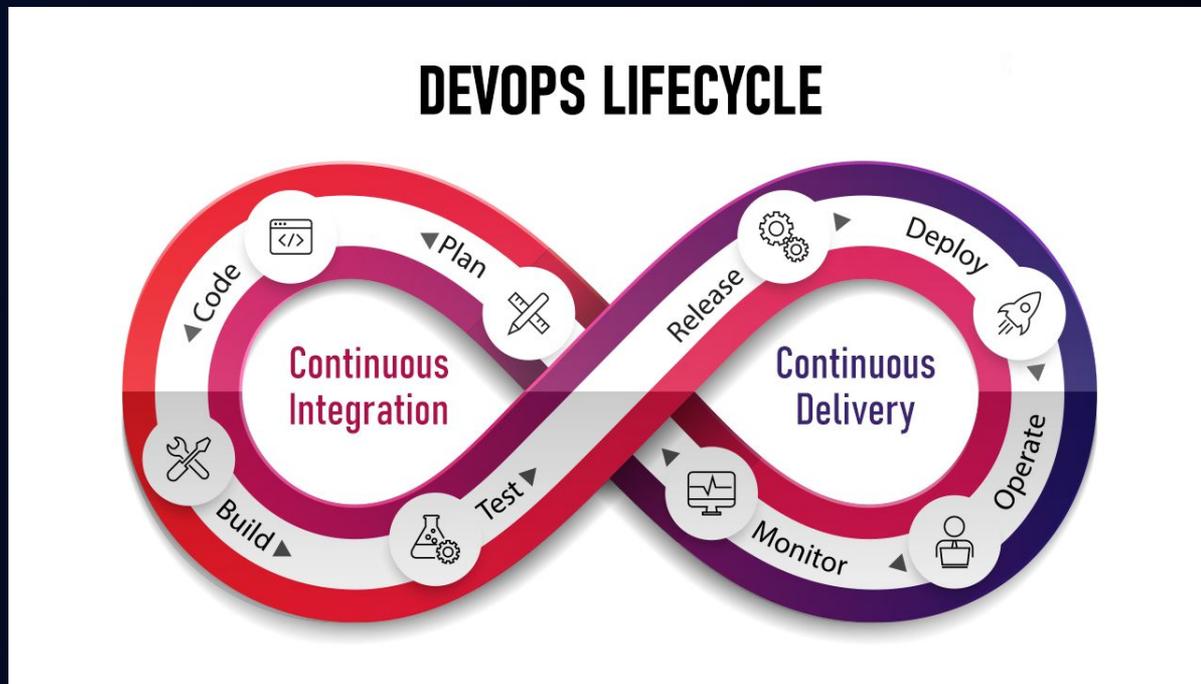


- Tackle some tech debt
 - Enhanced horizontal scalability
 - Dependency updates (Spring, etc)
 - Performance optimizations
- Enhance our automated test suites
 - Performance tests
 - REST tests
 - Selenium tests
- Streamline deployment
 - K8s helm chart (AIS)
 - Dev and prod

Coming soon(ish)!

Nonfunctional requirements, cont'd

- Improve instrumentation & metrics collection
- Optimize the SDLC (FWE)
 - Monorepo
 - Robust CI
 - TBD branching model, moving toward CD
 - Increase release cadence
 - MVP
 - Feature flags
 - Path for community contributions



Thank you! 🙏

These near-term advancements are made possible by numerous valuable collaborations and contributions.

In particular, we would like to acknowledge work from the IC3R @ WUSTL, ICR/NCITA, AIS, and Erasmus Medical Center, as well as funding and support from Flywheel's commercial clients, and efforts from the entire Flywheel team.

We are thrilled to have such a vibrant community!



The Future

What are our longer term goals?

- **Modernize** the XNAT platform architecture
 - Simplify the XNAT codebase
 - Enable faster development cycles
 - Improve maintainability, security, scalability, and performance
- **Expand** XNAT core capabilities
 - Focus on integrations
- **Develop** new XNAT capabilities
 - Leverage integrations
- **Support and grow** the XNAT community

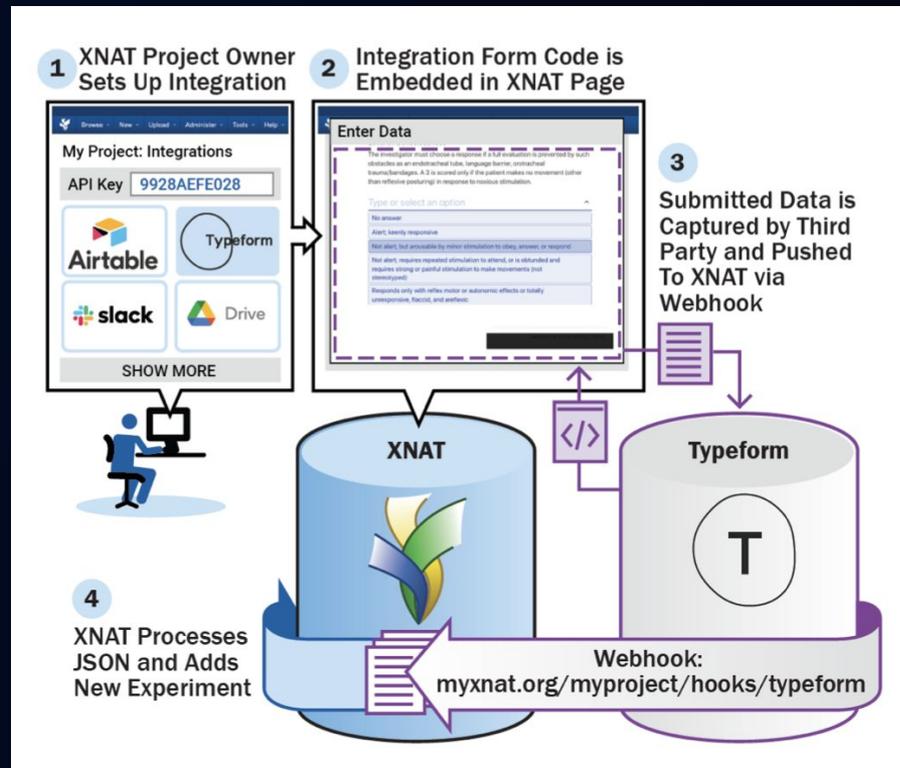
Modernize the XNAT platform architecture

- UI overhaul
- New **archive** management service
 - Abstract storage (file, object, perhaps more!)
 - Direct database tracking, no more catalog files
 - Improved versioning
 - Billing
 - Native zip support
- New **database** management service
 - Replace XFT with a standard ORM (e.g., Hibernate)
 - Explore database technologies (horizontally scalable relational database, noSQL, graph, etc.)
- Multiprovider **compute**
 - Container execution across multiple providers and platforms (swarm, k8s, HPC, etc.)
 - Access controls (and billing) by project, user, and container requirements
 - Federation-ready
- Monolith → **microservices**
 - Scalable, reliable (isolated), flexible (independent services), maintainable, CD

Expand XNAT core capabilities

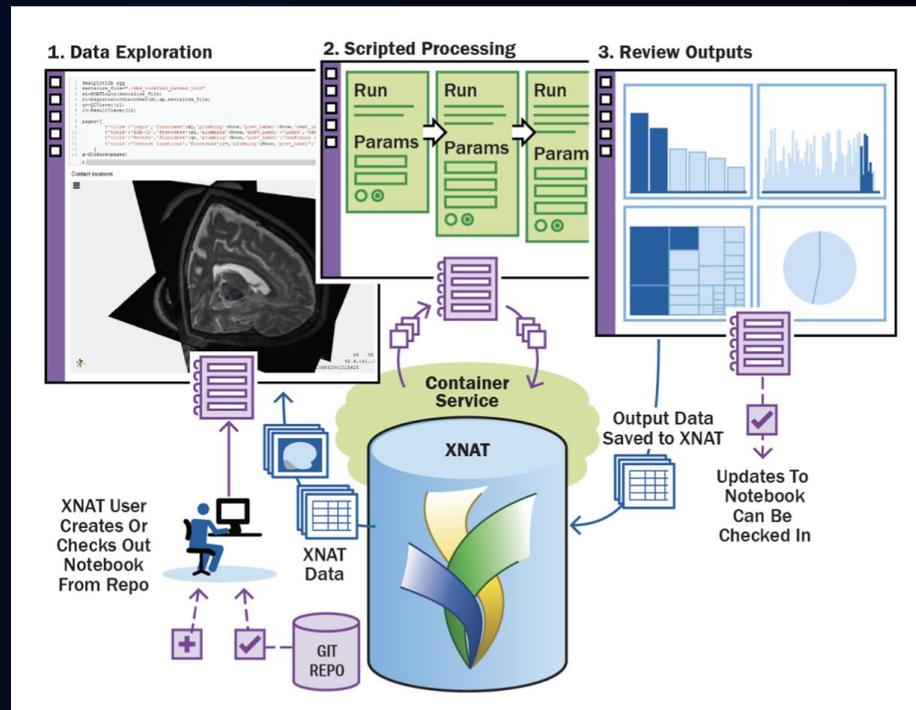
Facilitate integrations via flexible tooling

- Consistent, well-documented RESTful APIs
 - DICOMweb
- Robust SDKs
 - xnatpy! [Erasmus MC](#)
- Webhooks



Develop new XNAT capabilities

- User-facing **worklists** to streamline manual, task-oriented activities
 - E.g., rapid reader with hanging protocols
- Portable user **workspaces** for cohort building, exploration, and processing
 - Filter and snapshot
 - Lessons learned in XNAT-ML dataset builder
- **Orchestration/workflow engine** supporting complex, multistage pipelines including human-in-the-loop tasks
- **Productivity applications** that bring it all together for a streamlined, targeted UX
 - E.g., ML Studio



Support and grow the XNAT community



- Outreach
 - Hosting workshops and hackathons ✓
 - Conferences
 - Social media
- Documentation and support
 - Updated website & documentation
 - Moderating discussion group
- XNAT Academy
 - “Virtual Lab” courses
- Promote and integrate code and documentation contributions

Discussion & Feedback



What should be easier to do in XNAT?

slido



**What should be easier to do
in XNAT?**

① Start presenting to display the poll results on this slide.

What is missing in XNAT?

slido



What is missing in XNAT?

① Start presenting to display the poll results on this slide.

Why do you use XNAT instead of another tool or platform?

slido



**Why do you use XNAT
instead of another tool or
platform?**

① Start presenting to display the poll results on this slide.

What's your favorite thing about XNAT?

slido



What is your favorite thing about XNAT?

ⓘ Start presenting to display the audience questions on this slide.

Roadmap feedback

We would love to hear from you!





XNAT WORKSHOP LONDON 2022

