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**
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
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

Level 3: Service Economy

User

Service: Grid Application

Service: SLA Monitoring, Accounting and Charging

Service: SLA Monitoring, Accounting and Charging

Service: Web Service Market

Service: Service Hoster

Service: Scheduler (User Preference Translator)

Service: Scheduler (User Preference Translator)

Service: Risk Broker

Service: Grid Monitoring, Accounting, and Charging

Level 2: Grid Service Economy

Service: Web Service Market

Service: Service Hoster

Service: Scheduler (User Preference Translator)

Service: Grid Monitoring, Accounting, and Charging

Service: SLA Monitoring, Accounting, and Charging

Service: Grid Monitoring, Accounting, and Charging

Service: Grid Monitoring, Accounting, and Charging

Level 1: Grid Resource Economy

Service: Web Service Market

Service: Service Hoster

Service: Scheduler (User Preference Translator)

Service: Grid Monitoring, Accounting, and Charging

Service: SLA Monitoring, Accounting, and Charging

Service: Grid Monitoring, Accounting, and Charging

Service: Grid Monitoring, Accounting, and Charging

Grid Resources

Aggregated PCs

GridEcon Work Area

Future Grid Middleware

Existing Grid Middleware

Grid Cluster Management System

Grid Middleware (glite, Globus, etc)

Data Center
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!