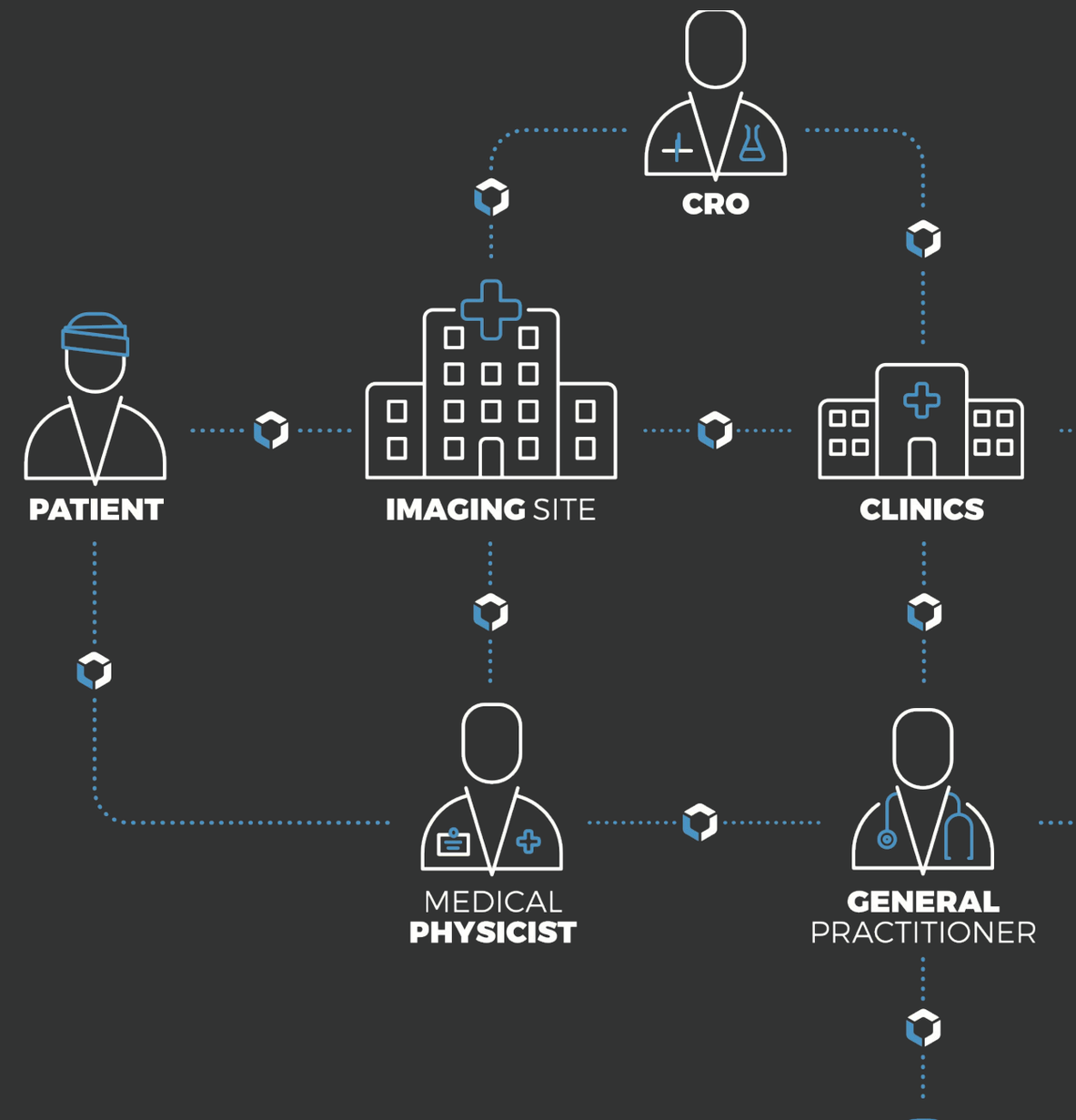
ORTHANC

Looking back through the palantír



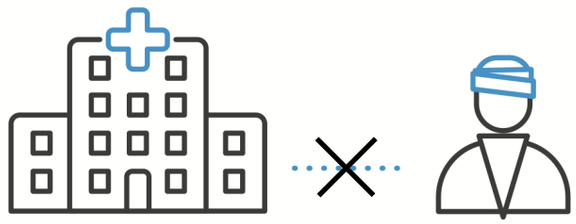
2011: Inception

“We want to make use of our medical images by ourselves”

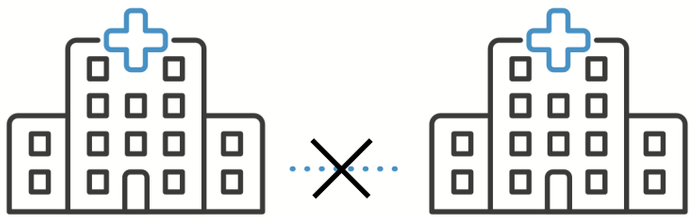
Lesson: Accessing/sharing images is painful

inside hospitals

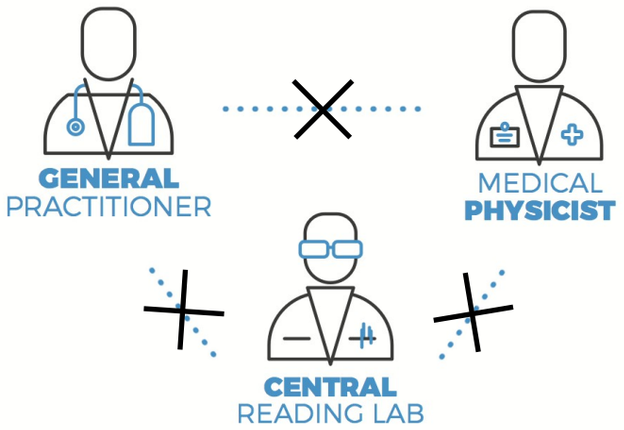
hospitals to patients



between hospitals



among skilled workers



The real-world difficulties

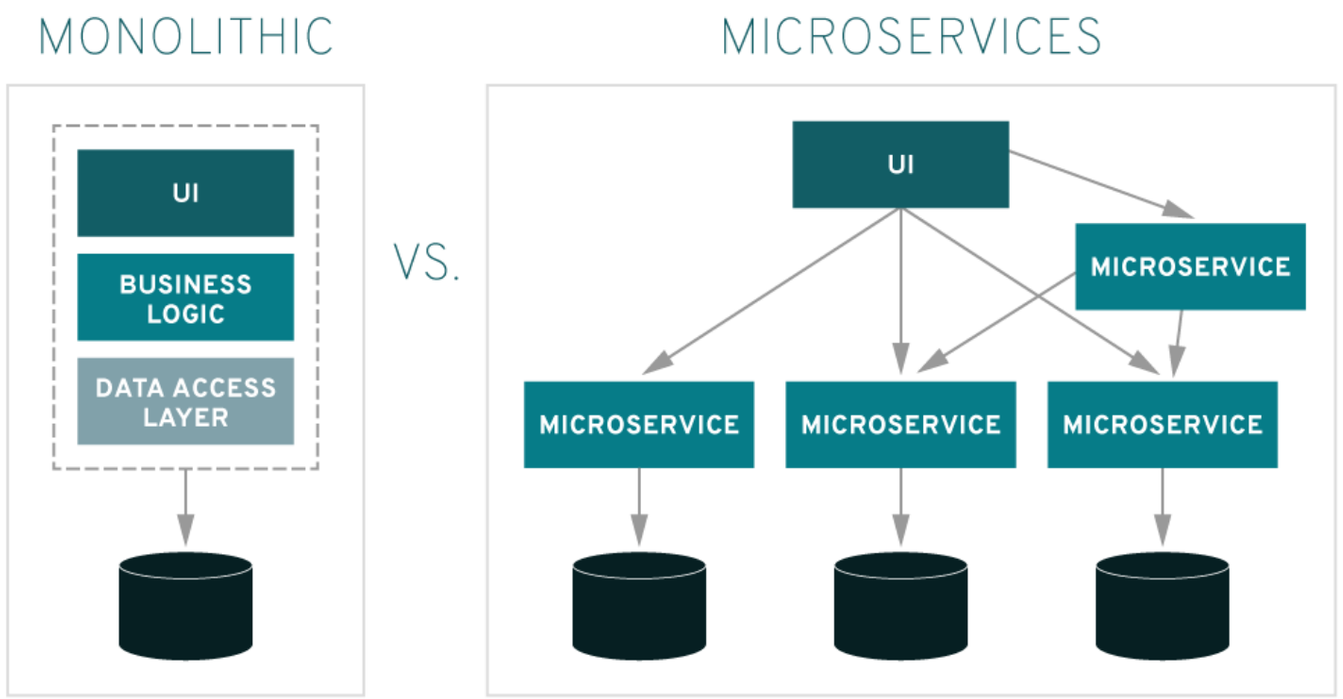
Access, specialized software

Interoperability, lock-in

Automation, exchanges

Each hospital in the world redevelops its own scripts:
Huge cost inefficiency for public health systems!

Basic idea behind Orthanc



+

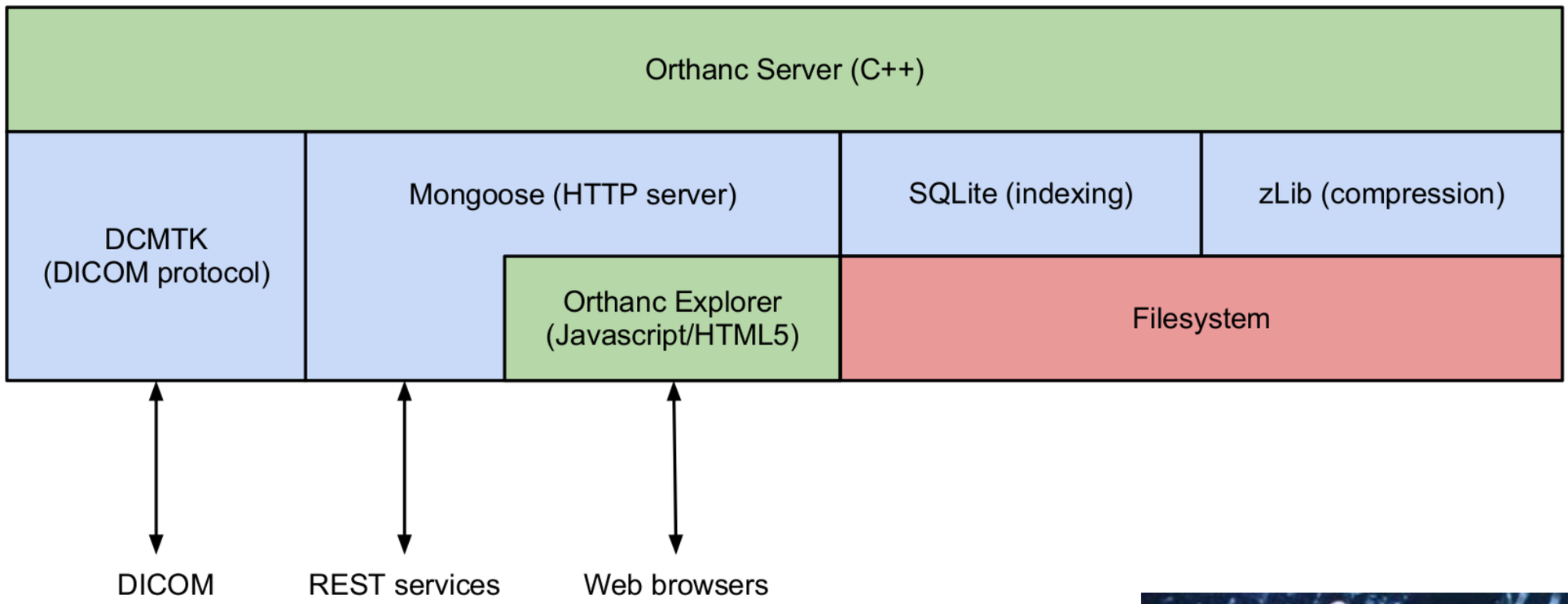
DICOM℠
Digital Imaging and Communications in Medicine

*"Let's create a **microservice (SOA)** for medical imaging that leverages the worldwide **DICOM open standard**!"*

*"Let's release it as **free software (GPL)**, as it is our responsibility as a University to **share knowledge** and to **foster innovation**!"*

July 2012: Palantír is released!

First free DICOM server with REST that starts “out-of-the-box”



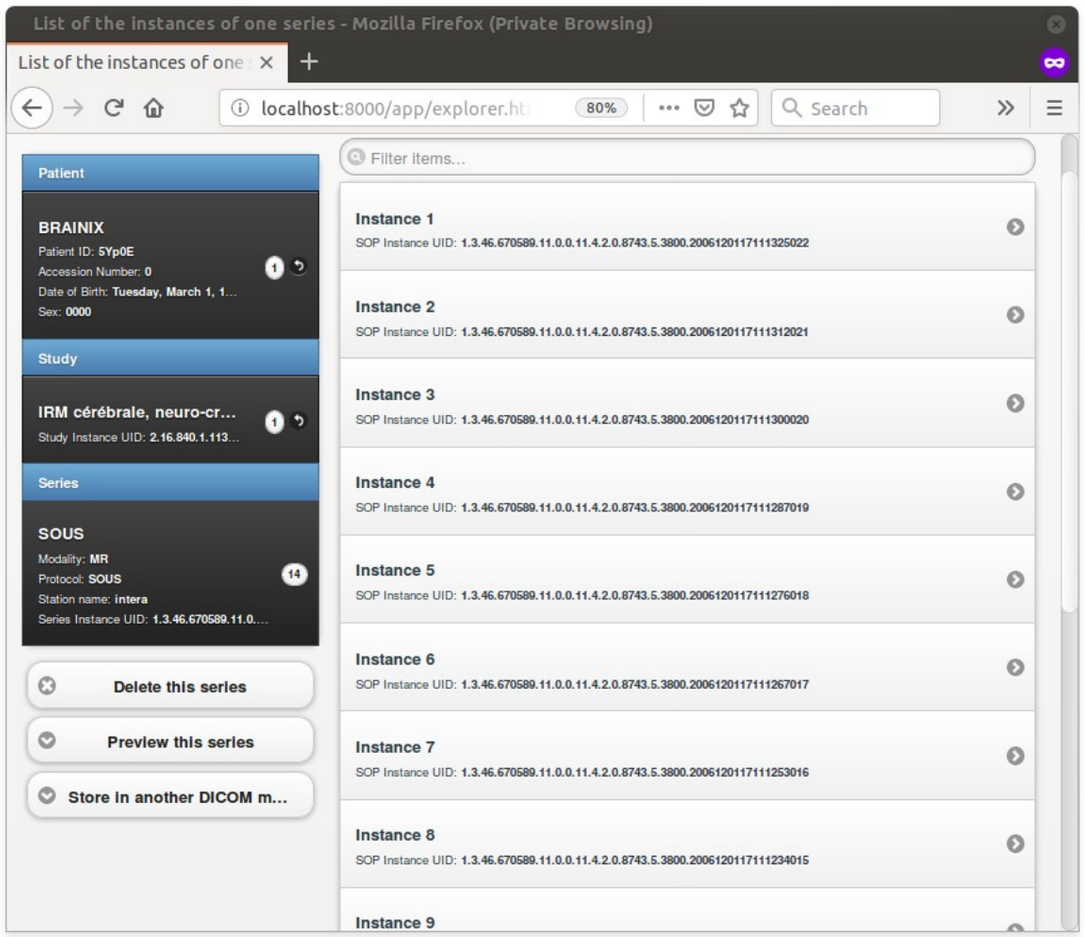
What is a “Palantír”?
“Crystal ball, used for seeing events in other parts of the world”

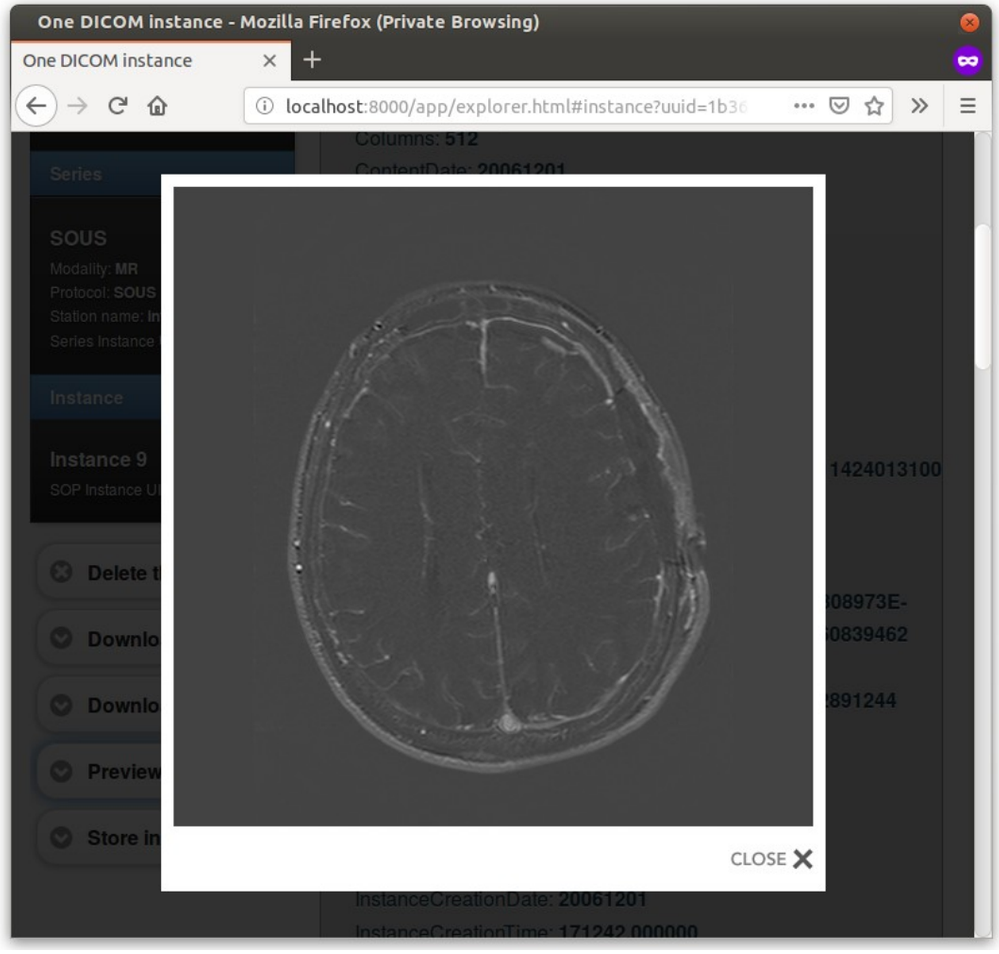
September 2012: “Orthanc” and the logo contest

Orthanc contains the RTH (radiotherapy) trigram,
while being the tower holding one of the seven palantíri

Winner: Benjamin Golinvaux!
(new logo: 2016)

The first Orthanc Explorer interface





Basically looks the same as nowadays!

Automated routing = still the main use at CHU Liège

University Hospital of Liège:
>300 modalities

PACS manager

Partner
(VPN, SFTP, CD)

Specialized server
(DICOM)

Clinical study
(SFTP)

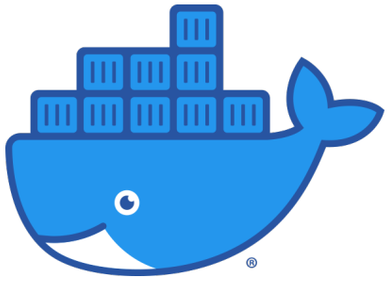
Orthanc in the hospital: Ancillary mini-PACS

- Focused on simplicity and portability
- Built-in support of Web technologies
- Programmable by external scripts
- Industrial grade
- Libre software (GPL)

Lightweight

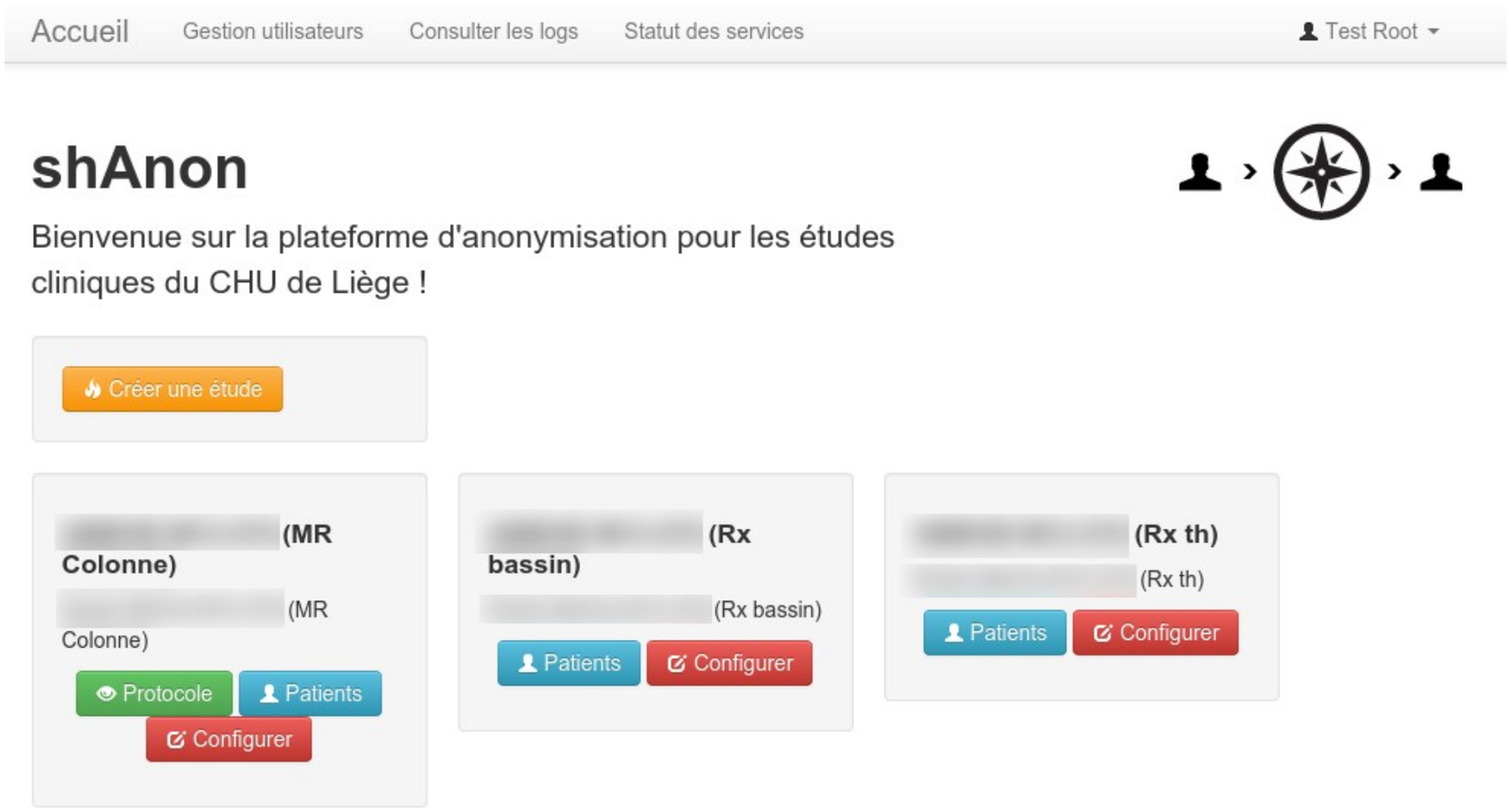
Rest API

debian



Docker (2015)

January 2013: Anonymization and ZIP



shAnon is a tool built on Orthanc to send anonymized images outside of CHU Liège for **pharmaceutical studies** (still in use)

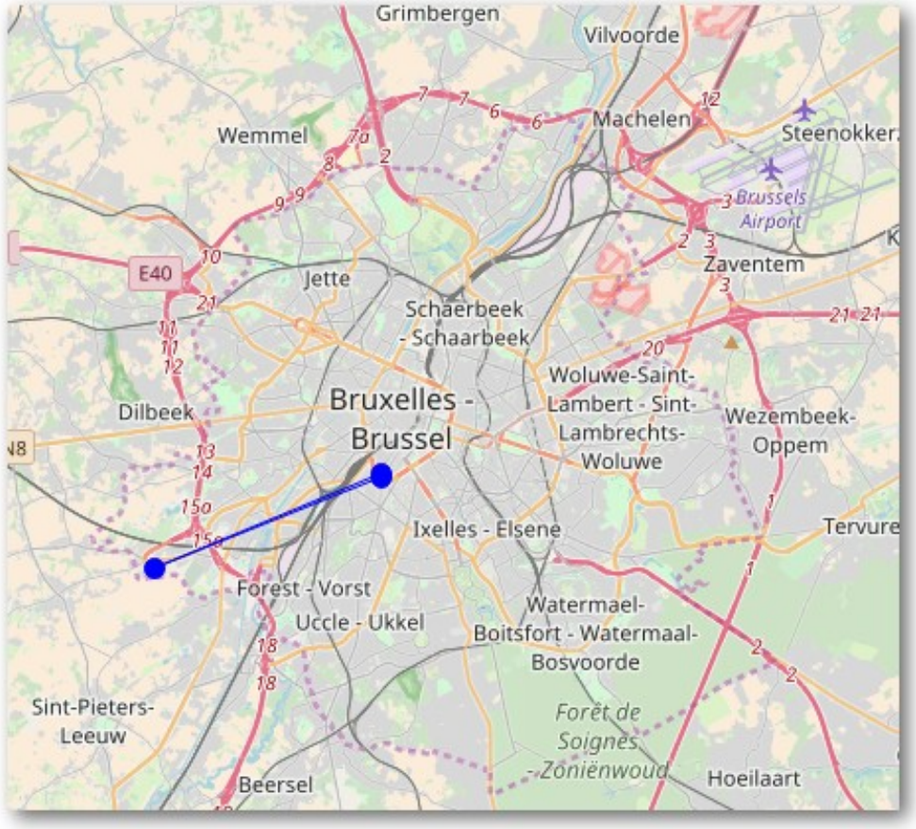
June 2013: Orthanc peers

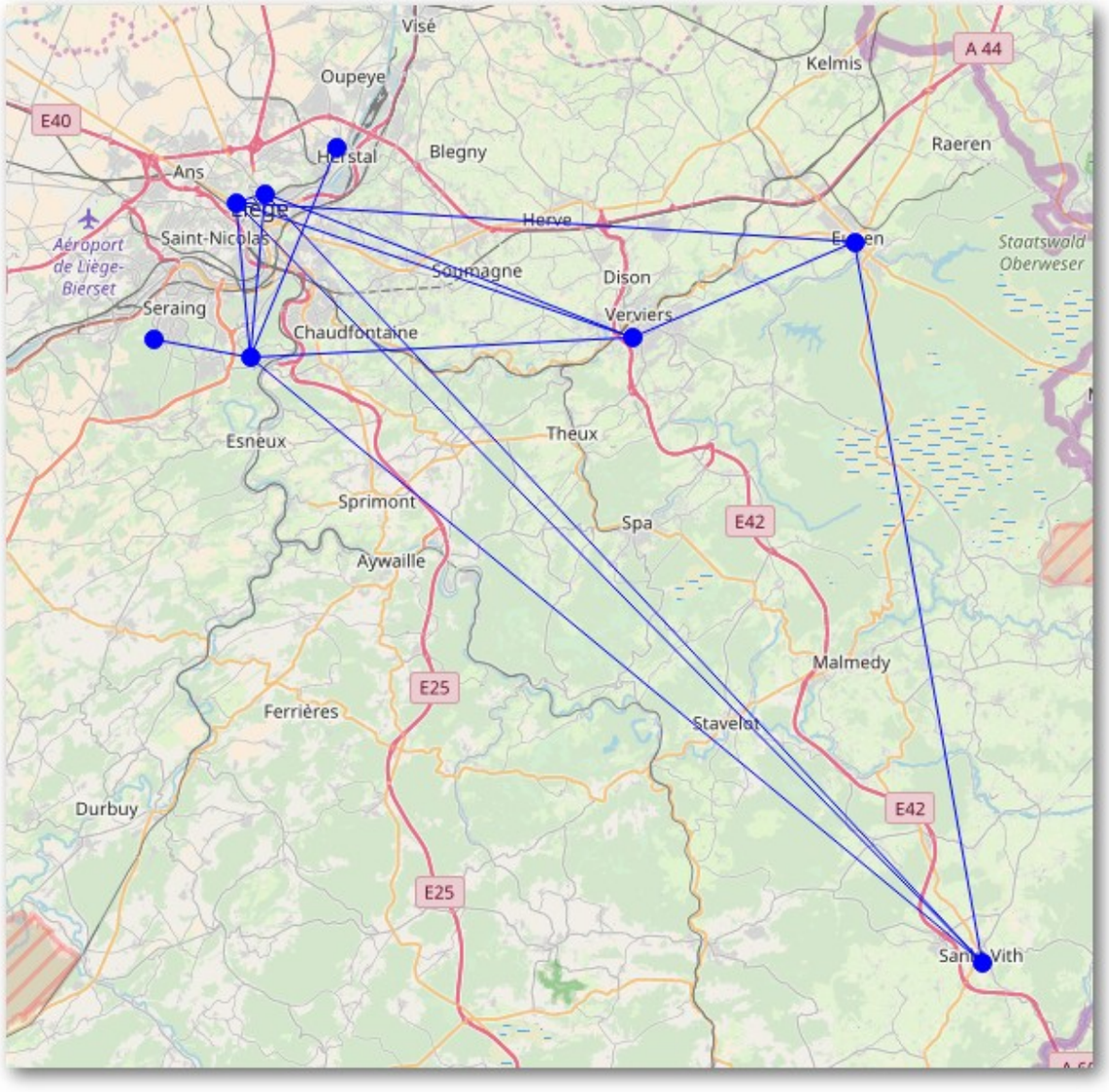
Exchanging DICOM images between two Orthanc servers
through HTTPS (over Internet), instead of DICOM (for Intranet)

Oncology, continuity of care, rationalization of studies, ionizing radiations, clinical research...

The “Interhosp” network nowadays

Initiated and still maintained by CHU Liège.
Installations in other hospitals are done by Osimis (see later).



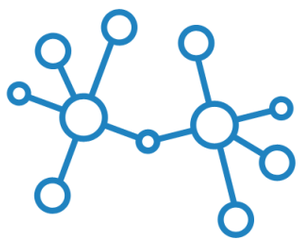


October 2013: Orthanc becomes a VNA

Picture archiving and communication system (PACS)

Vendor neutral archive (VNA)

Storage



Network

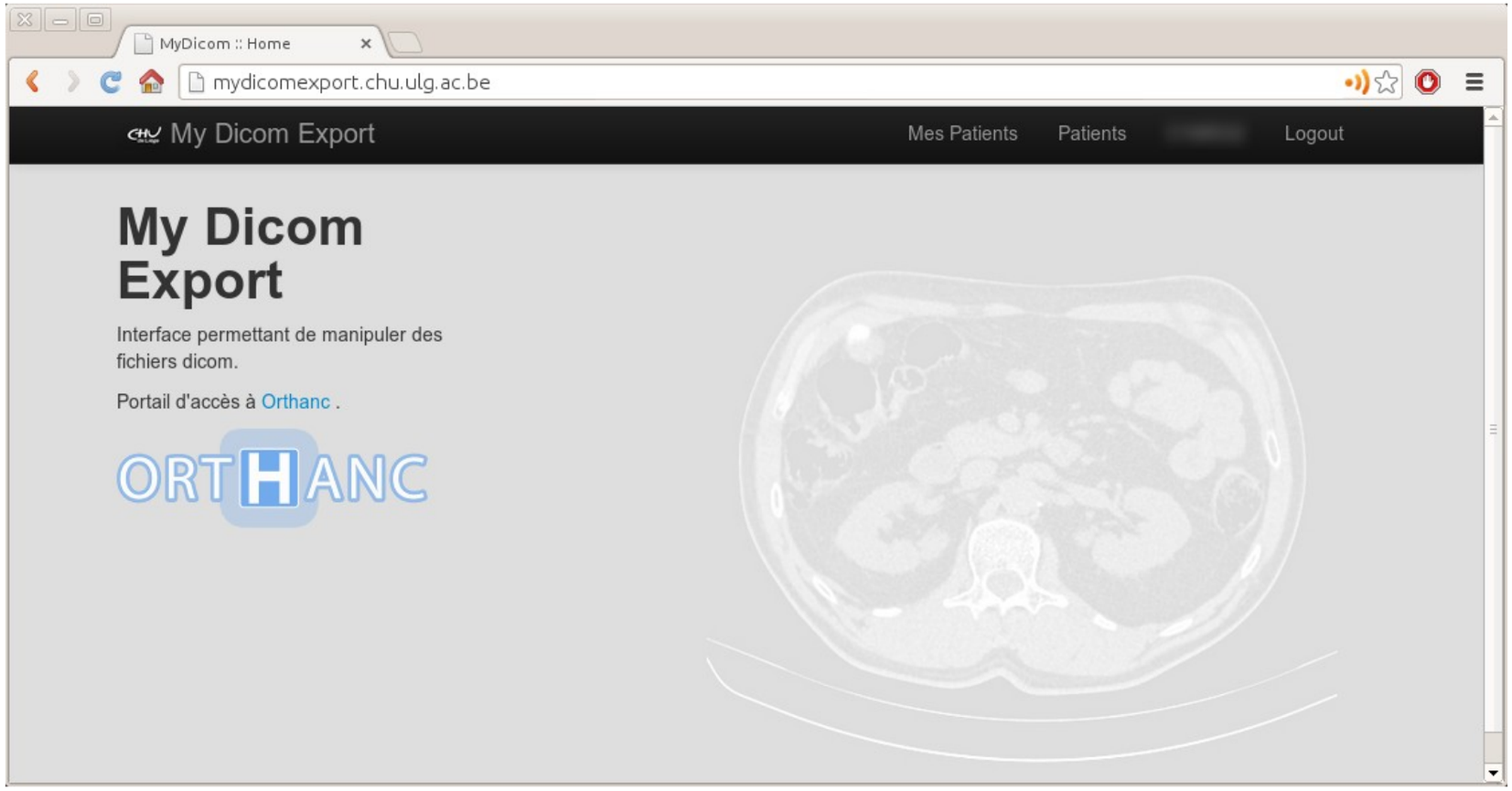
DICOM query/retrieve
to remote servers
is now supported!

Viewer

RIS

Transcoding

Downloading images from the PACS

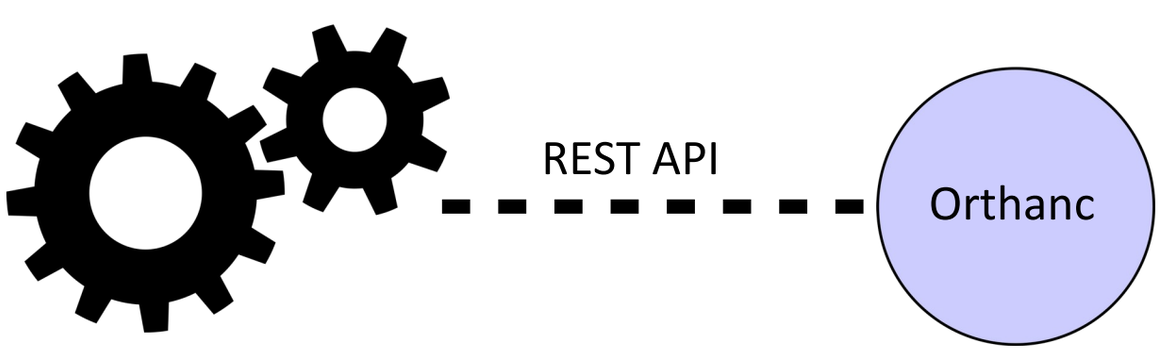


Academic uses at CHU Liège:

Teaching, research and quality control

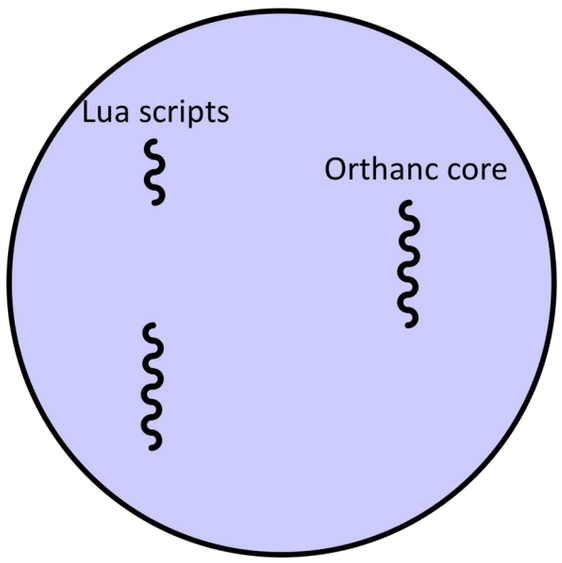
July 2014: Lua scripts can route images

External script in Python, Java, bash...



2 processes

Embedded script can call the full REST API

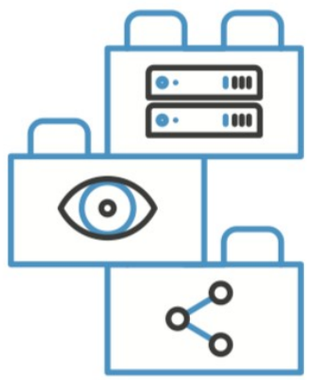


1 process, simple language: easy to develop and synchronize

Highly popular feature of Orthanc

Fall 2014: Orthanc plugins

- Extend the Orthanc core with **shared libraries** (1 single process)
- Plugins are developed in **C or C++**
- Features:
  - Add routes to the REST API → new Web applications
  - Triggers on events
  - Custom storage engines
  - Fine-grained authorization
  - Decoders for images (JPEG2000)



Extensible

External applications **Imaging modalities**

REST API

DICOM protocol

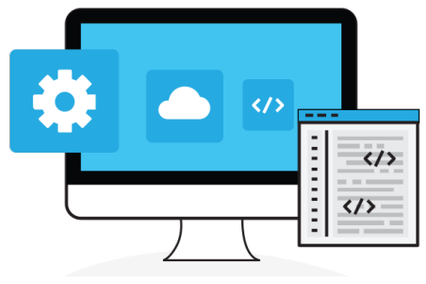
Orthanc process

Lua scripts

```
function OnStoredInstance(instanceId, tags, metadata)
  Delete(SendToModality(instanceId, 'pacs'))
end
```

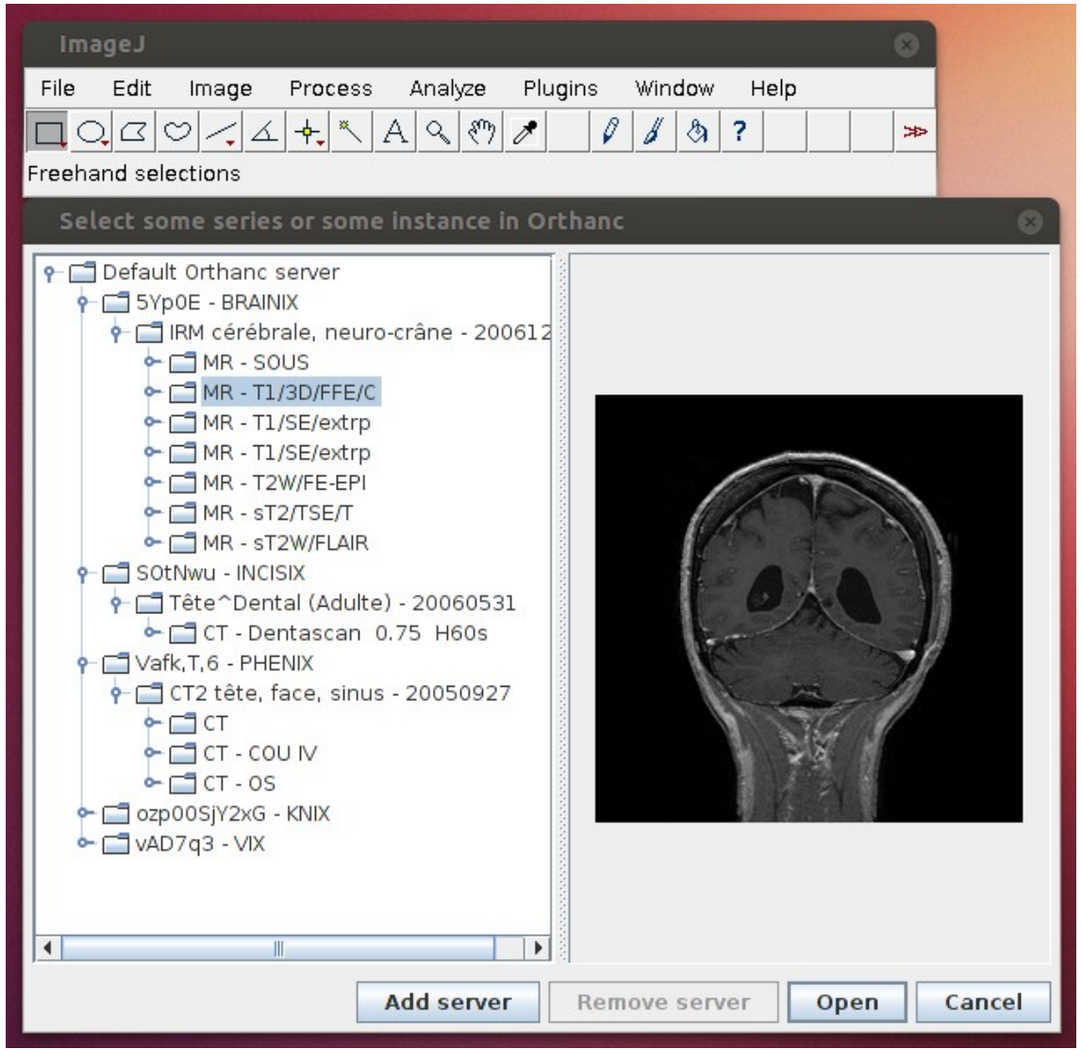
Plugin SDK

Storage plugins
(default: filesystem and SQLite)



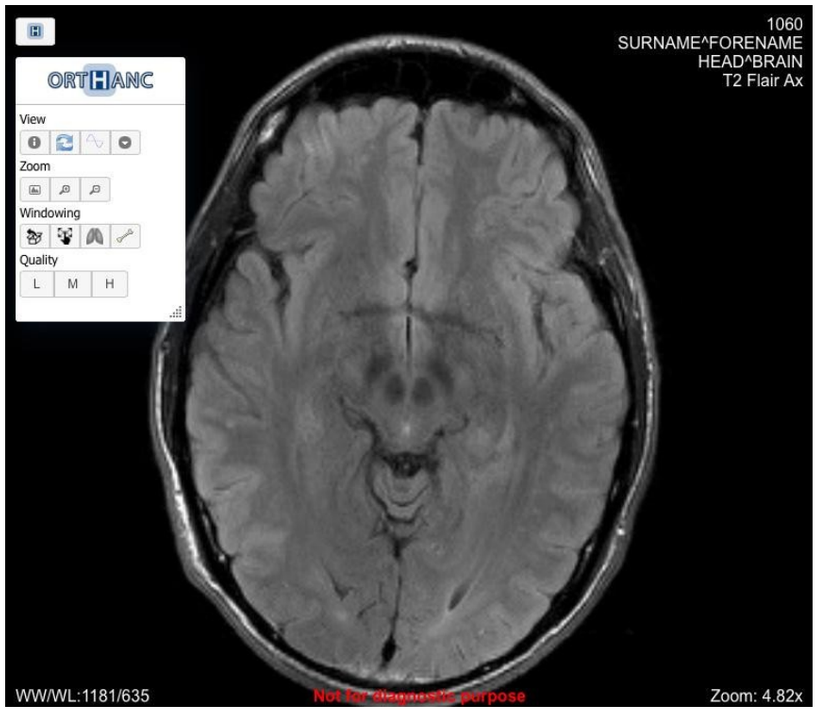
Web applications
(extended REST API)

December 2014: Interfacing with ImageJ

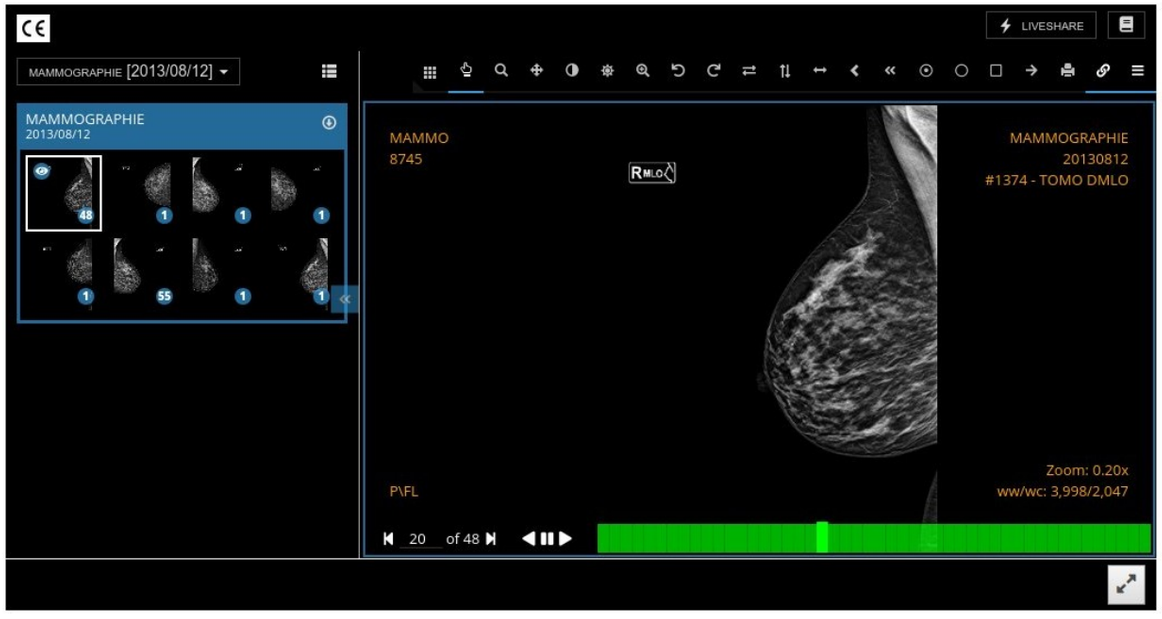


Quality control and clinical research on PET and MRI (through the REST API)

February 2015: Web viewer plugin



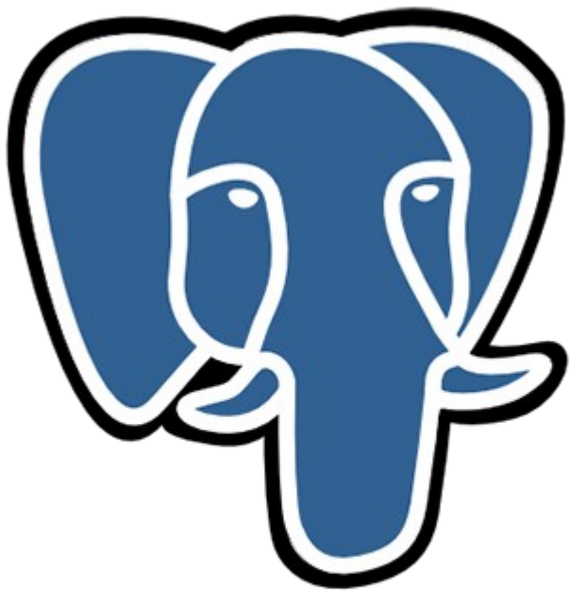
Original Orthanc Web viewer (single-series)



Advanced Web viewer by Osimis (muti-series with measure tools and **CE marking**, since January 2016)

For teleradiology applications

February 2015: PostgreSQL plugin



PostgreSQL

Thanks to the professional PostgreSQL database, Orthanc is being used in production in hospitals with more than **15TB of data**, 125,000 studies and around 50 millions of instances.

Orthanc becomes a high-capacity VNA

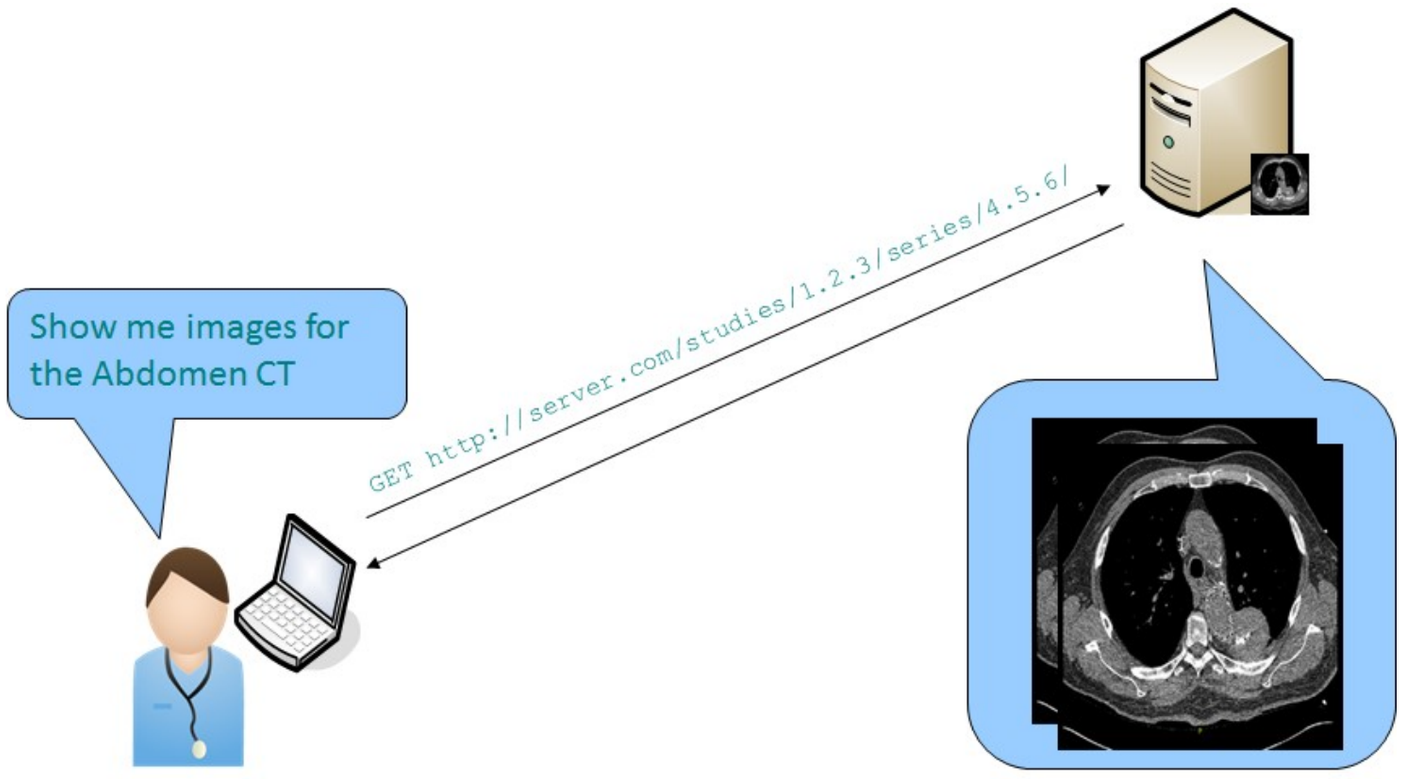
March 2015: Award for the Advancement of Free Software

FREE SOFTWARE FOUNDATION

Huge boost in the visibility of the Orthanc project

August 2015: DICOMweb plugin

- The future of DICOM
- Standardized access to medical images over Internet
- Actively pushed by major companies (Google, NVIDIA, Agfa…)
- REST API of Orthanc is more general, as it allows full programmatic access
- Orthanc proposed the first reference FOSS implementation of DICOMweb



September 2015: Founding of Osimis

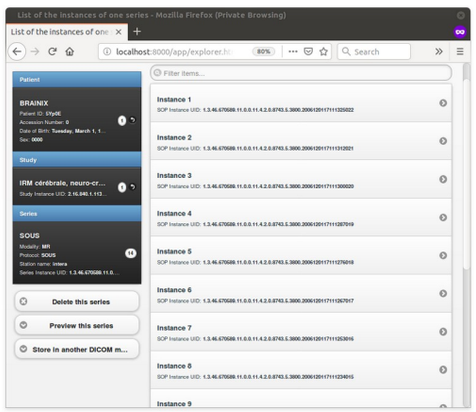
OSIMIS

IMAGING • RE-WIRED

First spin-off of University Hospital of Liège (2015)

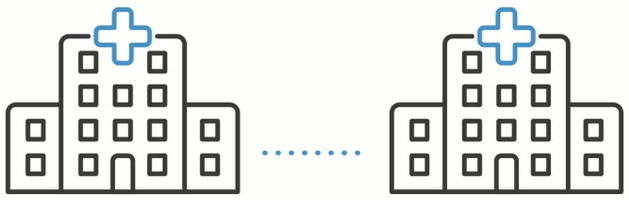
Business model

Free software
Academic use



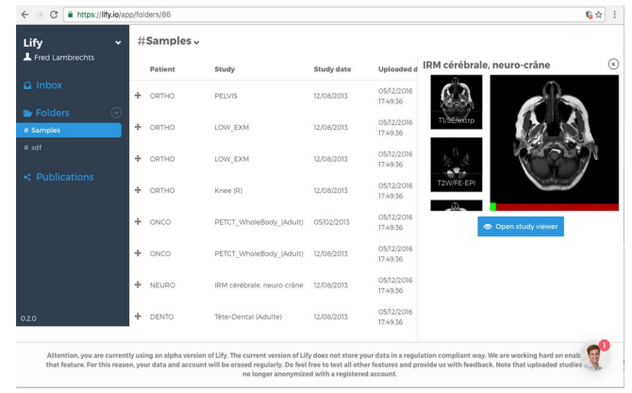
Community

Expertise in
medical imaging



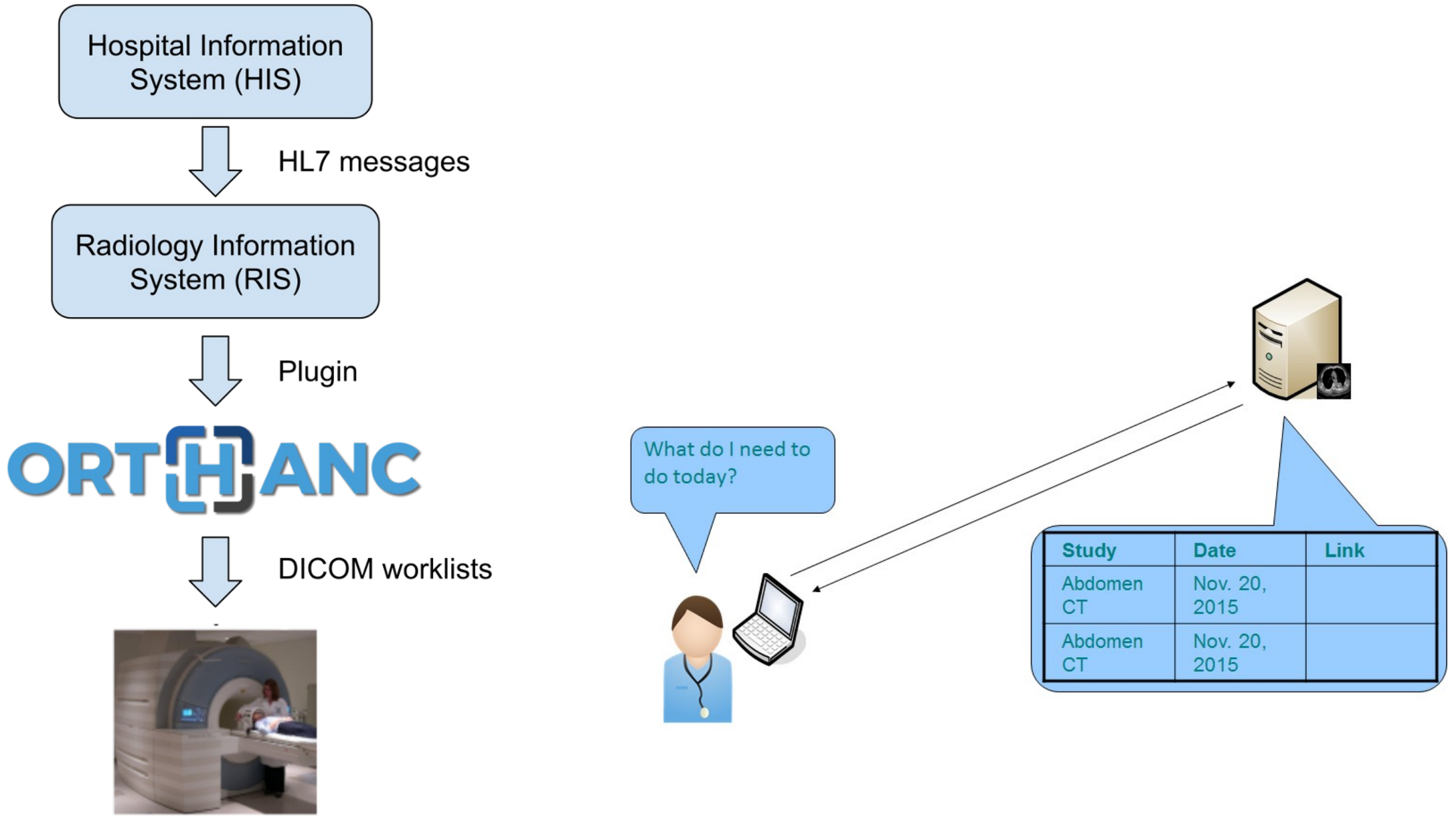
Support services (hospitals)
Custom developments
(industry)

Packaged versions of
Orthanc with integration
services (cloud or on-
premise)



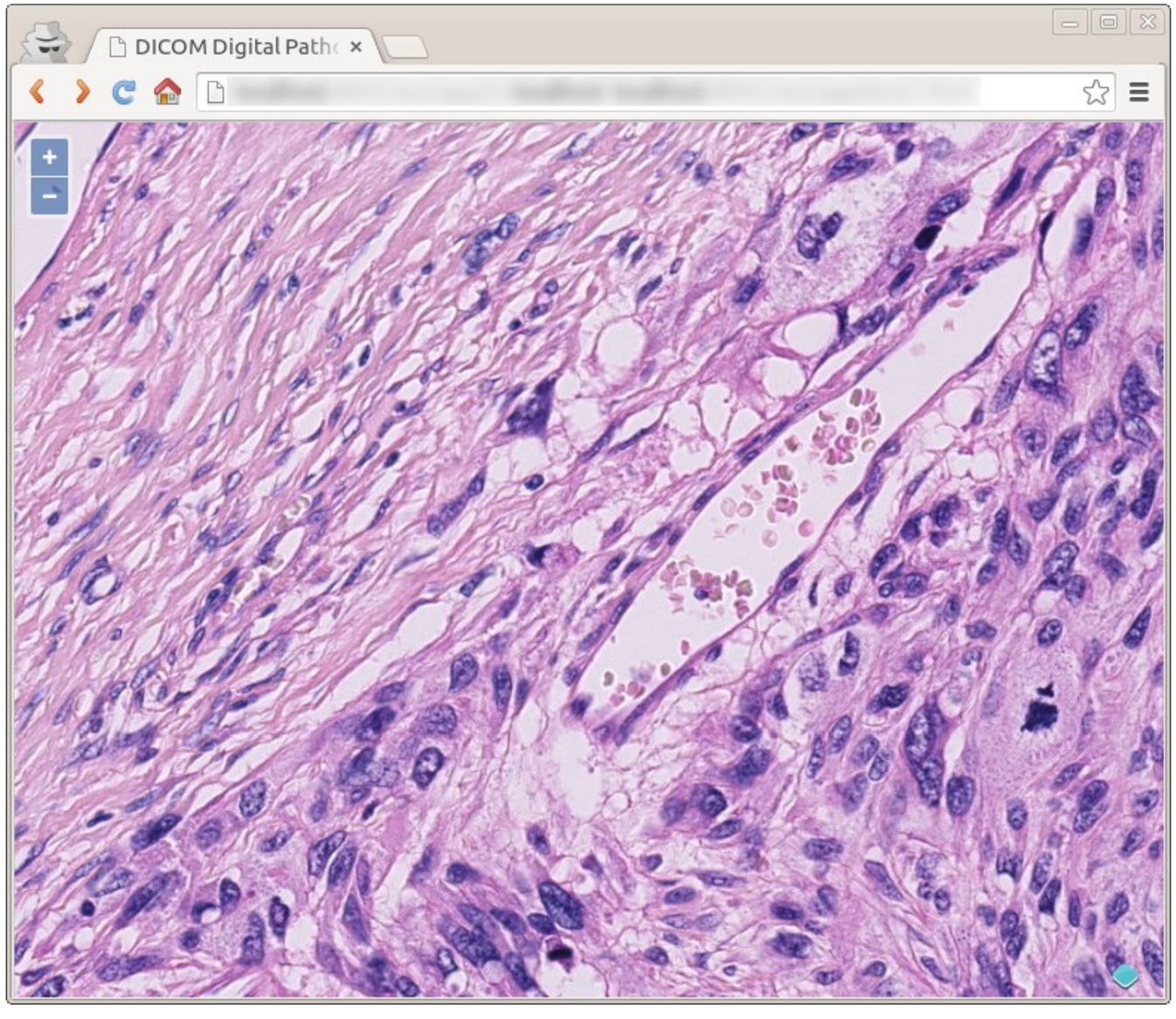
Product for hospitals

December 2015: Stable release (1.0.0) and worklists



Integration with existing RIS through plugins

October 2016: Whole-slide imaging



Encoding and viewing according to the DICOM standard (no annotation, read-only vs. Cytomine)

2016 to 2019: Time of maturity

Many improvements in performance and compatibility

Industrial sponsorship

Jobs engine to control asynchronicity (1.4.x)

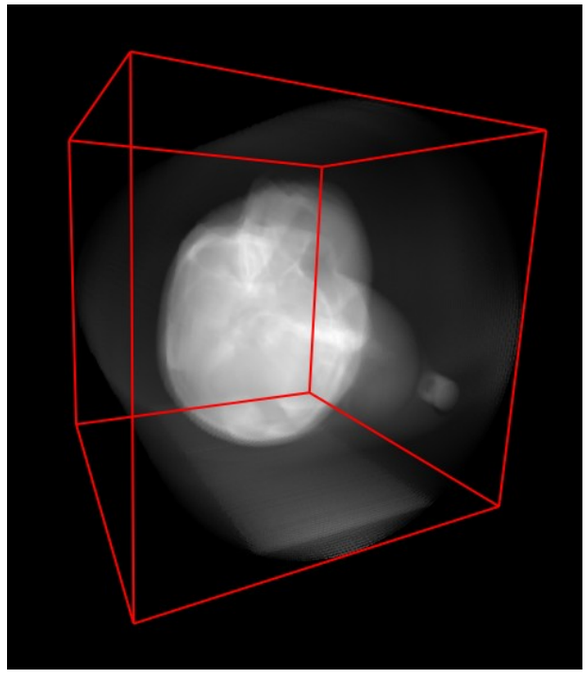
MySQL/MariaDB plugin

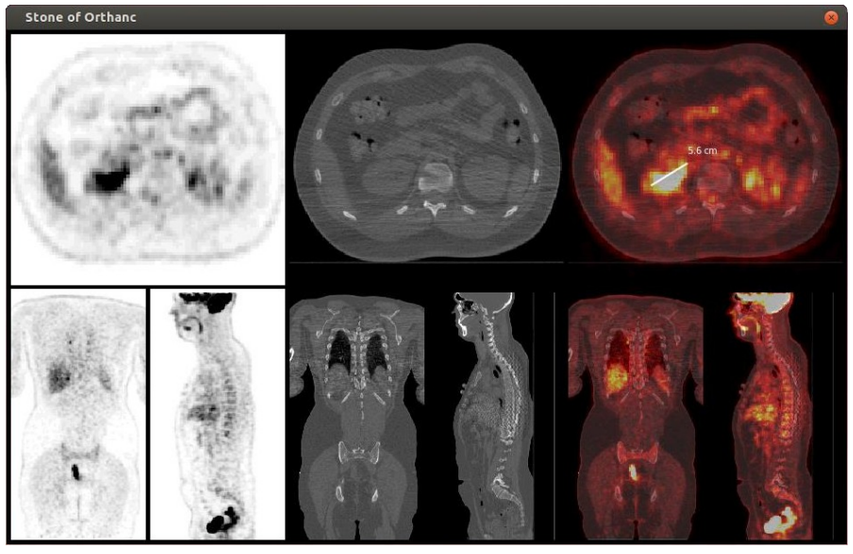
Transfers accelerator plugin

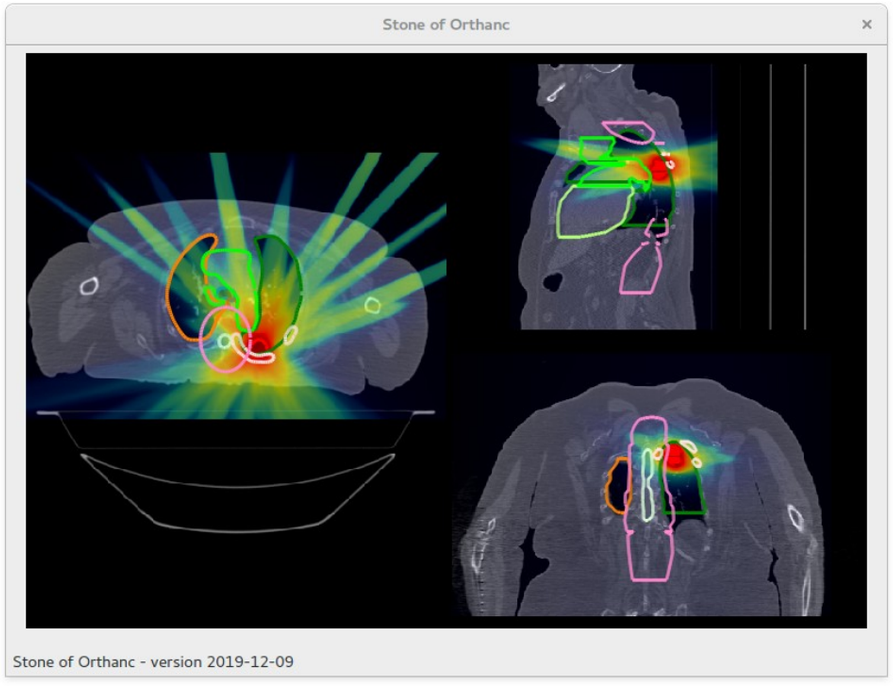
Focus on security (1.5.8)

2016 to 2019: Stone of Orthanc

- Standalone, companion project to Orthanc for **viewers**
- **Lightweight, cross-platform C++ library to render medical images** (cf. VTK)
- **Can be run by Web applications** (WebAssembly)
- 2D hardware acceleration (OpenGL/WebGL)
- Built-in support of 3D coordinates (MPR, volume reslicing)
- Support of oncology: PET-CT fusion, doses, contours…

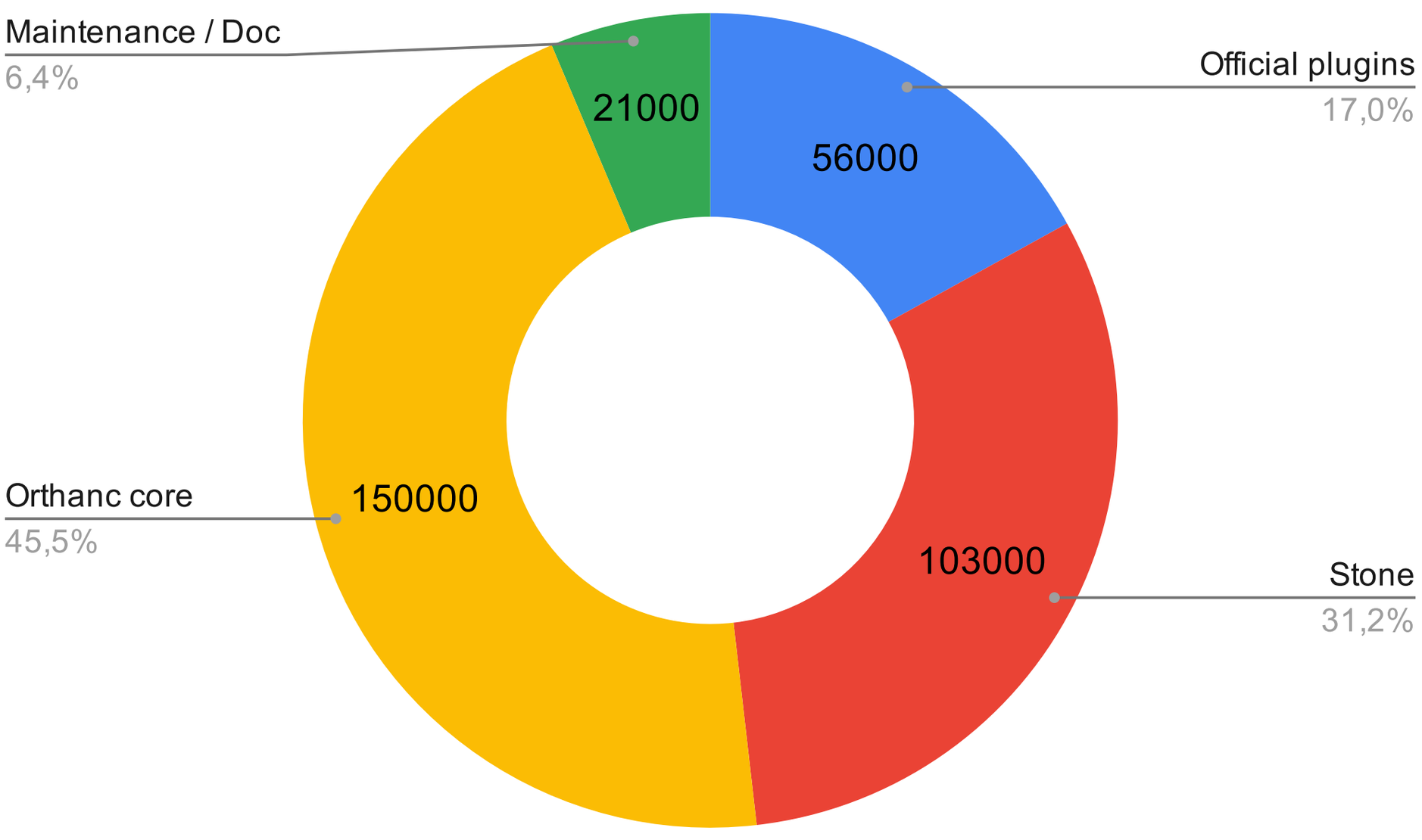






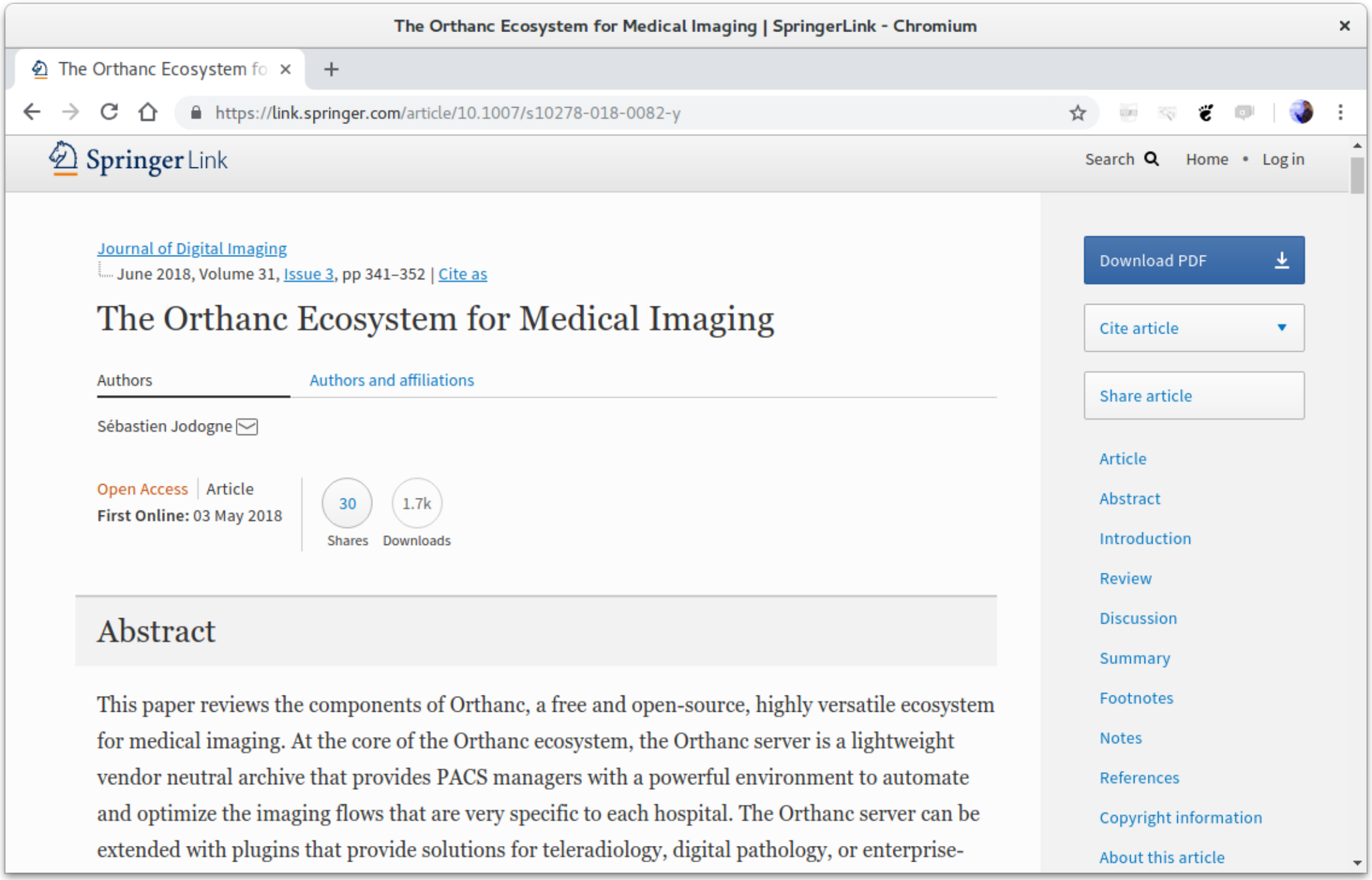
Ultimate goal: Fast development = build a new viewer in a handful of days

December 2019: The size of Orthanc



Total: 330.000 LOC

Reference paper in open access



Exciting news!

Thanks GNU Health!

Thanks Axel Braun!

Thanks Frank and Tobias Scholl!

ORTHANC

Thanks for your attention!