



Grid y Computación
de Altas Prestaciones

GRyCAP

GRID PROTOTYPE TO SUPPORT CANCER OF BREAST DIAGNOSTICS IN CLINIC PRACTICE

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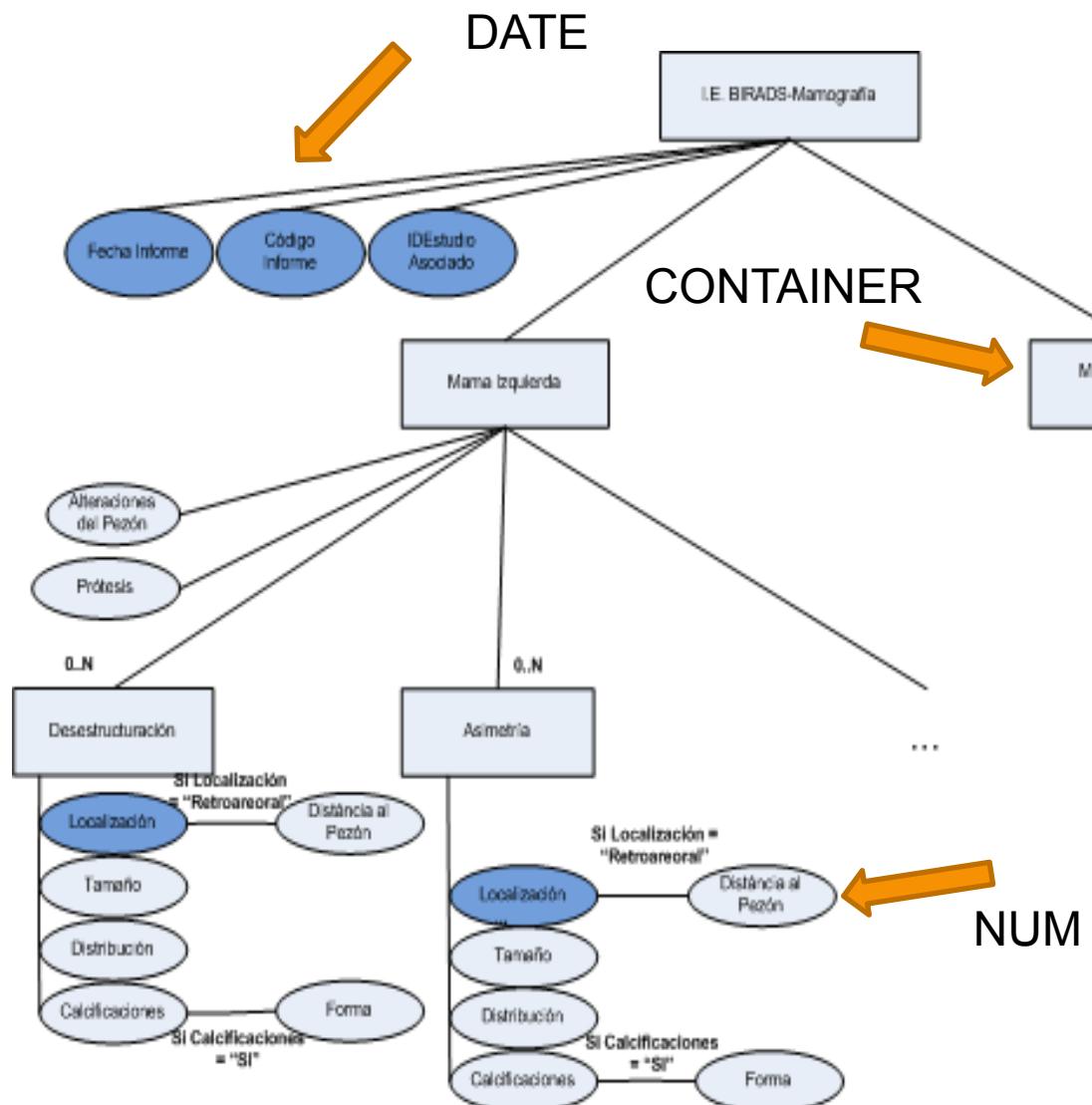
- **Introduction**
- TRENCADIS
- Objectives
- Prototype
 - Deployment
 - Use Cases
 - Web Interface
- Conclusions and Future Works

Introduction

- **DICOM** was created to aid in the distribution, integration and viewing of medical images (mammography, scan, MRI...) in Hospital Systems.
- DICOM has developed new features and now it is also used to manage diagnostic reports (DICOM Structured Reporting - **DICOM-SR**).

Introduction

DICOM-SR Information tree



- Tree based structure

- Unique identifier (Concept Names)

- Types of Nodes (CONTAINER, CODE, NUM, TEXT, DATE, SCOORD, etc...)

NUM

Introduction

- **Structured Reports (DICOM-SR) implicates....**
 - Properly Stored and Coded using Standard Lexicon and Semantics.
 - Fields Agreed by the Community.
 - Links to Images, Audio, Measures and Postprocessing Results.
- **DICOM-SR can be used ...**
 - To index medical images and to perform searches based on diagnostic information.
 - To provide researchers with a knowledge database to compare and consolidate diagnostics in clinical practice.
 - To foster Evidence Based Medicine.

- **Motivation:**

- DICOM-SR reports based on **federated report templates** → Hospitals would be able to share and exploit all their information through computing procedures.
- But it is not enough...

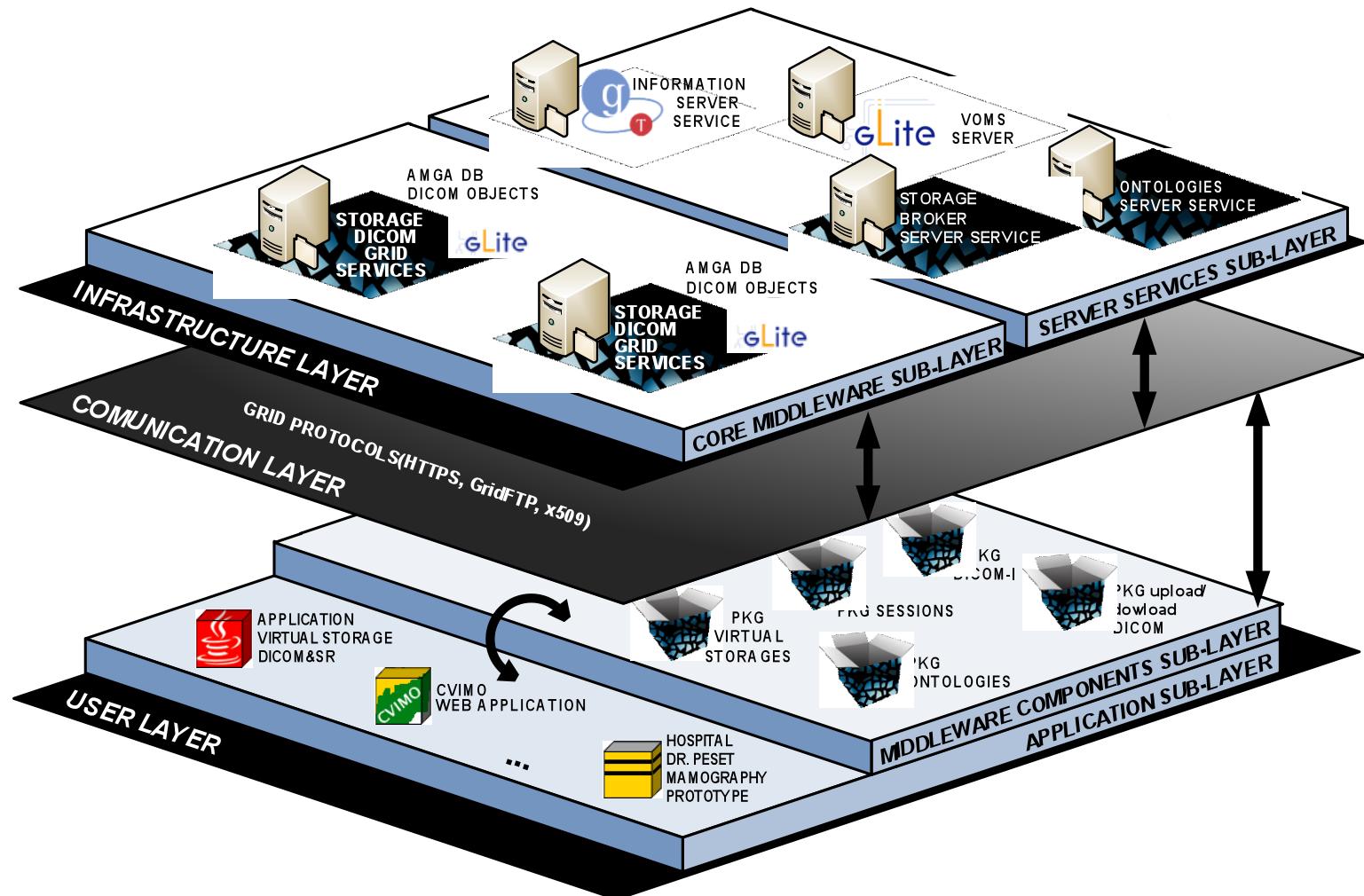
- **Difficulties:**

- **Total Consensus** of all the centres involved in the definition of the federated report templates is nearly impossible.
- **Protocols and systems** used at intra-hospital level are not valid to joint different centres (different administrative domains).
- **Data security** is a key requirement due to the different national regulations and procedures in terms of privacy.

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- **TRENCADIS** (Towards a Grid Environment for Processing and Sharing DICOM Objects).
- The specific objective of **TRENCADIS** is to **share DICOM objects** among different medical centres, including annotation data from DICOM-SR.
- It uses **Standard Components** that can be integrated in existing Grid infrastructures (such as EGI or ES-NGI).
- A test infrastructure of TRENCADIS has been deployed (CVIMO).



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Objectives

- Design a prototype based on **TRENCADIS** able to **federate** DICOM-SR objects among different **centres**.
- Focusing on the **support of breast cancer**.
 - To develop software components needed to store and index DICOM information in the resources.
 - To deploy these resources among the institutions implied (UPV and University Hospital Dr. Peset).
 - To identify the most important use cases that could happen in the proposed prototype.
 - To design an interface accommodated to the identified use cases, easing the structured report data input task.

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Prototype

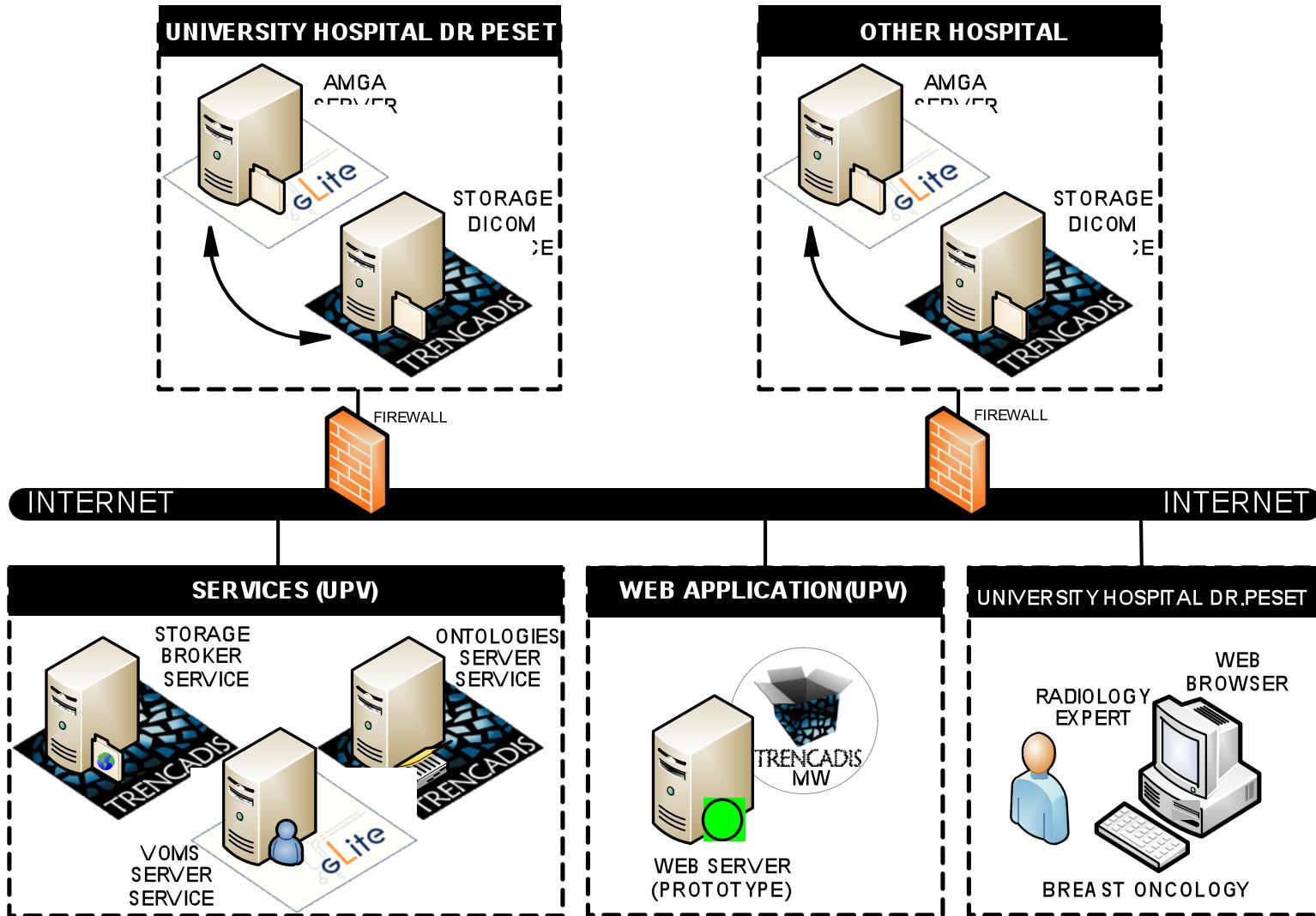
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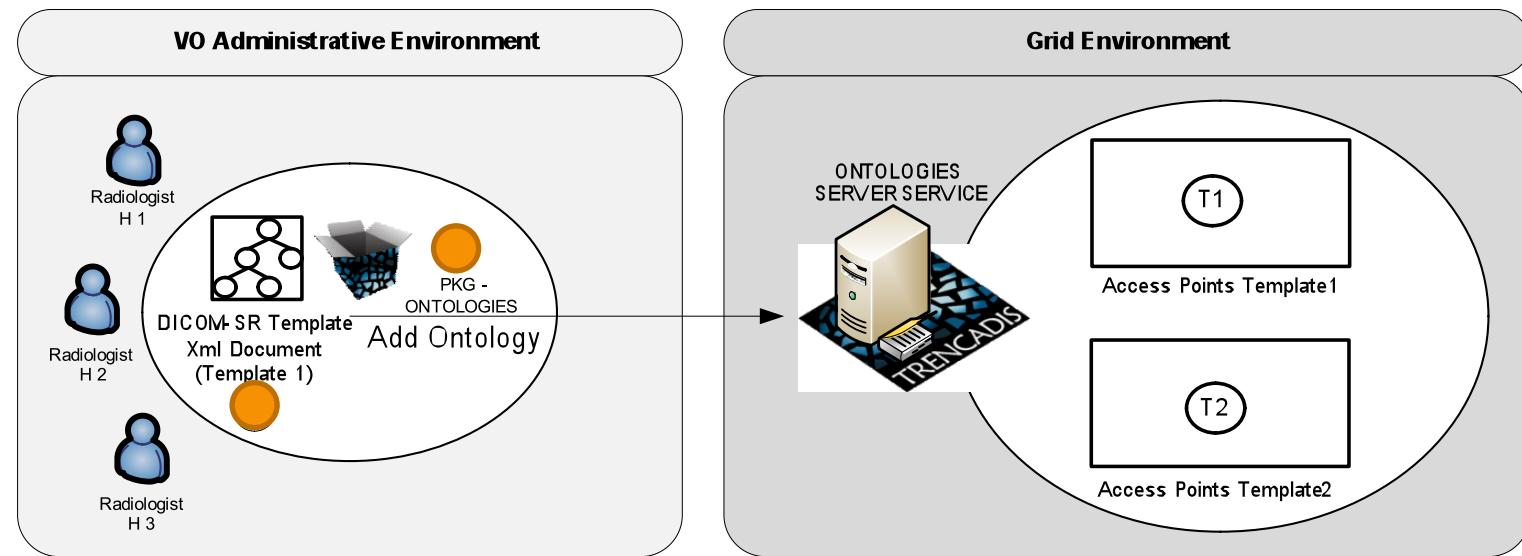
- The prototype manages all the **explorations** for any breast cancer episode (**Diagnostic, Follow-up and Response**).
- In clinic practice, each **episode** has a related set of **explorations** (DICOM Study), and each DICOM Study has one or more DICOM-SR associated.

Prototype - Deployment



Prototype - Use Cases

- Defining Report Templates in the VO

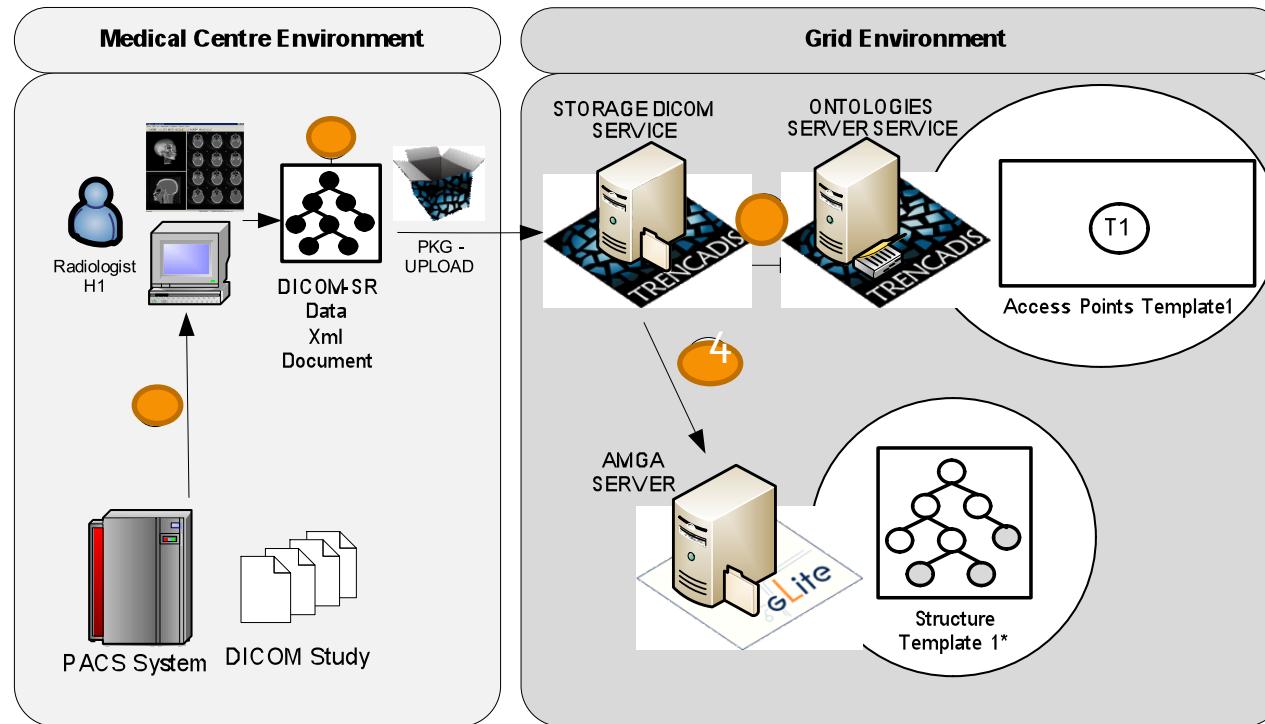


Step1 - Templates are defined by a consensus from all the centres involved.

Step2 - Uploading an XML file with the template definition to the Ontologies Server using Middleware components from PKG-Ontologies.

Prototype - Use Cases

- Interaction: Inserting DICOM-SR data from Medical Centres



Step 1 - A user decides to add a new report to a study of images.

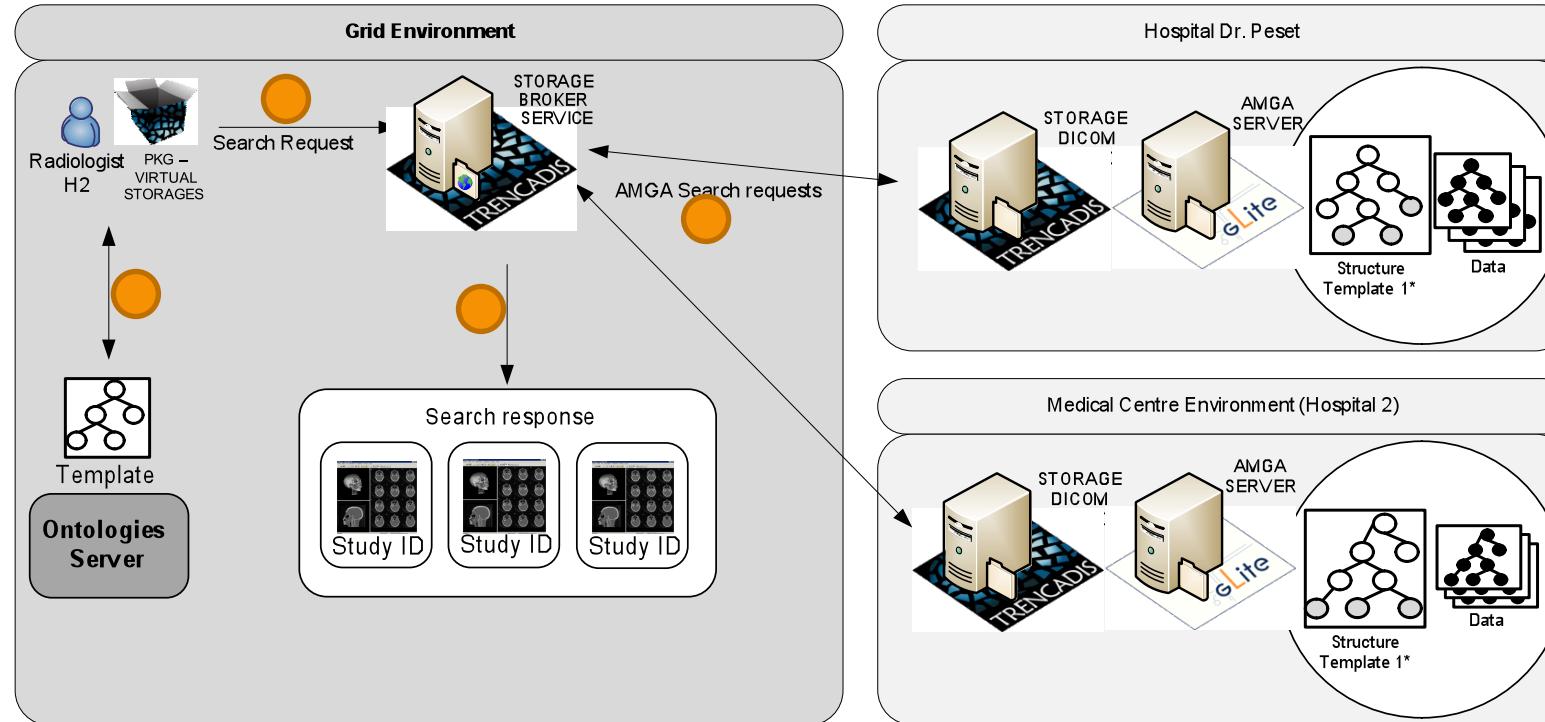
Step 2 - Clinician must choose a report template and introduce data report.

Step 3 - Storage DICOM gets the template from the Ontologies Server.

Step 4 - Document structure fits the template structure and is stored in AMGA Server.

Prototype - Use Cases

- Interaction: Searching DICOM-SR Data



- Step 1 - The user decides to create a query based on a given template.
- Step 2 – The user sends the query to the Storage Broker.
- Step 3 - The query is performed concurrently in all data repositories.
- Step 4 – Mediator joins the results and presents a single result to the user.

Prototype - Web Interface

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- **Use in real clinical practice** → provide a high level of efficiency when managing large amounts of information from various sources.
- Reports must be integrated following the **tree structure** defined in the underlying DICOM Storages Grid Services (AMGA).

Prototype - Web Interface

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- The interface design has implied several interviews
 - A radiology expert user, developers of the Grid middleware and a specialist in design of interfaces have participated.
- The first group of interviews was to gather information for the design of the use cases.
 - Use cases outline the common management tasks needed, the interface requirements and the interactions with the Grid infrastructure through the Middleware Components.

Prototype - Web Interface - Use Cases

- Web Interface : Inserting DICOM-SR data from Medical Centres

The screenshot illustrates the GRyCAP web interface for managing medical imaging reports. On the left, a sidebar titled "Paciente: J. Damian Segrelles Quilis" shows a hierarchical tree of findings:

- Informe (Introducción)
- BI-RADS en Mamografía(A7-1)
 - Mama Izquierda(A71-1)
 - Desestructuración(A714-1)
 - Calificaciones Aisladas(A717-1)
 - Hallazgos Asociados(A718-1)

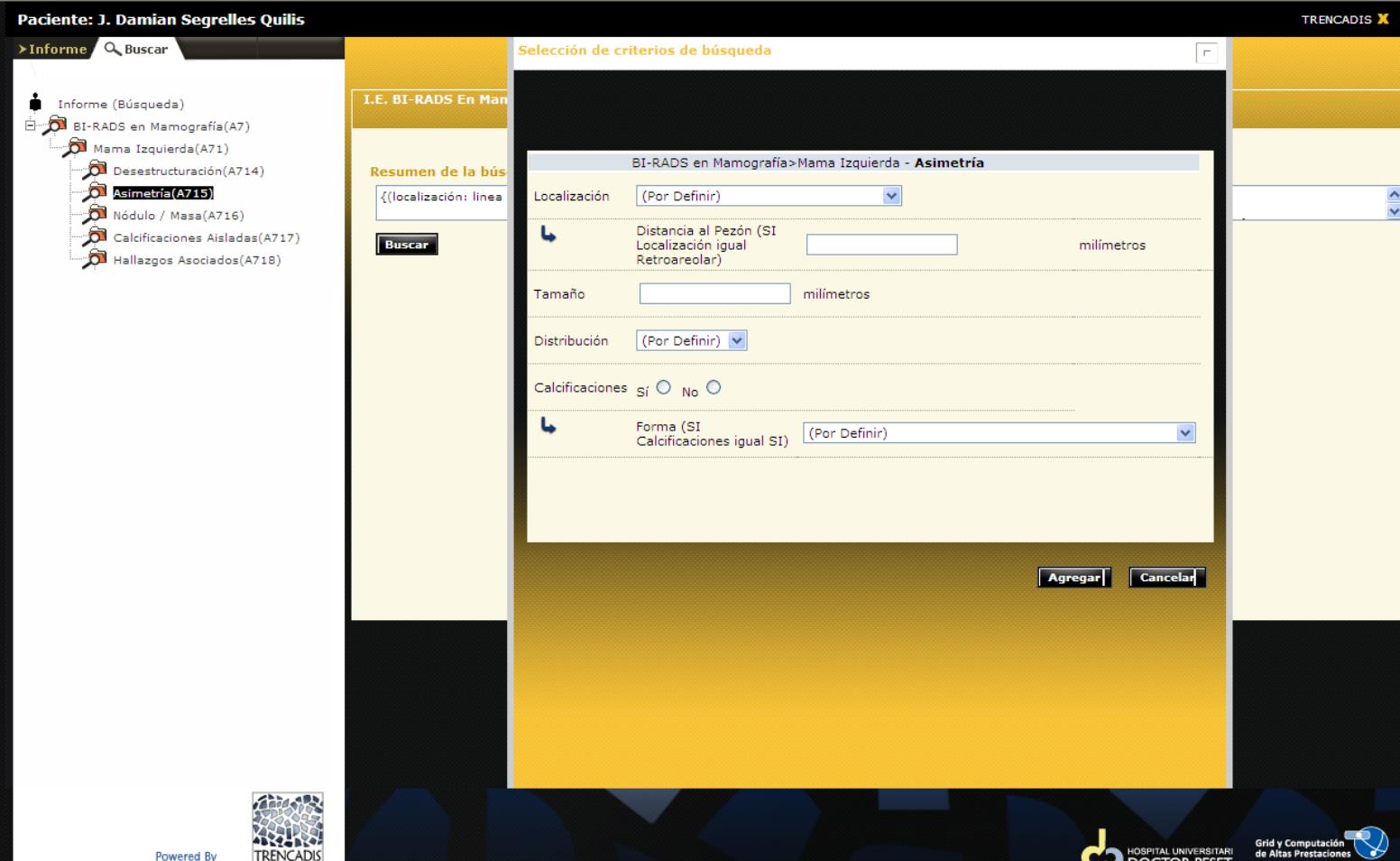
The main panel is titled "BI-RADS en Mamografía - Mama Izquierda - Desestructuración". It contains the following fields:

- Localization: Retroareolar
- Distancia al Pezón (SI Localización igual Retroareolar): [empty input]
- Tamaño: [empty input] milímetros
- Distribución: (Por Definir)
- Calcificaciones: Sí No
- Forma (SI Calcificaciones igual SI): (Por Definir)

At the bottom, there are logos for "Powered By TRENCADIS", "HOSPITAL UNIVERSITARI DOCTOR PESET", and "Grid y Computación de Altas Prestaciones GRyCAP".

Prototype - Web Interface - Use Cases

- Web Interface: Searching DICOM-SR Data



The screenshot displays a web-based medical search interface. At the top left, it shows "Paciente: J. Damian Segrelles Quilis". Below this is a navigation bar with "Informe" and a search icon. The main area is titled "Selección de criterios de búsqueda" (Selection of search criteria) and is specifically for "I.E. BI-RADS En Mam". A sub-dialog box is open, titled "BI-RADS en Mamografía>Mama Izquierda - Asimetría". This dialog contains fields for "Localización" (Localization), "Tamaño" (Size), "Distribución" (Distribution), and "Calcificaciones" (Califications). It also includes dropdown menus for "Forma" (Shape) and "Calcificaciones igual SI" (Califications equal SI). At the bottom right of the dialog are "Agregar" (Add) and "Cancelar" (Cancel) buttons.

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CONCLUSIONS

- The prototype allows sharing DICOM Studies and DICOM-SR reports based on TRENCADIS.
- The infrastructure is able to integrate new centres (adding new Storage DICOMs), integrating users in the VO.
- The most important use cases have been identified and implemented.
 - Flow of information among the Grid services.
 - A customized interface has been designed, easing the structured report data input and search tasks.

Future Works

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- Contacts have been made with other middleware developed at Spain and Portugal (DRI).
 - It is envisaged that the annotated mammographic database being developed in Portugal by INEGI, using the DRI technology of CETA-CIEMAT, will be linked to the deployment at the Valencian Hospital Dr. Peset.

Questions

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