A SUSTAINABLE GRID INFRASTRUCTURE FOR EUROPE

Executive Summary of the e-IRG Open Workshop on e-Infrastructures
Heidelberg, Germany, April 19 – 20, 2007

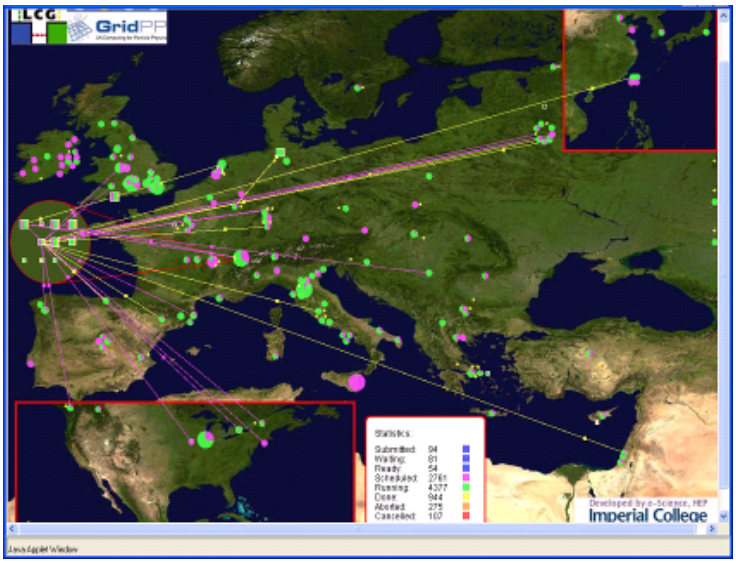
The series of open workshops supports the e-IRG activities by enabling and stimulating the discussion of e-infrastructure related topics with the community across thematic and country borders. The main theme of the Heidelberg workshop was on "A sustainable Grid infrastructure for Europe", including the topics:

- Towards a European e-infrastructure
- Sustainability for e-Infrastructures
- Bridging the gap between academia and industry

The workshop was hosted by EML, the European Media Lab, on behalf of the German Federal Ministry of Education and Research. Details can be found at: http://e-irg.eu/workshopGermany

Topic 1: Towards a European e-Infrastructure

In launching the partnership for growth and jobs as a new start for the Lisbon strategy, the 2005 European Council called knowledge and innovation the engines of sustainable growth and stated that it is essential to build a fully inclusive information society, based on the widespread use of information and communication technologies (ICT). To get the full benefits from ICT, EU Member States need more ambitious plans to exploit those, reveals the Commission's first annual progress report on i2010. In this political and economic context, the European driven e-Infrastructure enables researchers across Europe to face today's big challenges, fostering the emergence of a new generation of ICT-based infrastructures for the good of the European and world economy.



EGEE Grid in Action: every day, more than 100.000 compute jobs are distributed all over Europe.

There is a common vision for the requirements of a global e-Infrastructure to support data-driven e-Science that will overtake us in the next 5 to 10 years. Many sciences will generate orders of magnitude more data to capture, manage, mine, analyse and preserve than in the whole of human history. One key area of concern for the e-Infrastructure agenda is the federation and interoperation of repositories. Technological and social forces make some form of open access to both research papers and research data inevitable. However, this is unlikely to be an area with a strong commercial driver, and the research community needs to support emerging standards that will allow deep interoperability between repositories.

In the future, e-Infrastructures could be commonly used by users from various Research Infrastructures which are essential for developing top-class research activities. Because of their ability to assemble a 'critical mass' of people and investment, they contribute to European economic development. Among the areas where Research Infrastructures are most prominent in Europe are specialised archives, libraries and databases and all the 'virtual' infrastructures,

where scientists can share data and carry out their work across the Internet and through virtual office spaces. The process of creating an instrument for helping to identify those projects that are crucial for the scientific community has resulted in Europe's first ever Roadmap of large scale research facilities, the ESFRI Roadmap (done in cooperation with e-IRG).

During the Heidelberg workshop, European Grid and HPC infrastructure initiatives such as EGEE, DEISA, HET (PRACE), and EGI have presented their lessons learned and recommendations for building and operating e-infrastructures. One of their key requirements for the further advancements of e-infrastructures is sustainability, as pointed out under Topic 2. Already today, many scientific applications depend on production Grid infrastructures. New scientific collaborations have been formed thanks to the advancements of Service Grids, and business and industry are getting more and more interested.

Recommendation 1: To enable and support collaborative scientific discoveries across the wider research community in Europe, a sustainable Grid Infrastructure should be established with a long term perspective for the availability of Grid services and support, driven by the needs and requirements of the European research community, and supported by the National Grid Initiatives.

Recommendation 2: There is a need for high-end computing resources in Europe. It is important to carry on the discussion between HPC specialists and scientists to look for optimal solutions. Scalable application development, integration and interoperability with the existing computing centers and Grid Infrastructures, and competence development are key issues when aiming at efficient usage of HPC facilities.

Recommendation 3: An European e-Infrastructure has to address the common ICT-based needs of the new Research Infrastructures that are identified in the relevant roadmap of the European Strategy Forum for Research Infrastructures (ESFRI).

Topic 2: Sustainability for e-Infrastructures

Europe has started early in building community Grid services, with the mission to provide coherent access for researchers to computational and data resources required to carry out their research. To achieve this, initiatives in many European countries are currently deploying and operating common Grid production and support infrastructures to support ICT based research.

Despite the success of the last years, several challenges remain, not least that of agreeing and promoting a shared vision of a common sustainable research infrastructure including all significant resources and services of a community. Lack of user confidence in the long term future of any infrastructure makes defining this vision more difficult. Success of a shared research infrastructure depends critically upon the acknowledgement by key stakeholders of their responsibility to help define and support it.

The community has been slow to get to grips with the sustainability challenges posed by the widespread adoption of e-Infrastructure. An important example is the impact of a potentially vast increase in both the numbers and types of research resources (data, services, learning objects, etc.). The accumulation, sharing and re-use of resources lies at the heart of the e-Research vision. However, it seems that responses to the support and financial issues have yet to be factored into planning for e-Infrastructure sustainability.

Grid technology enables transparent sharing of computing resources that are provided by the participants into a common pool, leading to efficient multiplexing and use of economies of scale. However, there has been so far no careful study of the effects of particular sharing policies to the total size of the final facility resulting from the contributions of the various participants. The decision by an organisation on how many resources to contribute in the common resource pool is influenced by the resource sharing policy that will be deployed in the future when the system will operate, and hence it greatly influences sustainability.

In Grids optimal resource allocation has to be carried out in two dimensions. One is the maximisation of the utilisation of technical resources, guaranteeing that all resources are used and no resources are "wasted". In contrary to this allocation paradigm the economic resource allocation is aligning the deployment of resources along the economic utility of the individual Grid nodes.

An important driver for sustainability will be Grid economy market mechanisms to enable a two-tiered allocation of Grid resources. In the first tier of these markets, service consumers can trade with service providers about their service needs. Service providers then act on a second market tier – the resource market – where they purchase the resources they need in order to carry out the services. These two markets are interrelated through the price that is determined in the first tier.

Recommendation 1: Governments and funding agencies need to drive development of a shared vision for a common sustainable e-infrastructure, engaging key stakeholders. Strong strategic commitment from, and coordination between, funding agencies and key user communities are an important driver for the current infrastructure development. Possible mechanisms include: high level policy statements; requirements on ongoing or new funding; creation of explicit new bodies or organisations; and a mechanism for developing and sustaining confidence in the emerging infrastructure.

Recommendation 2: A key focus should be on enlarging the infrastructure user and provider community. Joining the infrastructure must become easier, justifiable and self sustaining. Policies for operating and sharing the common infrastructure should be clearly defined and made publicly known to the participants before they decide on their contributions. Finally, efforts in education and training should be increased.

Recommendation 3: Efforts for the development of economic standards and interaction schemes should be fostered for the utilisation of e-Infrastructures, including pilots for Grid business models and markets where researchers from computer science, economics and business administration jointly work on dynamic, economically sound and vertically integrated business concepts for the utilisation of e-Infrastructures.

Topic 3: Bridging the Gap Between Academia and Industry

In many areas, Grids are now widespread in industry, both as compute or enterprise Grids for sectors such as finance, life sciences, oil and gas, but also as the basis for major providers of compute, data, and application services. Several European infrastructure projects contain a strong industrial component, intending to reduce the gap between e-Science and e-Business so that the on-going transfer of knowledge and technology can be better focused and result in establishing new services and business opportunities. Other projects aim at extending their reach beyond research and attract industry by offering HPC resources as part of their evolving Grid environments. However, these activities have not yet created a general Grid approach for industrial usage of HPC. Experience so far is mostly with existing computer centres who have set up special programs to encourage industrial usage of their resources.

For a wider industry acceptance and use of Grid resources beyond enterprise boundaries, major efforts are still necessary to solve technology, legal and economic issues (such as interoperability, standardisation, security, licensing, infrastructure complexity, and regulations). Ignorance of these issues will lead to failure and discourages sustained usage of public research infrastructure.

Last but not least, an opportunity of general importance, far beyond but often including e-Infrastructures, is for the public sector to procure R&D services, called pre-commercial procurement which is about public sector procuring research and development services in view of acquiring solutions to tackle strategic public sector challenges. Areas of public interest from health through education to inclusion and security represent a large part of the EU economy. Closing the gap between public sector needs and private sector R&D would have a direct impact not only on the long term efficiency and effectiveness of the public sector, but also on the competitiveness of European industry. Long time to market and fragmentation of public demand are key reasons why industrial activity directed towards the public sector lacks a strong single European market for the development of new innovative products that can improve public services.

Aerospace engineering simulations of turbine flows, as performed in the D-Grid AeroGrid project

Challenges such as the increasing competition on a global scale, the ageing population, climate change, energy efficiency and security – will require significant quality improvements in public services in a sustainable and cost effective way. These improvements can be best achieved through mid to long term strategic transformations in ways services are acquired, developed and delivered and by making use of the latest inventions and innovations.

Recommendation 1: Coordination between EC funded projects with business related objectives has to be improved. While there is a general willingness to come together and discuss their findings, it is difficult to find significant documented evidence on projects indicating their proven solutions to the business sectors. Identifying mutual benefits for sharing resources between research and industry, finding working business models by addressing the economic and legal issues of a mixed usage model that considers the organisational and economical boundary conditions, developing mechanisms that allow the trading of computing resources, and providing clear information on the business case for e-Infrastructures, will help businesses to understand e-infrastructure opportunities.

Recommendation 2: EC funded projects have created technologies and opportunities to convert into new businesses. Current entrepreneurship initiatives should be enlarged and supplemented with information about how entrepreneurs can get access to funds to help create new companies. To aid entrepreneurship, public organisations employing researchers should be encouraged to define employment conditions that permit individuals to continue their research while developing business opportunities in parallel.

Recommendation 3: Networking and cooperation between public procurers in the development process of new solutions would lead to better interoperability and exchangeability in the public sector and thereby better productivity and lower costs, on one hand, and economies of scale and thereby a better competitive position for the industry, on the other hand. When strategically linked with other demand and supply measures such as standardisation, regulations and well functioning venture capital markets – pre-commercial procurement can be geared to contribute directly to the development of important new lead markets for innovative products and services and thereby to the creation of growth and jobs in Europe.

A detailed workshop summary and the presentations can be found at:
http://e-irg.eu/meetings/2007-DE/workshop.html