



GIFT-Cloud

A secure data storage and collaboration platform

Technical Manual Version 1.2

Tom Doel
Dzhoshkun Shakir



1 Introduction

GIFT-Cloud is a platform for securely sharing medical imaging data for use in academic research. It was developed as part of the GIFT-Surg project, by the Translational Imaging Group at University College London [1].

GIFT-Cloud is built using XNAT, a widely-used open source imaging informatics platform developed by the Neuroinformatics Research Group (NRG) at Washington University [2][3].

GIFT-Surg is funded by the Wellcome Trust and the Engineering and Physical Sciences Research Council, and is a collaboration between University College London (UCL), Katholieke Universiteit Leuven (KU Leuven), University College Hospital (UCLH), Great Ormond Street Hospital (GOSH), and Universitaire Ziekenhuizen Leuven (UZ Leuven).

2 Disclaimer

GIFT-Cloud is intended for academic research use only. It is not permitted to use GIFT-Cloud for diagnosis, treatment planning, or any other purpose that can impact on patient care.

3 Technical requirements

GIFT-Cloud uploader service

The GIFT-Cloud uploader service is a Java application that can be used to anonymise and transmit DICOM data to GIFT-Cloud from a PACS system. The software can be run in a passive mode (service) where it acts as a DICOM node. Data pushed to the node will automatically be anonymised and uploaded to the GIFT-Cloud server. The application can also be run interactively, where the user can query data from the PACS and select data to be anonymised and uploaded. The GIFT-Cloud uploader service can be run on any computer that meets the following requirements:

- The internet must be available with ports open for HTTPS connections;
- The local machine must have Java installed, minimum version 1.6 (later versions preferable);
- The machine must be configured to permit the running of the Java application;
- The IP netblock (address range) of the machine must be added to the GIFT-Cloud server whitelist.

The service may temporarily store clinical data on the local machine, which will be deleted after it has been uploaded to the GIFT-Cloud server. The uploader service can be optionally configured to store a database file of pseudonymisation keys to real patient identifiers at a configurable location (either the uploading machine or a suitable location on the local network).

Web-based uploader

The web-based uploader is a Java applet which a user launches from the GIFT-Cloud website. The user selects data to be uploaded, which is then anonymised and sent to the GIFT-Cloud server. This uploader applet can be run from any computer that meets the following requirements:

- The internet must be available with ports open for HTTPS connections;
- Internet Explorer or Safari must be available;
- The local machine must have Java installed, minimum version 1.6;
- Java on the machine must be configured to permit the running of self-signed applets;
- The data to be uploaded must be available from directories accessible from the local machine;
- The IP netblock (address range) of the machine must be added to the GIFT-Cloud server whitelist.

GIFT-Cloud server

The GIFT-Cloud server must be configured with the netblock (IP address range) for any machines that wish to connect, including:

- any machines that will be used to browse and download data;
- any machines that will be used to upload data using the web-based uploader;
- any machines running the uploader service.

Communication with the GIFT-Cloud server uses HTTPS. If non-standard ports are required, these may require special configuration of the GIFT-Cloud server and UCL firewalls.

4 Confidentiality of clinical data

XNAT is used to securely host clinical research data at many institutions worldwide [3]. UCL has a well-established XNAT installation on the CMIC-XNAT server [4] which is used by a number of research projects involving clinical data [5][6].

GIFT-Cloud will be installed on a new server at UCL based on the established security model used by the CMIC-XNAT server. This includes the following security features:

- a. The server is accessible only through the well-established HTTPS protocol [7], which makes it mandatory that the data traffic between the client and the server be encrypted.
- b. A firewall on the server blocks access except from trusted clients (the UCL and UCLH domains, and research partners outside UCL), via IP whitelisting.
- c. XNAT implements a security model that allows user access control on a per project basis. This allows us to restrict access for certain data to specific groups of users, if required [8].

The confidentiality of personal identifiable data (PID) is protected in GIFT-Cloud through pseudonymisation. Pseudonymisation in general comprises:

- a. Deleting a large portion of PID (including pixel data that could potentially be used for identifying a patient), which is not relevant to the research objectives,
- b. Replacing relevant PID with uniquely generated identifiers (e.g. enumerated values, hash codes), allowing for later re-identification by authorised personnel (e.g. the radiologist who keeps the map of real identifiers versus generated identifiers).

We aim to provide an intuitive mechanism for fully automated, on-site pseudonymisation (i.e. such that no PID is transmitted over the network). Existing well-established policies (see [9][10][11][12]) and laws (UK, EU, USA where applicable) are the basis of the pseudonymisation procedure.

Data upload and download procedures

The following figures illustrate how data confidentiality is ensured by the procedures.

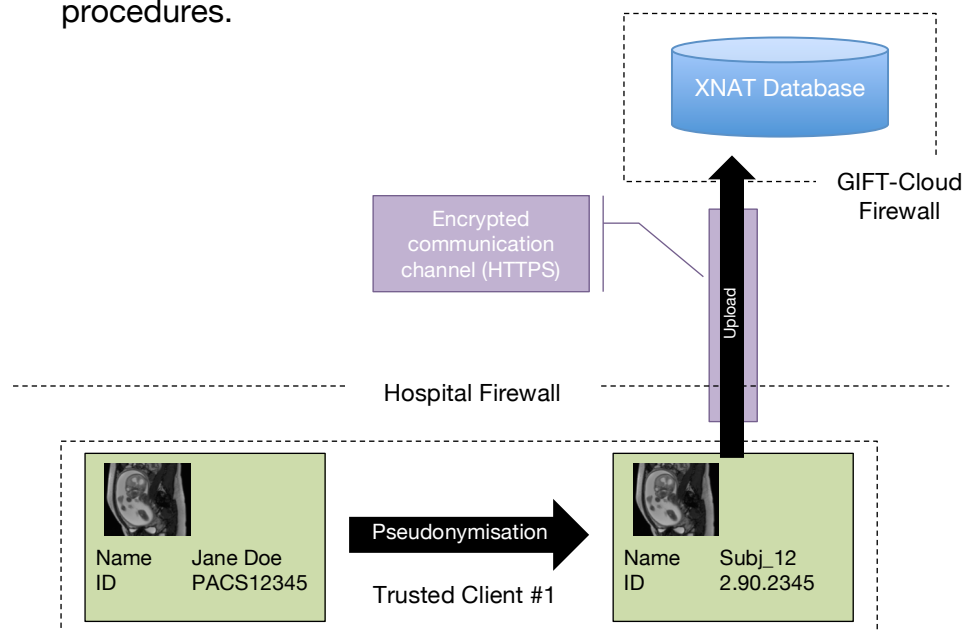


Figure 1: Data upload. Every PID is anonymised **on the client, prior to upload**. This ensures that the server does not store any sensitive information that could lead to patient identification.

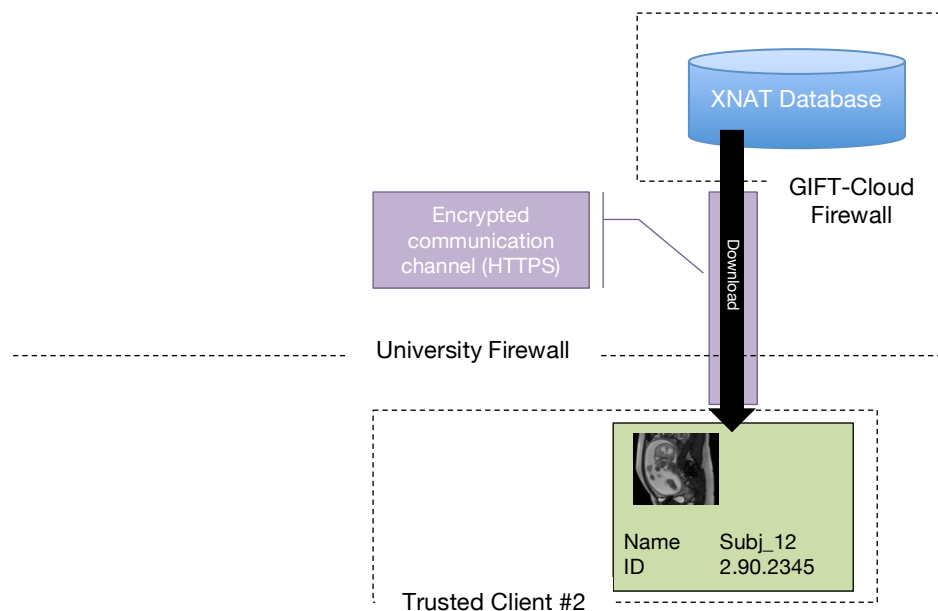


Figure 2: Data downloaded by researcher in a collaborating academic institution. The researcher **has no access to PID**, but rather only to **pseudonymised identifiers**.

5 References

- [1] Translational Imaging Group <http://cmictig.cs.ucl.ac.uk>
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- [5] Patient Information Combined for the Assessment of Specific Surgical Outcomes in Breast cancer (PICTURE), http://cordis.europa.eu/project/rcn/106628_en.html
- [6] EPICure – Population based studies of survival and later health status in extremely premature infants, <http://www.epicure.ac.uk/epicure-1995/epicure19/>
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- [10] Standards for patient confidentiality and RIS and PACS, Royal College of Radiologists, UK
[http://www.rcr.ac.uk/docs/radiology/pdf/BFCR\(12\)19_Standards_patient_confidentiality.pdf](http://www.rcr.ac.uk/docs/radiology/pdf/BFCR(12)19_Standards_patient_confidentiality.pdf)
- [11] Clinical Research and the HIPAA Privacy Rule, NIH, USA (not necessary, but compatibility with this would allow for smooth inclusion of potential collaborators from USA)
http://privacyruleandresearch.nih.gov/pdf/clin_research.pdf
- [12] Supplement 142: Clinical Trial De-identification Profiles, DICOM Standards Committee, USA
ftp://medical.nema.org/medical/dicom/final/sup142_ft.pdf

6 Contact details

Principal Investigator for GIFT-Surg

Professor Sebastien Ourselin s.ourselin@ucl.ac.uk

Co-investigators for GIFT-Cloud and GIFT-Surg platform

Dr Tom Vercauteren t.vercauteren@ucl.ac.uk

Dr Tom Doel t.doel@ucl.ac.uk

Dr Dzhoshkun Shakir d.shakir@ucl.ac.uk

Website

<http://cmictig.cs.ucl.ac.uk>

Address

Translational Imaging Group
University College London
3rd Floor, Wolfson House,
4 Stephenson Way
London, NW1 2HE