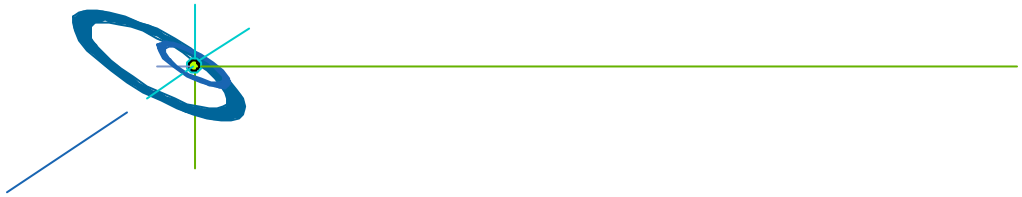
Similarities between Grid-enabled Medical and Engineering Applications

Sabine Roller, Matthias Assel

High Performance Computing Center Stuttgart
roller@hlrs.de, assel@hlrs.de



HLRS

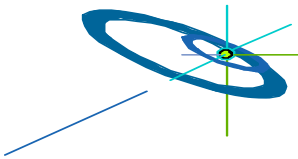
Outline

Engineering on the Grid – InGrid

A grid-based “Virtual Laboratory” – ViroLab

Overlap of both domains

Conclusions



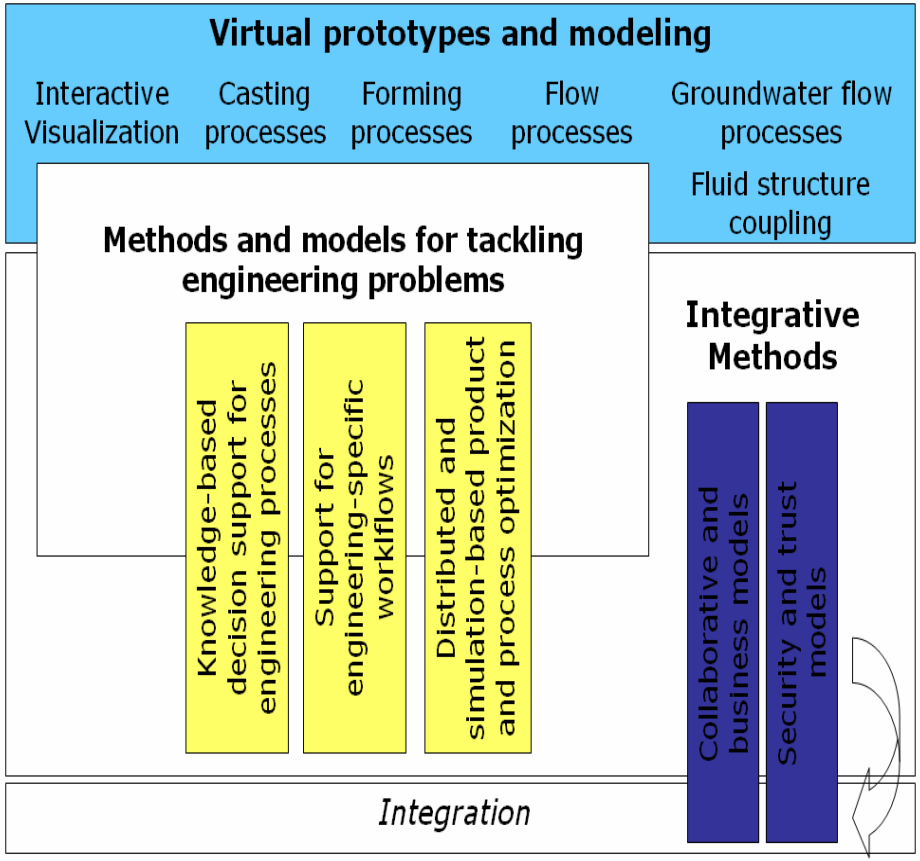
InGrid – Innovative Grid developments for engineering applications

- Funded by German Federal Ministry for Education and Research (BMBF) within German Grid initiative (D-Grid)
- Engineering community project in D-Grid
- 8 partners from research and industry
- Usage and community-specific extension of existing Grid environments for engineering applications
- Efficient use of common resources for
  - Modeling
  - Simulation
  - Optimization

1(CO)	Universität Stuttgart, Höchstleistungsrechenzentrum
2	Frauenhofer SCAI
3	ACCESS e.V.
4	T-Systems SfR
5	Philipps-Universität Marburg, FB Mathematik und Informatik
6	Universität Siegen, Institut für Wirtschaftsinformatik
7	Universität Stuttgart, Institut für Hydraulische Strömungsmaschinen
8	WASY Gesellschaft für wasserwirtschaftliche Planung und Systemforschung mbH

InGrid – Innovative Grid developments for engineering applications

- Heterogeneous engineering applications – different scenarios and entry points
- User-friendly and simple usability of workflows and knowledge together with collaboration support
- Business-oriented scenarios – security, business models, license management, accounting / billing



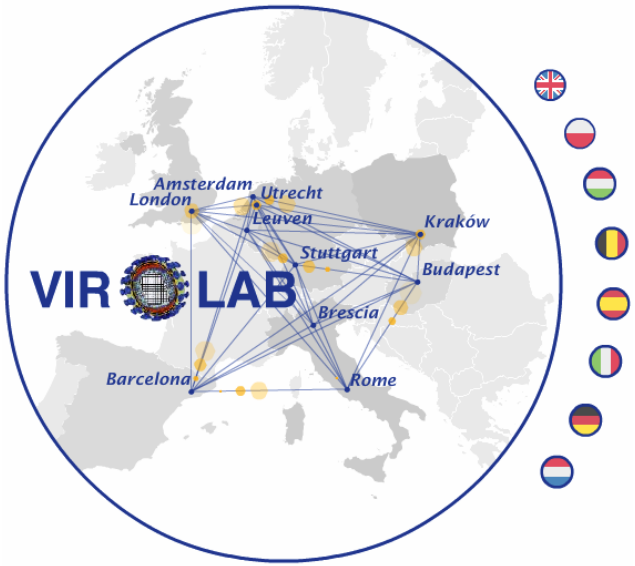
ViroLab – A virtual laboratory for infectious diseases

- Funded by European Commission within the 6th Framework Programme for Research and Technological Development

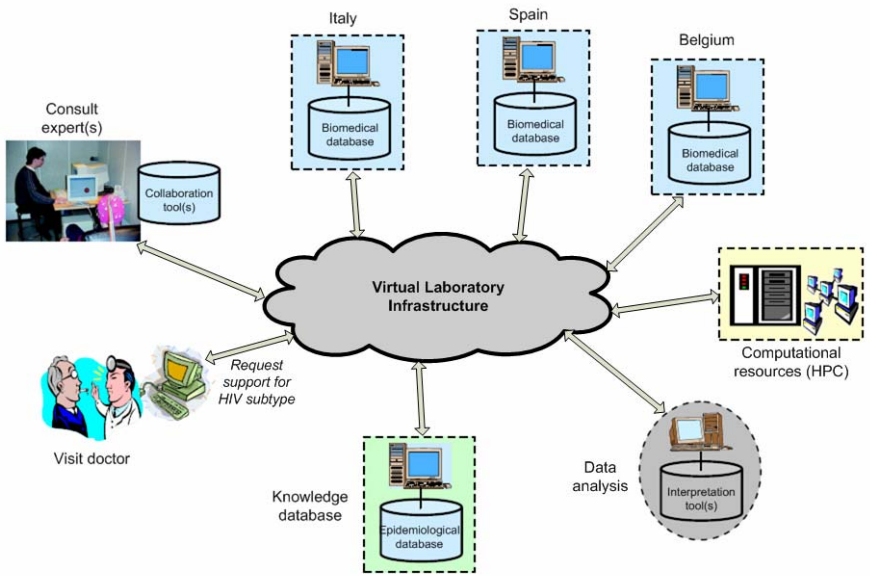
- Project in the area of integrated biomedical information for better health

- 12 partners from 8 different European countries

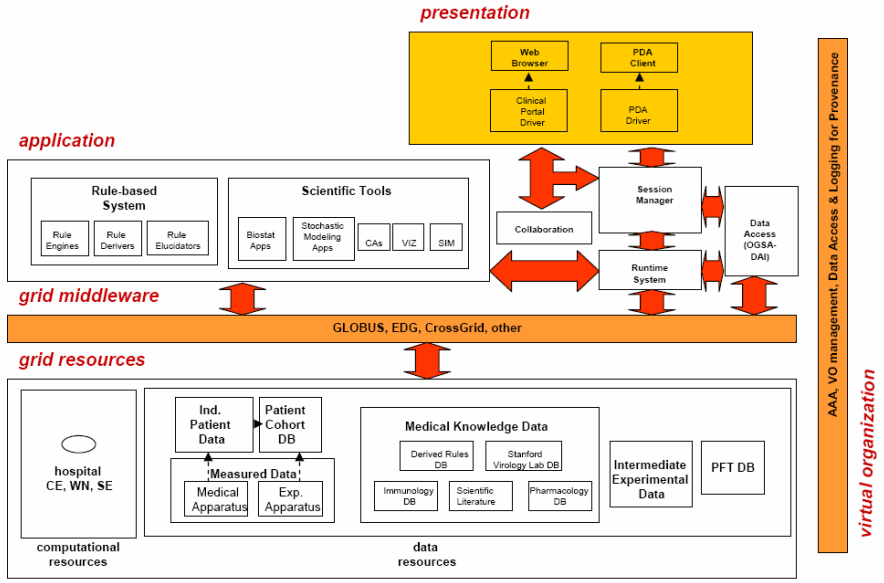
- Mission:
  Develop a "Virtual Laboratory" for researchers and medical doctors that facilitates medical knowledge discovery and decision support



ViroLab – A virtual laboratory for infectious diseases



Simplified Workflow



ViroLab Architecture

ViroLab – A virtual laboratory for infectious diseases

- Objectives and Challenges

  - Develop a virtual organization, providing the "glue" for binding the various components of the ViroLab virtual laboratory and guaranteeing a maximum of security and trustworthiness

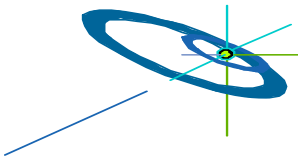
  - Develop a virtual laboratory infrastructure for transparent workflow, data access, experimental execution and collaboration support

  - Virtualize and enhance state-of-art in genotype resistance interpretation tools (applications) and integrate them directly into the virtual laboratory infrastructure

  - Establish epidemiological validation that ViroLab correctly and quantantitavely predicts virological and immunological outcome and to disseminate the results of ViroLab to other European medical experts

Overlap of both domains (1)

- **Usability**: Simple and user-friendly interface(s) for accessing grid-enabled applications
- **Transparency and Interoperability**: Data as well as computer resources hidden from the users behind a layer of virtualization services to guarantee access in a consistent and resource-independent way (Standardization of data formats, data structure, and data model)
- **Collaboration**: Set up an infrastructure allowing interactive and on-demand collaboration support among different experts of particular fields
- **Scalability**: QoS requirements differ with application scenarios and have to be considered during design and development
- **Availability**: Robust and fault tolerance infrastructure to guarantee 24/7 (“always-on”) operational capability

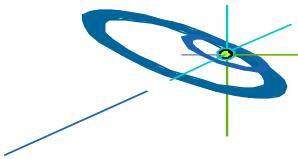


Overlap of both domains (2)

- **Security**:
  - Decentralized **A**uthentication **A**uthorization **I**nfrastructure (**AAI**) based on **S**ingle-**S**ign **O**n (**SSO**) procedure
  - Hierarchical user roles together with unified user attributes to perform role-based access control
  - Dynamic management and control of attribute-based access policies necessary to authorize users before using services, applications and resources
  - Secure transmission and storage of data
  - Trustworthiness and integrity of exchanged information
  - Satisfying requirements under the Data Protection Act
  - Keeping privacy and protecting confidentiality of users by anonymizing and / or excluding irrelevant information

Conclusions

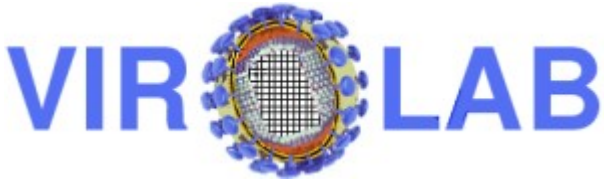
- Strong similarities between both domains
- Exchanging experiences and knowledge among research projects
- Support for collaborative working environments
- Security of upmost significance
  - Confidentiality: patient data vs. industrial data
  - Access control of resources / services
- Efficient usage and sharing of resources (data and computation)
- Need to extend existing technologies (Grid middleware, security solutions)



Where to find more information?

http://www.hlrs.de

http://www.ingrid-info.de



http://www.virolab.org

http://www.d-grid.de

Thank you for your attention