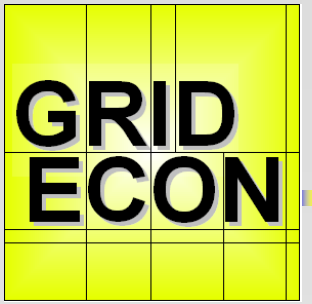

GridEcon: Analyse von Geschäftsmodellen für das Grid

Workshop: Nachhaltigkeit im D-Grid
Forschungszentrum Karlsruhe, 9-10. Oktober 2006

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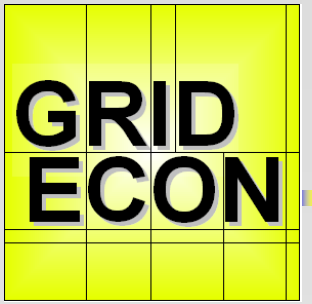
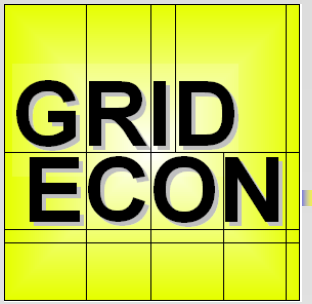


GridEcon: Project Facts

- **GridEcon – Grid Economics and Business Models**
- **EC funded project**
  - Within the EU Sixth Framework Program, Priority IST, objective “Advanced Grid Technologies, Systems, and Services”
  - **Funding period** is July 2006 to December 2008
  - **Project size** is 3.89M Euro (EC funding is 2.35M Euro)
- **9 consortium partners**
  - **Coordinator:** International University of Bruchsal
  - **Partners:** Athens University of Economics and Business, Imperial College London, 451Group, LogicaCMG, ATC, Ernest&Young, RealTimeEngineering, Gigaspaces

GridEcon: Project Scope

- **The goal is to advance the functionality of existing Grid technology, so that**
  - an **economics-aware operation of Grid applications and services becomes possible** (new Grid business models can be implemented)
  - **end-users can not only consume but also sell services (resources) on the Grid**, therefore, creating a new economy in which all end-users can actively participate (generate income)



GridEcon Approach

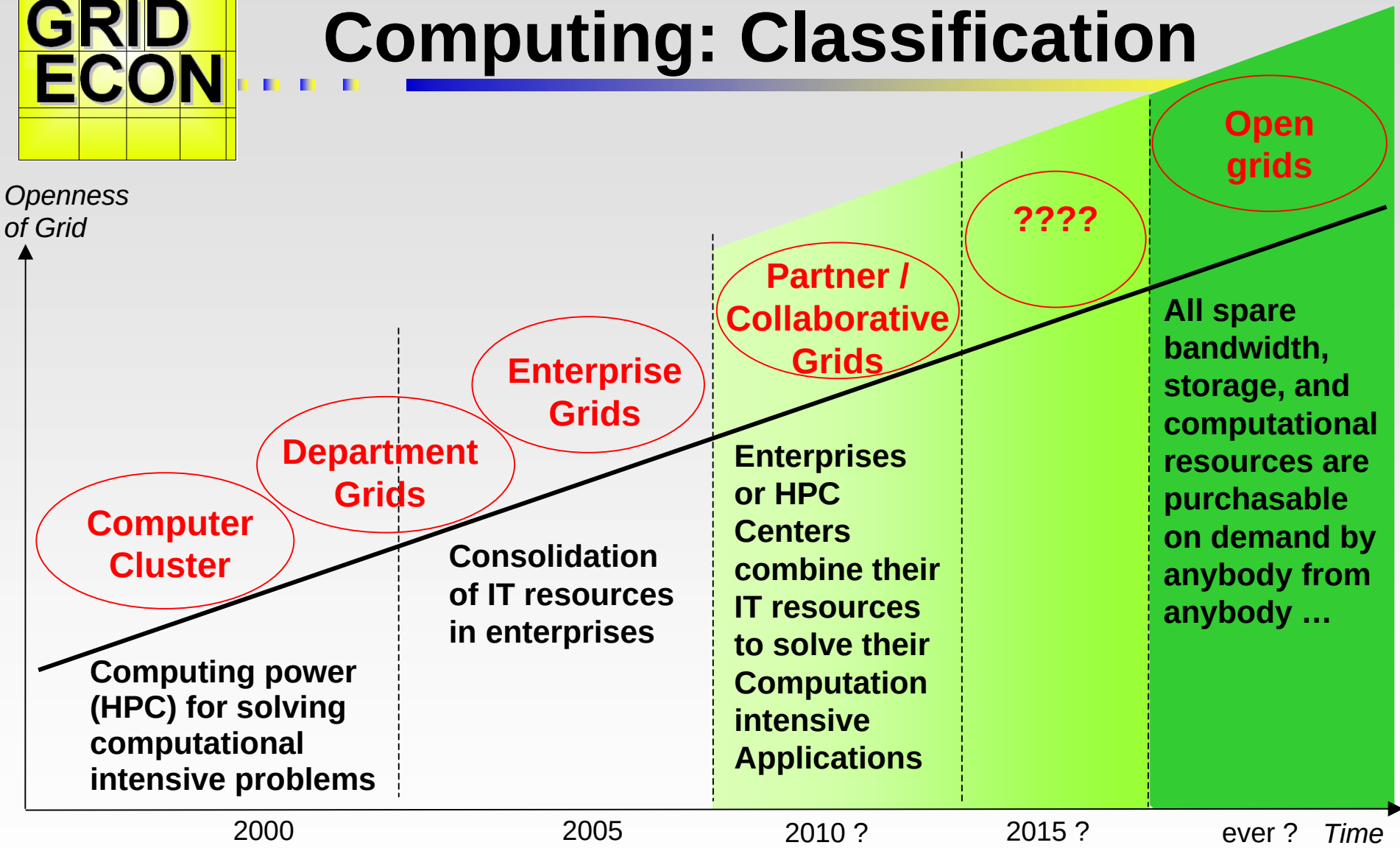
- **Consider three Grid scenarios in which preference conflicts (but trust) exist**
  - **Scenario 1:** Interconnection of HPC centers
  - **Scenario 2:** Franchising enterprises
  - **Scenario 3:** Internet Service Market
- **Identify stakeholders and roles**
- **Analyze common issues in those scenario**
- **Design solutions based on economic models**
- **Integrate them into existing Grid middleware**

State of the Art in Grid Computing

- **There are many technical solutions for Grid computing**
  - Middleware systems (Globus, glite (dgas), GRIA, Unicore, etc) have been developed
  - There are also a few commercial implementations

- **But, only a few sustainable applications of Grid technology exist. They are**
  - In the area of **scientific computing** and,
  - To a **limited extent, in the commercial environment**

State-of-the-Art in Grid Computing: Classification



- Classification of Grids by ownership and use, utility, kind of resources (software and hardware)

Incentives for Using the Grid: Addressed Features of the Grid

- **Cost reduction through IT Outsourcing (e.g. Enterprise Grids, Department Grids)**
  - Enterprises are using Grid technology to
    - **Interconnect** their IT resources
    - **Consolidate** their enterprise-wide IT resources

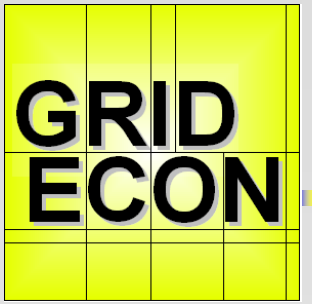
- **Capability to solve computationally intensive problems that cannot be solved without combining resources**
  - **Examples**: scientific computing, commercial calculations (Shortening time-to-market of products)
  - **Society benefits by getting**
    - New knowledge
    - Reputation
    - Technology leadership

Incentives for Using the Grid: Not Addressed Features of the Grid

- **Availability of on-demand computational power**
  - Speeds up research output and time-to-market of products
- **Low cost of ownership (no upfront investment)**
  - Small and medium-size enterprises have not to purchase high-end servers and software anymore (e.g. injection molding simulation)
  - General public can establish home enterprises
  - Any researcher can have access to high-performance computers
- **Simplicity of using resources (hardware and software)**
  - Availability of a **pool of applications** in the e-science space
- **Pay-for-use / pay-as-you-go**
  - Grid computing could provide **small-medium-size enterprises, any researcher, or partner in a partnership** pay-for-use access to high-end servers and software

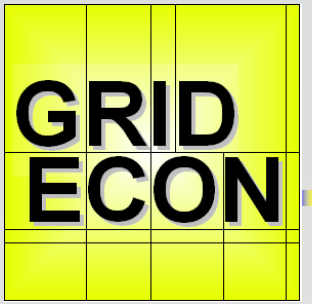
Sustainability from the Perspective of Economics

- **Definition of sustainability**
  - A **business model** which guarantees revenues to cover the cost for the service provisioning
- **Achieving sustainability in the Grid environment by**
  - **Providing the infrastructure and tools to entities** (researcher, organizations, companies, etc) so that they can benefit from the Grid and money gets invested into the Grid
    - Ontology definitions, data structure updates
  - **Getting return on the investment** in Grid hardware and software which can be reinvested or can cover the cost
- **Consequence**
  - In the long run, commercial Grids or scientific **Grids would merge** (e.g. Internet)



Economics

- Economics does not have to be about profit maximization (business),
- But instead, economics could address
  - Social welfare maximization,
  - Utility maximization,
  - Cost recovery, and
  - Fairness
- For the e-science community, government funding still has to come in. But, the way of allocating the resources could be re-considered



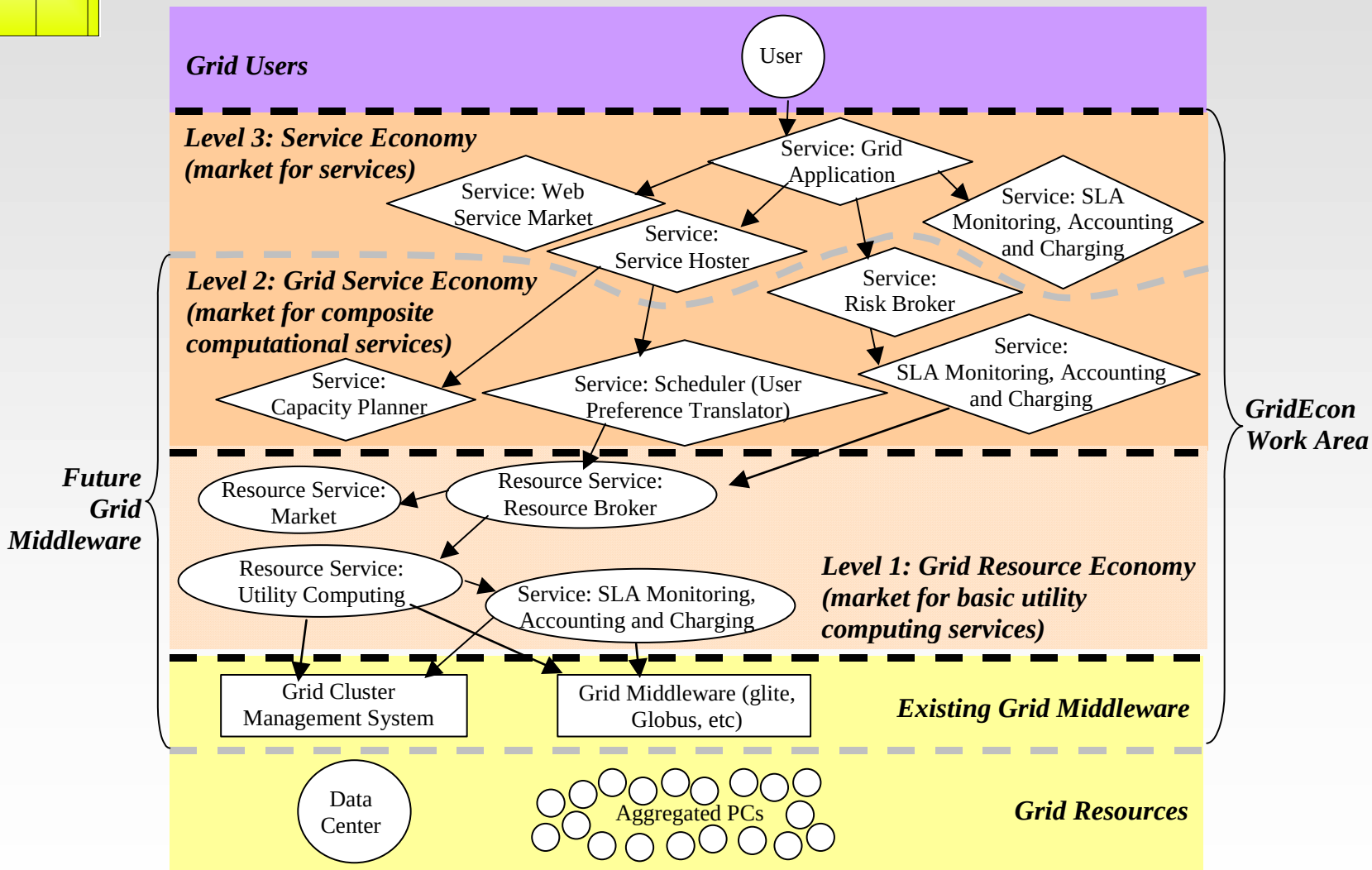
Economics: Interconnection of HPC Centers: Issues

- **Even then, not every researcher has access to the Grid**
  - A researcher in a poor state (poor country) cannot execute his/her application since he/she does not have access to HPC environment
- **Conflicts in preferences between stakeholders cannot be resolved**
  - **Why** should state A (/ country A) allow a researcher of state B (/ country B) accessing its high-performance computer (which has been paid by tax payers of state A)?
  - **Will** the researcher of the local HPC center have higher priority over other researchers?
  - **How much** of the high-performance computing resources should be made available to the Grid?
- **Policies exist which try to address the issue of resource allocation but provide not economically efficient solution**

Research Topics

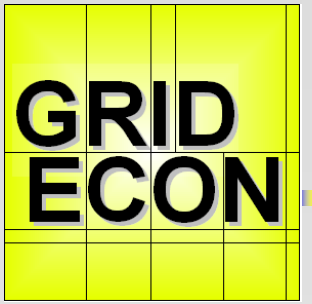
- **Trust that the data at the remote site is safe and sufficiently protected**
- **Billing stack for different kind of services has to be in place (so that providers can be compensated for the resources provided)**
- **Guarantee of fairness of resource allocation in order to reduce policy limitations**
- **Capacity planning support through business Intelligence tools**

Research Topics: GridEcon Reference Architecture



Conclusion

- **If GridEcon will be successful, there will be an environment to collaborate across individual organizational boundaries**
  - **reduced participation risk** by paying an appropriate price, and
  - **economically fair sharing** of costs and generated value



Thank You!