e-Infrastructure Reflection Group (e-IRG)
Task Force on Sustainable e-Infrastructures (SeI)

The overall vision of this document:

"The linking of individual computers into increasingly complex networks has been transforming the scientific enterprise for several decades. Networking has affected every aspect of research, including data gathering, sharing of large databases, brute-force computing, modelling and simulation, and publishing of preprints and papers."

Background for this work

At the fifth e-IRG delegates meeting in London December 2005, during the UK Presidency of the EU, Kyriakos Baxevanidis (EC) presented the preliminary EC proposal for budget allocation for European e-Infrastructures in FP7. The current situation creates challenges because of the limited resources, duration, and support of infrastructures. The current instruments have difficulties accommodating permanent service provisioning.

At the e-IRG meeting it was decided to set up an e-IRG Task Force for "Sustainable eInfrastructures" following the recommendations from the e-IRG delegates during the meeting. There was a common belief that the importance of this endeavour is obvious for everybody in the e-Infrastructure community, and that there is the pressure to deliver a consistent view to the European Commission by the end of April. This Task Force falls directly under the e-IRG troika (representative for the previous, present and upcoming Presidency of EU) and reports back to e-IRG. It addresses the following questions and goals:

- Establish the Terms of Reference for the e-IRG Task Force on "Sustainable e-Infrastructures", including the Membership and participation in the discussion of the Task Force
- Develop a strategy to answer the following questions:
    - What impacts do e-Infrastructures have on the research process in general and on which areas in particular?
    - What is needed in terms of policies and funding to be sustainable over the long term?
    - What can be done to increase the acceptance and convenience of non-e-Infrastructure-enthusiasts?
    - How to integrate industrial efforts and SMEs into sustainable e-Infrastructures?
    - How to attract the industry to use the sustained e-Infrastructure in the daily work?
- Once these questions are answered, and only then, how to achieve sustainability?

The results of the Task Force shall be communicated to the e-IRG delegates for feedback whenever possible.

The initial task force members are:

- Leif Laaksonen (Appointed TF Chair and e-IRG Troika member)
- Victor Alessandrini
- Bob Jones
- Mirco Mazzucato
- Anne Trefethen
- Klaus Ullmann

A corresponding statement provided and agreed upon by the Task Force should be delivered to the e-IRG in time for approval of submission to the European Commission and the membership countries before the end of April.

Scope and relevance of e-Infrastructures supporting European Science

Europe has been able to show through a federated approach, co-funded by the European Commission and member states on top of national infrastructures, that it is able to take a leadership role in the field of e-Infrastructures. Many disciplines in the areas of the humanities and social sciences are poised to exploit these developments that have been championed by domains such as life sciences and physics. Digital libraries, repositories and other cultural resources have already proved to be a valuable asset to meet the challenges in many research disciplines.

In general, scientific research existed before the e-Infrastructures and would presumably exist anyhow without them. However, e-Infrastructures add substantial value by integration of resources and enabling new efficient ways of collaboration through new services and enhancing the capabilities and potentials of the existing computational infrastructures. In some particular key areas e-Infrastructures have a stronger enabling role, in the sense that research as it is done today would be impossible in their absence – both in working on grand challenges and in enabling interdisciplinary collaboration.

The future e-Infrastructure eco-system is built around components and services predominantly already available within existing systems today. In the future these should be available in a much more powerful and flexible way capable of crossing thematic and regional borders. This e-Infrastructure is built using components including those ranging from data management, curation and analysis, computational and visualisation resources to tools for collaborative computing.

How to make e-Infrastructures sustainable

The e-Infrastructures established during the EU Sixth Framework Programme (FP6) represent a big step forward. The efforts required to build a large scale production e-Infrastructure are extremely expensive and in order to protect Europe's current investment, the next phase of the pan-European e-Infrastructure needs to be based on existing e-Infrastructures. To ensure the long term sustainability, shared e-Infrastructures should be economically and resource-wise independent of any individual user community or resource provider.

e-Infrastructures are mainly driven by national funding, addressing specific user communities but mechanisms are required to coordinate and pool investments across national borders in order to compete on a global level. Sustainability can only be achieved through strong national e-Infrastructure initiatives willing to merge efforts to form coordinated pan-European structures and be open to all user communities.

Recommendation I: governments and the Commission should develop policies and mechanisms to encourage increased investment in a more coherent and interoperable way across Europe

The instruments used to fund e-Infrastructure both on a national level and on a European level must be adapted to allow the development of new coordination structures, both at national and European level, having a life time at least equivalent to the Framework Programme itself. The existing European infrastructure projects should be superseded by a new Pan-European structure, adequate to support permanent services, that builds on the work of such projects and on the national e-Infrastructures organizations and on existing national e-Infrastructures.

Modern research requires a greatly improved and well developed infrastructure maintained on a sustainable and long term basis. The short stop-start approach to funding is inefficient and cannot sustain the effort to create and improve such infrastructures.

Recommendation II: the existing e-Infrastructure projects must be superseded by integrated sustainable services at national and European levels

To ensure the long term sustainability, e-Infrastructures should be largely shared and not depend economically from any individual user community or resource provider and rely on a financing model based on user communities usage.

Current e-Infrastructure projects involve partnerships from a large number of service provider or research oriented organisations, fully competent to operate on the field, but in general with no mandate on national funding or policies. It is therefore important to encourage the creation of national or regional infrastructure organisations, as recommended by the e-IRG itself during the meeting in London December 2005:

> *In order to facilitate international collaboration the e-IRG wishes to reaffirm the importance of the national e-Infrastructure initiatives that aggregate on a national level relevant e-Infrastructure activities.*

To ensure the greater impact of e-Infrastructures on the research community such infrastructures have to be inclusive by nature and be open to new user communities and resource providers. Embedding the concept of openness into national policies by making it a prerequisite for funding will ensure the greater impact.

Recommendation III: e-Infrastructures must be application-neutral and open to all user communities and resource providers. National funding agencies should be encouraged to fund multi-disciplinary and inclusive infrastructures rather than disciplinary-specific alternatives

Many of the scientific and research communities, which are the current primary users of this infrastructure, already operate on a global scale. For this reason it is imperative that e-Infrastructures in Europe inter-operate among themselves and with the rest of the world.

Recommendation IV: e-Infrastructures must inter-operate and adopt international standard services and protocols in order to qualify for funding

It is also imperative to avoid divergences and duplication of efforts both at national and European level.

Recommendation V: the Commission should, within the seventh Framework Programme, develop a pan-European e-Infrastructure which explicitly encourages the further integration of national e-Infrastructure initiatives

Increasing efficiency and impact

Beyond the recommendations made above and to further increase the efficiency and impact of e-Infrastructures the Task Force recommends the following actions:

⇒ To strengthen the integration of industrial efforts and SMEs into sustainable infrastructures in this context, industry has to be seen as both a potential user and a major partner for service provision. Clear policies have to be established for access from industrial research projects in pre-competitive domains, industrial production projects accessing innovative technologies or deploying innovative strategies and industrial production projects with occasional exceptional requirements (critical computing on demand).

⇒ Infrastructures need to remain state of the art; therefore new technologies should be evaluated and introduced continuously. In order to make investments in R&D more efficient, the take up of new technology in production infrastructures should be improved by appointing e-Infrastructure providers as stakeholders in relevant R&D efforts.

⇒ To accelerate and expand the adoption of e-Infrastructures attention must be paid to their ease of use. Investing in improving the usability (e.g. by hiding complexity and increasing interoperability) will broaden their user base, adding significant value to the science community and increasing European competitiveness.

⇒ The new opportunities presented by distributed infrastructures requires increased training and an improved skills base for the research community, which also needs to form part of any national or European strategy for e-Infrastructure. This will require further advisory and guidance services that collaborate across Europe.[1]

[1] The proposed e-IRG Task Force on Training and Education should look into this and make in due time necessary recommendations to support these activities.