European Commission

Information Society Technologies

RadiotherapyGrid

Enhanced IMRT planning using Grid services on-demand with SLAS

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BEinGRID
BUSINESS EXPERIMENTS IN GRID

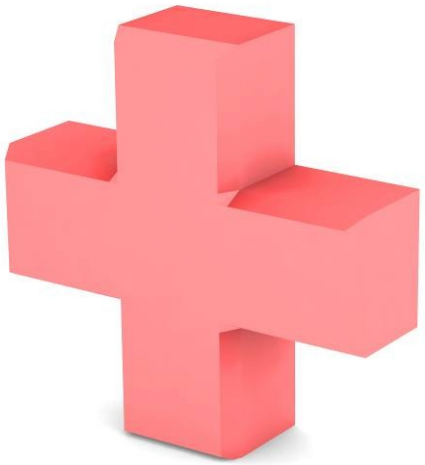
- Background
- Technical Overview
- Demonstration
- Business Case
- Conclusion

Cancer

- **Europe's second largest cause of death.**
- **Collection of diseases characterized by:**
  - **Uncontrolled cell growth**
  - **Ability of cells to spread to new locations in the body**

Common Treatment

- **Radiotherapy**
  - **Exposes cancerous cells to ionizing radiation**
  - **Cancerous cells more sensitive to radiation than healthy cells**
  - **Two main forms, brachytherapy and teletherapy**
  - **RadiotherapyGrid works with teletherapy**



Teletherapy

- Tumour is attacked from several angles
  - Each contributes to total dose without over-exposing nearby healthy tissue
- Two main forms
  - Conformal Radiotherapy (CRT)
    - Beam takes form of tumour
  - Intensity Modulated Radiation Therapy (IMRT)
    - Strength and form of beam changes during delivery
    - Allows more control over dose
- Each patient needs unique treatment
  - Complicated and lengthy calculations
  - Currently run on local TPSs.

Linac & TPS

- **Linear Accelerator or Linac**
  - Delivers radiation dose
- **Treatment Planning System (TPS)**
  - Used to calculate treatment plans for patients
  - Expensive to licence
  - Can take a long time

RadiotherapyGrid

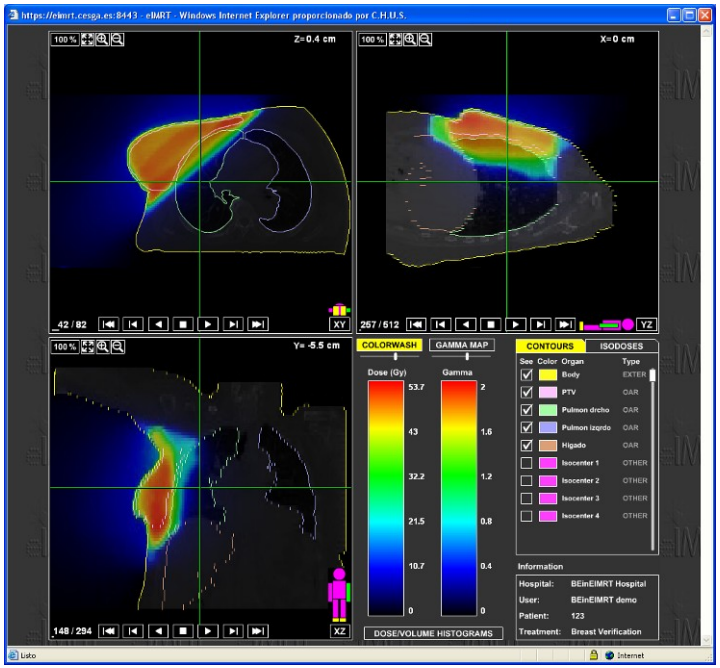
Helps hospitals plan best possible treatments

Two core functions:

1) **Automatic search for optimal treatments**

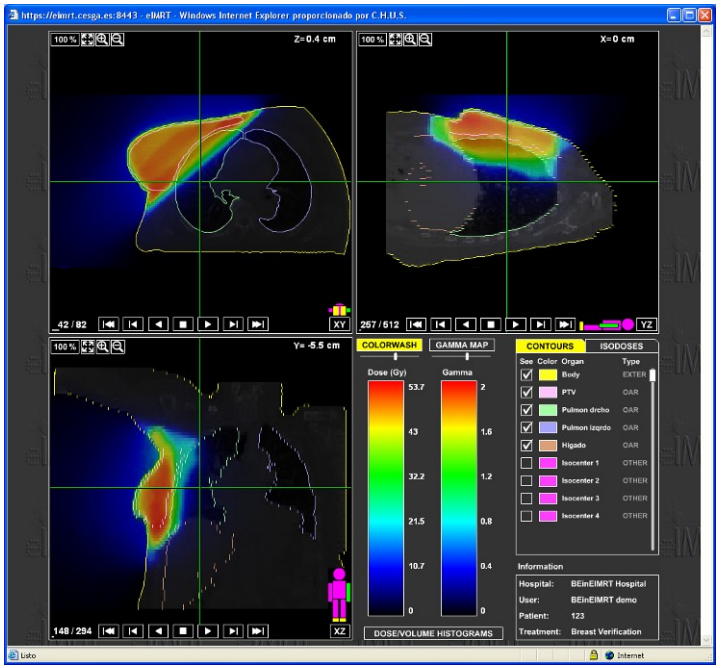
2) **Verification of plans**

(Accurate but computationally expensive)



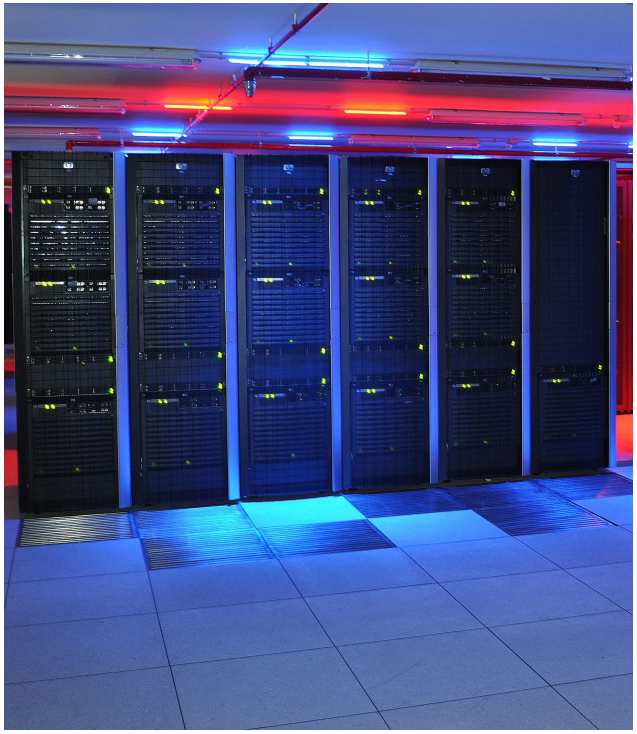
Benefits

- Improves efficiency and effectiveness
- Reduces overall cost
- Easily extended with further tools as new techniques are developed



Grid

- **Grid is:**
  - **On-demand access to huge computing resources**
  - **The technology that makes this possible**
- **Enables better verification and selection of treatment plans**
  - **Alogrithms that would take to long time to run locally can be used**
- **Can cope with increasing demand**
- **Hospitals focus on treating patients**



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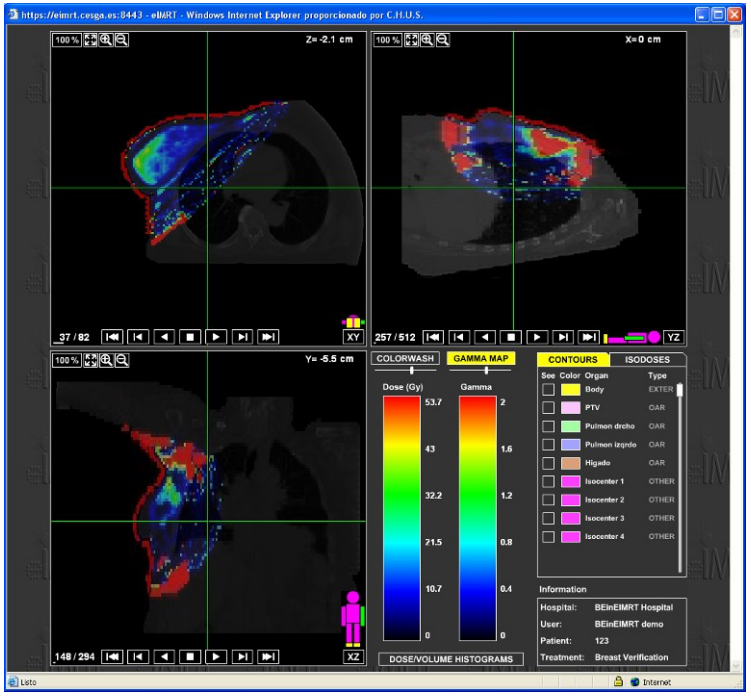
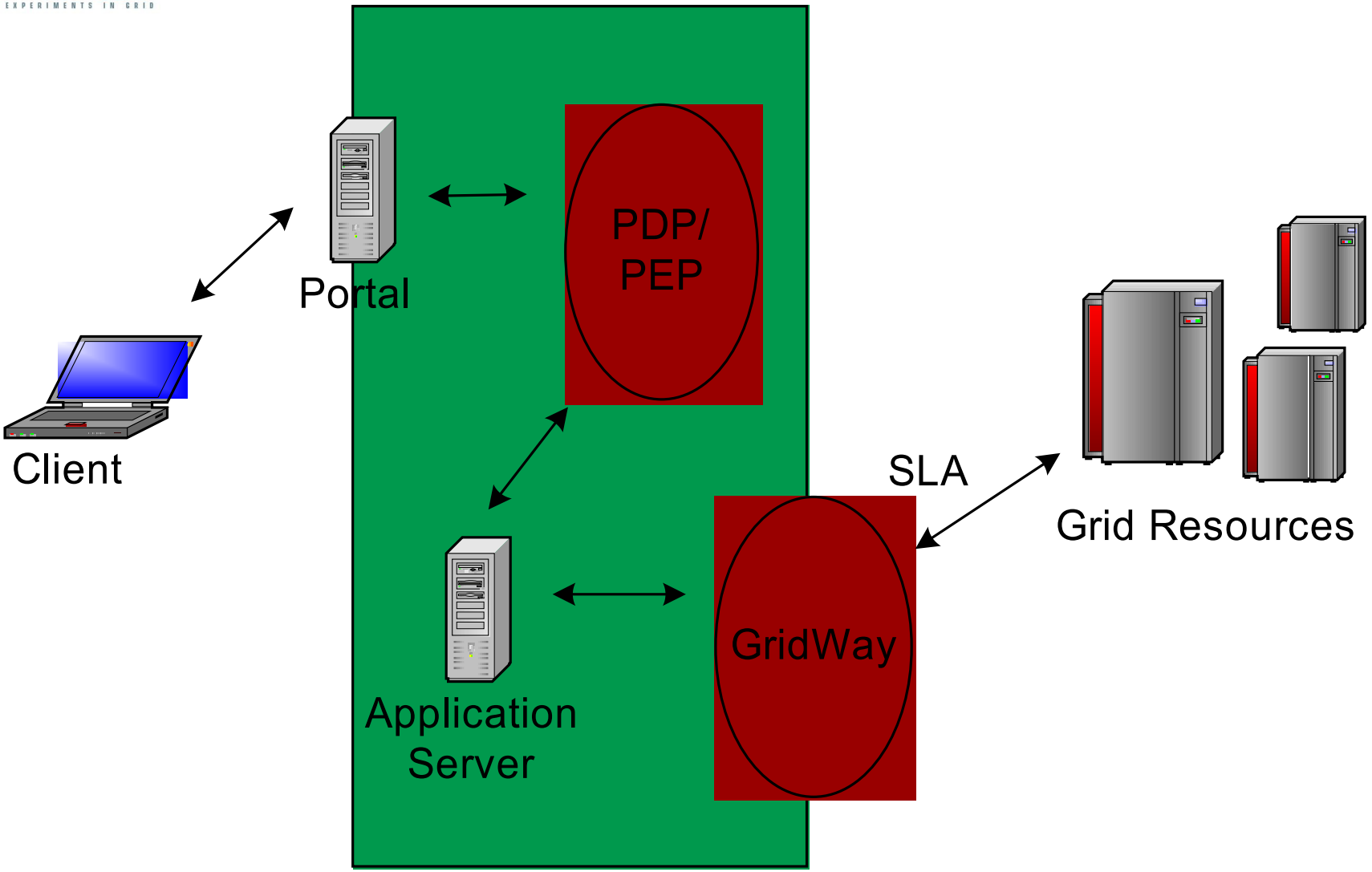
Radiotherapy Services

- **Automatic search for optimal treatment plans**
  - **Suggests treatment plans based on CT scan and given constraints**
- **Verification of plans**
  - **Recalculates treatment and compares to TPS results**
  - **Detects hot and low-does areas**
  - **Uses accurate but computationally expensive Monte Carlo algorithms**

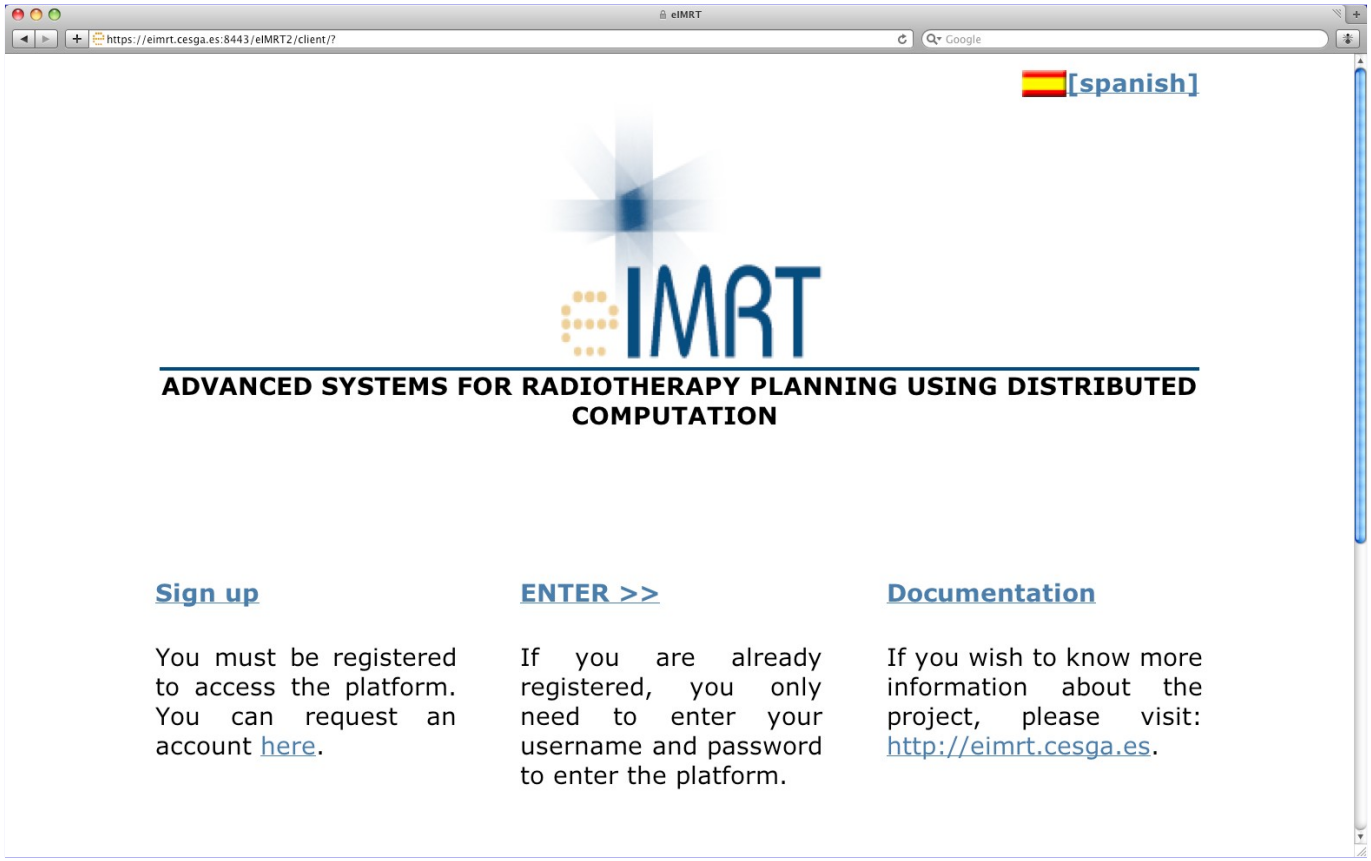


Architecture



Portal Interface

Simple Portal Interface: secure, access from anywhere



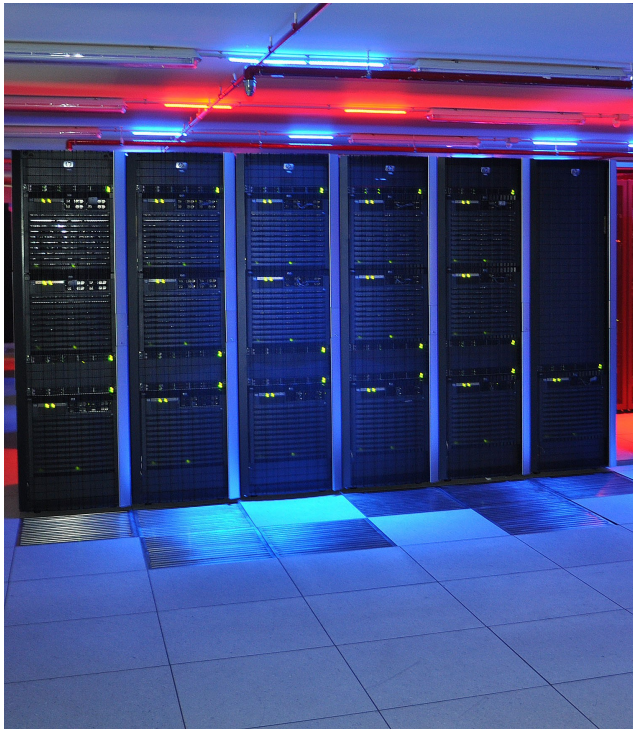
PEP/PDP

- All requests pass through the PDP/PEP security software
- Security essential due to confidential nature of data
- PEP - Policy Enforcement Point
  - Vordel's XML Gateway
  - Catches all incoming requests
  - Calls out to PDP for policy decision
- PDP – Policy Decision Point
  - Axiomatics' Policy Server
  - Checks request against authorisations defined in policy
- Integrated by BT Innovate as part of the BEinGRID project
- Validate BEinGRID common capabilities

http://www.gridipedia.eu/policy-enforcement-point.html
http://www.gridipedia.eu/policy-decision-point.html

Contracting Grid Resources

- **GridWay Middleware**
  - **Submits jobs to Grid resources**
- **SLA Negotiation**
  - **Automatically contracts external resources as needed.**
  - **Integrated with GridWay**
  - **BEinGRID Component**



http://www.gridway.org
http://www.gridipedia.eu/sla-negotiation.html

SLA Negotiation overview

TREATMENT SERVICES

DRMAA

GRIDWAY

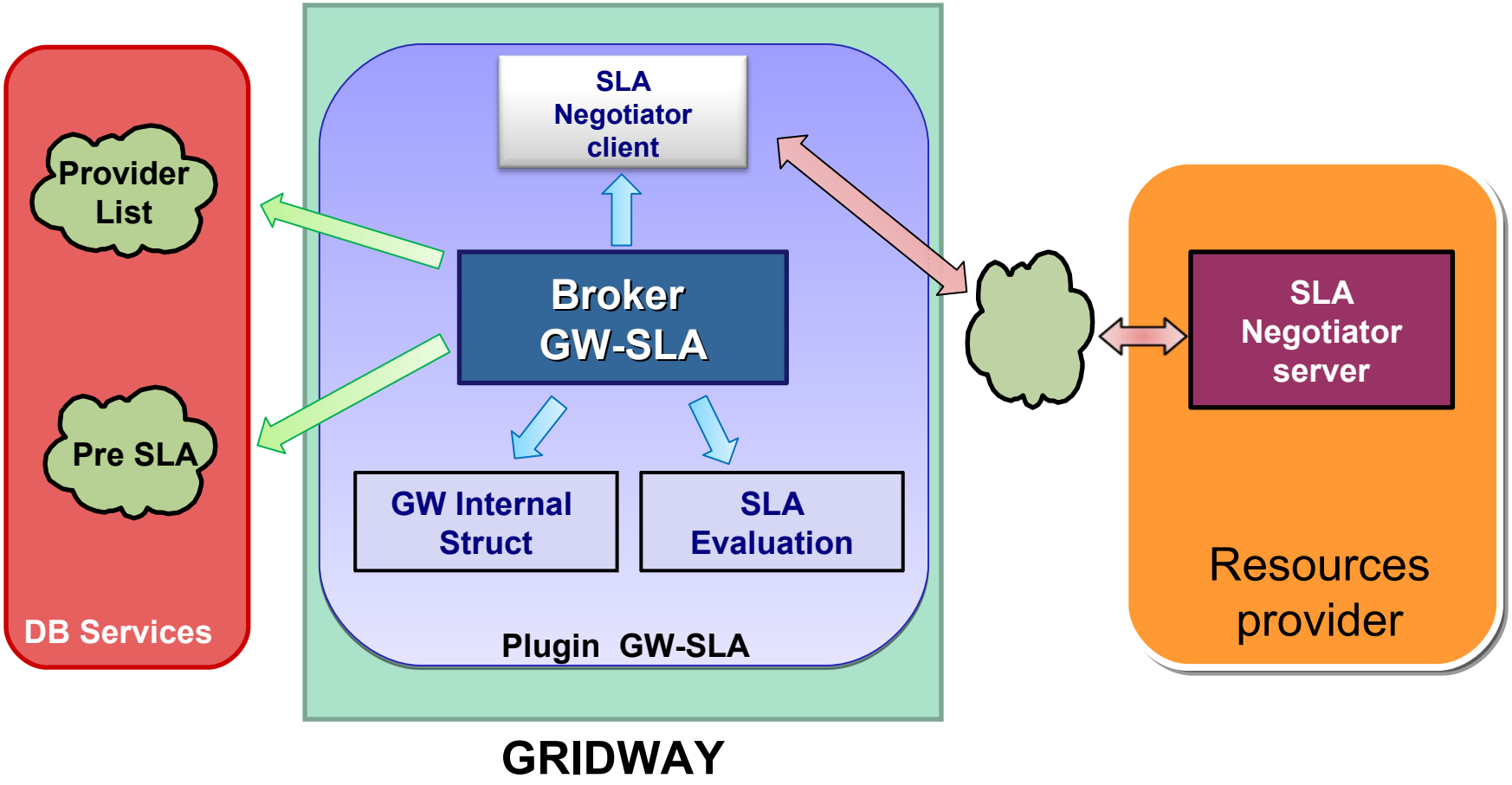
SLA Negotiator client

SLA

SLA Negotiator server

EXTERNAL RESOURCES PROVIDER

SLA components interaction



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SORRY.

NO TIME NOW.

SEE DEMO NEXT

24 AT 16:30

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Sales Model

- **Software as a Service (SaaS)**
  - Charging for access to the services over the internet
  - No hardware/software installed at hospital

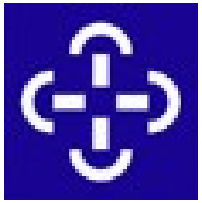
- **Software as a Product (SaaP)**
  - For cases where internet access not available or practical
  - Both software and hardware installed at hospital
  - Hospitals need to maintain computing hardware

Target Market

- **Large and Growing Market**
  - Population age increasing
  - Number of treatment facilities increasing
- **EU is second large market in the world**
  - 6200 Radiotherapy institutions in the world.
  - 618 in Europe.
  - Average of 1.9 Linacs per centre
  - 65% of these in France, Germany, Italy and Spain
  - Aim to service 24 hospitals in next 4 years
- **Economic crisis may help drive customers**
  - Potential budget savings

Exploiting Partners

- **Complejo Hospitalario Universitario de Santiago de Compostela (CHUS)**
  - **Final User**
  - **Steer and verify design and development**



- **CESGA**
  - **Galicia supercomputing centre**
  - **Initial providers of the service**
    - **Intend to move to spin-off company**

Potential competitors

- Several providers of TPS software (CMS, BestNOMOS, Nucletron, DOSIsoft…)
- Why RadiotherapyGrid is different:
  - Unique services
  - Designed to inter-operate:

    TPS vendors can integrate RadiotherapyGrid services into their offerings
  - Work with rather than compete

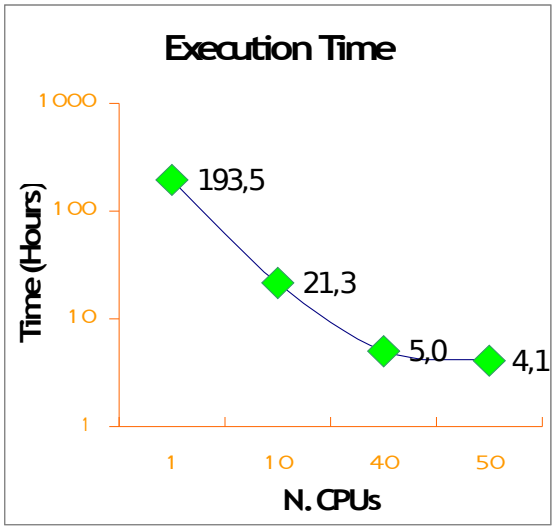
    against big players

Pricing

- €100 per unit
  - One treatment verification is one unit
  - One treatment search may use several units
- 50 to 200 CPU hours per unit
  - Internal cost of €0.24 per CPU hour
  - Estimated gross profit of €40 per unit
- €2000 Annual Fee
  - Covers registration and set-up costs
- Other services
  - Deployment
  - Training
- Expected income of €10,000 per new hospital

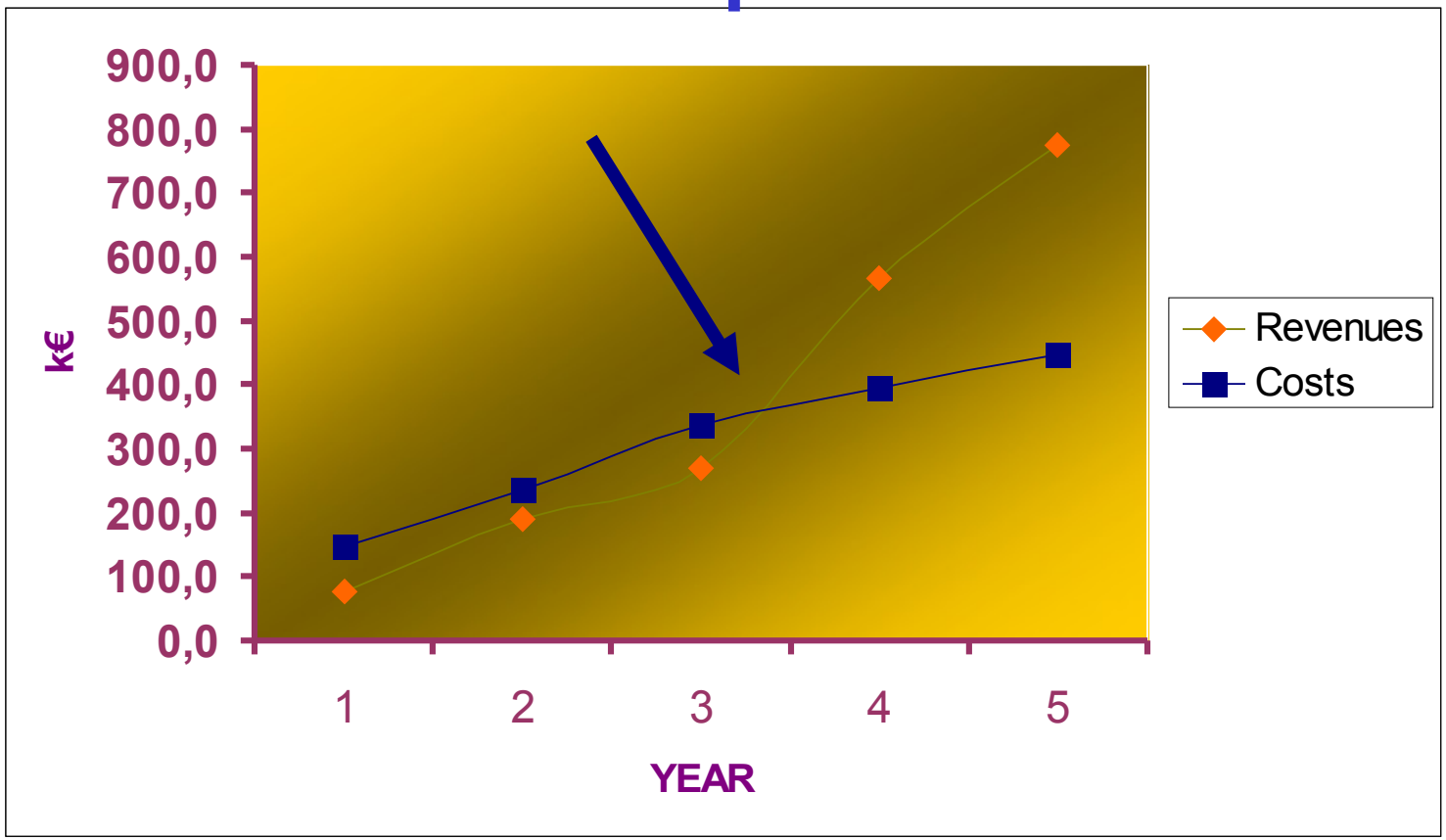
Benefits to Hospitals

Time saving	The treatment search facility saves radio-physicists time Faster turnaround of treatment plans from use of Grid
More accurate	Verification service could check treatments VIRTUALLY
Stay focused on core skills	Don't need to worry about HPC facility
Enormous resources	Enough computing capacity to meet peak demand



Financial Aspects

Break even point



Current Users (TEST)

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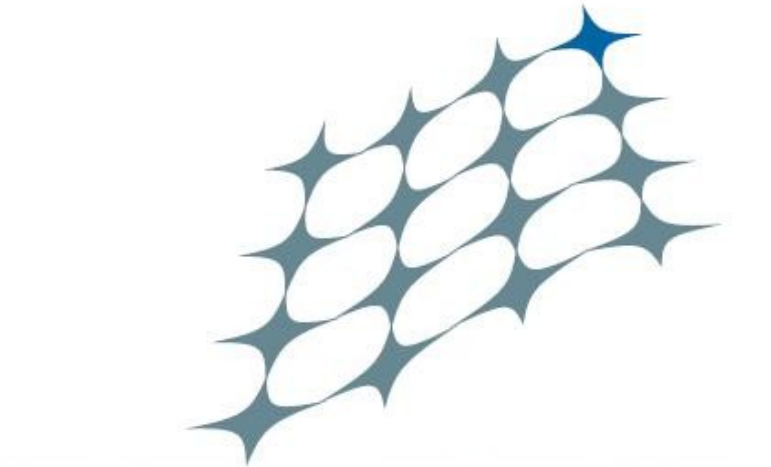
Conclusion

- RadiotherapyGrid
  - Finds better treatment plans for patients
  - Verifies existing plans
  - Is quicker and more accurate than current methods
- Grid technology
  - SLA Negotiator to automatically contract resources
  - PDP & PEP to secure access
- Hospitals
  - Save money
  - Focus on treating patients
  - Treat more patients



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THANK YOU

Thanks to IDCHUS for the provided treatment data

http://eimrt.cesga.es
http://www.gridipedia.eu
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Not yet granted CE mark
Not yet granted FDA approval

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