What’s new in the XNAT Ecosystem?

1.8+ and Beyond
Presenter: Tim Olsen, Flywheel

- Founding Architect & Developer of XNAT from 2003-2011
- CTO at Radiologics, Inc (2011-2021)
- SVP of Engineering, Flywheel (2021+)
- Still coding on XNAT :)
- Resides in Peoria IL, USA
- Father of 6 (18-3)
- Geeks out about: Star Trek, home improvement projects, smart devices, marriage & family enrichment
What’s New in the ecosystem?

Overview:

● Walk through the most recent releases
● Favorite Plugins & Tools
● Merged Teams / Processes
Last Major Release: 1.8

Introduced:

- Event Service
- XNAT ML Support (CLARA 3)
- Enhanced DICOM Routing
- Pipeline engine deprecation
- Scan Searching
- DicomEdit Improvements (Pixel masking, Date shifting)
1.8: Event Service

- Added Event Triggers and Subscriptions to facilitate user customizable workflows
- Available Triggers:

  - Image Assessor -- Created
  - Image Assessor -- Updated
  - Project Asset -- Created
  - Project -- Created
  - Project -- Deleted
  - Subject -- Created
  - Subject -- Deleted
  - Subject Assessor -- Created
  - Subject Assessor -- Deleted
  - Session -- Created
  - Session -- Deleted
  - Scan -- Created
  - Resource -- Created
  - Resource -- Updated
1.8: Event Service

- Subscriptions can log messages, launch containers
1.8: XNAT ML Support

1. Configure a dataset
2. Install a new model
3. Launch Training
1.8: Enhanced DICOM Routing

- Administrators can modify DICOM Routing using runtime rule definitions (Project, Subject, Sessions)
1.8: Pipeline Engine Deprecation

- Replaced by Container Service
- Image snapshots generated on demand
  - No longer need AutoRun pipeline
1.8: Scan-level Searching

- Scan-level data types can now be registered to allow scan level searching
1.8: DICOM Edit Improvements

- **Pixel Editing**
  
  ```
  alterPixels["rectangle", "l=100, t=100, r=200, b=200", "solid", "v=100"
  ```

- **Date shifting**
  
  ```
  (0008,0020) := shiftDateByIncrement[ (0008,0020), "14"]
  ```
1.8.1: Microscopy Support

- Basic data type support added
1.8.2 Tomcat 9 Support

- Modifications to support Tomcat 9 configuration options
  - Due to end of life of Tomcat 7 support
1.8.3 Direct To Archive

- More performant method for archiving data
- Skips Prearchive
- Writes directly to archive space
- For well-defined datasets

Caveats
- Accessible via REST and DICOM PUSH
- Corner cases fall back to prearchive
1.8.4 Access Restrictions

- Admins can limit access to download and sharing of data
- Doesn’t limit backend access to the functionality (i.e. REST api)
- But, does limit easy access via the browser, which is desirable for some groups.
1.8.5 Scheduled Events

- Schedule events for notifications and container execution
- Sys-admin only
1.8.5 Receiver specific routing

- Allows having distinct receiver’s for specific projects
- Send data to a specific AE Title / Port combination and it will route directly to the project
1.8.6 Front page tab customization

Admins can now configure the search options on their index page.
Container Service

- 3.2.0
  - Kubernetes Support

- 3.3.0
  - Command Secrets

```
$ minikube start --mount /opt/data

minikube v1.25.2 on Amazon 2
Automatically selected the docker driver. Other choices: none, ssh
Starting control plane node minikube in cluster minikube
Pulling base image ...

Downloading Kubernetes v1.23.3 preload ...
  > preloaded-images.k8s-v17-v1...: 505.68 MiB / 505.68 MiB 100.00% 242.29 M
  > gcr.io/k8s-minikube/k8sbases: 379.06 MiB / 379.06 MiB 100.00% 85.29 MiB p
Creating docker container (CPUs=2, Memory=7996MB) ...
Preparing Kubernetes v1.23.3 on Docker 20.10.12 ...
  kubectl.hkepkeeping-interval=5m
  Generating certificates and keys ...
  Booting up control plane ...
  Configuring RBAC rules ...
Verifying Kubernetes components...
  Using image gcr.io/k8s-minikube/storage-provisioner:v5
  Enabled addons: storage-provisioner, default-storageclass
Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
```
Batch Launch Plugin

- Supports bulk execution of containers
- Runnable on Subjects, Sessions, or Scans
Batch Launch Plugin

Select from registered containers

See statuses of all containers across your dataset
## Batch Launch Plugin

Advanced view per container gives runtime info and number of files output

<table>
<thead>
<tr>
<th>Project</th>
<th>Subject</th>
<th>Experiment</th>
<th>dc2m-ggg-sessions</th>
<th>Launched</th>
<th>Last Mod</th>
<th>JPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotrimoxom-Demo</td>
<td>05220027</td>
<td>02-20-2000-522-20564</td>
<td>Ready</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotrimoxom-Demo</td>
<td>05220003</td>
<td>08-31-1999-NeckHeadNeckPETCT-84836</td>
<td>Ready</td>
<td></td>
<td></td>
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<tr>
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<td>04-24-2000-PETCTHEADNECKCA-89925</td>
<td>Ready</td>
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<tr>
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<td>01-19-2000-HEADNECKIMRT-50644</td>
<td>Ready</td>
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<td>Cotrimoxom-Demo</td>
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<td>Ready</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Batch Launch Plugin

View build directory contents:

- 9f4f6f0-703e-3e50-8b4-c214e0b02885
- BIDS
- IMG

View logs and errors live:
DQR Plugin - DICOM Query Retrieve

- ssh://git@bitbucket.org/xnatdev/dicom-query-retrieve
- Uses C-FIND, C-MOVE
- Queries a PACS, identifies a dataset and facilitates a data push (C-STORE)
- Configurable pulls to ‘make nice’ with your PACS administrator
XSYNC Plugin - Data Copying

- Sync data across XNAT's or to the same server
- Apply anon before push
- Works best against the same XNAT version
XNAT Desktop Client

- The latest and greatest of XNAT's upload tools
- Works with XNAT 1.7.5+
- v3.1.0 released Sept 1 2022
- Pixel editing
- Buik uploads/downloads
- Auditing history
XNAT Desktop Client: Bulk Uploads

Upload Image Session to [192.168.56.100/xnat]

Bulk Upload

The bulk upload process allows you to modify session metadata and add parameters for multiple image sessions, and also includes visual PHI inspection and pixel anonymization, before uploading to your XNAT.

Project / Data Selection

Confirm Details

Inspect Images

Inspect Bulk Images

Upload to XNAT

Project Settings

Project ID

Segmentation (SEG) Modality DICOM Data Project

Subjects

14

Image Sessions

14

Storewide Analysis Script

Project tree script

Storewide Allow Subject Creation

Project Allow Subject Creation

Storewide Series Import Filter

Project Series Import Filter

Upload destination

ARCHIVE (Reject duplicates)

Data Verification Required

Allow Bulk Uploading (for Project)

Select Project

SEG Demo Project

Behavioral Database

QC_Review

ALL_UR_XBR

BMN_Pilot

Fruit/Vegetable Structure

NIRS Processing Project

PETCT_X9

Resource Demo

TEST

Select Data To Upload (Choose a Folder)

Selected folder must contain one or more sets of uncompressed DICOM image files. Selected folder can contain files in a flat directory structure or in subdirectories.

Browse

Cancel

Next >
XNAT Desktop Client: Pixel Anon

Grouped Scans for Visual PHI Removal.

**Group 1 (1 scan)**
- Modality: CT
- SOP Class: CT Image Storage
- Resolution: 819 x 512
- Color: MONOCHROME2
- Templates: 0

**Group 2 (63 scans)**
- Modality: CT
- SOP Class: CT Image Storage
- Resolution: 512 x 512
- Color: MONOCHROME2
- Templates: 1
Experience on the team

@ Flywheel
- Dan Marcus (2002)
- Kevin Archie (2007) - Back this week!!!
- Kate Alpert (2008)
- Angela Farrar (2008)
- Will Horton (2010)
- Rick Herrick (2011)
- James Dickson (2010)
- James Ransford (2011)
- Michael Hileman (2012)
- Charlie Moore (2013)
- John Flavin (2013)

@ WUSTL
- Dan Marcus (2002)
- Jenny Gurney (2008)
- Mike Hodge (2010)
- Matt Kelsey (2015)
- Steve Moore (2016)
- Andy Lassiter (2020)
Merged Teams (WASHU, Radiologics, Flywheel)

- New developers, operations staff, etc
- Product-driven development
  - User Stories
  - User Requirements
- Enhanced QA
  - Every change has a ticket
  - Every ticket gets QA’d
  - Automated (run nightly on dozens of plugin configurations)
    - REST test suite (490 tests)
    - Jmeter Performance Tests
    - 2 separate selenium test suites
  - BURP Security Scan (OWASP) - Every release
Merged Teams (WASHU, Radiologics, Flywheel)

- Direct connection with dozens of XNAT sites (clients)
- Business relationships with prominent Cancer Research Institutes and Academic Medical Centers
- Large pool of developers and support staff to draw from
- Close collaboration with external contributors (ICR/NCITA, AIS, etc)
- Cloud infrastructure to support a robust and reliable hosting/development environment