

CyGrid – Infrastructure and Applications

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The relentless increase in microprocessor performance

- you can buy multi-gigaflop systems for less than €800

The availability of reliable high performance networking

- in Europe the GEANT network links 32 countries at speeds of up to 10Gbps (and beyond)
- in the UK : from 100Mbps -> 10Gbps academic backbone since 2000
- 1 Gbps is commonly available to the desktop

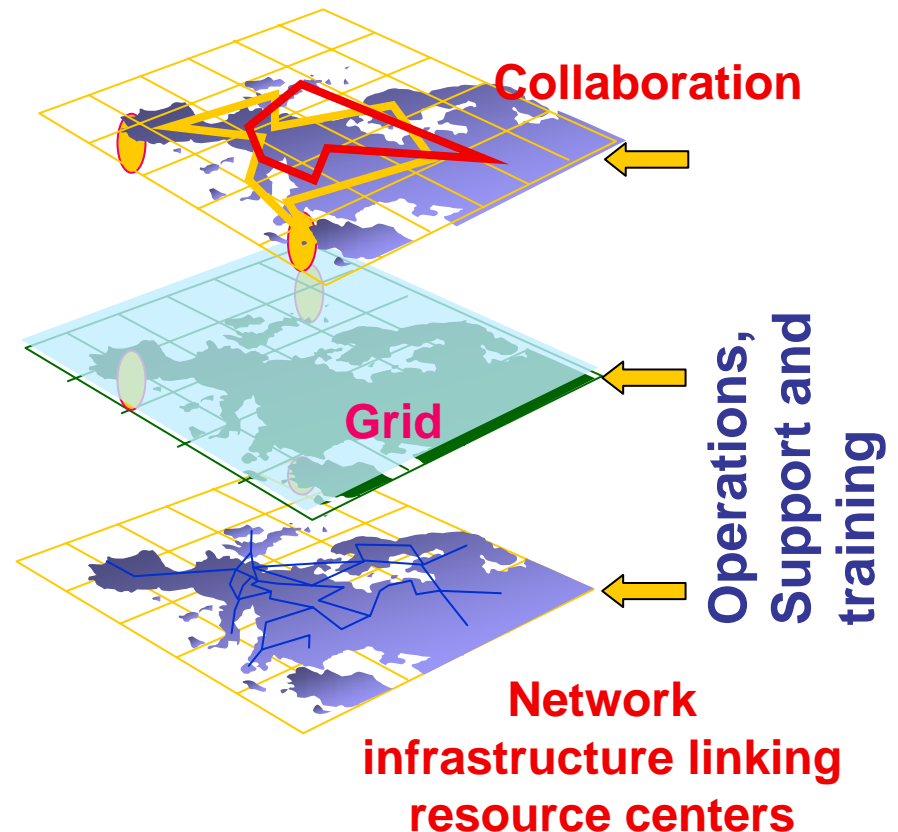
e-Science: the desire to push the boundaries of scientific discovery by computational analysis and simulation

Why “e”-Science

- Invention and exploitation of advanced computational methods
 - To generate, investigate and analyze research huge **data collections**
 - From experiments, observations and simulations
 - To develop and explore computational **models** and **simulations**
 - Computation and data at extreme scales
 - Trustworthy, economic, timely and relevant results
 - To enable dynamic distributed **virtual organizations**
 - Facilitating **collaboration** with information and resource sharing
 - **Security**, reliability, accountability, manageability and agility

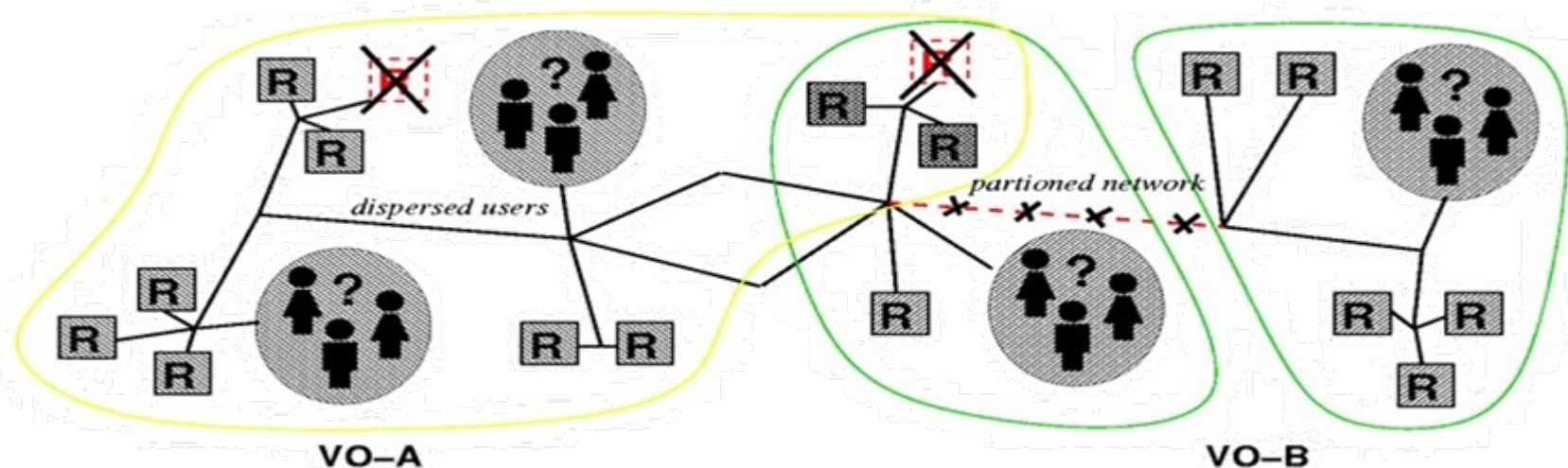
e-Science / e-Infrastructure

- Comprised of:
 - Computing systems
 - Data and Digital Libraries
 - Information resources
 - Networking
 - Digitally-enabled sensors
 - Instruments
 - Virtual Organizations
 - Observatories
- ... along with
 - Interoperable suite of **software services** and **tools**
- ... used by
 - Interdisciplinary** teams of professionals that are responsible for its development, deployment and its use in transformative approaches to scientific and engineering discovery and learning
- ... supported by
 - Educational** and **workforce initiatives** necessary for both its creation and effective use



a new born giant

“Resource sharing & coordinated problem solving in dynamic, multi-institutional virtual organizations”



1. Enable integration of distributed resources
2. Using general-purpose protocols & infrastructure
3. To achieve better-than-best-effort service

Grid: five big ideas

- The most important is the **sharing of resources** on a **global scale**; the very essence of the Grid.
- **Security** is a critical aspect of the Grid; establishing trust.
- The Grid really starts to pay off when it can balance the load on the resources, so that computers everywhere are used more **efficiently**
- **Distance** no longer matters.
- Use **open standards** to make sure that R&D worldwide can contribute.



- **Established in 2002 in the University of Cyprus**
- **Main goals:**
 - To establish a Cypriot presence in international Grid infrastructures.
 - To develop local know-how and expertise on the development and operation of Grid technologies.
 - To promote the uptake of Grid technologies in Cyprus, the interconnection of existing and future resources, and the deployment of new applications.
 - To support research in Grid and Global Computing.

- **Infrastructure Management and Operation**
 - Grid service in Cyprus as of 2002
 - Production-quality service as of 2004
- **Certification Authority and User Access**
 - Security and Digital Certificates (keys to the Grid)
- **Application Deployment**
 - Help Cypriot scientists to gain access to and make use of the Grid
 - Invite and support local applications: medicine (IC), computer science, applied mathematics, chemistry, physics
- **Training and Dissemination**

CyGrid - Infrastructure

- **Two EGEE production sites with over 100 CPUs and 3.5 TB of storage**
 - UCY-HPCL
 - University of Nicosia (Intercollege)
- **CyGrid Certification Authority**

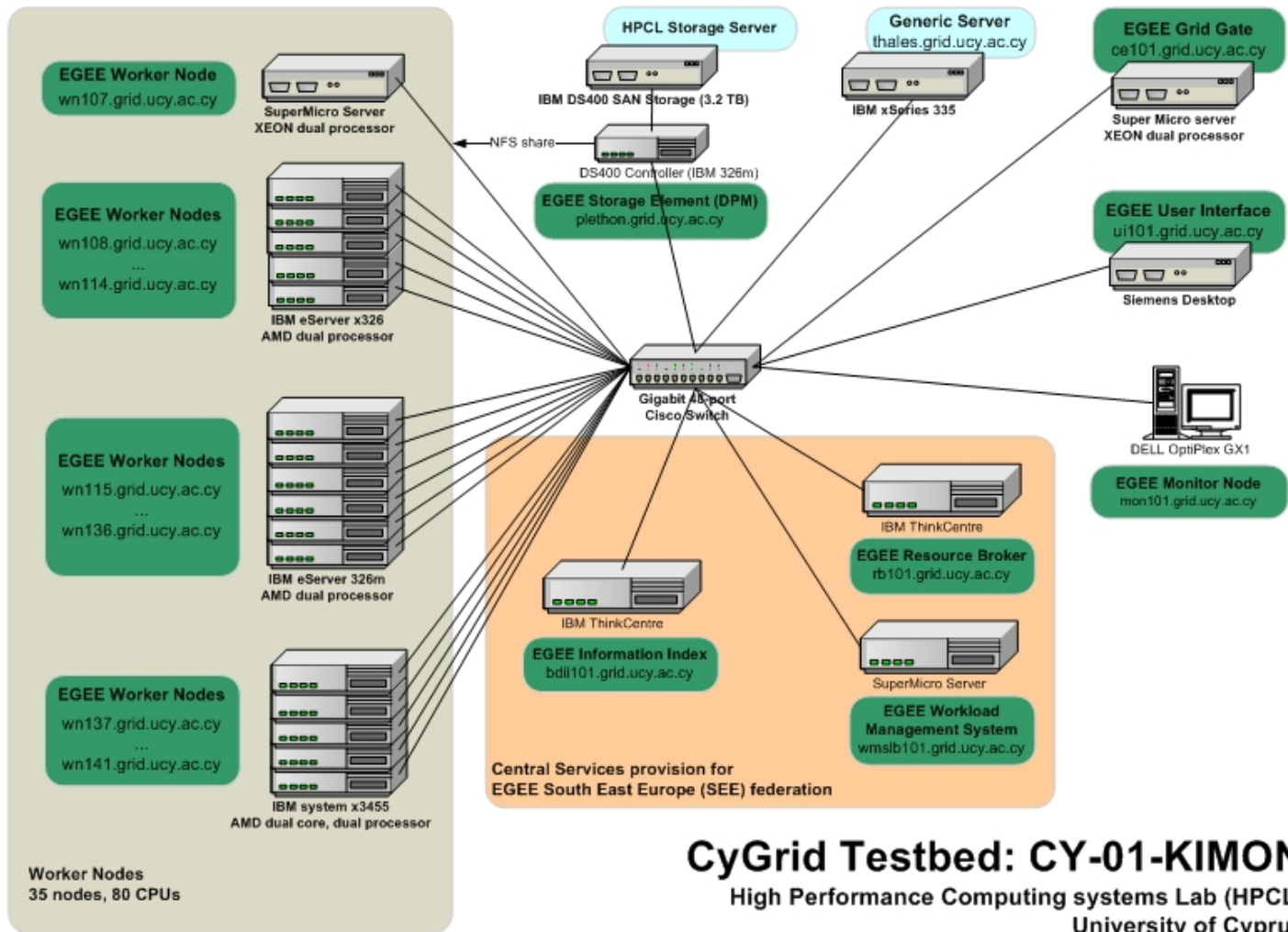


CyGrid - Infrastructure

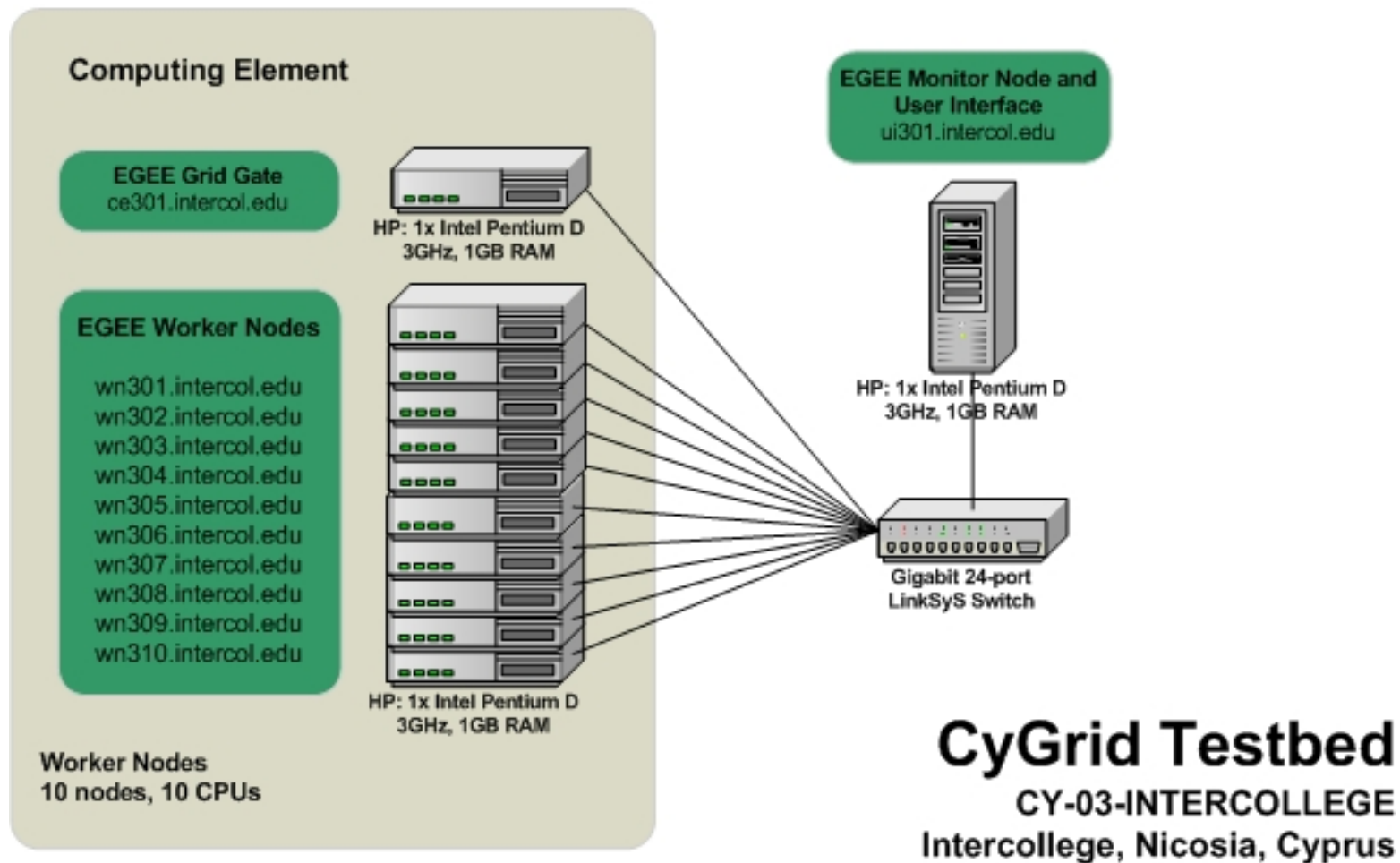


- **The KIMON cluster:**
 - 35 computing nodes with
 - 80 CPUs (2.6 GHz Opteron, 2GB RAM per node)
 - 3 TB Storage Server (FiberChannel)
 - 1 Gbps switched ethernet
- **Funding from the Research Promotion Foundation of Cyprus (infrastructure project)**

CyGrid - Kimon



CyGrid - Intercollege



CyGrid – User Applications

Computer Science

- **Thermal-aware simulations of multicore chip architectures**, Xi Computer Architecture Group, Computer Science, UCY (Dr Y. Sazeides)
- **Local Search for Planning Graphs**, Dr Y. Dimopoulos, Computer Science, UCY
- **Vehicular Networks Simulation**, Dr M. Dikaiakos, Computer Science, UCY

This work is an evaluation of the VITP (Vehicular Information Transfer Protocol).

- **Theoretical Mechanistic Studies of the Water-Gas Shift Reaction, Dr C. Zeinalipour, Chemistry, UCY**

The main scientific scope of this work is to obtain an in-depth understanding of the reaction mechanism of the water-gas shift reaction. This will help in the future design of more efficient catalysts that operate at lower temperatures and that have longer lifetimes.

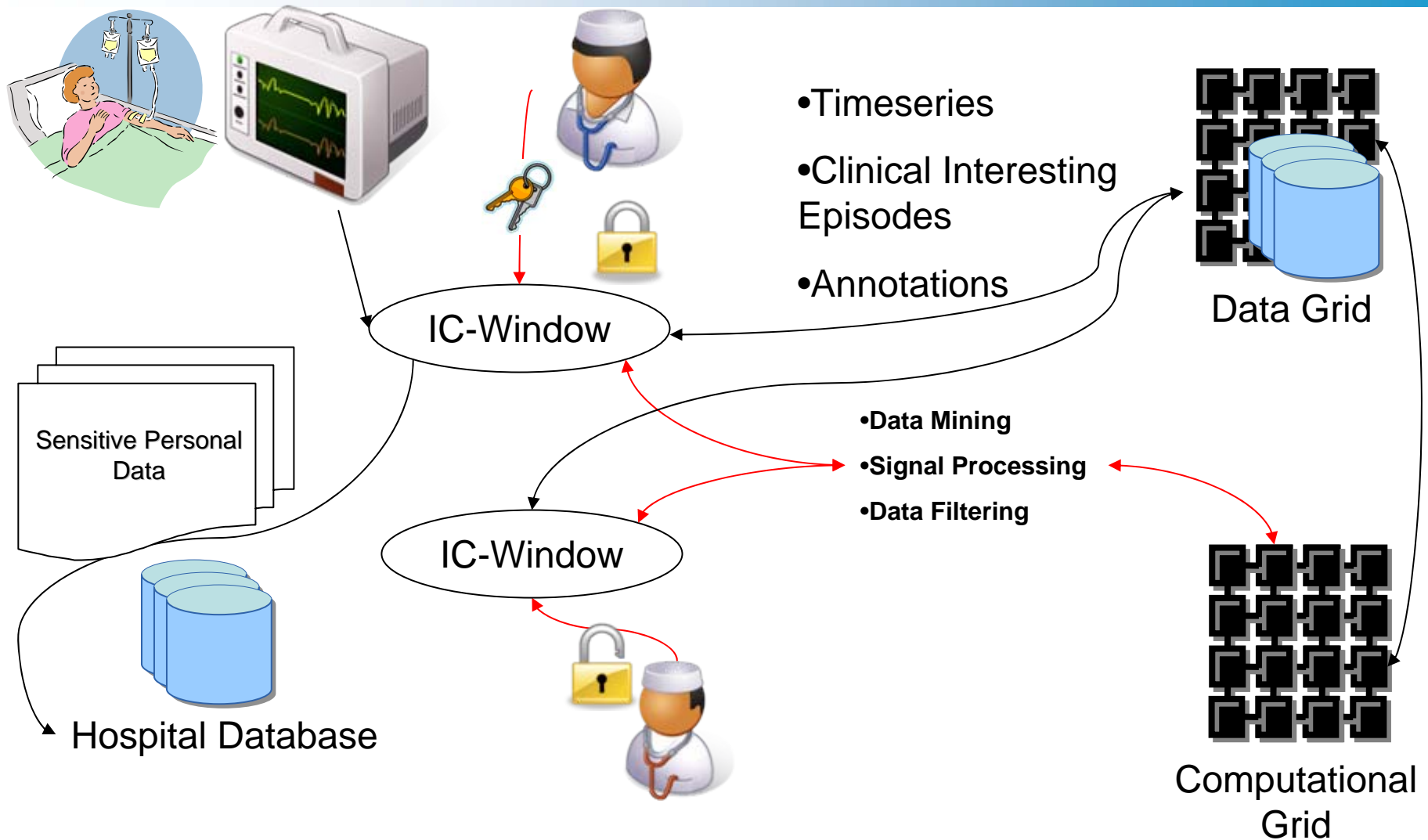
- **Material Ultra fast Laser Interaction, Physics, UCY**
Loukas Loumakos, PhD candidate

CyGrid – User Applications

Health & Medical Sciences

- **Development of New Conformal Prediction Methods with Applications in Medical Diagnosis**, Dr Harris Papadopoulos, Frederick University (a project supported by RPF)
- **ICGrid**, HPCL (DoCS, UCY), NGH (Nicosia General Hospital)

*Create a (distributed) tool that enables the seamless, **integration, correlation and retrieval** of clinically interesting episodes across Intensive Care Units.*



Virtual Organizations

- **What is a VO?**

A VO is simply a group of Grid users with similar interests and requirements who are able to work collaboratively with other members of the group and/or share resources (data, software, CPU, storage space, etc) regardless of geographical location.

Virtual Organizations

- **Do I need to create a VO?**

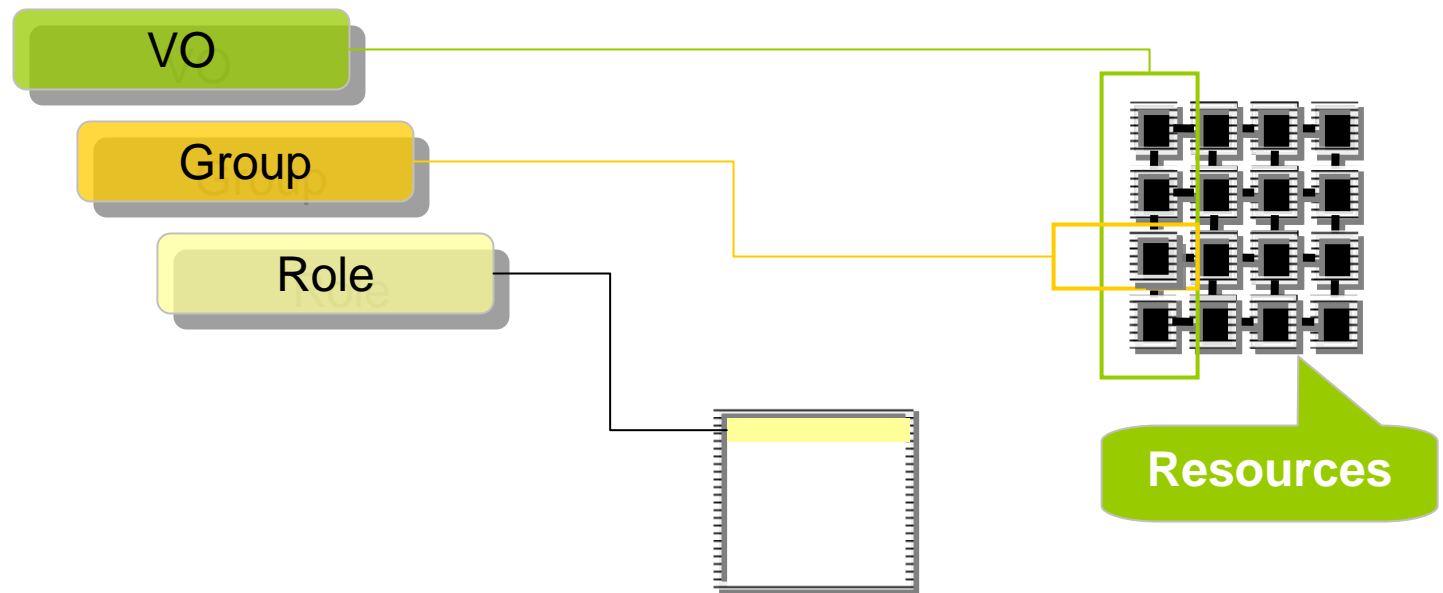
The EGEE grid works with Virtual Organizations (VO), of which there are currently around 200, therefore it is possible that your potential application for the grid is already covered by one of these VO's.

Virtual Organizations

- **What do I need a VO for?**
 - Accessing the Grid
 - Authorization
 - Proxy Certificate
 - Access Resources (SW Libraries & Applications, Data Warehouses)

Virtual Organizations

- **VO, Groups and Roles**



- <http://egee-na4.ct.infn.it/biomed/>
- **How to participate?**
 - Review information provided on the [EGEE web site](#)
 - Establish contact with the EGEE biomedical applications group ([Johan Montagnat](#) and [Christophe Blanchet](#)).
 - Provide information by completing [a questionnaire](#) describing your application
 - Applications are selected for direct support based on scientific criteria, Grid added value, effort involved in deployment, resources consumed/contributed etc.
 - Follow a training session
 - Migrate application to EGEE infrastructure with the support of EGEE BMI technical experts
 - Initial deployment for testing purposes
 - Production usage. Contribute computing resources for heavy production demands.

Biomed VO Applications

- **Clinical Decision Support System**
- **Geant4 Application for Tomographic Emission**, reduce the computing time of Monte Carlo simulations in order to provide a reasonable time consuming tool for specific cancer treatment requiring Monte Carlo accuracy
- **GPS@**, Grid genomic web portal
- **SiMRI3D**, Parallel MRI Simulator
- **gPTM3D**, DICOM data analyzer for the EGEE Grid

MORE: <http://egee-na4.ct.infn.it/biomed/applications.html>

Enter the Grid

- Apply for a certificate
- Choose a VO and Register
- Build your application
- Deploy your application
- Get Results