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Setting up an open-source XNAT IT platform for medical imaging research

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With the advent of Artificial Intelligence, there is an increasing need for appropriate data management and administration systems. In particular, collecting and organizing large datasets of medical imaging data presents several challenges, especially in multi-centric studies. These include ensuring data security, maintaining data integrity, and addressing privacy requirements according to GDPR and privacy laws. Institutions engaged in medical research projects often face an IT gap due to the absence of adequate IT tools enabling them to share everything they need at all process stages: input data collection, analysis methods and models, and storing results for future use. Within the PNRR THE (Tuscany Health Ecosystem) project, investigating the radiobiological mechanisms of the new FLASH radiotherapy requires a well-organized database to store and connect heterogeneous data from heterogeneous groups'experiments. In order to meet all these requirements we propose to use XNAT (https://www.xnat.org/), an open-source IT software platform designed to facilitate the storage, custom workflow processing, and secure distribution of medical images and related patients'data. An XNAT server has been installed at INFN-Pisa Data Center, it serves as a pilot project structured with incremental multi-phase deployment and feasibility valuation step by step. At phase 1, we created a new vm (vmware cluster) on top of that we deployed the XNAT instance as a dockerized container with configurable dependencies. Subsequently, we set up storage (GPFS cluster), customized authentication plugin (INFN-AAI), user notification system and SSL Certificate. At phase 2, we would like to implement these requirements:

- Multi-institutions authentication (IDEM GARR AAI)
- Run workflow data analysis (infrastructure integration)

The main goal is setting up an integrated medical research environment to promote data sharing and collaboration between multidisciplinary groups, preserving input data privacy, custom workflow analysis and results for future applications.

[1] Fantacci., M. (2024). Characterization and quantification of image quality in ct imaging systems: A phantom
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Primary authors: RETICO, Alessandra (Istituto Nazionale di Fisica Nucleare); FORMUSO, Antonino (Istituto Nazionale di Fisica Nucleare); SCAPICCHIO, Camilla (Istituto Nazionale di Fisica Nucleare); MAZZONI, Enrico (Istituto Nazionale di Fisica Nucleare); AREZZINI, Silvia (Istituto Nazionale di Fisica Nucleare)

Presenter: FORMUSO, Antonino (Istituto Nazionale di Fisica Nucleare)

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