GIFT-Cloud

A secure data storage and collaboration platform

Technical Manual
Version 1.3

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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 (UCL) [1].

Data are anonymised and hosted on a dedicated server. Users may view and download data by logging into a secure website, or by using GIFT-Cloud compatible software. Users can upload new data using the GIFT-Cloud Uploader software. This automatically anonymises data before upload, and provide PACS integration making it suitable for use in a hospital environment.

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 Welcome Trust and the Engineering and Physical Sciences Research Council, and is a collaboration between 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.

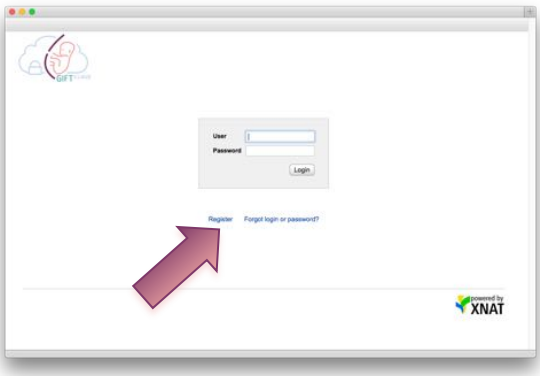
3 How to access GIFT-Cloud

Data for the GIFT-Surg project are hosted on a dedicated GIFT-Cloud server at UCL, and can be accessed using the website or compatible client software.

The server can be accessed from anywhere within the UCL and KUL networks. Access from other collaborating institutions can be arranged by the GIFT-Cloud administrators as required.

You will need to create a personal account on GIFT-Cloud. To do this, go to the website, click ‘register’ and follow the instructions:

https://gift-cloud.cs.ucl.ac.uk



For security reasons, your account needs to be approved by the GIFT-Cloud administrators before it as activated. This may take a few days. You will also receive an email asking you to verify your email address.

Once your account is activated you can log into the website above and view and download data.

Data are contained within a number of different ‘projects’ on GIFT-Cloud. Users are granted access to projects as permitted by the data sharing agreements between the collaborating institutions.

You can use the same login details to access data using software that is compatible with XNAT or GIFT-Cloud. The same requirements for server access apply as with the website.

4 Browsing the GIFT-Cloud website

GIFT-Cloud uses a customised version of the standard XNAT web interface. Detailed user documentation can be found on the XNAT website:

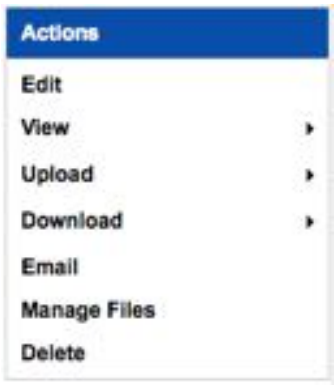
https://wiki.xnat.org/display/XNAT16/Home

Data is grouped into a number of projects, some of which contain clinical data, while others contain testing data. The projects to which you have access are listed on the Home tab. Click on a project to view its contents.

Within each project are the imaging subjects. When data is uploaded, it is anonymised and subjects are assigned an auto-generated name such as UCH-GIFTSURG-42. Click on a subject to view the data for that subject.

For each subject, images are grouped into ‘experiments’ (each corresponding to Dicom ‘studies’), and these are further grouped into ‘scans’ (each corresponding to a Dicom ‘series’). Within each scan (series) are the individual files. By clicking on a scan you can see a preview image and examine the Dicom headers for the files in that scan.

When examining scans, the action menu on the right side of the screen gives you options to download and examine files:



5 Downloading data

There are two main methods for downloading datasets from GIFT-Cloud

Download data from the GIFT-Cloud website

The image downloading interface is available from individual imaging sessions (via the Actions menu on the right) or from search results (via a drop-down menu). The downloading options are explained on the XNAT website:

https://wiki.xnat.org/display/XNAT16/XNAT+Data+Management#XNATDataManagement-HTTPDownload

Download using XNAT-compatible software

Programs that provide GIFT-Cloud or XNAT compatibility can also be used to download data, for example GIFT-Proto (see application-specific documentation).

6 Uploading data

You can add new data to GIFT-Cloud using GIFT-Cloud Uploader. You can install this software from the GIFT-Cloud server. Once installed you can run it on your computer to upload data.

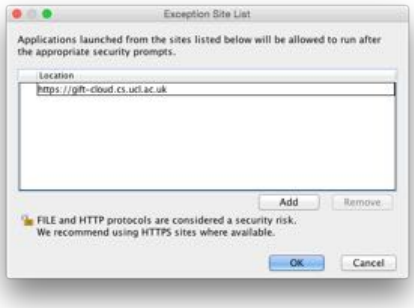
GIFT-Cloud Uploader supports the following methods for uploading:

- Anonymise and upload multiple datasets from your local machine, network drive, USB stick, DVD etc.
- Act as a Dicom listening node, and automatically anonymise and upload data pushed to your machine
- Manually query multiple datasets from a PACS or other Dicom-compatible service, then retrieve, anonymise and upload the data.

Installing GIFT-Cloud Uploader

GIFT-Cloud Uploader is a cross-platform Java webstart application.

- Install Java if is not already installed.
- Open the **Java Control Panel**
  - *Mac OSX: System Preferences > Java*
  - *Windows XP: Start > Control Panel > Java*
  - *Windows 7: Start > Control Panel, then enter Java Control Panel in the **Control Panel Search***
  - *Windows 8: search for Java Control Panel*
- Under **Security**, edit the **Java Exception Site List** and add https://gift-cloud.cs.ucl.ac.uk



- In a web browser, go to the GIFT-Cloud website https://gift-cloud.cs.ucl.ac.uk and log in.
- Click “Upload” from the top bar of any webpage.
- If GIFT-Cloud Uploader does not download automatically, click the direct download link as instructed.

- If GIFT-Cloud Uploader does not start automatically, check your **Downloads** folder and launch the webstart.jnlp file there.

Running GIFT-Cloud Uploader

Once installed, you can run GIFT-Cloud Uploader by launching the webstart.jnlp file that was downloaded.

You may get a certificate warning similar to that shown here:

This is normal because GIFT-Cloud uses a self-signed certificate. Click **Continue**.

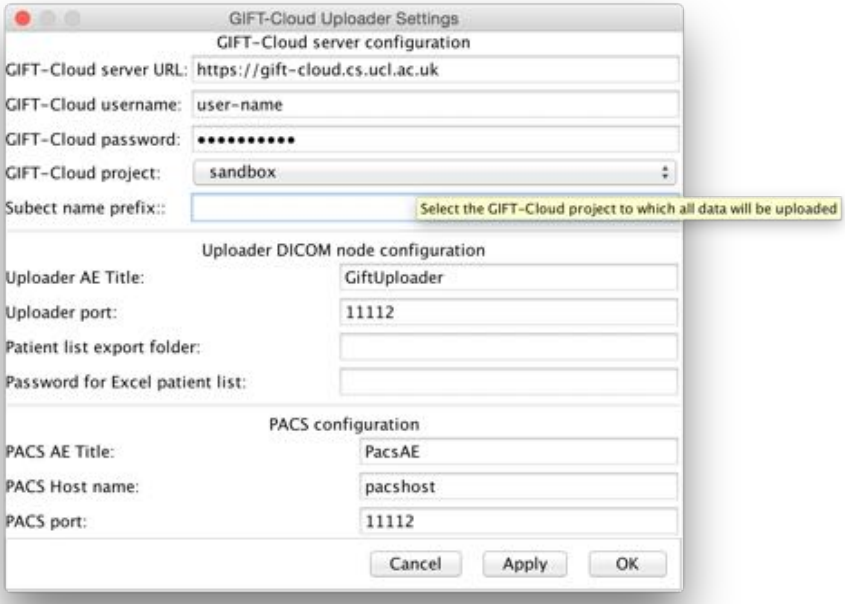
GIFT-Cloud Uploader will automatically update to a new version when available.

When the Uploader launches it will show the main window.

Before you upload any data you will need to configure the Uploader by modifying the settings – see the following section.

Configure the GIFT-Cloud Uploader

Click **Settings** to open the configuration dialog:



- Enter your GIFT-Cloud username and password.
- Click **Apply** – this will log into the server.
- Select a project from the GIFT-Cloud Project list. This is the project to which your data will be added.

    *NOTE: the project list will not appear until the login has been successful. If you enter the wrong username/password, correct it and click **Apply** again.*

- If you want the Uploader on your machine to act as a Dicom node, so that you can push data to it from another Dicom program or PACS, and that data will be automatically anonymised and uploaded, then set the **Uploader AE Title** and **Uploader port**.

    NOTE: please configure your machine's firewall to open the port you specify. The standard Dicom port is 11112. This port is not normally open by default. If you are pushing data from a different network, you will also need to ensure your network firewall allows this.

- If you want to be able to query/retrieve data from PACS or another Dicom-compatible program, set the values of the PACS server in the **PACS configuration** section.

Saving a patient list

You can configure GIFT-Cloud Uploader to automatically maintain an Excel patient list on your local machine. This list remains on the local network and does not get uploaded to the GIFT-Cloud server. The patient list contains the patient names, PACS IDs and GIFT-Cloud anonymisation identifiers for patients uploaded on this machine.

To automatically save a patient list as an Excel file, fill in a folder under **Patient list export folder**. To turn off patient list saving, leave this blank.

If you wish the Excel file to be password-protected, enter the password under **Password for Excel patient list**. To turn off the password, leave this blank.

Troubleshooting

If you have problems using GIFT-Cloud Uploader, please check the following:

- Your machine's IP address (or your site's IP netblock) must be added to the GIFT-Cloud whitelist by the GIFT-Cloud administrators (see above);
- Your firewall must be configured to allow https internet communication with the GIFT-Cloud server;
- Your firewall must be configured to allow communication on the port you have specified, if you are using the Dicom listening service;
- The local machine must have Java installed, minimum version 1.6 (later versions preferable);
- You must add the GIFT-Cloud server URL to the Java Exception Site List (see above);
- Your machine must be configured to permit the running of the Java webstart application;
- In some cases, restarting the GIFT-Cloud Uploader webstart application may fix server communication issues.

7 Configuring the GIFT-Cloud server

This section is for GIFT-Cloud server administrators, or for users who wish to set up their own GIFT-Cloud server.

Installation

GIFT-Cloud uses a custom fork of the xnat_builder codebase. You will need to install XNAT according to the standard instructions, but use this codebase instead of the default XNAT codebase.

Firewall

The GIFT-Cloud server firewall 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.

8 Confidentiality of clinical data

XNAT is used to securely host clinical research data at many institutions worldwide [3]. In addition to GIFT-Cloud, 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 at UCL is 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 KUL 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.

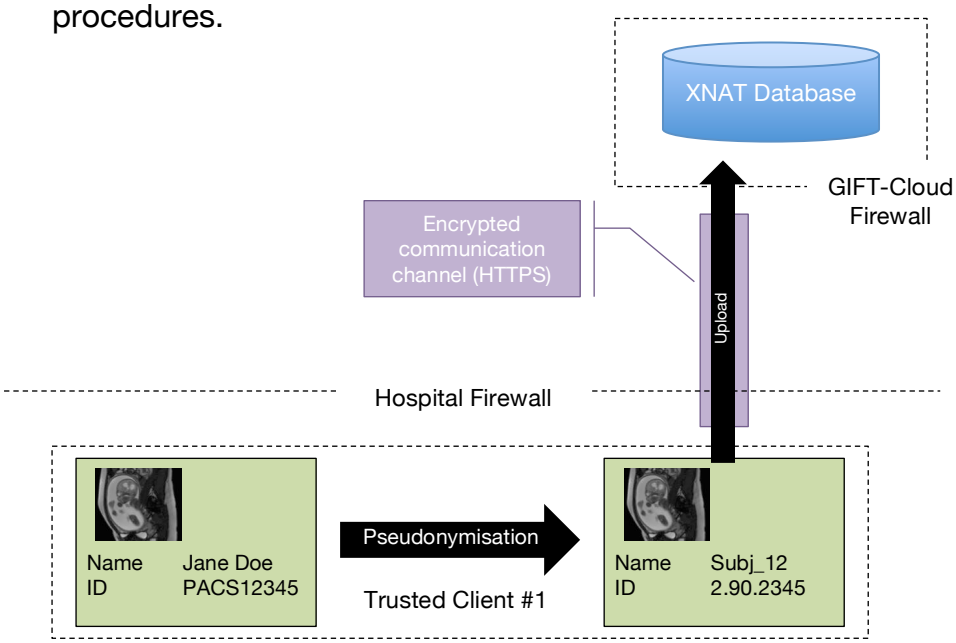


Figure 1: Data upload. Every PID is anonymised **on the client, prior to upload**. This ensures that the server does not store any sensitive information that could lead to patient identification.

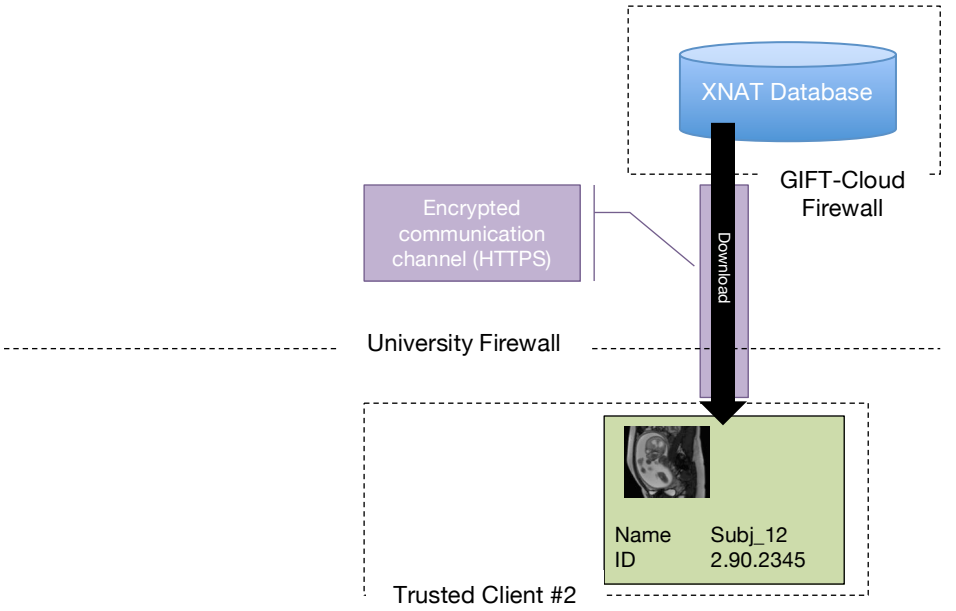


Figure 2: Data downloaded by researcher in a collaborating academic institution. The researcher **has no access to PID**, but rather only to **pseudonymised identifiers.**

9 References

[1] Translational Imaging Group http://cmictig.cs.ucl.ac.uk
[2] XNAT Open Source Imaging Informatics Platform, Neuroinformatics Research Group at Washington University, USA http://xnat.org
[3] XNAT implementations around the world, http://xnat.org/about/xnat-implementations.php
[4] CMIC-XNAT Server. https://cmic-xnat.cs.ucl.ac.uk
[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
[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

10 Contact details

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