MediGRID

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Medical Image Processing in MediGRID

Medical Image Processing

Image Processing is of high importantance for medical research, diagnosis and therapy

- High storage capacity
  - Volume data, high resolution images, screening
- High computing power
  - large datasets, increase of accuracy
- High variety of applications
  - specialized processing steps
- Complex workflows
  - Image processing chains

Grid Computing

Grid Computing is the collaboration of distributed resources across institutional borders

- Scalable storage
- Scalable computing power
- Heterogeneous hardware
- Distributed administration
- Service oriented architecture

Grid Computing is a promising solution for increasing demands on medical image processing

Medical Grids

Medical Grids demand special requirements with respect to mere computing Grids

High security and safety

- Patient data, traceability of processing steps

User friendliness

- User accustomed used to graphical user interfaces

Virtualization of grid resources

- Heterogeneous data and applications

Current research on modern Grids is working to overcome these barriers

MediGrid

MediGrid builds an infrastructure for medicine and life sciences

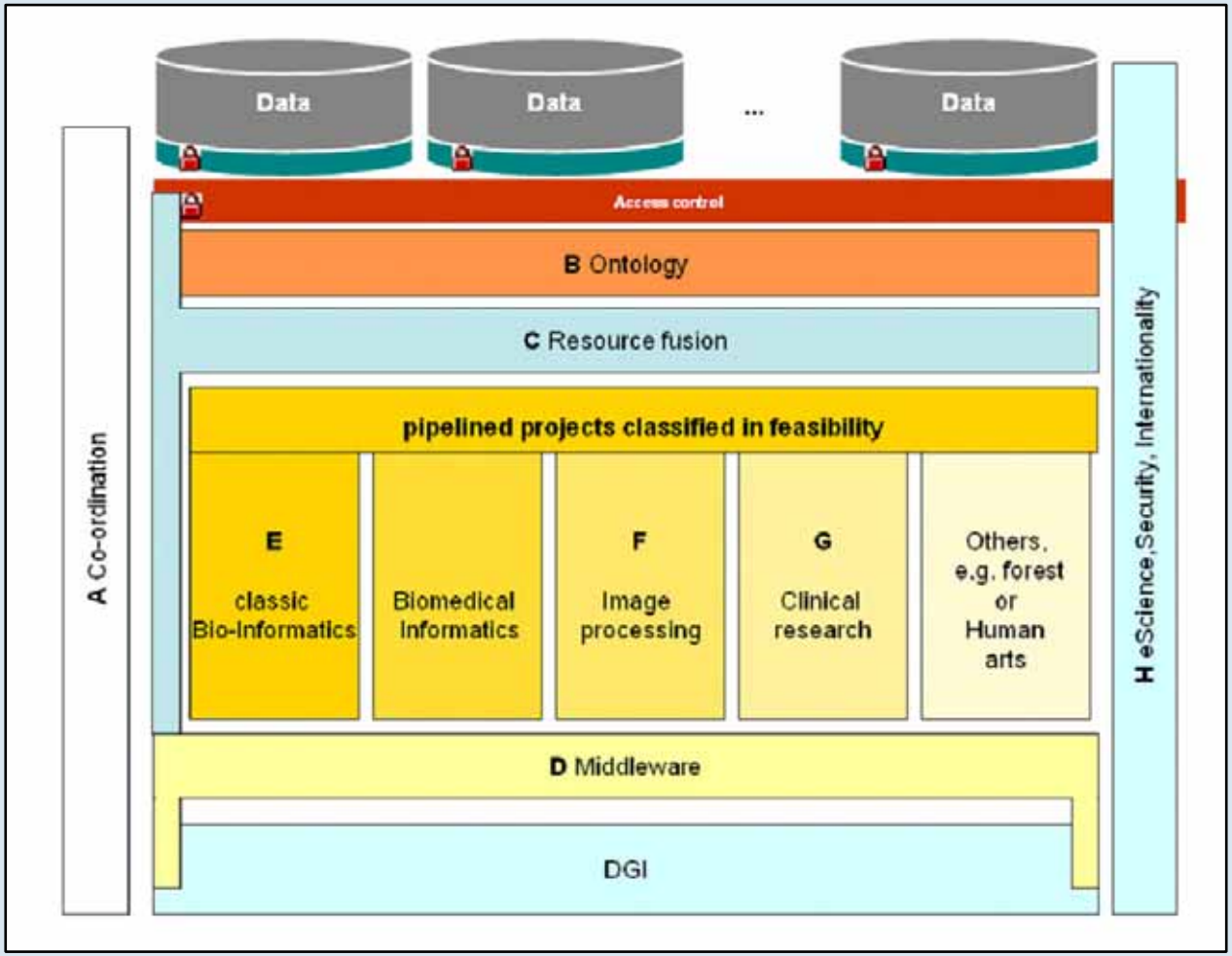


Image Processing Module

The image processing module implements representative applicaton scenarios in the MediGrid

Current research projects

- High benefit from grid, anonymized data

Main image processing components

- Preprocessing, registration, segmentation, classification, numerical simulations

Main tools and programming languages used in research

- Matlab, itk/vtk, c++, java, ...

Main standards and integration of external resources

- DICOM, PACS, Image Retrieval

Functional MRI Analysis

Functional MRI allows for localization of activated brain regions.

Statistical analysis over many repetitions of activation experiments

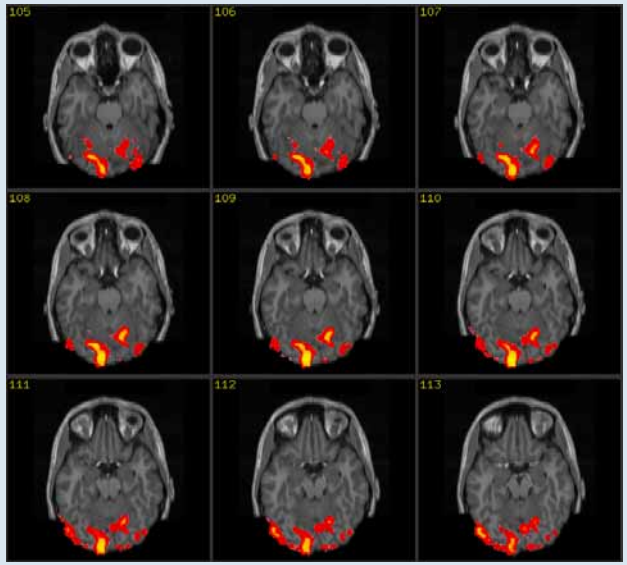
- high data volume and transfer

Preprocessing on single or few image level

- Smoothing of data
- Volume reconstruction
- Atlas-based registration

Standardsoftware SPM,

- based on Matlab



Virtual Vascular Surgery

Hemodynamic simulations based on a patient's vascular geometry allows for virtual surgery of cardiovascular deseases

Segmentation of vascular geometry from CT images

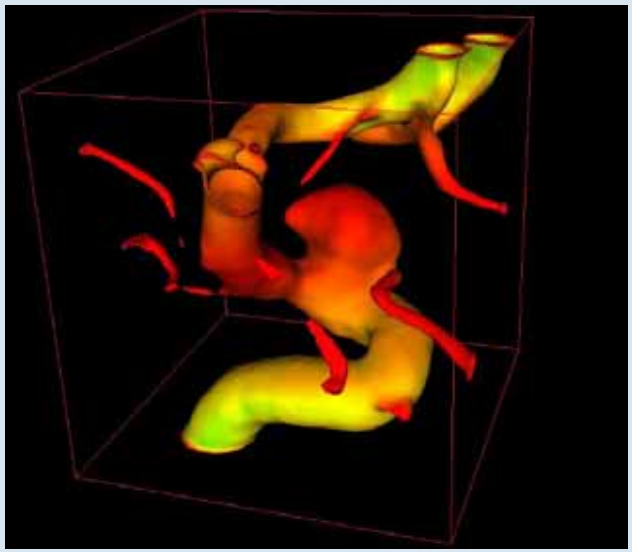
- interactive segmentation and virtual surgery

Numerical simulation of blood flow

- time consuming processing step
- initial parameters/geometry

Visualization of results

- Blood flow, pressure field



Computer Aided Prostate Cancer Diagnosis

Location of tissue probes within the prostate volume supports prostate cancer diagnosis and therapy planning

Location of biopsy needles in TRUS images

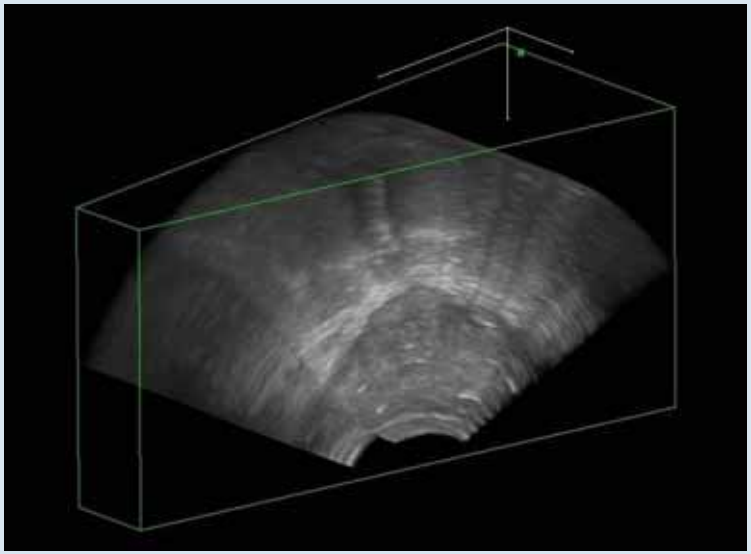
- Segmentation on 2D sequences

Location of 2D images within the prostate volume

- 2D-3D registration
- time - accuracy

Complex workflow

- further processing steps
- image retrieval
- documentation database



Middleware Solutions

Existing middleware is adapted and – where necessary – modified or extended. New components are developed.

Basic middleware: Globus TK 4

- Mature security concept
- service oriented architecture

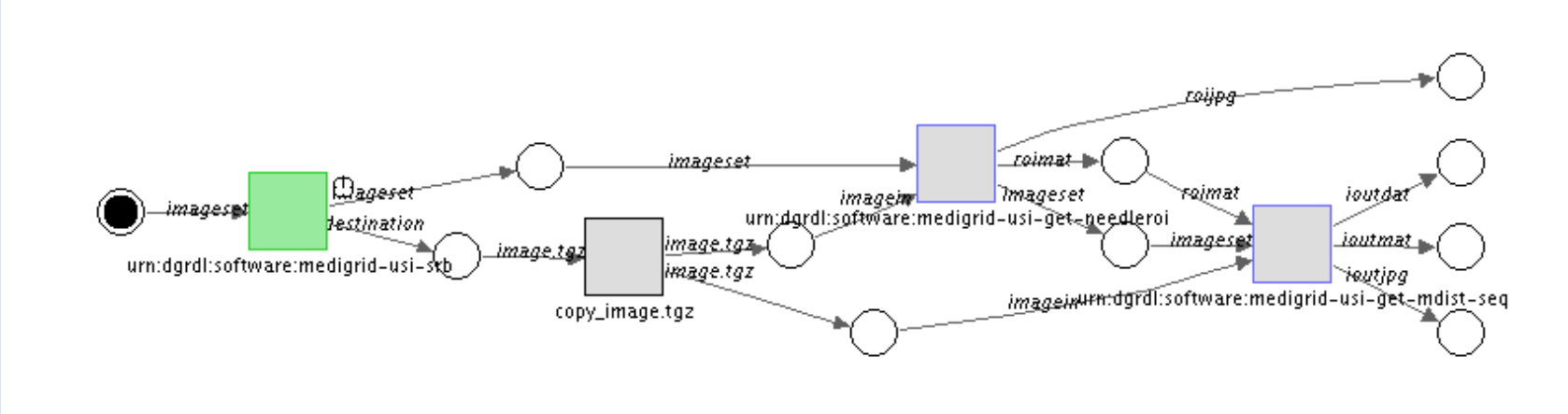
Data management

- Images: grid-Dicom
- Diverse data: SRB
- Metadata: OGSA – DAI

Middleware Solutions

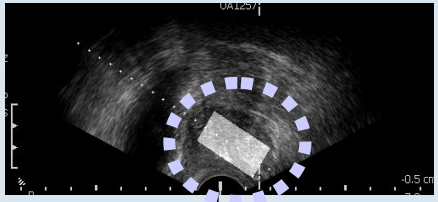
Workflow management GWES

- D-Grid resource description language (DGRDL)

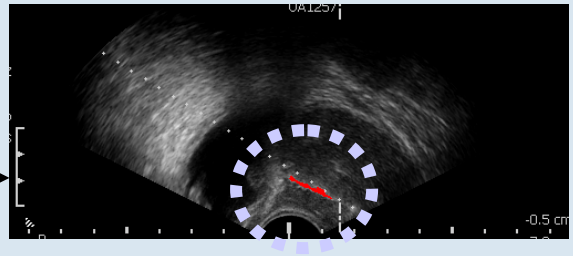


TRUS - Bildsequenz

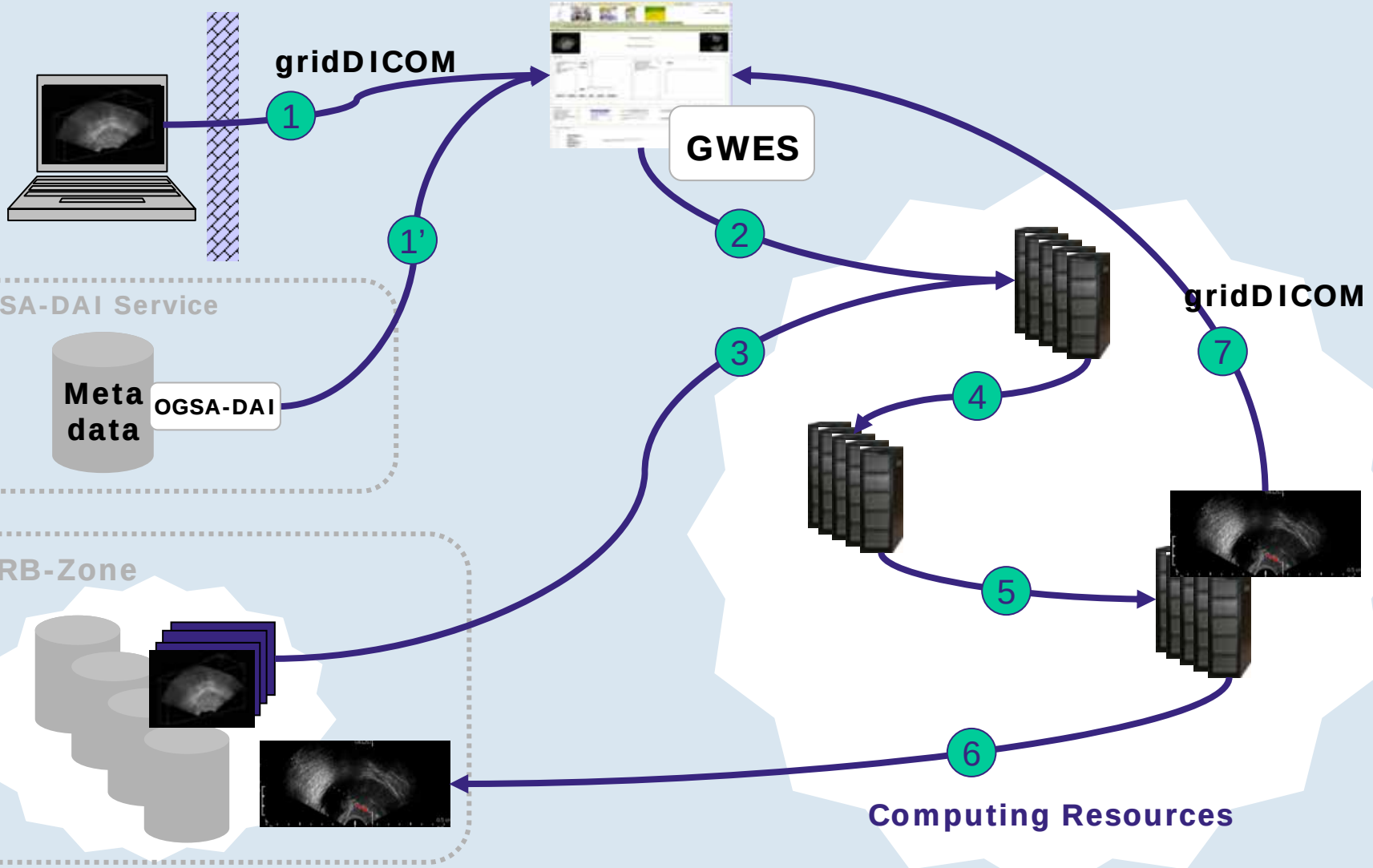
Region of Interest



Detektierte Nadel



Middleware Solutions



Web based Access

MediGRID User

MediGRID Developer

MediGRID Admin

Grid Certificate

MediGRID Portal

Bioinformatics

Gensequenzanalyse

SNP Selection

Ontology Access

Ontologiezugriff

Medical Imaging

fMRI

TRUS

Hemodynamics

Standard Grid Portlets

Credential Management

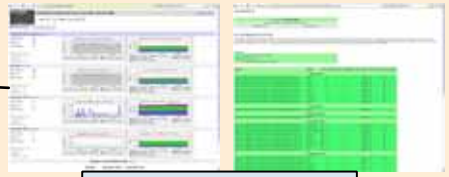
File Browser

Developer-support

Workflow Management

D-GRDL Metadaten-Erstellung

Administration



Resource Monitoring

D-GRDL Metadaten-Management

Resource Management

Results and Discussion

The scenarios could be implemented successfully in the testbed

All time consuming steps are implemented

- coarse-grained parallelization

Workflow management

- load dependend scheduling

Userfriendly access via application specific portlets

- Guidance through processing steps

Limitations and further challenges

- Interactive image processing
- Enhanced Security

Further informationen:

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