

ViroLab – A Virtual Laboratory for Infectious Diseases

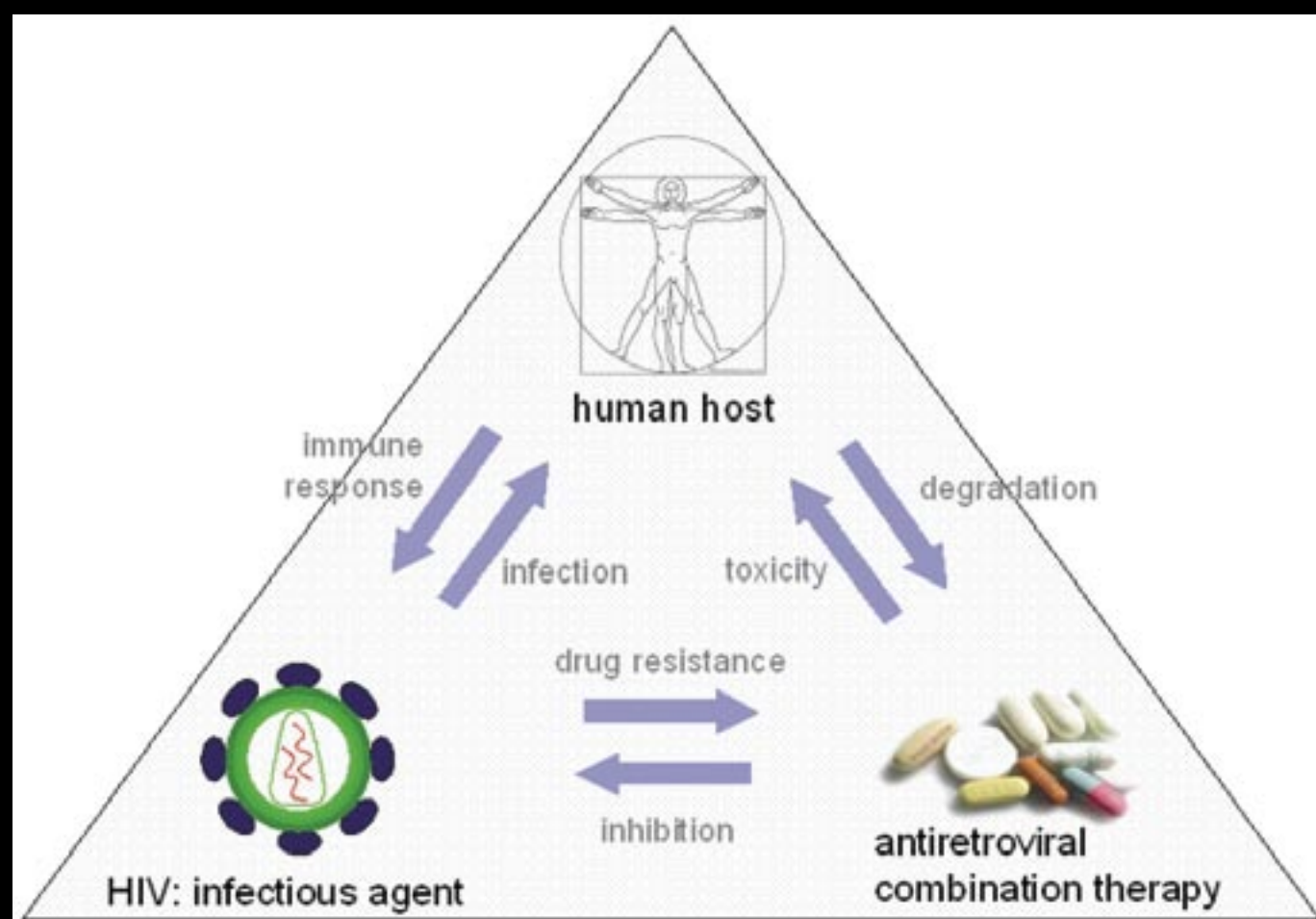
Mission of ViroLab

	HIV-infected adults and children	HIV prevalence among adults (%)	New infections per day	Daily deaths from AIDS
Subsaharian Africa	25,000,800	7.2	8,700	6,500
South and Southeast Asia	7,400,000	0.7	2,700	1,300
Eastern Europe and Central Asia	1,600,000	0.9	740	170
Latin America	1,800,000	0.6	550	180
East Asia	870,000	0.1	380	110
North Africa and Middle East	510,000	0.2	180	160
North America	1,200,000	0.7	120	50
Caribbean	300,000	1.8	80	70
Western and Central Europe	720,000	0.3	60	30
Australia, New Zealand and Pacific Region	74,000	0.5	20	10
Total	40,300,000	1.1	13,530	8,580

The AIDS Epidemic

- AIDS is the fastest growing infectious disease on earth
 - HIV treatment made significant progress over the past years
 - Health professionals are currently fighting against new phenomenon of modern medicine: Drug Resistance
- ViroLab – funded by the EC in the area of integrated biomedical information for better health – as a prototype for a virtual laboratory for infectious diseases that facilitates medical knowledge discovery and decision support for HIV drug resistance

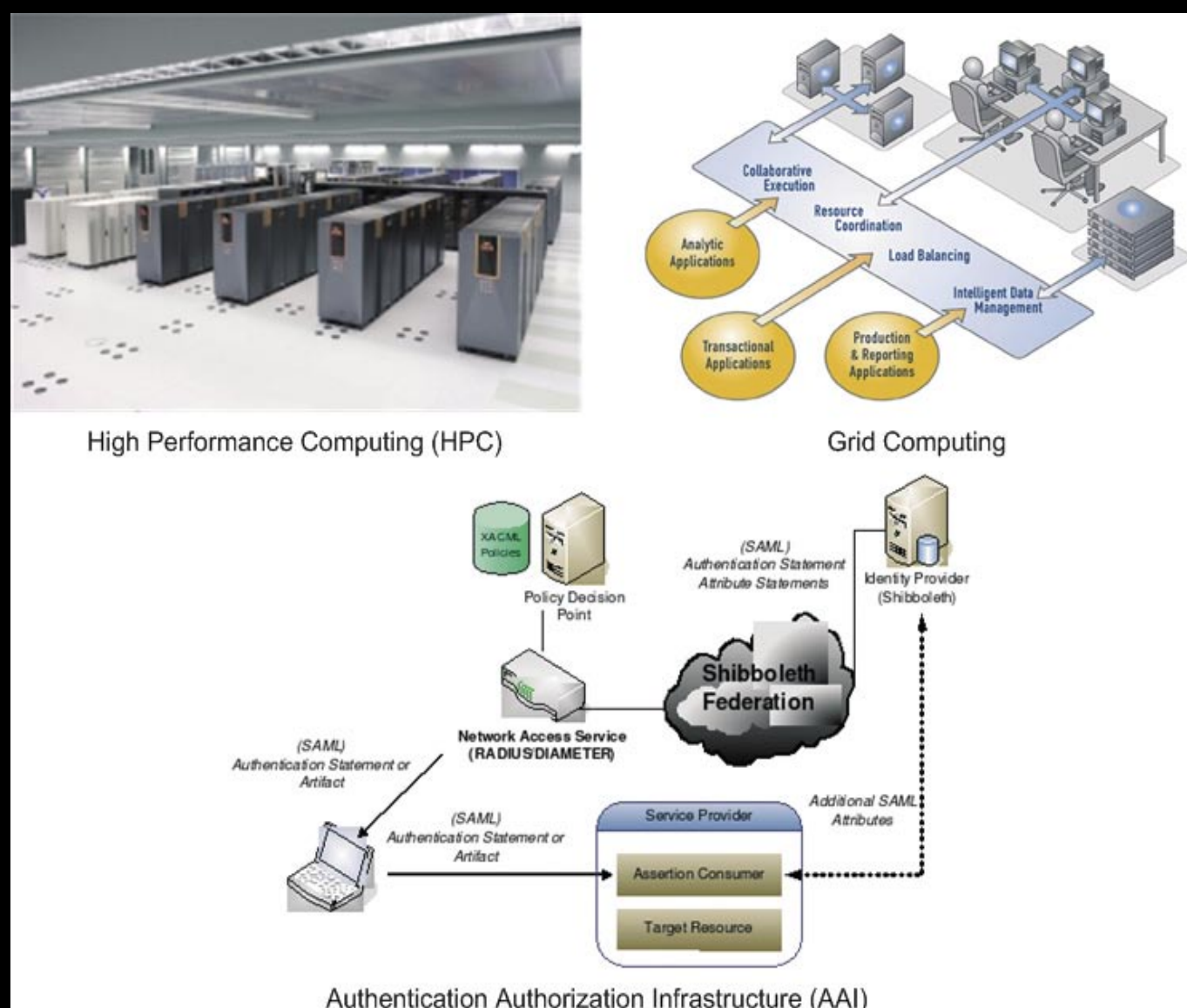
Approach



The Complexity of HIV Treatment

- Complex interplay in HIV treatment requires an interdisciplinary collaboration of multiple sciences
 - One needs all scales, all disciplines and all data
- User-friendly collaborative working environment for clinicians and researchers distributed in Europe, which allows
- Usage of well-defined rule sets to correctly predict virological and immunological response for all antiretroviral drugs
 - Planning of experimental workflows for computing and analyzing genotypic resistance

Technological Requirements



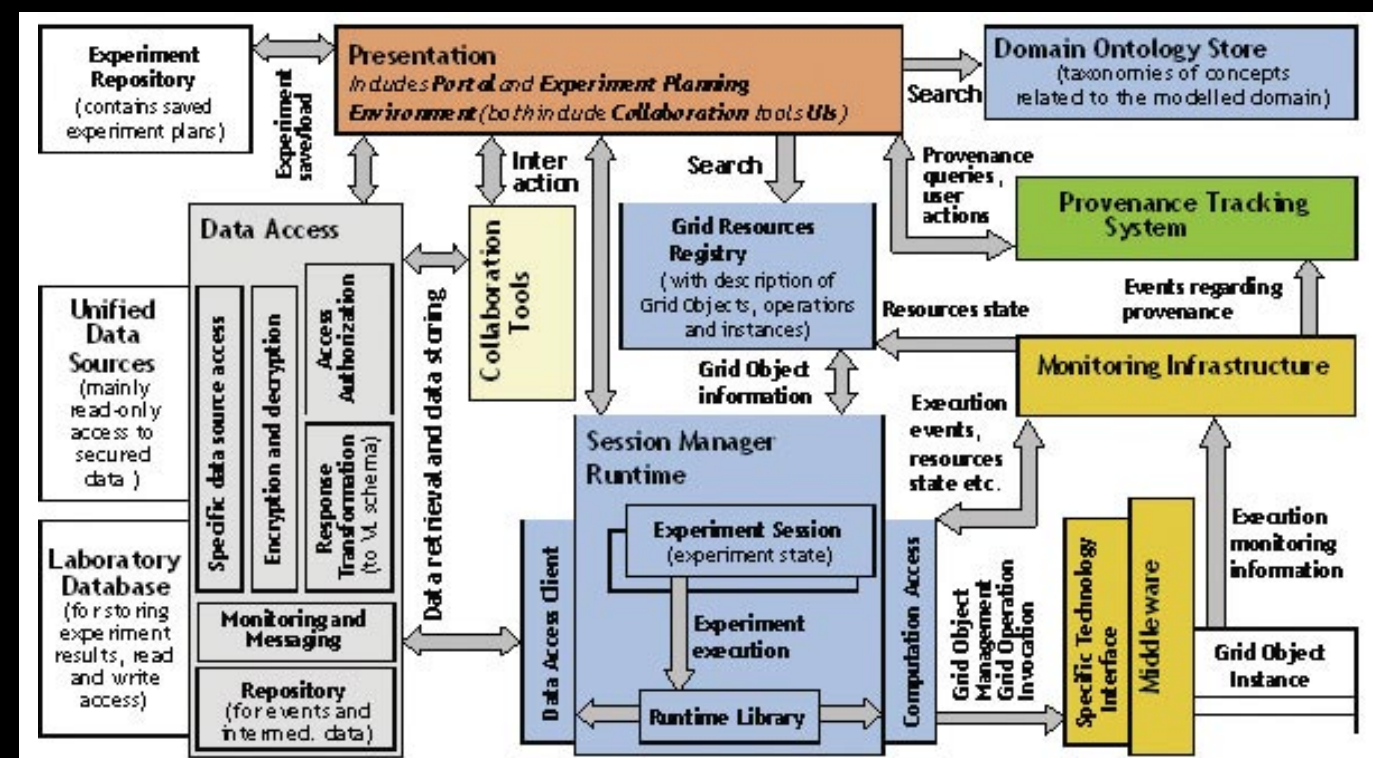
Technologies addressed by ViroLab

- High Performance Computing (HPC): Analysis of biological processes demands strong computational power
- Grid Computing:
 - Creating virtualization services that combine data disclosure and data fusion capabilities
 - Virtual Organization (VO): Building a VO for secure exchange of confidential information forming the „glue“ for all Virtual Laboratory components
- Authentication Authorization Infrastructure (AAI): Strong mechanisms for user identification as well as service / resource authorization to prevent an abuse of sensible data

Partners

- University College London, United Kingdom
- Gridwisetech, Poland
- ACK Cyfronet AGH, Poland
- Eotvos Lorand University, Hungary
- Catholic University of Leuven, Belgium
- IRSICAIXA Foundation, Spain
- Catholic University of Rome, Italy
- University of Brescia, Italy
- University of Stuttgart, HLRS, Germany
- University of Amsterdam, The Netherlands
- University Medical Center Utrecht, The Netherlands
- Virology Education, The Netherlands

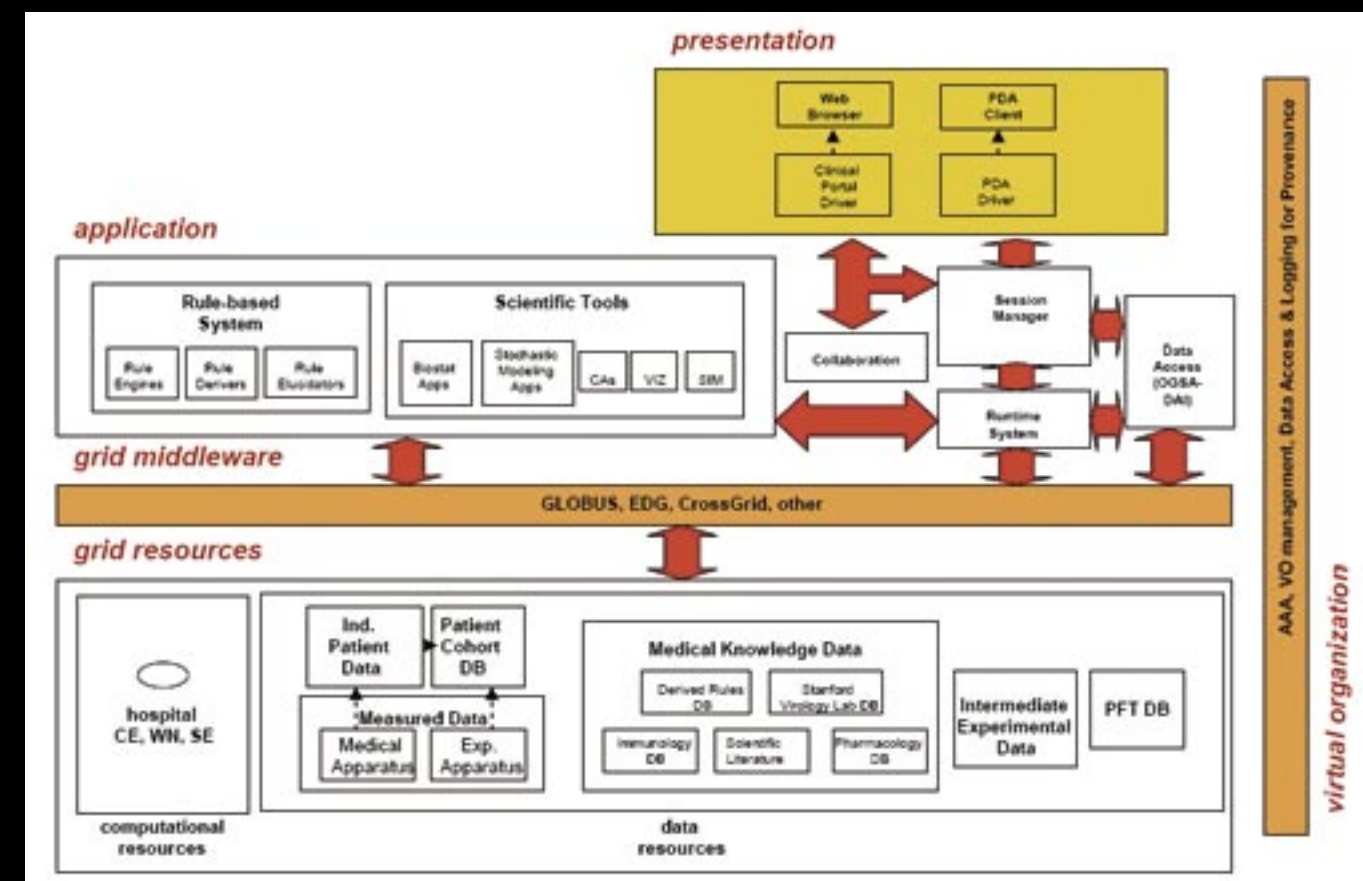
General Laboratory Architecture



The Core Components of ViroLab

- Virtual laboratory to be used by medical doctors to review previous results and rankings and /or scientists to conduct new experiments starting from pre-defined process flow templates
- Topmost part is devoted as Presentation Layer providing two main user interfaces:
 - ViroLab Portal* defining the entry point for scientists and medical doctors
 - Experimental Planning Environment (EPE)* used by experiment developers
- All data access operations are coordinated by the *Data Access* module linked with the *Presentation* and the *Runtime system*
- Provenance Tracking System* stores all information relevant from the point of view of data [results] and publishes that information for interesting parties

Virtual Organization Architecture



The ViroLab Virtual Laboratory from the Grid (VO) Perspective

- VO concept mainly used for access control of resources
- Architecture divided into three main layers:
 - Presentation*: Front-end for ViroLab users
 - Security Infrastructure*: AAI and mechanisms for data encryption
 - Middleware Stack*: Access to different grid middleware solutions
- Presentation layer contains all interfaces and is responsible for user authentication by interacting with the security layer
 - AAI using Shibboleth approach
 - Grid Security Infrastructure (GSI) for secure communication
 - Authorization decision always taken by the service / data provider based on user's attributes