



## Dimitris Deniozos

### CURRICULUM VITAE

Born on 10 December 1946 in Athens.

Graduate of the Technical University of Athens, School of Mining and Metallurgical Engineering, 1969.

Graduate of the Business Administration Institute, University of Grenoble II, 1970.

Doctor in Economics and Business Administration of the University of Grenoble II (Social Sciences), 1975. Thesis subject: "the introduction of technological innovations in one European country: the case of Greece - a managerial approach".

### EMPLOYMENTS

GATT and Economic Commission for Europe of the United Nations, Geneva, 1970 to 1974.

Federal Technical University of Lausanne (EPFL), Foresight and Institutional Research Office (Bureau de Prospective), 1974 to 1977: Research on university research management and on university "productivity" indicators.

Conference of Chancellors and Rectors of the Swiss Universities, Planning Committee, 1977.

General Secretariat for Research and Technology, Ministry of Industry, Energy and Technology Greece, 1978-1996.

Under-secretary for education, Ministry of Education, E.U. Programmes and multi-annual Structural Programme for Education and Initial Professional Training, Apr. 1996 – Dec. 1997.

President of the National Labour Institute 1997-2000. Main task to develop the research and analysis activities of the Institute, in the area of employment, labor market, vocational training and social security, and to support the implementation of the dialogue among the social partners.

Since May 2000 head of the General Secretariat for Research and Technology. Initiator of the new national structural programme on research and technological innovation 2000-2006 and of the revised legal framework for public research institutions.

Elected assistant professor of the Technical University of Crete, Department of Production and Management Engineering, 1985. Since winter 1998: teaching innovation and technology policy, assessment and evaluation and research management at the Programme on "Human Resources Management" of the University of Athens.

Author of various articles and studies in scientific and technical journals.



# 4.1 Session 1: New

## 4.1.1 Dimitris Demiozos – eInfrastructures and ERIA

The European Research Area (ERA) is the central pillar of Framework Programme 6 (FP6) and beyond. It is a key component of the strategy to make the European Union (EU) the most competitive knowledge-based economy globally by the year 2010. The Greek presidency of the EU has stated the importance of innovation with regard to competitiveness – encapsulated in the idea of the European Innovation Area – and considers that the convergence of these two equal components should be represented as the European Research and Innovation Area (ERIA). The objectives of ERIA should be to: create an internal market in research, knowledge, researchers and technology to stimulate competition and better allocation of resources; to improve coordination of national research activities and policies; and to revisit the “subsidiarity principle” to understand how European thinking may influence national

approaches – it is not enough to only reflect national priorities in EU strategies. The Greek presidency of the EU is committed to the ERIA process.

In the context of Research Infrastructures (RIs) and European competitiveness, which have been supported for the last decade through the Framework Programmes, the Competitiveness Council in Brussels agreed on the 3rd March 2003 that a high priority should be given to the Information Society in order to meet the objectives of eEurope identified in Lisbon and Barcelona. We must therefore debate the need for mechanisms: to jointly identify new research and technological challenges and how to respond to them in a rapid and effective manner; to increase the financial support by both the public and private sectors for RIs; to strengthen the role of RIs to lift obstacles to




### eInfrastructures and the ERIA

**The way forward**

Dimitris Demiozos  
General Secretary for Research and Technology,  
Ministry of Development, Greece  
Athens June 12th, 2003




### From ERA to ERIA

- European Research Area (ERA)
  - Central pillar of research activities in the European Union, beyond the FP.
  - Key component of the strategy aiming to make the European Union the most competitive knowledge-based economy by the year 2010.
- European Innovation Area
  - A recognition that competitiveness is linked directly to innovation.
- The Greek Presidency considers the two areas have to converge in order to achieve the desired rates of competitiveness and sustainable growth.



### Objectives of ERIA

- Creation of an internal market in research, knowledge, researchers and technology, stimulate competition and better allocation of resources
- Improving coordination of national research activities and policies
- Taking into account all relevant aspects of other EU policies
- Revisiting the “subsidiarity principle” in away that the European thinking will prevail over the national approaches.
- The Greek E.U. Presidency is committed to the ERIA process



### Research Infrastructures in ERIA

- The essential role of R.I, particularly in providing access to users
  - has been supported for the last decade through the Framework Programmes,
  - has to be strengthened further, with considerable financial support,
  - major instruments for advancing Europe's competitiveness
- The 33/2003 Competitiveness Council in Brussels agreed that
  - “... High priority should be given to the Information Society and to increasing the capacity of scientific board communication networks (GEANT and GRID-the eInfrastructure concept)....”

# challenges for Europe on eInfrastructures

mobility and promote the integration of European scientists; to increase the contribution of national infrastructures to ERA; and to strengthen support for the successful deployment of Grid enabled eInfrastructures across Europe making full use of the GEANT pan-European research network.

The objectives of the eInfrastructure initiative are fully in line with the objectives of ERIA. They can be seen as providing a framework for: easier, faster and more cost-effective access to all researchers in Europe; allowing seamless access to information resources distributed across Europe; strengthening equal opportunities for all European scientists; and as a means to spread the benefits of "big science" to less advanced, remotely-located regions throughout Europe. These infrastructures should not be seen only as instruments for advanced science.

They involve the development and use of many advanced technologies and many innovative solutions. It is crucial to promote best practice in RIs rapidly and to accelerate commercial uptake.

Greece is catching up in developing its knowledge based economy and is showing strong overall trends in improved innovation performance. GSRT funds technological infrastructure in Academic and Research Institutes. These Research Institutes are ready to use and provide Grid resources connected to GEANT through GRNET, the Greek Research and Technology Network, which operates the national network at speeds up to 2.5Gbps. Greece is also supporting the extension of ERIA to the Balkans and Mediterranean countries.



## Key issues for debate

- Need for a mechanism to jointly identify new research and technological challenges and respond to them in a rapid and effective manner
- Increase the financial support by both the public and private sectors for Research Infrastructures
- Strengthen the role of Research Infrastructures for lifting mobility obstacles and promoting the integration of European scientists
- Increasing the contribution of the intergovernmental research organisation's Research Infrastructures in the ERA
- Strengthen the support for the successful deployment of Grids enabled eInfrastructures across Europe over the pan-European research network GEANT.



## The EU eInfrastructures initiative

- The objectives of EU eInfrastructures initiative is fully in line with the ERIA and
  - Provide for a framework for easier, faster and more cost-effective access to all researchers in Europe
  - Allow seamless access to all types of information resources (networking, computing, data storage) distributed across Europe
  - Offer equal opportunities in the use of resources independent of location or affiliation of the scientist
  - Can be seen as a means to spread "Big Science" to less-advanced, remotely-located regions of our continent



## The EU eInfrastructures initiative

- R I are not only instruments for advanced science!
- They involve the development and use of advanced Technology and many technological innovations
- It is crucial to promote rapidly the best practice in the use of R I to accelerate a later commercial uptake
  - how those technologies could create a competitive advantage for Europe?
  - how new differentiated services and products could be developed?
  - how the industry can be involved in the developments from the beginning?



## Greek Secretariat for R & T supporting activities

- Greece is catching up in developing a knowledge-based economy...
  - ...with strong overall trends in improved innovation performance
- GSRT funds technological infrastructure in Academic and Research Institutes
- Greek Research Institutes are ready to use and provide Grid resources (note applications - offer resources)
- GSRT operates MAN in Athens at 2.5 Gbps (nation-wide by end 2003)
- Supports the extended ERIA in the Balkans and the Mediterranean







## Yannis Kalogirou

Yannis D. Caloghirou, Secretary for the Information Society of the Ministry of Economy and Finance, is responsible for the implementation of the Operational Program Information Society and the development of policies regarding new economy in Greece.

From April 2000 to June 2002 he served as Secretary General for Industry at the Ministry for Development. In that capacity, among others, he coordinated the preparation of the 'Operational Programme on Competitiveness' and the part of the 'Operational Program Information Society' that relates to the development and the employment in the digital economy. He also had the responsibility for the planning and the implementation of the policy and related programs for the optimal use of ICT's by small to medium-sized enterprises, such as the 'go-online' and 'e-business' programs. He also had in July 2000 the responsibility for the creation and the operation of the 'e-business forum' that was later accredited by the European Commission as one of the best examples of public policy in Europe.

He has also been Special Advisor to the Alternate Minister of National Economy Mr K. Vaitos (1982-1985), Scientific associate at the Ministry of Industry, Energy and Technology (1985-87), Special Advisor to the Alternate Minister for Industry Mr G. Giannaros (1989-1990), expert at the Ministry of Development (1993-1997) in the framework of the 'future of Greek Industry' project, promoted by Mr K. Simitis then Minister of Industry.

Moreover, he has been a member of the Management Board of the Commercial Bank of Greece, scientific adviser to the National Telecommunications Commission (1997-1999) and expert to the European Commission for financial analysis of public procurement issues (1992-1996). Finally he has been a member of the European Commission's Enterprise Policy Group (2000-2002).

Mr. Caloghirou has a Diploma in Chemical Engineering from the National Technical University of Athens (NTUA), a BA in Economics from the University of Athens, an MSc from the University of Strathclyde and a Ph.D. in Economics from NTUA on "The Interlocking between the Purchasing Power of the State and Industrial Activity: The Case of Greece."

He is Assistant Professor of Industrial Economics and Business Strategy at the National Technical University of Athens and has taught at the Athens MBA (common postgraduate program of the NTUA and the Athens University of Economics and Business).

He has participated in over 30 funded research projects and has been the scientific coordinator in several National and European projects.

He published over 30 scientific articles and participated in the writing of many books.

At present he is co-editing along with Prof. Vonortas and Prof. Ioannides the book "European Collaboration in Research and Development: Business Strategy and Public Policy" (Edward Elgar, 2003), and along with the aforementioned and Mrs Constantelou, the book "Knowledge Flows in European Industry: Mechanisms and Policy Implications" (Routledge, 2003).





### 4.1.2 Yannis Kalogirou – Broadband & eInfrastructures:

The Greek Government believes that eInfrastructures represent the future of the Information Society. Greece itself is an excellent example of the importance of this statement. The emergence of a ubiquitous Information Society in Greece is a prerequisite for the convergence of the Greek economy with the EU average. A key point is that the Information Society is not just for top universities and large companies; it should represent society at large.

The eEurope Action Plan has set a number of challenging objectives for 2005 that include: broadband connections for all public administrations, schools, universities, museums and libraries; widespread availability and use of broadband networks throughout the EU; and the reduction of barriers to broadband deployment. Where applicable the eEurope plan supports the use of struc-

tural funds to achieve these objectives in less favoured areas. Broadband networking is central to the eEurope Action Plan and in many ways it can be seen as the “railway network” or “electricity power grid” of this century. In any country, broadband deployment requires a clear strategy and political commitment and this is magnified in Greece due to its rural nature and all of the challenges that this brings with it.

In the context of the Information Society there is a need for equal opportunities to make use of resources, independent of location or affiliation of the user. This is just as important for nations building their knowledge economy as it is for mature knowledge economy countries. The Greek Government supports the creation of a pan-European distributed environment for the provision of computing and storage resources to

eInfrastructures  
The future of the Information Society



Yannis Kalogirou  
Secretary for the Information Society  
Ministry of Economy and Finance  
[www.mef.gov.gr](http://www.mef.gov.gr)

“EU infrastructure initiative”  
Athens, June 12 2003



Greek IS strategy Objectives

- The development in Greece is a priority role for the convergence of the Greek economy and society in terms of convergence with the world and quality of life with EU Average
- The Information Society is a priority for Society and Human Resources. It is not only a matter of high time and top universities and Research Institutes. It is also a matter of the convergence of the Greek economy and society at large
- The strategy objectives of the use of ICTs in Greek Economy and society are:
  - Create an educational and research system for the Digital Age
  - Increase the quality of life and quality of infrastructure, services and environment for the citizens and the business community
  - Increase productivity in the Public Administration
  - Increase the quality of life and quality of services of the business sector
  - Upgrade skills and the creation of new jobs
  - Promoting of the Greek culture and environment of local content
  - Development of high quality services and products in the infrastructure and services
  - Narrowing down the digital divide and promote regional development
- The main tasks in building the IS in Greece are the IS National Strategy and the Operational Programmes (OPs) based on the National Strategy

Broadband Networking as a prerequisite

- Broadband is for the Information Society and the Knowledge economy when electricity, the net and high speed were for the Industrial Age
- Broadband deployment is at the heart of the eEurope 2005 Action Plan
  - A prerequisite for the development of the Information Society and the Knowledge economy
  - A prerequisite for the development of the Information Society and the Knowledge economy
- “Fast access, reliable access” broadband is a prerequisite for “advanced” services for the nation and the development of local and national level better education and **knowledge** development of higher skills through learning, the promotion of cultural heritage, tourism and new forms of entertainment, **services** and **security** services
- Broadband is also a prerequisite for improved **services** and **security** services
- Broadband is a prerequisite for **development of the Information Society and the Knowledge economy**

Broadband Infrastructures and services deployment and the role Public Policy

- It is widely accepted that in many cases successful deployment of broadband infrastructures and services for **all** require a clear strategy and political commitment
  - To counter market failures where:
    - competition fails to provide essential services in particular in remote and underdeveloped regions
    - there is limited interest for the private sector to lack of enough money
    - important digital divides occur
  - to aggregate demand by using BB services for the public administration needs (G2C) and to provide advanced **services** and content for citizens and business (G2B, G2E)
  - to create the necessary **regulatory framework** (facilitate competition)
  - Ensure security, privacy and Trust

# a path to Regional Development and InfoSociety

support scientists from across Europe. This statement has brought with it many challenges: Grid technologies are not yet mature enough to apply at a national level and furthermore the Greek market is reluctant to invest in these new technologies; there was also no national body for Grids in Greece (HellasGrid has now been created to meet this need and also to represent Greece in pan-European efforts like EGEE); and there was no separate funding for Grid projects (funding has had to be found from OPIS – the operational programme for the Information Society in Greece).

The Greek Government has taken specific actions to foster the deployment of broadband in Greece. This has involved the funding of broadband infrastructure and services deployment through OPIS. In the context of these actions,

there has been a specific need to consider regulatory issues and wholesale prices in a deregulated communications environment. This environment has been structured in a way that encourages the development of a competitive broadband infrastructure for Greece.

To date, Greece has taken the lead in establishing eInfrastructures in South-East Europe through the work of GRNET in SEEREN. There is still much to do. For instance, Grid technologies are not yet mature enough to apply in the business domain. We must focus on defining policies for resource sharing, accounting, trust and security so that in future Grids may serve both the science and business communities. Only then will we be able to say that Grids are the “railways” of the 21st Century.

Broadband Policy measures for Greece

- The Secretariat for Information Society in collaboration with the Ministry of Transport and Communications has established a broadband Task Force that already produced a National strategy for Broadband access
- Measures to develop broadband services through OPIS
  - Total budget 77M€
  - Support domains: WAP Hotspots, DSL, UDS, UTM-E
- Support supply of Broadband Infrastructures through OPIS
  - Total budget 30M€
  - Need to find the right model for deploying broadband infrastructures in order to ensure future profit, high quality and cheap broadband services for all Greece
- Need to consider some regulatory issues in particular regarding wholesale prices (backbone access) in order to ensure competition on broadband services

Grids: the Driver for the future development of the Information society and knowledge economy

- Future of sharing devoted to:
  - Research tasks
  - Sharing information
  - Scientific publication
  - Path to development and growth
- Integrating distributed human resources for systematic and economical use
- Reliance on the availability of fast networks and high speed broadband access for all the sectors of Grids builds on the size of human resources both in computing power and in data storage capacity. Thus Grids can become the Driver for the future development of the Information society and knowledge economy
- Grids are also a new element to the ERA, boosting research activity through a systematic and continuous effort. Europe, promoting existing research networks (GEANT) with distributed resources sharing capabilities
- Grids will be the backbone and connectivity of the underlying infrastructure providing a uniform way of accessing, processing and storing data

Greece and the Grid

- GRNET provides Gigabit connectivity in Greece for over 70 research and education institutions and DEANT connectivity
- HellasGrid Task Force created by the Secretariat of Information Society Ministry of Economy and Finance
  - Looking for a Greek effort towards Grids harmonization and planning as well as the participation of the Greek Academic community in international efforts
- Grids through GRNET, is lending the efforts towards Advanced ICT and Human resources in South-Eastern Europe
  - South-East European Research and Education Networking
  - South-East European Grid Development Impulse
- EnterpriseGrid – Firm attention to Open Source Grid technologies
- Grids will support advanced research applications in areas such as:
  - Medicine, Agriculture, production, Environment, social, educational and Training, environment, Chemical process simulation, Disaster prevention, etc.

Greece: still a long way to go...

- Policy initiatives and action lines
  - HellasGrid prepared a policy document for the promotion of Grid technologies in the Information Society strategy
  - Need to develop broadband networks throughout Greece and upgrade local area networks
  - Grid technologies are not yet mature to supply a viable business models are untried
  - Need to attain best practices and knowledge at the EU and international level
  - OPIS Funding for Grid – Cluster Computing, only for grid pilot project – Full scale projects under planning
  - Encourage the adoption of a sharing concept
  - Need to adapt applications to the Grid environment



## 4.1 Session 1: New challenges for Europe on eInfrastructures

### 4.1.2 Yannis Kalogirou – Broadband & eInfrastructures: a path to Regional Development and InfoSociety

#### Concluding remarks

- The Grid is an enabler for equal opportunities in the use of resources - Need to define a policy for sharing resources
- The future of grids lies in finding a way to serve both e-Science, e-Business and e-Government requirements and delivering applications/services to all of them
- Expand grids beyond academic research to include
  - for national resources for export to other countries exactly like electricity
- Through sharing of resources important economies of scale can be achieved
- Computer centers in Schools, Universities, Business and Government as well as home PCs can be integrated into Grids and become always and everywhere available resource through a flexible allocation management scheme

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#### Expanding the potential of Grids

- Need to develop models to incorporate the power of Grid resource systems into the economy and society at large
  - HomePC users can become resource providers to consumers ranging from Govt agencies, libraries, research centers etc. winning money or credit for the fees or other exchange
  - A whole new range of resource providers (an example is a public or private firm that manages and allocates them to charitable services)
    - means that business, not academic, volunteer centers can out-bid costs for having their own processing and storage capacity and just rent it from a provider - great benefits for **NGOs**
  - PC users or companies can also test their idle PC capacity to non-for-profit business causes, medical research programs, etc. already existing (<http://www.gridnet.org/infocenter/faq/faq4.html>)
- **Crucial Issues**
  - Develop an accounting and billing system for measuring "Grid units" (G-units), computing capacity
  - Many issues to be solved, among which security, privacy, trust etc.

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## Spyros Konidakis

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Born in Athens (13 Sept 1940)

Graduated the University of Athens (BSc in Physics) and received his Master of Technology and Doctor of Philosophy Degrees in Microelectronics and Optoelectronics in Brunel University London, UK.

He did post-doctoral work in the 'Institute for Telecommunication Studies' (Boulder- Colorado) and at the 'Optical Sciences Center' (University of Tucson -Arizona) on Fiber Optics.

He worked as a researcher in the Research Department of the Greek Telecoms Organization and held positions as a Ministerial advisor in Telecommunications Policy and Technology.

In 1985 he joined the European Commission in the launching of the European Union Telecommunications R&D Programmes (RACE, ACTS). He was responsible for the technical co-ordination of the whole Programme, directed research in Optical communications, networks, UMTS. etc and held the position of the Acting Director of the ACTS Programme in its final phase.

With the launching of the Information Society Programme (IST) he was appointed Acting Director responsible for the Research Networks, Future and emerging Technologies, Trans-European Networks, Programme Strategy, International relations, as well as the Programme administration.

During that period he had the privilege to launch major activities such as the GEANT Network, and GRIDs, seeing Europe to take the Global leadership and international recognition.

Between Sept 2001 and May 2002 he was in the USA as a 'Visiting European Union Fellow' based in the Graduate School for Political and International Affairs and the Centre of West European Studies –University of Pittsburgh.

Currently he is the Advisor to the Deputy General Director in the DG/INFSO.



### 4.1.3 Spyros Konidaris - Global eInfrastructures – The

Greece has a long history of gathering and sharing knowledge. This Greco-Roman approach of creating, sharing and propagating knowledge in an environment open to everyone is embedded in Western civilisation and points to what global eInfrastructures can offer civilisation. In contrast, consider the Egyptian model of privileged elites where most of the knowledge was restricted within the walls of the Pharaohs temples and much of which is as a result now lost.

It is instructive to consider the major milestones we have witnessed over the past 3-4 years. On the 31st October 2000, GEANT was legally born. GEANT reflected the NRENs desire to be more ambitious and have a clear vision, articulated in their charter, for European networking. As a result we have witnessed a meteoric rise in bandwidth from 155Mbps to 10Gbps. Although GEANT represented a large risk it is clear this has paid off – particularly in comparison to the Internet 2 infrastructure in the US which is currently only providing 2.5Gbps.

Shortly before this, on the 20th June 2000, the first Grid Workshop was held at the European Commission. This workshop clearly resonated both with the European scientific community and with the EC.

Very shortly thereafter, funding was made available and serious Grid projects were launched in Europe – DataGrid, EuroGrid etc. During this time the speaker was in the US working as an EU Fellow. In talks and meetings two messages were repeatedly stated. Firstly, Europe is leading the world in its deployment of the GEANT infrastructure and secondly, in doing this we are not thinking regionally but globally. In this regard the US had to acknowledge the reality that, for once, it lagged Europe.

To broaden this discussion we must consider globalisation and cooperation. Today there are both positive and negative connotations associated with globalisation. On the positive side it is clear that communications networks (predominately telecommunications networks) have been the drivers behind globalisation. Our challenge now, in order to mitigate the negative effects of globalisation, is how to find a mechanism of plausible fair governance in order to make the most of it. As the performance of networks increases and as they become all pervasive, the process of globalisation will deepen. In this context the process of evolution of eInfrastructures is worth observing since they represent the spearhead of the network evolution with an impact much greater than just research and education.

## EU leading the way

Considering cooperation, the history of mankind has been determined by the equilibrium of two opposite forces: cooperation and competition. Both must exist, but we can now see clearly that the cooperation model will always win: for example consider the monotonic growth in the size of societal granularity from tribe, to village, to city, to state, ... to the world. This growth has been catalysed through the willingness of mankind to cooperate. As our problems become global the need to extend and deepen global cooperation at the expense of sterile antagonism becomes imperative. The European Union has been at the forefront of advancing this cooperative model for the past 50 years. This gives us the opportunity and the mandate to be at the forefront of the development of knowledge through global cooperation – this can be called the Ecumenical Network of Knowledge.

eInfrastructures bring together the resources of powerful new network infrastructures with potent new tools – such as Grid technology – to make knowledge resources accessible on demand and under agreed rules of conduct to all. In the US the phrase “democratisation of knowledge” is used to describe similar ideas. In Europe we often call this “e-Science”. In this context we must pursue a

model which is not just regional but global. Although eInfrastructures are presently destined for an elite – the scientific research community – as they evolve and mature we will see their takeup first by business and professional users and eventually by ordinary citizens. A new end-user is being created, empowered and free to unleash unlimited human creativity.

In conclusion, the NREN community in Europe has assumed in recent years an acknowledged world leadership in the deployment of the most advanced network infrastructures. It has also become a major player in the development and deployment of Grids. By combining these two elements in the concept of eInfrastructures, and building on Europe’s cooperative skills we can set Europe on the path to global leadership in this area. The Grid community has been afforded the opportunity to articulate a key vision – we must challenge our politicians to understand and support that vision.

Athens has always been a place that inspires new ideas. The location of this event is a happy coincidence – we should take advantage of the ghosts around us – Aristotle, Plato, Socrates ... to guide our thoughts and decisions.







## Mario Campolargo

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Mario Campolargo is Head of Unit “Research Infrastructure” within the European Commission DG INFSO (Information Society).

Mario Campolargo has been heavily involved in the launching of new initiatives in the area of Research Networks, namely in the deployment of the high speed high capacity backbone network for research in Europe operating currently at 10Gbps. The next challenge he is addressing is the deployment of a new Grid-empowered e-Infrastructure for Research in Europe and the further development of large-scale testbeds for integration and validation of new technologies, in the context of user trials.

Mario Campolargo has previously been responsible, within IST and ACTS programs, for co-ordinating the work in areas such as Communication Management and Service Engineering. Before 1990, Mario Campolargo spent 12 years of his carrier in the R&D Centre of Portugal Telecom where he was responsible for Software development.

Mario Campolargo has a Degree in Electrical Engineering by the University of Coimbra - Portugal, is Post graduated in Computing Science by the Imperial College - London, has a Post graduate Diploma in Management by the Ecole de Commerce de Solvay - Brussels and received a “Diplôme d’Etudes Européennes” by Université Catholique de Louvain-La-Neuve - Belgium.



In terms of ERA it is clear that the elnfarastructure initiative must be one of its cornerstones, spearheading and expanding as it does the ideas of an elnfarastructure for Europe as described in the eEurope Action Plan. However, it goes beyond this by integrating national infrastructures, acting as a powerful instrument for international cooperation and contributing to policies such as cohesion, cooperation, standards, industrial competitiveness etc. We are already seeing direct examples of this in, for instance, the e-VLBI work, the infrastructure for the LHC at CERN, the HealthGrid applications and the early adoption of Grid solutions by some industries.

**Moving towards an e-infrastructure**

The diagram illustrates a multi-layered architecture for e-infrastructure. At the top, a green layer represents 'Grids'. Below this is a red layer labeled 'Grid middleware'. The bottom layer is blue and represents 'IP networks'. Arrows indicate data flow between the layers and between different grid components.

# EU perspectives

**Vasilis Maglaris introduced the second session and described how it focussed on presentations from three European Commission officials charged with developing the eInfrastructures concept.**

eInfrastructures need to serve both “normal” user communities and demanding user communities in a dynamic way. They must challenge the technologies employed by the research networks and push the developers of Grid middleware towards stable, robust solutions. We must address several levels of challenges: technology – middleware; organizational – virtual organisations; and policies. We need to articulate the policies we need at both a national and European (global) level and these policies should tackle issues such as: access to resources, geographical coverage, rationalisation of investments etc.

Developing these concepts will require the use of several instruments at both an EU and national level. In the EU context, the most powerful instrument is the Integrated Infrastructure Initiative (I3) supported by Specific Support Actions and Coordination Actions. We must also make use of national initiatives, regional/structural funds, ERANNet-like initia-

tives, and mobilising initiatives such as eEurope. In the context of national initiatives the idea of a steering group for national initiatives has been proposed. This steering group could: exchange information on the various initiatives, reflect on the challenges raised by a Europe-wide infrastructure, promote the adoption of long term common strategies, policies and practices; initiate workshops; broaden user communities; trigger white papers; and give input to future National and EU workplans – FP6/7. We obviously must discuss the formalisation of such a body and this meeting is intended to act as a starting point for this.

In conclusion, eInfrastructures are a very ambitious concept that deserves a correspondingly ambitious approach. The current Grid testbeds have created high expectations that need to be met. The initial response to these ideas has been very positive and we have a real opportunity to lead worldwide – so long as we can move quickly.

## Moving towards an e-infrastructure

In FP6, development of a 12th improved e-infrastructure



## Vision - creating an e-infrastructure...



## e-Infrastructure...

Contributing to EU policies:

- “corner-stone” of ERA
- “spin-off” of an “eEurope infrastructure” (e.g. broadband plus)
- “integrator” of National Infrastructures
- powerful “instrument” for international cooperation
- ... cohesion, cooperation, standards, industrial, etc.



## e-Infrastructure...

Changing the way research is done:

- e-VLBI – radio telescopes
- Large Hadron Collider
- Health Grid initiatives
- Crash simulations





### 4.2.1 Mario Campolargo - The EU eInfrastructure initiative

#### e-Infrastructure...

Serving the user communities:

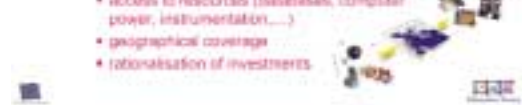
- Serving both the 'normal' user and the demanding communities in a dynamic way
- Challenging the Research Networks... calling for the use of the latest technology and possible access to dark fiber
- Raising the requirements to be fulfilled by the Grids initiative (stable provision of services, operational support to different research communities, continuous integration of new research communities, ...) aiming at the establishment of virtual research communities



#### e-Infrastructure...

Addressing requirements of different nature:

- Technology
  - middleware, brokers, re-engineering of solutions, interworking
- Organisational
  - projects, clustering, conferences, forum networking, provision of services
- Policies
  - articulation of national and European (global) policies
  - access to resources (databases, computer power, instrumentation,...)
  - geographical coverage
  - rationalisation of investments



#### e-Infrastructure...

Developing the concept means using several instruments:

- EU projects (I3 in Research Infrastructure Programme... but also CA and SSA)
- National initiatives
- Regional structural funds
- ERA-NET like initiatives
- Mobilising initiatives such as eEurope
- ...
- Any role for national initiatives in the European (EU) context?



#### e-Infrastructure...

Role of National Initiatives in the European (EU) context:

- Steering Group of the National Grids Initiatives<sup>9</sup>
  - Exchange information
  - Reflected on the challenges raised by a Europe wide infrastructure
  - Promote the adoption of long term common strategies, policies and common practices
  - Initiating workshops
  - Broaden the involvement of user communities
  - Trigger white papers
  - Give input to National EU workplans
- 'Formalisation' of such body?



#### e-Infrastructure...

- Very ambitious concept that deserves a correspondingly ambitious approach
- Current testbeds created high expectations that need to be met
- Initial response is very positive
- Real opportunity to lead worldwide
- Time to move fast



Thanks for your attention!

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## Jean-Louis Picqué

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Born on 23 April 1946 in Boulogne-sur-Mer (France).

Graduated through Ecole Normale Supérieure and holds the Agrégation de Physique and the Doctorat d'Etat es Sciences Physiques.

Entered the Centre National de la Recherche Scientifique (CNRS) as a permanent researcher in 1970, and became Directeur de Recherche in 1988.

His scientific work has concerned mainly lasers and atom-radiation interactions: Doppler-free spectroscopy, optical pumping, radiation pressure, laser cooling, atomic clocks, laser-synchrotron studies, laser-induced collisions.

In 1991, J.L. Picqué was appointed as Head of the administration of CNRS for the northern part of France (Region Nord–Pas de Calais and Region Picardie). He became Deputy-Director for Physics and Mathematics at the national level in 1996, and he joined the staff of the Director General of CNRS in 1999.

Since September 2001, he is a National Expert at the European Commission in Brussels (Directorate General for Research). He is involved in policy-oriented activities (e.g. European Strategy Forum on Research Infrastructures) and the liaison between the Commission and national or international research organisations (e.g. the European Intergovernmental Research Organisations like CERN, ESA, ESO, EMBL).



JL Piqué represented the EC's DG-RESEARCH at the meeting. The focus of their work is on supporting and building scientific communities across Europe. As such, Commissioner Philippe Busquin is strongly supportive of the Infrastructures Initiative. Commenting on the earlier presentation from Dimitris Demiozoz it was stressed that innovation has always been key to the European Research Area (ERA).

access to enabling infrastructures to all European Scientists regardless of their location. The expected outcome will be a structuring of scientific communities in the European context in various disciplines.

The overall budget for the Framework programmes has increased markedly over time. The total FP6 budget is €17.5 billion and this is shared between three major activities: integrating European research; structuring ERA; and strengthening the foundations of ERA. The largest of these activities being the goal of integrating European research with around 82% of the proposed budget allocated to it. In FP6 the Research Infrastructures action has an increased budget compared to FP5 of €655 million, which includes €200 million for GEANT and Grids. Its main objectives are to provide access to infrastructures irrespective of their location in Europe and to promote the optimum development of new and enhanced infrastructures.



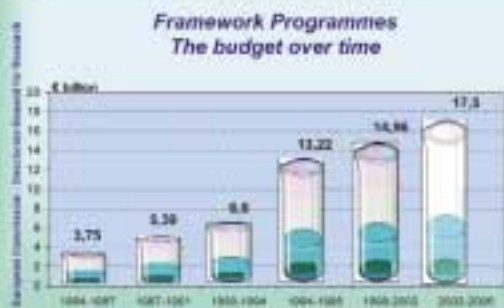
It is open to all fields of science and technology. There are a number of instruments associated with this action which include, for existing infrastructures, Integrated Infrastructure Initiatives, Transnational Access, and Communication Network Development. For new infrastructures the instruments include Design Studies and Construction of New Infrastructures.

In the context of this meeting, the Research Infrastructures action focuses on the Communication Network Development Scheme that is implemented by DG INFOS in conjunction with the IST priority thematic area. It covers high capacity, high-speed communication networks (GEANT) and high performance Grids and test-beds.

An FP6 Coordination Group has recently been set up, and includes DG RESEARCH and DG INFOS, to coordinate efforts between priority thematic areas and the Research Infrastructures action. The aim is to explain the strategy and

actions on Grids and GEANT and to take into account the emerging needs from the user communities.

A little over a year ago, the European Strategy Forum on Research Infrastructures was set up by Member States to support a coherent and strategy-led approach to policy making in the context of European Research Infrastructures and to facilitate multilateral initiatives for the development of Research Infrastructures, in particular focussing on acting as an incubator for "variable geometry" arrangements. The EC provides support to this informal group of high-level national representatives and five meetings have been held since April 2002. At the meeting on the 28th April 2003, the French delegation proposed the establishment of a Working Group on High Performance Computing & Networking. This could be used to identify science needs and to propose how to coordinate national Grid initiatives.



#### Structure of the new FP\*



#### The FP6 Research Infrastructure action

- Increased budget:
  - € 455 Mio (incl. € 200 Mio for GEANT and Grids)
- Main objectives:
  - provide access to the infrastructures, irrespective of their location in Europe
  - provide optimum development of new and enhanced infrastructures
- Open to all fields of science and technology

#### Research Infrastructures in FP6 Support Schemes

- For existing infrastructures
  - Integrated Infrastructure Initiatives
  - Transnational Access
  - Communication Network Development (IST)
- For new infrastructures
  - Design Studies
  - Construction of New Infrastructures



### 4.2.2 Jean-Louis Picqué – The eInfrastructure Initiative

**The Communication Network Development Scheme**

- Implemented by DG INFSO, in conjunction with IST priority thematic area
  - high-capacity, high-speed communication network (GEANT)
  - high-performance Grids and test-beds

**The FP6 Co-ordination Group on Research Infrastructures**

Includes DG Research and DG INFSO

- To co-ordinate efforts between priority thematic areas and the research infrastructure action
- To explain the strategy and actions on Grids and GEANT
- To account for the needs from the user communities

**The European Strategy Forum on Research Infrastructures**

- set up by Member States
- with the Commission providing support and synergies with FP actions
- informal group of high-level national representatives
- 5 meetings since 25 April 2003

**The European Strategy Forum objectives**

- to support a coherent and strategy-led approach to policy making on research infrastructures in Europe
- to facilitate multilateral initiatives for the development of research infrastructures (incubator for "variable geometry" arrangements)

**European Strategy Forum**

- Creation of a Working Group on High Performance Computing and Networking
  - to identify the scientific needs and challenges
  - to co-ordinate the Grid Initiatives





## Kyriakos Baxevanidis

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Mr. Kyriakos Baxevanidis is a scientific officer of the European Commission. His current activity is the co-ordination of the Grid related efforts of the Research Infrastructures EU-RTD Programme including the monitoring of big European Grid projects, like the European DataGrid (EDG) project. Previously, he served in the areas of Services Engineering, Communications Management and Security of IST and of previous EU-RTD programmes.

Before joining the Commission, he worked for several years in Siemens in the field of telecommunication systems as an engineer and leader of a development group.

He holds degrees from the Aristotle University of Greece and from Carnegie-Mellon University, US.

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### 4.2.3 Kyriakos Baxevanidis - Towards a common European

In 2003 the MIT Technology Review identified Grids as one of the “ten technologies that will change the world”. The advantages of the Grid approach for science and business are clear. Grids will transform the IT landscape from discrete infrastructure components to a distributed information processing model where people share and do not necessarily own IT-resources. Organisations can therefore focus on their business objectives – be they scientific or commercial – rather than on the management and maintenance of underused (in many cases) IT-infrastructures. Our aim must be to construct a “one stop shop” service for users providing them with access to IT-resources, which meet their needs, and thereby transform Grids into a public utility.

Of course, technical and process developments will drive this transformation. By focussing on solving

the technical challenges of security, quality of service, and ease of use while understanding the central business needs of users and also where Grids can bring immediate benefit, we can move towards this vision. As we do this we will see the price/performance ratio of IT installations decrease as the homogeneity of policies for accessing and using these resources are better understood. Tackling these non-technical barriers – the need for global agreements and policies to enable global use – are key to the future development of eInfrastructures.

Platform Computing has recently published a survey focussing on the non-technical barriers to the widespread uptake of Grids. The results make interesting reading. As one major EDA chip manufacturer says in the report: “If we move to a global Grid, we need agreement on a global infrastructure ... We will be managing a cultural change;

#### e-Infrastructures (Athens, 12 June 2003)

##### Towards a common European Networking & Grids infrastructure area - how can it work?

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European Commission, Information Society Directorate-General



##### Grids: one of “Ten technologies that will change the world”, MIT Technology Review, 2003



#### What is the advantage for science, business?

From discrete infrastructure components to distributed information processing model where people share, do not own IT-resources

- Organisations can focus on business objectives rather than on upgrade/operation of (underused...) IT-infrastructures - better alignment of business objectives with underlying IT-infrastructure
- Skilled (IT) people always at scarce...
- “One stop shop” service to users for accessing IT-resources (Grids: a public utility)
- Real-time collaboration patterns (of global scale)



#### How evident is this advantage?

- Technical issues: security, QoS, easy service creation...
- Understanding central business needs where Grids can bring more immediate benefit (e.g. helping businesses harness their IT-infrastructure may be more important than providing access to supercomputing power...)
- Price for performance: improves with homogeneity of policies for accessing & using discrete resources (e.g. commodity compute time now costs roughly a penny a gigahertz/hour - if Grid access costs more, building a dedicated supercomputer is a more attractive economical proposition...)



## European Networking & Grids infrastructure area - how can it work?

people will need to broaden the scope of their thinking". Likewise a global auto manufacturer comments that: "When you try to build a Grid and you have to do it within a company, you have to set policies and guidelines and everyone has to agree to give up their own resources in a shared pool. A global infrastructure causes global problems". In the Platform Computing survey a startling 89% of organisations identified organisational politics as a barrier to implementing Grid solutions in their organisations. The key conclusions from the report are that these non-technical policy aspects of Grids are significant barriers to their implementation – people in general do not have a resource sharing attitude. Moreover, very different policies for accessing resources across institutions, application domains and national boundaries in Europe exist. The harmonisation of such policies at all levels is therefore a major challenge.

The implementation of GEANT has taught us many things in this context. Tackling pan-European connectivity resource sharing policy aspects at a European level has resulted in the world's fastest research network that provides affordable access to all researchers. This has been achieved through fully-fledged operational support and a policy committee to resolve policy issues. We have learnt that interconnecting people matters more than interconnecting machines when trying to meet our goals.

To meet the policy challenges created by eInfrastructure, we need to create structures and mechanisms to harmonise IT-resource access and use policies across Europe for e-Science and beyond. We should formulate an eInfrastructure policy framework and use it to establish appropriate administrative, operational and policy support

### What are the non-technical aspects?

*"If we move to a global Grid, we need agreement on a global infrastructure ... We will be managing a cultural change; people will need to broaden the scope of their thinking."*

Major EDA chip manufacturer (Platform Computing survey)

*"When you try to build a Grid and you have to do it within a company, you have to set policies and guidelines and everyone has to agree to give up their own resources into a shared pool. A global infrastructure causes global problems."*

IT project leader, global auto manufacturer (Platform Computing survey)



### Non-technical barriers

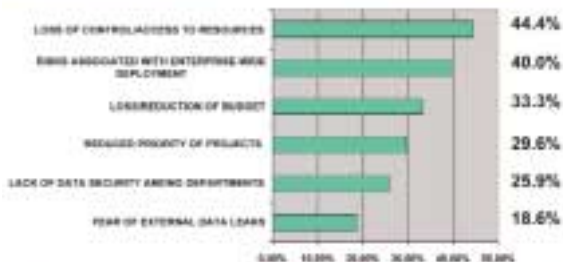
- A survey in the US (by Platform Computing) had as a purpose to determine the nature and severity of non-technical barriers that impact the widespread adoption of Grids on enterprise scale

Answers to question: are organisational politics a barrier to implementing Grid?

NO (11%) YES (89%)



### Key findings of the survey



### Some conclusions and observations...

- Non-technical aspects including Organizational policies are significant barriers in the implementation of resource sharing technologies (Grids)
  - People do not (in general) have a resource sharing attitude
- Very different policies of accessing resources across institutions, application domains, national boundaries in Europe

**The harmonization of such policies at all levels is a major challenge!**





### 4.2.3 Kyriakos Baxevanidis - Towards a common European Networking & Grids infrastructure area - how can it work?

schemes for IT-resource sharing at all levels. We should consider setting up a high-level expert group to monitor this process and provide advice. We must ensure that all interests and groups are sufficiently represented and consider the allocation of EU resources to catalyse the process.

One in twelve citizens of this planet is a member of the largest common market in the world – the European Union. Can we afford not to establish common market structures for the use of our IT-resources?

#### What did we learn in Europe from GÉANT?

- Tackling connectivity resource sharing policy aspects on European level resulted in a pan-European coverage by a high-speed research network (the fastest in the world) that provides affordable access to all researchers
  - full-fledged administrative & operational support
  - a policy committee to resolve policy issues



**Interconnecting people matters more than interconnecting machines!**



#### The e-Infrastructure (policy) challenge

- An e-infrastructure in Europe to provide "one stop shop" IT-service to researchers (fully integrated communication & information processing service)
- Create structures and mechanisms to harmonize access and use policies of IT-resources (*the only way such a scheme can work!*)
- For eScience and beyond...



#### What is the way to go?



- Formulate an e-Infrastructure policy framework
- Create appropriate administrative, operational and policy support schemes for IT-resource sharing
  - on institutional, scientific discipline, national levels
- Set up a high level expert committee to monitor the process and provide advice?
- Existing mechanisms may be ok but make sure all interests and groups are sufficiently represented!
- Allocate EU funding to catalyse the process?



#### A common market for IT-resources...

One out of twelve citizens in this planet is member of the largest common market in the world

**Can we afford not having common market structures in the use of our IT-resources?**







## Fernando Liello

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Fernando Liello is Chairman of the Consortium of the European National Research and Education Networks, the organisation responsible for procurement and management of the European Gbit network G<sup>2</sup>ANT and member of the GARR technical and scientific board.

Previously he has been chairman of the Quantum consortium (that built the TEN-I55 network) and of the TEN-34 consortium.

He has been active in the field of international research networking since 1986, contributing to the establishment of such organisations as RARE (later evolved into TERENA) and DANTE, the organisation that has managed the various generations of European networks since 1988.

His research interests have ranged from biophysics to particle physics and is now active in research on cosmic-ray physics. Formerly F. Liello has been scientific associate at CERN from 1983 to 1985 and has been co-ordinator for non-accelerator and neutrino physics in the Trieste branch of INFN until 2000.

Since October 2000 F. Liello is chairman of the INFN (Istituto Nazionale di Fisica Nucleare) computing and networking committee.

F. Liello published 65 articles in the fields of biophysics and particle physics research on international journals.

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## 4.3 Session 3: A

### 4.3.1 Enzo Valente: Moving towards European Research

Enzo Valente presented this talk in place of Fernando Liello who sent his apologies.

In the context of networking and ERA, Europe has filled the gap with the GEANT network. This network is the most advanced in the world today with a core bandwidth of 10Gbps. It has exploited telecommunications liberalisation in Europe and built on the rich experience of the NRENs and the essential support of the national and European funding bodies. GEANT is directly in line with the concepts of subsidiarity and complementarity.

GEANT and the NRENs are mutually dependent on each other for their success – without the

NRENs GEANT would be useless and vice versa in the European context. Taking this approach has provided a more complex but more flexible architecture able to meet the end-to-end challenge of providing connectivity across the continent for all research users. GEANT has two foci: it provides a network for research – based on advanced, transparent worldwide services – and also undertakes research on networking – based on a quickly evolving, segregated infrastructure for “risky” activities – without neglecting the overall need for sound operation.

From the point of view of GEANT and the Grid, the provision of services is key. Bandwidth for the

**On the shoulders of**



**Moving Towards European Research Area:**  
the two sides of the coin



**Europe has filled the Gap**

- GEANT is the most advanced network in the world, today
- Exploit liberalization in Europe
- The rich experience made by the NRENs
- The essential support of the funding bodies



**A Layered Structure**  
in line with the subsidiarity principle

The Research network as seen by the user



**Complementarity's Success**

- **GEANT and the NRENs**
  - One without the others would be useless
  - Use Europe and the Continent
  - More complex but more flexible architecture
- **Independency and Coordination**
  - The end-to-end challenge
- **Scientific and Technological Research are in the driving seat**
  - Through the agencies (NREN) mandated to that
  - Without forgetting sound operation

# European networking/NREN perspective

## Area: the two sides of the coin

sake of bandwidth is useless and researchers must be supported with the most advanced services achievable. In FP5 the successful and fruitful experiences with both the DataGrid and DataTag Grid projects have been very important.

In networking, global collaborations are clearly important when focussing on research excellence. In terms of FP6, the new countries that are acceding to the EU are putting pressure on the GEANT model. These countries are pushing the technology envelope forward and may well use dark fibre for instance. Our challenge is to fight the divide created by different telecommunication markets in Europe and work with the diversified procurement strate-

gies evident across Europe to provide the best possible service to our user. In particular, there is a great need for close coordination between the Grid Research Infrastructures community and the networking community throughout Europe.

However, solving the connectivity issues in Europe is not enough. Research networks must be global as well. One issue is that international initiatives are not specifically included in the main stream of EU support. There are ongoing projects to connect emerging regional networks to GEANT, for instance in the Mediterranean, Latin America and Pacific Rim. These activities should be further strengthened and supported in FP6.



**Infrastructure. Development**

- **Network for Research**
  - Research requires support of IT Services
  - Network
  - Hardware
  - Software
- **Research on Networking**
  - Requirements for evolving infrastructure
  - Understand and experiment new technologies
  - The ability of segregating risky activities



**European Research Network and the GRID**

- **Services are the keyword**
  - Bandwidth for the sake of bandwidth is useless
  - Researchers must be supported with the most advanced services
- **The successful experience in FP5**
  - Support of other projects' communication requirements
  - The fruitful experience of DATAGRID and DATATAG



**Research Excellence and Global Collaborations**

- **Communication of ideas and results**
  - Access to data
  - Communication services
- **Allow People and Resources to meet**
  - Mobility of the Researchers
  - Virtual Mobility of Resources
- **New approaches**
  - Virtual Communities
  - Virtual Instruments



**Research Networks in the 6th Framework Programme**

- **Fight the divide created by different markets in Europe**
- **Diversified procurement strategies in different parts of Europe**
- **Stronger involvement of the NRENs**
- **Tight coordination and collaboration with the GRID infrastructure initiatives**



#### 4.3 Session 3: A European networking/NREN perspective

##### 4.3.1 Enzo Valente: Moving towards European Research Area: the two sides of the coin

**Europe is Not Enough**

- Research is Global: Research Networks must be global as well
- Intercontinental initiatives are not specifically included in the main stream of EC support
- But intercontinental connectivity is of strategic value to exploit the ERA potential
- We have to seek specific support wherever is possible

**The NREN Consortium and EC opened the way**

- Connectivity with other regions on a bilateral basis
  - North America
  - Japan
- Projects to encourage and support the emergence of regional networks in other areas and to connect them to GÉANT
  - Mediterranean countries
  - Latin America
  - Pacific Rim

**Thank you**



## Dany Vandromme

Dany Vandromme has been a university professor since 1988 at the National Institute for Applied Sciences at Rouen. As a researcher, he is responsible of the Computational Fluid Dynamics Laboratory (LMFN), a component of CORIA, UMR 6614 of CNRS (National Center for Scientific Research). Research domain is the numerical modeling applied to supersonic and reactive flows with a special interest for turbulence physics.

Responsible for the regional network SYRHANO (Upper Normandy region) since its beginning in 1993, and chairman of the networking and computing Centre of Upper Normandy (CRIHAN) since its création (1992), Dany Vandromme has been a user of ARPANET in the early 80's, and later on, of INTERNET, as a post-doc and associate research fellow at NASA Ames Research Center from 1980 to 1990.

He was in charge of the networking and computing activities at the Engineering Sciences Department of CNRS from 1993 to 1998. As such, he was also supervising the CNRS laboratories depending from the section #10 of the "Comité National de la Recherche Scientifique".

He has been director of GIP RENATER since July 1st, 1998.

As director of RENATER, Dany Vandromme works on evolutions of the public Internet in France, on technical aspects as well as on economy models, suited to the specific requirements of the research and education community.

Dany Vandromme represents RENATER in the European NREN consortium in charge of GEANT ([www.geant.net](http://www.geant.net)). Since January 2001, he served as member of the DANTE ([www.dante.org.uk](http://www.dante.org.uk)) Board of Director. Since January 2003, he is the Chairman of the DANTE Board.

He participates to the works of ICANN, through the non-commercial constituency (NCDNHC) of the Domain Name Supporting Organisation (DNSO)

Dany Vandromme awarded as "Chevalier de l'Ordre National du Mérite" on January 31st, 2002. His acknowledgement speech is available in French: [speech](#).

The grand opening ceremony of CRIHAN, at Sant Etienne du Rouvray has been a good opportunity to summarize the regional activities (in French only). Then, the 10th anniversary of RENATER has also been a good opportunity to recall some basic principles (in French only) for the action.





### 4.3.2 Dany Vandromme: An eInfrastructure in Europe:

In order to understand the formation of eInfrastructure it is instructive to consider the history of networking infrastructures in Europe from the point of view of an NREN – in this case the French NREN, RENATER.

Like many NRENs across Europe, RENATER has developed in parallel with the European interconnection network. From the early 1990's, RENATER was an IP service established between a series of PoPs provided by the national operator – in many respects it was a black-box service. At the same time telecommunication companies provided a European service through a series of packaged service – X25 with IXI, ATM with JAMES and IP with EUROPANET. These services provided a maximum of 2Mbps connectivity.

From 1996, France Telecom had to provide the IP service on a dedicated ATM infrastructure to meet the growing needs of users (to fill the gap between 2Mbps and 34/45Mbps connectivity) and to allow monitoring from the user edge. At the same time, TEN-34 was started and built on half-circuits provided by monopoly telecommunications operators on a very ad hoc basis. Bandwidth provided was around 10Mbps.

In 1999 RENATER was set-up as a major procurement action where circuits, equipment, PoP hosting and network management were sought. The outcome of this procurement was that France Telecom retained most of the circuit provision but lost the network management. Equipment was acquired directly by RENATER and PoPs were

#### An eInfrastructure in Europe: a NREN perspective

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Renater

The I.T. eInfrastructure initiative

Albi, 17 June 2007

1

#### A bit of history (1/5)

- Parallel development of RENATER (and many other NRENs) and the European interconnection network.

Renater

The I.T. eInfrastructure initiative

Albi, 17 June 2007

2

#### A bit of history (1/5)

- Parallel development of RENATER (and many other NRENs) and the European interconnection network.
- From early 90s, RENATER was a IP service between a set of PoP of the national operator. Regional networks were also that way => Black box service!

Renater

The I.T. eInfrastructure initiative

Albi, 17 June 2007

3

#### A bit of history (1/5)

- Parallel development of RENATER (and many other NRENs) and the European interconnection network.
- From early 90s, RENATER was a IP service between a set of PoP of the national operator. Regional networks were also that way => Black box service!
- At the same time, Telecom monopolies provided packaged services (X25 with IXI, ATM with JAMES, IP with EUROPANET) (max 2 Mb/s).

Renater

The I.T. eInfrastructure initiative

Albi, 17 June 2007

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# an NREN perspective

installed in Universities and Research Institutes around France. Similarly, TEN-I55 was organised as a major procurement action by DANTE on behalf of the NRENs across Europe. A single operator won the circuit provision and the ATM layer while an NREN network operations centre managed the IP service. Equipment was acquired separately by DANTE.

From 2002, RENATER-3 has been built on WDM/SDH circuits. France Telecom has lost almost all of the circuit provision and the network is totally under the control of RENATER. By 2002, GEANT was also operational with eight different connectivity suppliers. Equipment was procured separately and the network management service was outsourced to a specialised company. The net-

work is totally under the control of DANTE on behalf of the NRENs.

In the future we must be careful not to take over all of the tasks of telecommunications providers – they should be our partners – although we realise that research networks provision can never be “off the shelves” because they must remain innovative and at the leading edge. We need to work with the telecommunication operators to convince them to provide raw capacity at the lowest rates possible but leaving much of the mastering of the technology in the hands of the NRENs. Moving from SDH to WDM, from WDM to lit fibres and eventually dark fibres instead of lit fibres when this is feasible.

## A bit of history (2/5)

- From 1996, France Telecom had to provide the IP service on a dedicated ATM infrastructure, to adjust the growing needs (filling the gap between 2 and 34/45 Mbit/s) and to allow monitoring from the user edge.

Renater

The I-2 telecommunications initiative

Slides, 11 June 2007

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## A bit of history (2/5)

- From 1996, France Telecom had to provide the IP service on a dedicated ATM infrastructure, to adjust the growing needs (filling the gap between 2 and 34/45 Mbit/s) and to allow monitoring from the user edge.
- At the same time, TEN-34 was started, made on half circuits provided by monopoly Telcos (based also on ATM to adjust carefully the pay-per-bandwidth feature): 10 Mbit/s Paris-London, 12 Mbit/s Paris-Frankfurt!

Renater

The I-2 telecommunications initiative

Slides, 11 June 2007

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## A bit of history (3/5)

- From 1999, RENATER-2 was organised as a major procurement action, where circuits, equipment, PoP hosting and network management were sought, eventually from different providers.

Renater

The I-2 telecommunications initiative

Slides, 11 June 2007

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## A bit of history (3/5)

- From 1999, RENATER-2 was organised as a major procurement action, where circuits, equipment, PoP hosting and network management were sought, eventually from different providers.
- France Telecom kept most of the circuit provision (PDH/SDH), but lost the network management (IP/ATM). Equipments were acquired directly by RENATER and the RENATER PoP were installed in University premises.

Renater

The I-2 telecommunications initiative

Slides, 11 June 2007

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## 4.3 Session 3: A European networking/NREN perspective

### 4.3.2 Dany Vandromme: An eInfrastructure in Europe: an NREN perspective

The key challenge is not to be destructive to the telecommunications providers but rather to provide them with incentives to provide new services. We must coordinate disparate actions, for instance the xx-Light initiatives that promote lambdas rather than usage and account for differentiated economical and regulatory contexts to harmonise the European network and reduce the digital divide.

TEN-155 and latterly GEANT have greatly improved the provision of pan-European networking but they have also increased the gap between European nations. Today for instance, the countries of South East Europe are amongst the most expensive for GEANT. We need to understand how to handle this challenge for the greatest benefit of the entire network – a challenge which has

#### A bit of history (4/5)

- From 1999, similarly, TEN-155 was organised also as a major procurement action by DANTE, on behalf of the NRENs.

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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#### A bit of history (4/5)

- From 1999, similarly, TEN-155 was organised also as a major procurement action by DANTE, on behalf of the NRENs.
- A single operator won the core circuit provision (PDH/SDH), complemented by monopolies in other places. The Operator provided also the ATM layer, while the IP service was managed by a NREN NOC.

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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#### A bit of history (4/5)

- From 1999, similarly, TEN-155 was organised also as a major procurement action by DANTE, on behalf of the NRENs.
- A single operator won the core circuit provision (PDH/SDH), complemented by monopolies in other places. The Operator provided also the ATM layer, while the IP service was managed by a NREN NOC.
- Equipment were acquired separately by DANTE, and the ATM layer was even removed before the end of the project.

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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#### A bit of history (5/5)

- From 2002, RENATER-3 was built on WDM/SDH circuits. France Telecom lost almost all the circuit provision. The network is totally under the control of RENATER.

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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#### A bit of history (5/5)

- From 2002, RENATER-3 was built on WDM/SDH circuits. France Telecom lost almost all the circuit provision. The network is totally under the control of RENATER.
- From 2002, GEANT was operational, with 8 different connectivity suppliers. The equipments were tendered separately, and the network management service was outsourced to a specialized company. The network is totally under the control of DANTE (on behalf of the NRENs)

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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#### Future trends

- Not to substitute to telecommunications operators, but acquire products and services not off-the-shelves.

*Renater*

The E.T. eInfrastructure initiative

Alimos, 17 June 2007

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been confirmed by the EUMEDCONNECT tendering process.

Finally, it is clear that it is much more beneficial to cooperate with telecommunications companies and work with them to solve challenges. This is

particularly important where little or no market exists due to the remoteness of some territories. In this regard France Telecom deserve thank from RENATER in the context of connectivity to remote French associated territories. It is always better to have one operator than none.

### Future trends

- Not to substitute to telecommunications operators, but acquire products and services not off-the-shelves.
- Cooperate with Telcos but convince them to provide raw capacity at the lowest rates as possible and bring most of the technology mastering in the NRENs hands: WDM instead of SDH, lit fibres instead of WDM, and eventually dark fibres instead of lit fibres when feasible.

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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### Future trends

- Not to substitute to telecommunications operators, but acquire products and services not off-the-shelves.
- Cooperate with Telcos but convince them to provide raw capacity at the lowest rates as possible and bring most of the technology mastering in the NRENs hands: WDM instead of SDH, lit fibres instead of WDM, and eventually dark fibres instead of lit fibres when feasible.
- Customize and provide network services by the NRENs themselves (DANTE for collective actions)

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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### Challenges

- Not to be destructive for the telecommunications industry, but incentive for new services

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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### Challenges

- Not to be destructive for the telecommunications industry, but incentive for new services
- Coordinate disparate actions like xx-Light initiatives which promote lambdas rather than usages

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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### Challenges

- Not to be destructive for the telecommunications industry, but incentive for new services
- Coordinate disparate actions like xx-Light initiatives which promote lambdas rather than usages
- Account for differentiated economical and regulatory contexts to harmonize the European network and reduce the digital divide.

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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### Challenges

- Not to be destructive for the telecommunications industry, but incentive for new services
- Coordinate disparate actions like xx-Light initiatives which promote lambdas rather than usages
- Account for differentiated economical and regulatory contexts to harmonize the European network and reduce the digital divide.
- TEN-155/GEANT issue was to managed simultaneously liberalized markets and monopolies: Next will be to manage also markets with no rules!

*Renater*

The I-2 telecommunications initiative

Alimuz, 11 June 2007

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## 4.3 Session 3: A European networking/NREN perspective

### 4.3.2 Dany Vandromme: An eInfrastructure in Europe: an NREN perspective

#### Facts

- It is acknowledged that TEN-155 and GEANT have significantly improved the research network situation in Europe.

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

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#### Facts

- It is acknowledged that TEN-155 and GEANT have significantly improved the research network situation in Europe.
- However, the gap between extremes has also significantly increased.

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

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#### Facts

- It is acknowledged that TEN-155 and GEANT have significantly improved the research network situation in Europe.
- However, the gap between extremes has also significantly increased.
- Today, SEE countries are among the most expensive countries from GEANT point of view!

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

23

#### Facts

- It is acknowledged that TEN-155 and GEANT have significantly improved the research network situation in Europe.
- However, the gap between extremes has also significantly increased.
- Today, SEE countries are among the most expensive countries from GEANT point of view!
- Poland and Czech Republic have adopted a different approach to be among the most advanced partners.

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

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#### Facts

- The difficulty, reported for the SEE is well confirmed by the EUMEDCONNECT tendering process!

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

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#### Facts

- The difficulty, reported for the SEE is well confirmed by the EUMEDCONNECT tendering process!
- Better to cooperate (eventually being VERY incentive) with telcos than to fight them to improve the market situation, induced by the lack of competition.

*Renator*

The E.U. eInfrastructure initiative

Adams, 17 June 2007

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## Facts

- The difficulty, reported for the SEE is well confirmed by the EUMEDCONNECT tendering process!
- Better to cooperate (eventually being VERY incentive) with telcos than to fight them to improve the market situation, induced by the lack of competition.
- Governments may help, because of specific needs for Education and Research.

*Renater*

The I.T. infrastructure initiative

Slides, 11 June 2007

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## Facts

- The difficulty, reported for the SEE is well confirmed by the EUMEDCONNECT tendering process!
- Better to cooperate (eventually being VERY incentive) with telcos than to fight them to improve the market situation, induced by the lack of competition.
- Governments may help, because of specific needs for Education and Research.
- New European rules for procurement will help.

*Renater*

The I.T. infrastructure initiative

Slides, 11 June 2007

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## But keep in mind:

- It is better to have one operator than none.

*Renater*

The I.T. infrastructure initiative

Slides, 11 June 2007

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## But keep in mind:

- It is better to have one operator than none.
- RENATER is also in charge of connectivity for overseas territories (Martinique, Guadeloup, Guyana, Reunion, Mayotte, New Caledonia, Tahiti, Wallis, Futuna). For all these places, RENATER is grateful to France Telecom to discuss about connectivity.

*Renater*

The I.T. infrastructure initiative

Slides, 11 June 2007

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END OF PRESENTATION!



*Renater*

The I.T. infrastructure initiative

Slides, 11 June 2007

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## Vasilis Maglaris

Professor Vasilis Maglaris is a Professor of the National Technical University of Athens (NTUA) and the Chairman of the Board of the Greek National Research & Education Network GRNET. He received the Diploma in Mechanical & Electrical Engineering from the National Technical University of Athens (NTUA), Greece in 1974, the M.Sc. in Electrical Engineering from the Polytechnic Institute of Brooklyn (now Polytechnic University), Brooklyn, New York in 1975 and the Ph.D. degree in Electrical Engineering & Computer Science from Columbia University, New York in 1979. From 1979 to 1981 he was a research engineer at the Network Analysis Corp., New York, a leading firm in designing the ARPANET (the predecessor of Internet). From 1981 to 1989 he was with the faculty of Electrical & Computer Engineering of the Polytechnic Institute of Brooklyn, involved in teaching and research on computer networks. Since 1989 he is with the School of Electrical & Computer Engineering at NTUA, where he is the Director of the Network Management and Optimal Design Laboratory (NETMODE).

Prof. Maglaris served in various academic and professional boards; from 1993 to 1995 he was the Managing Director of the National Hellenic Research Foundation (NHRF) and from 1996 until now he is the Chairman of the Board of GRNET. Since 1995 he serves as a Commissioner of the Greek National Regulatory Authority for Telecommunications. He participated in several R&D projects in the USA and in Europe, supervised nine graduate students that obtained their Doctoral Degree, authored more than sixty research papers and gave numerous talks in scientific conferences and other fora. Since 1992, he leads at NTUA a major development effort that resulted in a state-of-the-art integrated high-speed campus-wide Local Area Network and in 1996 he planned the development of GRNET. Throughout his career he served in several strategy boards on electronic communications and research – education networks at National, European and International levels.



### 4.3.3 Vasilis Maglaris: European NRENs and GTREN

Over the last decade the European NRENs have adopted a “business model” characterized by the following traits.

Firstly, in the vast majority of European nations, a single state-controlled advanced infrastructure serves all Universities and Research Centers networking needs. These, apart from pure “research” electronic communications (between or among researchers), may in many cases include “commodity” traffic, i.e. traffic that has a source or a sink in the Research & Education community, while the other end is the global Internet. Transient “commercial traffic” defined as connections using the NREN as a “via” structure to serve two commercial entities is not compatible with the current regulatory and financial organization of GEANT and NRENs. This is clearly stated in the written agreement between NRENs and end-users, referred to as the Acceptable Usage Policy (AUP). Thus, NRENs do not compete with the ISP community and do not distort electronic communications markets in a highly competitive environment. It is worth mentioning that only 3-5 NRENs applied for a general license (authorization) to provide public electronic communications services, out of more than 30 belonging to TERENA (Trans-European Research & Education Networking Association). In Europe, the NREN community maintains the academic & research networking tradition that was the driving force for the ARPAnet – NSFnet – Internet early stages in the USA. The successors of the Academic – Research network in the US (Internet2 initiative - Abilene, vBNS+, ESNET etc.) may be technologically advanced platforms for cutting edge applications (e.g. collaborative virtual environments with tele-immersing experiments, virtual distributed orches-

tras etc.) but are restricted to a small number of advanced users. For example, Abilene serves less than 200 Universities and Research Foundations (the University Corporation for the Advancement of Internet Development –UCAID); even within UCAID, Abilene serves a small minority of users (advanced eScience experiments), while the majority is being served by commercial ISPs. Few members of the US Academic community take advantage of the largely under-utilized Abilene resources, sometimes not even knowing of the option to use it. On the other hand, NRENs in Europe and their Pan-European gigabit interconnection GEANT, serve more than 3000 Institutions, half of which are using it as their sole gateway to the global Internet via a service provided by DANTE.

Secondly, the European Research & Education networking model evolved into a three-tier architecture: The campus LAN, the national MAN – WAN (the NREN) and the federal gigabit interconnection GEANT. All three tiers enable end-users to communicate with gigabit speeds as if the campus LAN is extended into the whole European Research Area. Apart from providing connectivity to researchers and the educational community, the three-tier structure may arrange for the provision of Virtual Private Network (VPN) resources to e-Science projects (e.g. GRIDs) on request, possibly with end-to-end Quality of Service guarantees (jitter, speed, security etc.) The strictly hierarchical structure of Research & Academic networking in Europe may exhibit scale economies in the provision and management of user, national and Trans-European resources, but may suffer from rigidity to follow the overall Internet paradigm, which is based on peering and neutral interconnection facilities



(GigaPoP telehousing). The latter becomes evident when planning the introduction of user-empowered infrastructures in Research & Education Networking such as dark fiber ownership, condominium sharing (the Canadian business model) and long-term IRU leasing. Note, that at present GEANT is based on IP/MPLS provision over DWDM “lambdas” (or over SDH circuits in cases where DWDM circuits are not available), on short-term leases from international electronic communications operators. The three-tier hierarchical model does not encourage NREN clustering at regional levels; this may introduce a fourth level in the hierarchy or may eventually render the Trans-European level (GEANT) obsolete and replaced by peering arrangements.

Thirdly, the hierarchical model is interpreted by some GRID end-users as a nuisance, introducing complicated capacity management schemes (involving NOCs of campuses, NRENs and GEANT) to set-up high speed end-to-end connections that in some cases could be provided by a direct “lambda” circuit, bypassing LANs, NRENs and GEANT. Nevertheless, the hierarchical (federal) model has been up to now a great enabler for Universal Service Provision and a means to bridge the digital divide across Europe. It is interesting to note that popular Pan-European multidisciplinary GRIDs are built or planned along the tier model, in fact imitating the NREN – GEANT paradigm. A reason may be the scale economy and organizational ease that this model achieves in managing vast shared computing and storage resources and the need for a strict trust schema, based on the tree concept of “root certification authority.” Finally, the European “federal” Research & Education Networking platform

attracted global interest as it unified thousands of advanced European researchers into a critical mass comparable or superior to US, Canadian and Japanese networked communities. Thus, the successor to GEANT is expected to be the driving force in the Global Terabit Research & Education Network – GTREN. As a first step, European NRENs (together with their non-for-profit organizations DANTE and TERENA) are tying together the European Research Area (GEANT) including South-East Europe (SEEREN initiative), North America (gigabit Transatlantic connections to Internet2 and Canarie), South American (@lice initiative), Mediterranean countries (EUMED-CONNECT initiative), links to NRENs in the Russian Federation, Ukraine, Asia – Pacific (TEIN initiative) etc. It is expected that GEANT+ (the future GEANT upgrade) will continue to drive networking technology to its limits (e.g. optical switching, terabit capacities) and will help establish the European researcher as an ever-growing user of world-wide distributed eScience applications. This is exactly the driving force in deploying GTREN from a European perspective. Planning of GEANT+ will have to successfully resolve its biggest challenge, i.e. to convince e-Science end-users of its capability in providing QoS enabled VPNs (at levels 1, 2 and 3) in a seamless, transparent mode to the user. Otherwise research and academic users will eventually drop-out from the established three-tier hierarchy in favor of direct connectivity solutions (via telco and/or owned optical links). As we very well know it is a jungle out-there, that researchers of the extended European Research Area (ERA) were able to overcome so far thanks to the orderly, universally provided hierarchical GEANT - NREN infrastructure.

**Business model adopted (2)**

- The European Research & Education networking model evolved into a three-tier architecture: The campus LAN, the national MAN – WAN (the NREN) and the federal gigabit interconnection GEANT.
- All three tiers enable end-users to communicate with gigabit speeds as if the campus LAN is extended into the whole European Research Area.
- The three-tier structure may arrange for the provision of Virtual Private Networks (VPN) resources to eScience projects (e.g. GRIDs) on request, with possibly end-to-end Quality of Service guarantees (jitter, speed, security etc.).
- The strictly hierarchical structure of Research & Academic networking in Europe may facilitate the provision and management of user, national and Trans-European resources, but may suffer from rigidity to follow the overall Internet paradigm, which is based on peering and neutral interconnection facilities (GigaPoP telehousing).
- Fourth level in the hierarchy or may eventually render the Trans-European level (GEANT) obsolete and replaced by peering arrangements?

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**Business model adopted (3)**

- The European “federal” Research & Education Networking platform attracted global interest as it unified hundreds of thousands of advanced European researchers into a critical mass comparable or superior to US, Canadian and Japanese networked communities.
- The successor to GEANT is expected to be the driving force in the Global Terabit Research & Education Network – GTREN.
- As a first step, European NRENs (together with their non-for-profit corporation DANTE and TERENA) are tying together the European Research Area (GEANT) including South-East Europe (SEEREN initiative), North America (gigabit Transatlantic connections to Internet2 and Canarie), South American (@lice initiative), Third Mediterranean countries (EUMED-CONNECT initiative), links to NRENs in the Russian Federation, Ukraine, Asia – Pacific (TEIN initiative) etc.

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## Claire Milne

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is an experienced independent telecoms policy consultant, active both nationally and internationally. She works closely with UK consumer organisations and sits on a number of public bodies. She has had a continuous close involvement since 1983 with UK telecoms regulation, and has a good general knowledge of relevant topics in many other countries, and especially of the evolving European scene.

She is a member of Nominet UK's Expert Panel for independent resolution of domain name disputes. Her early career was with British Telecom, where she held a variety of management positions spanning teletraffic, network engineering, regulation, marketing and mobile communications.

Trading since 1992 as Antelope Consulting, she works flexibly as an independent expert, team member or project leader. Recent projects include:

In 2002-3, for DANTE, contributing to the SERENATE project on the future of European research networking, with particular reference to regulatory aspects.

As part of a team financed by the UK Department for International Development and managed by the Adam Smith Institute, supporting the development of the South African regulator ICASA

In 2003, for the World Bank, supporting Nepal's Ministry of Information and Communications in developing a rural ICT policy for Nepal.

In 2001, for the UK Department for International Development, leading a team studying the costs of internet access in developing countries, focusing on the international component of costs. This project produced case studies of 6 developing countries as well as a review of the relevant law and regulation.

In 2000, for the UK Department for International Development, leading an overview study of the information and communications technology situation and needs of 16 countries of Central and Eastern Europe, with a view to identifying possible UK Government interventions in the interests of poverty alleviation and equitable development.



### 4.3.4 Claire Milne – Research networks and the new

Telecommunications regulation in Europe is entering a new era and this is an important moment to consider the effect of these new regulations in terms of the NRENs. The SERENATE project has been working to assess the main implications for NRENs of the emerging regulatory situation particularly with reference to new ownership models, market liberalization and the rules for running networks and providing services. It should of course be noted that these rules exclude NREN-specific rules as described in their own statutes.

We are in the middle of a sea change in Europe. From July 2003, telecommunications regulation will cover all electronic communication, which clearly reflects the outcome of convergence in this area. Content regulation is excluded from these regulations and will be dealt with separately. What will be regulated in future are services not telecommunications provision. This means that NRENs may

possibly come under the regulations because they receive remuneration for the provision of services. In theory all EU telecommunications markets have been fully liberalised since 1998 and the status of this is tracked by the EC's annual implementation reports. The new regulatory package was approved in April 2002 and must be implemented in all states by July 2003. However, many countries are not yet ready for these new regulations and NRENs have an opportunity to influence national law in their favour. The Accession Countries must adopt these regulations *acquis communautaire* by their date of joining. The idea of a European Regulator was floated in 1999 but this has now been dropped.

The main points of the new regime include: the creation of the freest possible market consistent with adequate consumer protection; continuing the basic principles of regulation; abolishing licens-

#### Research networks and the new European regulatory framework – competing public priorities?

Athens, 12 June 2003

Claire Milne

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#### Outline

- Telecoms regulation in Europe
- Impact of telecoms regulation on NRENs
  - Direct impacts (regulatory status)
  - Indirect impacts (market conditions)
- Some public policy issues



#### Introduction

- SERENATE regulatory work item aim: to assess main implications for European NRENs of regulatory situation, with particular reference to new ownership models
- Telecoms regulation: market liberalisation and rules for running networks and providing services (excludes NREN-specific rules, eg their own statutes).
- Main areas:
  - Competition rules
  - Limited resource management eg spectrum, rights of way
  - Universal service and consumer protection



#### Telecoms regulation in Europe

- From July 2003 actually "electronic communications" in place of telecoms – reflecting convergence (but excludes content regulation)
- EU (and EEA) markets in theory fully liberalised since January 1998; annual Commission "implementation reports" track progress
- New regulatory package approved April 2002 for transposition in all member states by July 2003
- Accession countries must adopt *acquis communautaire* by date of joining
- Idea of a European regulator floated during 1999 Review but dropped – no international regulation (apart from WTO)



# European regulatory framework – competing public priorities?

ing through the establishment of general authorisations for electronic communications service provision; and a market analysis procedure that must justify additional ex ante regulation to curb abuse of significant market power – aimed mainly at former incumbent operators. The implications for NRENs are generally positive. They will benefit indirectly from lower prices, increased choice and quality but the changes may bring some NRENs directly under the regulations and this may open up some issues.

Interconnection will now become a special case of access and is defined as “the physical and logical linking of networks to enable users of both networks to communicate with each other”. Public communications network providers are defined as providing wholly or mainly publicly available electronic communication services. They must negotiate their own access and interconnection con-

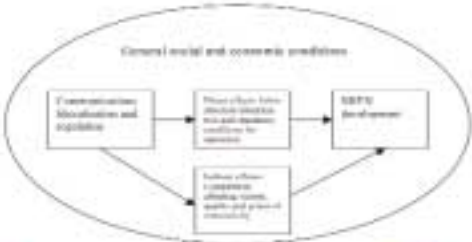
tracts but the regulator may intervene when required – particularly with respect to operators who still exercise significant market power. NRENs are not generally classed as public communications network providers because they serve a closed community. There have been some worries from ISPs in this context with regard to unfair competition and this is acknowledged as a hard problem particularly as the number of users served by NRENs expands to schools, homes etc. NRENs are funded for the public good and help close “digital divides” between and within countries. It is in the public interest for NRENs to get the best possible terms for interconnection and access even if they are not formally classed as public communications network providers. In this context public-private partnerships may be worth exploring for maximising the rapid provision of advanced infrastructures especially to less favoured areas.

## Main points of new regime

- + Aim is freest possible market consistent with adequate consumer protection; further opening plus “tidying up” exercise (but smooth transition intended from status quo)
- + Continuing basic principles: objective, non-discriminatory, proportionate, transparent; also technology-neutral
- + Licensing abolished, replaced by general authorisations for electronic communications service (ECS) provision subject to general conditions of entitlement – notification only, minimal fees
- + Market analysis procedure must justify additional ex ante regulation to curb abuse of Significant Market Power (SMP) – mainly, by former incumbent operators



## Main implications for NRENs



## Main implications for NRENs

- + Indirect: liberalisation (with continuing regulation, of leased line pricing, mobile termination rates) should eventually bring lower prices, higher quality and more variety
- + Direct:
  - No general regulatory barriers to owning or running networks
  - Nearly all NRENs will require authorisation as they do provide services for payment
  - Public network status brings special rights and responsibilities and may objectively justify discrimination (replaces old “infrastructure based” category)
  - Rights of way and construction permits may remain a problem



## Future of interconnection regulation

- + “Interconnection” is now a special case of “access” – is ability to use network elements and other facilities (eg buildings, ducts, software)
- + Interconnection means “physical and logical linking of networks to enable users of both networks to communicate with each other”
- + “Public communications network” (PCN)
  - Wholly or mainly for provision of publicly available ECS
  - ECS are normally provided for remuneration
- + PCN operators must negotiate access and interconnection, regulators may intervene where necessary
- + Regulators may require more of SMP operators:
  - Fair, reasonable, timely, non-discriminatory, transparent access
  - At cost-oriented prices (based on separated accounts)





## 4.3 Session 3: A European networking/NREN perspective

### 4.3.4 Claire Milne – Research networks and the new European regulatory framework – competing public priorities?

#### New regime for interconnection/ access

Issue	Now	From 25/07/03
Must negotiate interconnection	Any/all operators	Public ECN providers
Must provide interconnection/access to meet reasonable demand	SMP operators	SMP operators
Can request access	System-based operators	Any ECS provider
Can get colocation and facility sharing at regulated rates	Varies	Public ECN providers



#### NRENs are not generally public ECNs

- Normally serve a closed community and therefore plainly not public ECNs
- Acceptable Use Policies usually preclude commodity internet access, therefore not in competition with ISPs
- Extensions to schools/homes may serve significant groups and look "public"
- Ofcom: "where it is possible physically or logically to partition a network... the part that provides public services will attract interconnection rights..."



#### But NRENs have wide public benefits

- NRENs are mainly publicly funded, for good reasons:
  - education is a public good
  - NRENs help close "digital divides" between and within countries
- Need access to advanced infrastructure (especially fibre)
- It is in the public interest for NRENs to get best possible terms for interconnection and access – even if they are not technically public ECNs
- Public-private partnerships are worth exploring for maximising rapid provision of advanced infrastructure, especially to less favoured areas







## Tony Hey

Tony Hey is Professor of Computation at the University of Southampton and has been Head of the Department of Electronics and Computer Science and Dean of Engineering and Applied Science at Southampton. From March 31st 2001, he has been seconded to the EPSRC and DTI as Director of the UK's Core e-Science Programme. He is a Fellow of the Royal Academy of Engineering, the British Computer Society, the Institution of Electrical Engineers and the Institution of Electrical and Electronic Engineers. Professor Hey is European editor of the journal 'Concurrency and Computation: Practice and Experience' and is on the organising committee of many international conferences.

Professor Hey has worked in the field of parallel and distributed computing since the early 1980's. He was instrumental in the development of the MPI message-passing standard and in the Genesis Distributed Memory Parallel Benchmark suite. In 1991, he founded the Southampton Parallel Applications Centre in 1991 that has played a leading technology transfer role in Europe and the UK in collaborative industrial projects. His personal research interests are concerned with performance engineering for Grid applications but he also retains an interest in experimental explorations of quantum computing and quantum information theory. As the Director of the UK e-Science Programme, Tony Hey is currently excited by the vision of the increasingly global scientific collaborations being enabled by the development of the next generation 'Grid' middleware. The successful development of the Grid will have profound implications for industry and he is much involved with industry in the move towards OpenSource/OpenStandard Grid software.

Tony Hey is also the author of two popular science books: 'The Quantum Universe' and 'Einstein's Mirror'. Most recently he edited the 'Feynman Lectures on Computation' for publication, and a companion volume entitled 'Feynman and Computation'.

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e-Science web sites: <http://www.research-councils.ac.uk/>  
<http://umbriel.dcs.gla.ac.uk/NeSC/general/esi/>, EPSRC web site: <http://www.epsrc.ac.uk>



#### 4.4.1 Tony Hey – Building a European eInfrastructure:

The UK e-Science Programme is the largest national Grid initiative in Europe and one of the largest in the world. The funding has been split into two phases. In Phase I (2001 – 2004), application projects totalling £74 million of funding and a core middleware programme totalling £35 million of funding are presently underway. Phase 2 (2003 – 2006) has recently been confirmed and this brings with it funding of £96 million for application projects and a core middleware programme amounting to £41 million (although £25 million of this has still to be confirmed). By the end of 2006 the UK will have invested almost £250 million in e-Science and it is imperative we have a working infrastructure to show for it.

In Phase I the projects have largely been research and development projects and not production quality software engineering projects. The middleware that has been generated is not going to be easily deployed until more engineering effort is put in. Despite this, the programme has over 80 UK companies actively participating bringing a further £30 million of industrial contributions to the programme. These companies come from a variety of sectors including: engineering, pharmaceutical, petrochemical, IT, commerce and media.

To support these projects an e-Science Grid, focussed around ten University research centres and two government laboratories, has been estab-

#### Building a European e-Infrastructure: The View from the UK

Tony Hey,  
Director of UK e-Science Core Programme  
EPSRC, UK

#### UK e-Science Funding

##### First Phase: 2001 – 2004

- Application Projects  
– £74M  
All areas of science and engineering
- Core Programme  
– £35M  
Collaborative industrial projects

##### Second Phase: 2003 – 2006

- Application Projects  
– £96M  
All areas of science and engineering
- Core Programme  
– £16M + £25M (?)  
Core Grid Middleware

#### The UK Grid Experience: Phase I

- UK Programme on Grids for e-Science  
– £75M for e-Science Applications
- UK Grid Core Programme for Industry  
– £35M for collaborative industrial R&D
- Over 80 UK companies participating
- Over £30M industrial contributions
  - Engineering, Pharmaceutical, Petrochemical
  - IT companies, Commerce, Media

#### UK e-Science Grid



## 4.4 Session 4: National/regional initiatives

### the view from the UK

lished. Creating this Grid has proved very challenging and considerable experience has been gained in the practicalities of building a real heterogeneous Grid.

Over the past two years it has become clear that there is a need to develop an open source, open standard compliant middleware infrastructure which will integrate and federate with industrial solutions. Such work must have a software engineering as well as a research and development focus. The aim must be to produce robust, well-documented, re-usable software that is maintainable and that can evolve to embrace emerging Grid standards. With this in mind, a major focus of Phase 2 of the UK e-Science Programme is the creation of an Open Middleware Infrastructure Institute. This will act as a repository for all of the UK-developed Open Source “e-Science/Cyber-infrastructure” middleware. It will also act as a document repository and involve itself in quality assurance and compliance testing for GGF/WS standards. A key role of this Institute will be to fund software engineering effort to bring “research project” middleware up to “production strength” – which we know can take an order of magnitude more effort to achieve compared to the original development. The Institute will also fund middleware development projects for identified “gaps”

and work with US, EU and Asia Pacific projects. We intend that the work is supported by major IT companies.

In the EU context – should we consider a similar Open Middleware Infrastructure Institute for the middleware developed by the EU funded Grid projects? This would take a series of roles similar to those described above for the UK Institute.

In summary, there is a clear and urgent need for software engineering to develop a consistent eln-rastructure middleware stack. It is essential we have an Institute similar to the UK in the European context. This is a bold vision and calls for bold initiatives. We intend to invest £30 million in the UK; a similar amount of funding will be required in the EU. We believe this work, in both the UK and Europe, is vital to avoid a backlash from new users who find problems with what is currently “proof of concept” middleware. Unless we take coordinated action now we will not have a robust eln-rastructure for deployment by science and industry by 2007. As Tony Blair said in 2002, “[The Grid] intends to make access to computing power, scientific data repositories and experimental facilities as easy as the Web makes access to information”. Now is the time for action to meet this goal.

#### Open Middleware Infrastructure

- Need to develop open source, open standard compliant, middleware stack that will integrate and federate with industrial solutions
- Software Engineering focus as well as R&D  
Aim must be to produce robust, well-documented, re-usable software that is maintainable and can evolve to embrace emerging Grid Service standards
- Major focus of Phase 2 of UK e-Science Initiative is creation of an ‘Open Middleware Infrastructure Institute’

#### Role of UK Open Middleware Infrastructure Institute

- Repository for UK-developed Open Source ‘e-Science/Cyber-infrastructure’ Middleware
- Documentation, QA and Compliance testing for GGF/WS standards
- Fund software engineering effort to bring ‘research project’ Grid middleware up to ‘production strength’
- Fund middleware development projects for identified ‘gaps’
- Work with US, EU Projects and Asia-Pacific
- Supported by major IT companies



#### 4.4.1 Tony Hey – Building a European eInfrastructure: the view from the UK

##### An EU Open Middleware Infrastructure Institute?

- Open repository of Middleware from EU Grid Projects
- Compliance testing for GGF standards
- Software engineering to produce 'production quality' middleware
- Work with major IT companies
- Seek partnership with US Cyberinfrastructure Initiative
- Seek Asia-Pacific collaboration

##### e-Infrastructure: Conclusions

- Many EU R&D projects developing 'proof of concept' Grid middleware
- Urgent need for software engineering effort to develop consistent e-Infrastructure middleware stack
  - Typically requires order of magnitude more effort than required to produce research prototype
- Unless we take co-ordinated action now we will not have a robust e-Infrastructure for deployment for science and industry by 2007

##### e-Government and the Grid

'[The Grid] intends to make access to computing power, scientific data repositories and experimental facilities as easy as the Web makes access to information.'

Tony Blair, 2002



## Peter Kacsuk

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Prof. Dr. Peter KACSUK is the Head of the Laboratory of the Parallel and Distributed Systems in the Computer and Automation Research Institute of the Hungarian Academy of Sciences.

He received his MSc and doctorate degrees from the Technical University of Budapest in 1976 and 1984, respectively.

He received the kandidat degree from the Hungarian Academy in 1989.

He habilitated at the University of Vienna in 1997 where he is a private professor.

He is a part-time full professor at the University of Westminster and at the University of Miskolc.

He served as visiting scientist or professor several times at various universities of Austria, England, Germany, Spain, Australia and Japan.

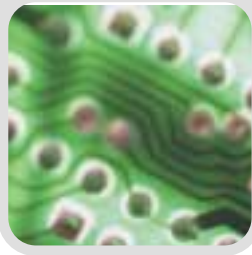
He has been published three books, two lecture notes and more than 120 scientific papers on parallel logic programming, parallel computer architectures, parallel software engineering and Grid tools.

He was the chair of the Performance Monitoring Working Group of the European Grid Forum and currently he is the co-chair of the Performance Monitoring Working Group of the Global Grid Forum.

He is a member of the Project Technical Board of EU DataGrid project led by CERN, as well as of the Scientific Advisory Board of the Hungarian CERN Committee.

He is the leader of the Grid Monitoring Work Package of the EU APART-2 project and member of the Board of Directors of the EU COST MetaChem project.





### 4.4.2 Peter Kacsuk - How to build an inexpensive production

Hungary has recently established the Hungarian Grid Competence Centre (MGKK) to lead an ambitious plan to coordinate Hungarian Grid efforts throughout higher education and research institutions. A key aim is to establish a cluster-based production Grid throughout Hungary's higher education institutions. MGKK is a virtual organisation founded by four leading institutions – MTA SZTAKI, NIIFI, BME and ELTE. The organisation is focussing on two main projects: ClusterGrid – which aims to connect the Hungarian University clusters into a high-throughput Grid system and SuperGrid – which aims to connect the Hungarian Supercomputers into a high-performance Grid system.

The central goal of the ClusterGrid initiative is to connect 99 new clusters, which have been installed throughout the Hungarian University system, to form a production Grid. Each cluster consists of 20 PCs and a network server PC. During the daytime

the components of the clusters are used for education. Overnight, the clusters are connected over the Hungarian Academic Network (2.5Gbps) to form a Grid. The total capacity of the Grid by the end of 2003 is expected to be 2079 PCs.

The basic concepts of the system have been to: keep the system as simple as possible; to use existing production quality network and Grid middleware components; to only develop missing components; and to utilise only one entry point for security reasons. The existing components that have been chosen are Condor (using its flocking mode for brokering) and VPN technology (solving the firewall issues with Condor). The new development undertaken has been to develop system boot software for the overnight Grid working mode. This software is designed to make switching between the different working modes as automated as possible. It runs continuously on the central Condor master and the local Condor masters.

#### How to build an inexpensive production Grid infrastructure? The Hungarian way

Péter Kacsuk  
Hungarian Grid Competence Centre

#### Hungarian Grid Competence Centre MGKK

- **Goal:** To co-ordinate the Grid efforts of the Hungarian higher education and research institutions
- Virtual organization established in April 2003
- Founding members:
  - MTA SZTAKI (Computer science research institute)
  - NIIFI (National Infrastructure Dev. Office - HungarNet)
  - BME (Univ. of Technology, Budapest)
  - ELTE (Univ. of Science, Budapest)
- Two main Grid infrastructure projects:
  - **ClusterGrid** (to connect the Hungarian university clusters into a high-throughput Grid system)
  - **SuperGrid** (to connect the Hungarian supercomputers and high-end clusters into a high-performance Grid system)

#### Hungarian ClusterGrid Initiative

- **Goal:** To connect the 99 new clusters of the Hungarian higher education institutions into a production Grid
- Each cluster contains 20 PCs and a network server PC.
  - Day-time: the components of the clusters are used for education
  - At night: all the clusters are connected to the Hungarian Grid by the Hungarian Academic network (2.5 Gbit/sec)
  - Total Grid capacity by the end of 2003: 2079 PCs

#### Basic concepts

- **Basic concepts:**
  - To keep the system as simple as possible
  - To use existing production quality network and Grid middleware components
  - To develop only the missing components
  - One entry point to guarantee security
- **Existing components:**
  - Condor (flocking mode - brokering)
  - VPN technology (solving the firewall problem of Condor)
- **Own development:**
  - System boot for the Grid working mode

## Production Grid infrastructure

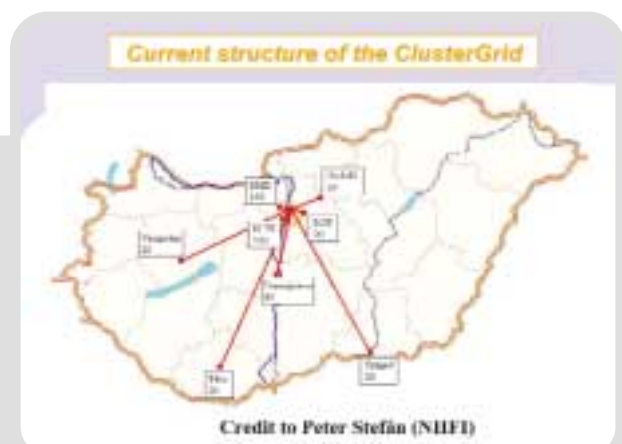
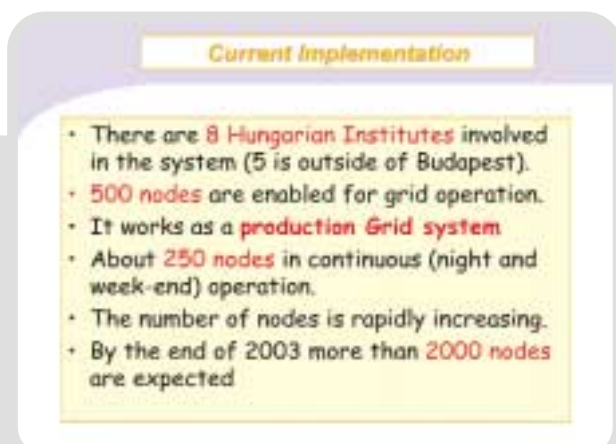
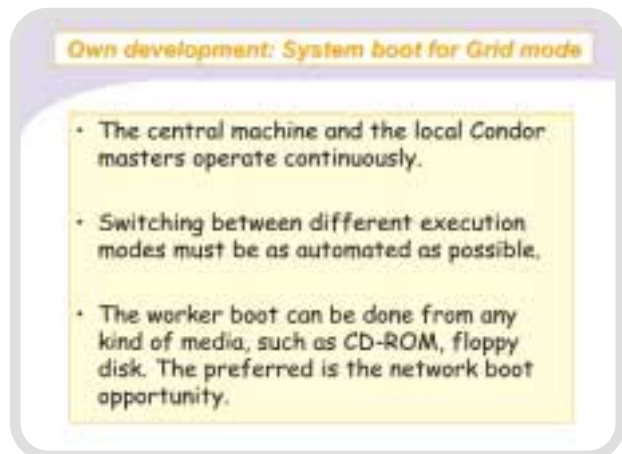
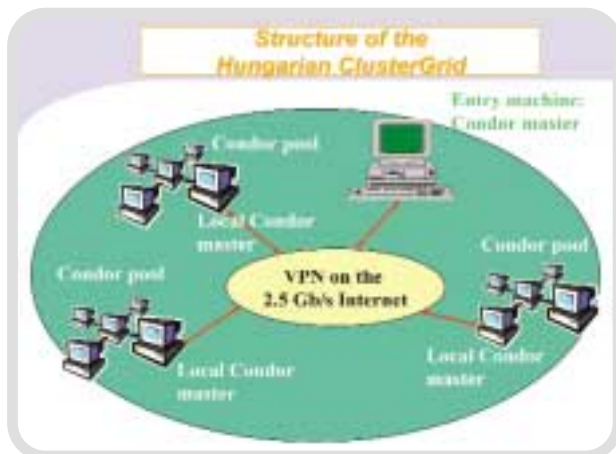
Currently there are eight Hungarian Institutes involved (five are outside Budapest). Approximately 500 nodes are currently enabled for Grid operation. About 250 of these nodes are brought into the Grid each night and at weekends. The total number of nodes is rapidly increasing. They are seeing utilisation levels of 40% already – prior to the service being properly opened and expect this utilisation to increase when it is. The management of the project is arranged around a Technical Committee and a Steering Committee.

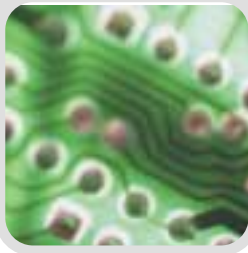
A number of further developments are foreseen to meet initial problems with the system. These include: a high level Grid programming environment is missing – this will be fixed by installing P-GRADE; there is no parallel checkpoint support in Condor – a joint development is underway to combine P-GRADE and Condor to provide this functionality; Condor job monitoring is not satisfactory – the GAMI software developed by MTA SZTAKI in the DataGrid and GridLab projects will

be adapted; and the single entry point is a cause for concern due to overloading – there are plans to configure a separate entry-point machine for each site.

There is a clear “chicken and egg” problem in relation to production Grids: should a user community be established first or does this require an existing infrastructure? In the context of ClusterGrid, the infrastructure is being put in place first in order to be ready to meet the needs of users. Social issues have also played a role in terms of convincing the cluster owners to allow their machines to join the Grid. This has been solved by demonstrating the benefits of the Grid to the cluster owners through some early success stories.

The Hungarian ClusterGrid Initiative is demonstrating how to create an inexpensive production Grid system. Other countries are already showing considerable interest in this approach. It is hoped to be able to take the idea further and connect to other Grid systems such as DataGrid and, in due





### 4.4.2 Peter Kacsuk - How to build an inexpensive production Grid infrastructure

#### Statistics of the work in April



Credit to Peter Stefan (NIIFI)

#### Organization of the project

- A **Technical Committee** led by NIIFI works on the technical realization of the project (6 persons and the system administrators of the Grid sites)
- A **Steering Committee** led by MGKK
  - defines the long-term development needs
  - Organizes international collaborations

#### Further Developments in 2003

- **Problems**
  1. High-level Grid programming environment is missing
  2. There is no parallel check-point support under Condor
  3. Condor job monitoring is not satisfactory
  4. The single entry-machine will be a bottle-neck due to the Condor file-handling mechanism
- **Solutions**
  1. P-GRADIE (Parallel Grid Run-time and Application Development Environment) will be installed
  2. A joint work is under way to combine P-GRADIE and Condor and to develop a parallel check-point system => **high-performance Grid**
  3. The GAMI (Grid Application Monitoring Infrastructure) developed by SZTAKI in the DataGrid and GridLab projects will be adapted
  4. On every site a separate entry-machine will be used

#### Reflection to some problems raised in the workshop

- Yannis Kalogirou:
  - Chicken and egg problem: first users or infrastructure?
  - Our answer: First a production Grid infrastructure and then the users can come
- Kyriakos Baxeivanidis:
  - Concern of loosing control/access to owned resources
  - Our answer: It was a real problem in the beginning but when the system started to work with the first 3 universities and 200 PCs, people realized that it is not the case and became **volunteers to offer their resources**

#### Conclusions

- The Hungarian ClusterGrid provides an
  - inexpensive way of creating large size Grid system
  - based on existing clusters/laboratories
  - even if they are used for other purposes during the day
- It already works as a **production Grid**
- There is already interest in other countries to build their national ClusterGrid (Ireland, Israel)
- We propose to form an **EU project** to further develop the ClusterGrid idea and to connect it to other Grid systems like the DataGrid and EGEE systems.





## Manuel Delfino

Manuel Delfino is Professor of Physics at the Universitat Autònoma de Barcelona (UAB), Spain and Adjoint Researcher at the Institut de Física d'Altes Energies (IFAE) in Barcelona.

He is currently the Director of the Port d'Informació Científica (Scientific Information Port) in Barcelona, the Coordinating Principal Investigator of the LHC Computing Grid Project in Spain and the Coordinator of the Southwest Federation of the EGEE Grid Infrastructure project.

He was on leave from UAB during 1999-2002 serving as Leader of the Information Technology Division of CERN, the European Organization for Nuclear Research in Geneva, Switzerland.

Prof. Delfino obtained his Ph.D. in 1985 from the University of Wisconsin in Madison, USA, based on research on weak neutral currents between electrons and positrons with the MAC detector at the Stanford Linear Accelerator Center, one of the first large scale implementations of gas calorimetry for colliding beam particle detectors.

He moved to Barcelona in 1987 to work on the ALEPH detector at CERN, for which he led the project to implement a quasi-online data processing facility based on a farm of loosely coupled commercial processors. His physics research was centered around precision measurements of Z boson decays to leptons.

In 1995, while on leave at the SCRI institute in Florida, USA, he organized the CERN RD-47 project which served as proof of concept for building processor farms using Personal Computers.

Prof. Delfino has served as referee for R&D projects for the future Large Hadron Collider, and as chairman of the High Energy Physics Network Requirements and the CERN Forum on Computing Users and Services committees.

During 2002, Prof. Delfino proposed the creation of the Port d'Informació Científica, an innovative center focused on providing Grid-enabled resources for data-intensive scientific computing. The PIC was created in October 2002 as a collaboration agreement between the Catalan Government, the Autonomous University of Barcelona and the IFAE, and enlarged in June 2003 with the participation of the Spanish Government through the CIEMAT institute. PIC is active in the LHC Computing Grid Project and evaluating other domains, such as Digitized Radiology Data Banks.

*A group photo of some of the grid collaborators of NIKHEF and SARA (NL):*

*Top row from left to right:*

*Walter de Jong (SARA), Jules Wolfart (SARA), Wim Heubers (NIKHEF),  
Antony Antony (NIKHEF/UvA), Oscar Koeroo (NIKHEF), Gerben Venekamp  
(NIKHEF), Martijn Steenbakkens (NIKHEF), Hui Li (NIKHEF),  
Ton Damen (NIKHEF).*

*Bottom row from left to right: Jeff Templon, David Groep, Kors Bos, Paul Kuipers  
(all NIKHEF).*





### 4.4.3 Manuel Delfino - The role of local and regional

Infrastructure enhancements will only succeed if we solve end-to-end issues at the technical, infrastructural, methodological and social/human levels. In this regard, local and regional coordination will be an essential ingredient for tackling these issues. The sophisticated structure of Europe is uniquely positioned to achieve this multi-level coordination. In the context of this talk a local area can be thought of as a city (eg. Barcelona), whilst a regional area can be thought of as an area of a country (eg. Catalunya).

Where appropriate, regions will provide the “flexible meso-level” between the national and local levels in order to catalyse the rapid and effective take-up of infrastructure technologies and methods of working. Regions should be seen as a complementary vehicle to the overall effort to achieve

the vision of eEurope. Groups of regions acting in a coordinated fashion with a direct connection to actors in e-Science, Technology, Health and Industry will enhance the benefits of introducing infrastructures.

At the local level, the involvement of cities and metropolitan areas are essential to avoid “first kilometre problems” and to provide the ultimate link to citizens in terms of the technical, social, and organisational problems they may encounter. Typically the competences required at the local level will be different but complementary to those at the regional and higher levels.

There are some obvious examples of how these levels may be structured. In the health sector we already see that hospitals and health centres are




**The role of Local and Regional coordination in the introduction of Infrastructures**

Prof. Manuel Delfino  
Director  
Port d'Informació Científica  
(Barcelona, Catalunya, Spain, European Union, Earth)  
delfino@ifac.es




**From the invitation:**  
**“Keep it short and get to the point”**

- Infrastructure enhancements will only succeed if we solve end-to-end issues:
  - Technical
  - Infrastructural
  - Methodological
  - Social / Human
- Local and Regional Coordination will be an essential ingredient for such end-to-end issues
- The sophisticated structure of Europe is uniquely positioned to achieve this multi-level coordination



**The Regional Level**

- Where appropriate, Regions will provide the “flexible meso-level” between the National and Local levels to catalyze rapid and effective take-up of infrastructure technologies and ways of working into specific areas and specific policy frameworks.
- Regions are a complementary vehicle to the effort to achieve the vision of eEurope.
- Groups of Regions acting in a coordinated fashion with a direct connection to key actors in Science, Technology, Health and Industry will enhance the benefits of introducing infrastructures



**The Local Level**

- Involvement of the Local Level, i.e. Cities and Metropolitan Areas, is essential in order to avoid First Kilometer Problems and provide the ultimate link to the Citizen.
- Not just technical, but also social, organizational, and interface to citizens.
- Typically, the type of competences held at Local level are different and complementary to those at the Regional level.



## coordination

organised at a combination of local and regional levels. In the Governmental sector there are an increasing number of agreements to present a unified “one-stop-shop” to the citizen for access to local, regional, national and EU services. From the point of view of consumers, they largely operate at a local and regional level and we must recognise this in the policies we set.

The GridPort concept encapsulates these ideas and is specifically designed to enhance the feedback between the growth of Grid infrastructures and the development and deployment of e-Science applications at the regional level. The Association of Regional GridPorts will catalyse the coordination and cooperation between individual GridPorts leading to the coordinated growth of e-Sci-

ence communities in a scalable and timely way – hopefully mitigating the creation of an “e-Science bubble”. In particular they will focus on the compatible and cost-effective deployment and growth of Grid infrastructures and avoid the problem of unfulfilled expectations of new users. These ideas are being incubated currently by the Governments of Baden-Württemberg, Catalunya, Lombardia and Rhône-Alpes but will be open to all.

In summary, local and regional coordination will be an essential ingredient to solving end-to-end issues. With support from the Association of Regional GridPorts we believe we have a powerful tool to best utilise the uniquely sophisticated structure of Europe for the benefit of all science.



### *Some examples to make it less abstract*

#### • *Health care*

*Primary attention centers and hospitals are often operated by combination of Local and Regional agencies inside a National framework.*

#### • *Government*

*Increasing number of agreements to present a “unified window” for Citizen access to Local, Regional, National and EU services.*

#### • *Consumers*

*EU citizens still walk on the street! Local and Regional levels can help catalyze innovative business models targeted with “local knowledge”.*



### *GridPorts: Regional Coordination of eInfrastructures and eScience*

- *A GridPort is a concept specifically designed to enhance feedback between the growth of Grid Infrastructures and the development and deployment of eScience Applications at the Regional level.*
- *Coordination and cooperation between GridPorts through the Association of Regional GridPorts will lead to:*
  - *Coordinated growth of eScience communities in a scalable and timely way, avoiding the creation of an “eScience bubble”.*
  - *Compatible and cost-effective deployment and growth of Grid Infrastructures, avoiding unfulfilled expectations of new users.*
- *This idea is being incubated by the governments of the Four Motors for Europe (Baden-Württemberg, Catalunya, Lombardia and Rhône-Alpes) but will be open to all.*



### *Conclusions: “Keep it short and get to the point”*

- *The creation of eEurope will only succeed if we solve end-to-end issues in Technical, Infrastructural, Methodological, Social, Human and Citizen-contact domains.*
- *Local and Regional Coordination will be an essential ingredient for such end-to-end issues.*
- *The concept of Regional GridPorts and their Association is being developed as a complementary tool for coordination in science. It will serve as a laboratory to learn about general introduction of eInfrastructures.*
- *The sophisticated structure of Europe is uniquely positioned to achieve this multi-level coordination.*





## Mirco Mazzucato

Name: Mirco

Surname: Mazzucato

Position: Director of research • INFN Grid project Manager

Organization: INFN - Istituto Nazionale di Fisica Nucleare

Full Name: Dr. Mirco Mazzucato

### CURRICULUM VITAE

Project Manager of the INFN Grid Project

Chairman of the Grid Deployment Board and INFN representative in the CERN LHC Computing Grid project

Member of the Management Boards of the FP5 European Projects DataGrid and DataTAG and of the Executive Committee of the FP6 Grid infrastructure project EGEE in negotiation

Head of the Research Unit 4 of the FIRB MIUR Grid.it project

Italian Delegate at the European IST Committee

Member of the International Grid EU-US coordination group

Coordinator of the Italian Grid for Business, Industry, Government, EScience&Technology initiative

### PAST ACTIVITIES

INFN national coordinator of many HEP experiments based at CERN: NAI6, NA27 and DELPHI

Head of the Team who set up in 1988 the DELPHI INFN Farm for the offline productions, one of the world pioneering examples of CPU clusters based on commodity components (Digital workstations connected via Ethernet)

Member of the DELPHI Management Board from 1993 to 2000 as coordinator of the offline computing activity

Chairman of the CERN LHC Computing Board from 1996 to 2000

Chairman of the CNTC the Committee which has fostered the introduction of the new computing technologies in INFN from 1998

President of the INFN Computing Committee from 1998 to 2001

General Chair of the Computing in High Energy Physics (CHEP) Conference 2000

Member of CHEP Advisory Board in 2001 and 2003 and Chair of the Grid Computing session in 2001

Member of the SC2002 program committee

Authors of more than 250 publications



At the top, from left to right: Marco Verlati, Andrea Caltroni, Stefano Lacaprra, Ugo Gasparini, Alessio Gianelle, Marco Corvo, Nikolai Smirnov, Vittorio Garbellotto (partly hidden), Mirco Mazzucato, Alessandra Casotto, Michele Michelotto.  
At bottom, from left to right: Volker Drollinger, Enrico Ferro.



### 4.4.4 Mirco Mazzucato - The Grid infrastructure in Italy

Italy started to develop Grid technology and related infrastructures in the second half of 1999 through the INFN-Grid project. It was based on the realisation that modern science is moving to a new phase of global collaboration to improve efficiency, avoid duplication of effort, combine distributed expertise and build critical mass – all of this being encapsulated in the idea of e-Science. INFN represents 25 sites and realised the pressing need to integrate these sites using Grid technology as we move towards the development and deployment of a whole range of new scientific digital instruments and their associated data rates.

Grids clearly have much wider applicability than simply e-Science. Modern industries, business and Government are relying more and more on innovative solutions to problems and are increasingly basing their decisions on a cycle of problem modelling, simulation of various solutions, selection of best solution and realisation. To maintain and increase Euro-

pean competitiveness we must put in place the technologies which will allow us to quickly and easily assemble distributed teams that utilise distributed data and computing resources based on well understood collaborative methods – the central philosophy behind the creation of Virtual Organisations.

Towards the end of 1999, INFN decided, after careful evaluation, that Grid technology promised to deliver a key enabling solution to the problems faced by High Energy Physics and e-Science in general. The development of the components of a national Grid infrastructure for Italy has been actively pursued since then. This has been achieved through the active participation in Grid middleware development projects such as EU DataGrid and DataTag, promoting international collaborations (largely with US initiatives such as Globus, Condor, iVDGL, PPDG and GGF) to allow worldwide interoperability in projects such as GLUE, WorldGrid and MAGIC. As a result the Italian national Grid infrastructure is now a reali-

#### The Grid activities in Italy

and the eBusiness  
eIndustry  
eGovernment  
eScience and  
Technology  
(BIGEST) Italian Grid Initiative

Athens - June 2003  
Mirco Mazzucato  
INFN-Padova  
mirco.mazzucato@pd.infn.it

#### Summary

- The general case for Grids
- The national Italian grid strategy
  - The evolution of the national projects
    - INFN Grid, F3B@grid, POC@HPC
- The new IS-BIGEST initiative for FFB
- The current challenges
- Conclusions

#### Why Grids are generally interesting ?

- Italy started to develop the Grid technology and related infrastructures in the second half of 1999 (INFN Grid). **Main motivations:**
- Modern fundamental Science requires more and more global collaboration (eScience) : improve efficiency, avoid effort duplication, combine distributed expertise (INFN has 25 sites), build up critical mass....
- The scientific world and modern societies have to face the large development of digital instruments which produce an enormous amount of distributed raw data
  - High Energy Physics detectors: 10 PB/year in 2007
  - Earth Observation satellites: 500 TB/year now
  - Mammography screening of the population in Italy: 300 TB/year
  - Genome databases now ~100 TB/year... quickly growing
- These raw data need to be transformed in precious pieces of knowledge:
  - Lots of active, new discoveries, innovative technologies, early cancer diagnosis ...
- Grids can provide a general technology to develop an infrastructure supporting this task

#### ...not only for e-Science

- Also modern Industries, Business and Governments rely more and more on innovative processes which are increasingly based on the cycle:
  - Theoretical modelling of the problem
  - Simulation/Calculation of different options and input data
  - Selection of best solution
  - Realization
- and to keep competitiveness require to assemble quickly distributed teams in Virtual Organization accessing large computing resources, distributed data and using collaborative methods similar to eScience
- The Grid middleware can provide common services that all e-Science, e-Industry, e-Business and e-Government Grid applications can use
- as TCP/IP provides a common Internet access protocol to Science and Industry
- As the WEB provides a general solution which has allowed large scale economies and large synergies between different sectors of the society

ty being developed by a series of coordinated national projects. This development has been led by the INFN-Grid project, which was approved at the beginning of 2000. Initially this work was focussed on the preparation of the INFN LHC computing service but since then has become a more general solution. The project was complex – involving 20 Italian sites, ~100 people and a budget of ~?30 million. It represents a successful collaboration between physicists, software engineers, computer professionals, computer scientists and Italian industries. It has resulted in a reliable INFN Grid infrastructure involving all 20 sites and with a focus on support and general services.

The next stage has been to transform this work into an Italian Grid and this is being accomplished through the national FIRB Grid.it eInfrastructure project. This three-year project, which started in November 2002, has a total budget of ?8.1 million and brings together, INFN, CNR, ASI and associated Universities. A wide range of sciences are now sup-

ported and this project has the responsibility for creating a national Grid infrastructure and prototyping a national Grid Operation Service (GOS). In addition to this, and building from INFN-Grid and Grid.it, the Italian Grid for Business, Industry, Government, e-Science and Technology (IG-BIGEST) has also been established. Its aim is to promote the establishment of a general EU Grid infrastructure for e-Science integrating all of the available EU national infrastructures. This work is coordinated by INFN who see this project as a key enabler in meeting the vision of ERA.

Current challenges facing the creation of an EU eInfrastructure include: delivery, robustness and stability of middleware, managerial and administrative structures, and policies for resource sharing, virtual organisations, security, and accounting etc. It is hoped that the proposed EGEE project will tackle many of these issues and it is clear that the time for such a project is now.

### The Italian Grid National Strategy

- At the end of 1999 in Italy, after a careful evaluation, INFN Grid decided that Grids were the promising enabling technology for HEP and eScience in general.
- The development of all components of a national Grid infrastructure has been actively pursued, since then:
  - Fostering the development of the Grid middleware and international integration through European funded projects: DataGrid, DataTAG
  - Leveraging from CERN managerial expertise
  - Promoting since the beginning the creation of European Standards
- Promoting the international collaborations (with US Globus Condor, IVOG, FIDES, GGF...) to allow worldwide interoperability:
  - GLUE, World Grid, MAGGIC...
- The national Grid infrastructure is now a reality constantly developed by a series of coordinated national projects:
  - Gom (GREN) for the underpin broadband Research Networking
  - InfGrid, FIRB Grid.it, S-FACS FON for Grids
- Integrated at international level through EU DataGrid, DataTAG...

Image: INFN Grid.it

Image: INFN Grid.it

### Early Grid R&D in Italy : The INFN-GRID Project



- Early national Grid project approved in Europe beg. 2000
- Focused on the preparation of the INFN LHC comp. infrastructure but aiming, since then, at a general solution
- The size of the project: 20 Italian Sites, ~100 people, ~50 FTEs
  - Budget of ~30 M€ devoted to the development of Regional Computing Centers and related collaborative Grid infrastructure
- It is a successful example of collaboration between physicists, engineers, computer professionals and computer scientists (CS Dep. of Universities of VE, PD, BO, CT, TO...) and Italian Industries
  - Datamat SPA and Nice have been major contributors in the development of the DataGrid middleware and have now top level expertise in Linux based Grid middlewares of European and International Level
- It has realized now a reliable INFN grid infrastructure (20 sites) with necessary supporting general services

Image: INFN Grid.it

Image: INFN Grid.it

### From INFN Grid to an Italian Grid: [www.gd.infn.it/bigest](http://www.gd.infn.it/bigest)

#### The FIRB Grid.it Project

FIRB: Fondo per gli Investimenti della Ricerca di Base (fondo MIUR da UMIS)

Image: INFN Grid.it

Image: INFN Grid.it

### The Grid National Program



#### CNR & University

HEP, Particle Physics, Grid computing, Scientific Research, Data base and Knowledge Discovery, High Performance Computing, etc.

#### INFN & University

Grid infrastructure, Grid middleware, Grid applications, Grid services, etc.

**Funding: €8.1 M**  
**3-Year Project**  
**Start-up: November 2002**  
**UR INFN: €1.58M**

Image: INFN Grid.it

Image: INFN Grid.it





## 4.4 Session 4: National/regional initiatives

### 4.4.4 Mirco Mazzucato - The Grid infrastructure in Italy

In terms of the Grid's relationship with networking, it is important that there is tight collaboration between the networking infrastructure providers and the Grid middleware development community. Grid infrastructures desperately need L1, L2 and L3 end-to-end provisioning. Support for IPv6 is also an important factor in the future development of Grids.

In summary, the Italian Government fully supports the establishment at EU level of eInfrastructures in the context of the Grid and in agreement, and well integrated with, national initiatives. Only in this way will eInfrastructures help to strengthen the vision and delivery of ERA.

#### The national Grid, it eInfrastructure

- In Grid.IT INFN is responsible for the creation of a national Grid Infrastructure and for studying and prototyping a national Grid Operation Service (GOS)
  - The generalization of the infrastructure support is a model successfully established in Italy with the research network (GARR)
- The GOS will also support several Italian Sciences applications and the operation of the Italian infrastructure also in the context of the new European Infrastructure project EGEE
- The Italian eScience Grid infrastructure currently support:
  - Astrophysics
  - Biology
  - Computational Chemistry
  - Geophysics
  - Earth Observation
- but other sciences are joining thanks to new MIUR funds (e.g. new IS-PACI and other PON projects)

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Mirco Mazzucato INFN Padova

#### The Italian Grid for Business, Industry, Government, ESience&Technology (IG-BIGEST)

- It is a new national initiative leveraging from INFN, FIRS-Grid.IT and PON projects and aiming at coordinating all Italian Grid efforts in view of the participation to EU FP6 and international grid projects
- IG-BIGEST is coordinated by INFN and includes all Italian Science Institutions, major computing centers and many Industries ready to invest in early tests
- The IG-BIGEST main objectives are:
  - To promote the creation of a general EU grid infrastructure for eScience, eIndustry, all available EU national infrastructures and open to industry early test. Make current Grid middlewares robust and fault tolerant for this production infrastructure to allow to start EU eScience.
  - EU eInfrastructure proposal: EGEE
  - To promote R&D on open Grid issues
  - To support development of specific components and usage of Grid, by major applications in e-Science, eIndustry and eGovernment
- New projects: SUGAR, SSA, ...

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#### Current Challenges for an EU eInfrastructure

- Grid infrastructures are now seen by many governments as a Science and society development enabling factor and large funds are made available in Europe but also in US (Cyber-infrastructure) and Japan.
- The Grid technology will become robust and stable thanks to new projects like EU EGEE
- EGEE will provide also:
  - effective integration of the national testbeds into an EU eInfrastructure
  - Development of user communities
  - Promotion of national and regional coordinating structures at national level
- However the general managerial and administrative structure to support these developments in Europe is very weak even if very good progress was done with EGEE
  - Projects like EGEE have definite goals, are focused and ends
  - Current provides effort but long term foundation for an EU eInfrastructure
  - Current provides EU wide roadmap integrated with national programs
- Policies for resource sharing within communities having common objectives (VO), security issues, accounting etc. must to be generally addressed only now and need some or numerous sort of efforts if not generally addressed and supported at a general governmental level

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#### Summary and some answers

- Italy with the IG-BIGEST initiative, has set up a national level of coordination to actively and concretely promote, with other EU partners, the development of ERA and of the related EU eInfrastructure supporting the development of EU wide eScience, eGovernment, eIndustry and eBusiness
  - ERA and EU eInfrastructure should give Europe the edge on Scientific Research and Industrial/Commercial outlook, allowing the building up of critical mass in all domains
- It is now time for Europe to address also the issue of putting in place a solid foundation to the Grid level of the EU eInfrastructure, similar to what was done in the past with NREN, Dante and Beant.

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#### Grids and Networks

- An EU grid infrastructure foresees two major layers:
  - Networks
  - Grid middleware Services (Including Computing, Storage, ...)
- Tight collaboration between the two layers should be put in place preserving the different objectives and expertise
- Grid infrastructures desperately require L1, L2 and L3 end-to-end provisioning
  - L2 with between CHAP and CERN allows sustained 1 Gbps traffic
  - CMS already next year need to transfer several TB/day
  - L3 is a Grid dream and Grids would certainly favor a collaboration with telecom operators to develop a purely optical networking system, but pursuing these developments may be dramatic for EU
- Grids connections will certainly profit of IPv6 but cannot probably compete with mobile market requirements of driving force

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#### Final Conclusions

- Italy and IG-BIGEST will continue to promote at EU level all aspects of Grids development: R&D, S/W Engineering, deployment of infrastructure, operation, development of specific components for applications for eScience, eBusiness, eIndustry/eGovernment, eHealth...
- The Italian Government encourages the constitution at EU level of appropriate level of coordination and structures for Grids to:
  - establish European roadmaps for the deployment of ERA,
  - related EU eInfrastructures
  - related Grid technology developments
  - promote and plan usage of EU eInfrastructure by application communities both scientific and industrial
  - address policies issues
- In agreement and well integrated with grid National programs

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### Members of INFN Grid team involved in grid developments

Executive Board		
Name	Department	Position
Mazzucato Mirco		Project Manager
Maggi Giorgio		Administration and external applications
Capiluppi Paolo		CMS Computing Coordinator
Ruggieri Federico		CNAF Director
Vistoli Cristina		GRID Operation manager
Prelz Francesco		Middleware Manager
Perini Laura		ATLAS, Deputy project Manager
Merola Leonardo		External Application
Luminari Lamberto		Technical Coordinator (applic.)
Gaido Luciano		Testbed Manager
Masera Massimo		ALICE Technical Coordinator
Ghiselli Antonia		Technical Coordinator (Soft.and infrast.)
Project Office		
Barbera Roberto	CATANIA	Coordinator
Casotto Alessandra	PADOVA	
Ferrari Roberto	PADOVA	
Michelotto Michele	PADOVA	
Platania Giuseppe	CATANIA	
Salente Giuseppina	PADOVA	
Middleware		
Prelz Francesco	MILANO	Responsible
Sgaravatto Massimo	PADOVA	Deputy
Giacomini Francesco	CNAF	Software Engineering manager
Di Stefano Antonella	CATANIA	System Eng.
Pappalardo Giuseppe	CATANIA	System Eng.
Tramontana Emiliano	CATANIA	System Eng.
Monforte Salvatore	CATANIA	System Eng.
Pappalardo Marco	CATANIA	System Eng.
Ronchieri Elisabetta	CNAF	System Eng.
Andreozzi Sergio	CNAF	Comp. Scientist
Ciaschini Vincenzo	CNAF	System Eng.
Ferretti Stefano	CNAF	System Eng.
Bocchi Laura	CNAF	System Eng.
Ceccanti Andrea	CNAF	System Eng.
Mezzadri Massimo	MILANO	System Eng.
Rebato David	MILANO	System Eng.
Gianelle Andrea	PADOVA	System Eng.
Peluso Rosario	PADOVA	Appl. Eng.
Pietrobon Valentino	PADOVA	Comp. Science
Fantinel Sergio	PADOVA	System Eng.
Guarise Andrea	TORINO	System Eng.
Grid Infrastructure Responsibles		
Vistoli Cristina	CNAF	GOC manager
Gaido Luciano	TORINO	Testbed manager
Ghiselli Antonia	CNAF	Tech, Coord. (infrastructure)
Luminari Lamberto	ROMA1	



#### 4.4.4 Mirco Mazzucato - The Grid infrastructure in Italy

##### Members of INFN Grid team involved in grid developments

###### GRID Operation TEAM and Application environment

Name	Department	Name	Department
D'Amato Maria	BARI	Badoer Simone	LEGNARO
Gervasoni Riccardo	BARI	Marchi Massimo	MILANO
Pierro Antonio	BARI	Resconi Silvia	MILANO
Coviello Tommaso	BARI	Vaccarossa Luca	MILANO
Donvito Giacinto	BARI	Taurino Francesco	NAPOLI
Luisetto Maria Luisa	BOLOGNA	Tortone Gennaro	NAPOLI
Calligola Patrizia	BOLOGNA	Esposito Rosario	NAPOLI
Semeria Franco	BOLOGNA	Mastroserio Paolo	NAPOLI
Grandi Claudio	BOLOGNA	Doria Alessandra	NAPOLI
Fanfan Alessandra	BOLOGNA	DeBortoli Natascia	NAPOLI
Mura Daniele	CAGLIARI	Michelotto Michele	PADOVA
Silvestri Antonio	CAGLIARI	Costa Fulvia	PADOVA
Barbera Roberto	CATANIA	Bredo Fabio	PADOVA
Belluomo Patrizia	CATANIA	Crescente Alberto	PADOVA
Platania Giuseppe	CATANIA	Ferro Enrico	PADOVA
Rocca Carlo	CATANIA	Zangrando Luigi	PADOVA
Cangiano Ernesto	CATANIA	Caltroni Andrea	PADOVA
Sava Giuseppe	CATANIA	Verlato Marco	PADOVA
Andronico Giuseppe	CATANIA	Fanzago Federica	PADOVA
Ghiselli Antonia	CNAF	Smirnov Nicolay	PADOVA
Dell'Agnello Luca	CNAF	Corvo Marco	PADOVA
Ferrari Tiziana	CNAF	Alfieri Roberto	PARMA
Ciuffoletti Augusto	CNAF	Covati Roberto	PARMA
Chierici Andrea	CNAF	Spataro Fabio	PARMA
Cavalli Alessandro	CNAF	De Vecchi Carlo	PAVIA
Italiano Alessandro	CNAF	Scannicchio Diana	PAVIA
Donatelli Massimo	CNAF	Vercesi Valerio	PAVIA
Bonacorsi Daniele	CNAF	Domenici Andrea	PISA
DeGirolamo Donato	CNAF	Pucciani Gianni	PISA
Lore Giuseppe	CNAF	Davini Maurizio	PISA
Negri Guido	CNAF	Mazzoni Enrico	PISA
Rosso Felice	CNAF	Amaranti Roberta	PISA
Ferraro Andrea	CNAF	Arezzini Silvia	PISA
Zappi Riccardo	CNAF	Anzellotti Daniela	ROMAI
Rubini Gianluca	CNAF	Bulfon Cristina	ROMAI
Luppi Eleonora	FERRARA	De Rossi Marco	ROMAI
Gianoli Alberto	FERRARA	Spanu Sandro	ROMAI
Gambetti Michele	FERRARA	Reale Mario	ROMAI
Antonoli Enrica	FERRARA	Palomba Cristiano	ROMAI
Veronesi Paolo	FERRARA	Camarrì Paolo	ROMA2
Andreotti Daniele	FERRARA	Celio Paola	ROMA3
Cecchini Roberto	FERRARA	Cerello Piergiorgio	TORINO
Brunengo Alessandro	FERRARA	Lusso Stefano	TORINO
Fasanelli Enrico	GENOVA	Amoroso Antonio	TORINO
Maron Gaetano	LEGNARO	Bagnasco Stefano	TORINO
Biasotto Massimo	LEGNARO	Macorini Tullio	TRIESTE
Berti Luciano	LEGNARO	Strizzolo Lucio	TRIESTE

###### LCG

Name	Department	Position
Masoni Alberto	CERN	Deputy Coordinator
Bettini Piera	CERN	
Donno Flavia	CERN	
Sciaba Andrea	CERN	
Serra Marco	CERN	
Desalvo Alessandro	CERN	
Leonardi Emanuele	CERN	



## Walter Hoogland

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Walter Hoogland is presently Dean of the Faculty of Science of the “Universiteit van Amsterdam” (UvA).

He studied experimental physics in Amsterdam and did his PhD on a topic in experimental particle physics.

He participated in various experiments at CERN and in the US and became in 1983 scientific director of NIKHEF, the Dutch National Institute for Particle Physics.

In 1989 he was appointed director of research at CERN and held that position till 1995.

For the last years of this period he was also responsible for scientific computing. With his return to Amsterdam he joined the Universiteit van Amsterdam to build a new faculty concentrating all the sciences from biology to mathematics and computer science into one large organisation.

He has been member of several scientific committees at CERN and DESY. He was the first chairman of the HEPCCC (High Energy Physics Computing Coordinating Committee).

He is member (chairman) of boards of various foundations in astronomy, biology, informatics, director of a company to spin off R&D in Sciencepark Amsterdam (which involves the UvA, the computing and networking center SARA and several research institutes funded by the Dutch National Science Foundation NWO, like NIKHEF, CWI, AMOLF) and member of the supervisory board of the UvA Holding and a small venture capital fund.

In Sciencepark Amsterdam he has been pushing for a common e-science profile and a strong involvement in GRID developments, exploiting the excellent connectivity of Sciencepark Amsterdam.



### 4.4.5 Walter Hoogland – Perspective from the Netherlands

In the context of the Netherlands the presentation by Manuel Delfino had a clear resonance. The Dutch e-Science approach has been one of integrating a very high bandwidth infrastructure with the computer science community (interfacing to the physical network and the applications community), a number of typical e-Science applications, and extending this work to possible e-Business developments. The e-Sciencepark Amsterdam has become a focal point for the nationwide programme. It combines infrastructure (SURFnet and SARA) with the computer science environment and a potentially large number of advanced users.

The essential ingredients of this work include: the establishment of a framework in which Grid producers and consumers interact; the key issue of removing bandwidth constraints; finding a balance

between technology push and applications pull; integrating networks and Grids; and producing a differentiated infrastructure capable of meeting the needs of high end applications and Internet users. Three large projects have been proposed for funding: the GigaPort, Virtual Laboratory for e-Science and GigaPort Next Generation Applications projects. Funding for these projects will be confirmed in September.

The Virtual Laboratory for e-Science will focus on creating an interactive problem-solving environment with a focus on methods and techniques for interactive High Performance Computing. It will also focus on adaptive information disclosure in the context of knowledge extraction, virtual reality based visualisation, collaborative information management and the integration of all of these compo-

**SCIENCE PARK AMSTERDAM**  
University of Amsterdam, Vrije Universiteit Amsterdam

**Perspective from the Netherlands  
A bottom-up approach**

Towards integrated Networking and  
Grids infrastructures for eScience and beyond,  
The EU eInfrastructures initiative

Walter Hoogland

19-9-2002 19:00:00 19-9-2002 19:00:00 1

**SCIENCE PARK AMSTERDAM**  
University of Amsterdam, Vrije Universiteit Amsterdam

**The Dutch e-science approach**

- An integral approach including
  - A very high bandwidth infrastructure
    - SURFnet (Gigaport and Gigaport Next Generation projects)
  - A computer science community, interfacing the physical network and the applications
  - A number of typical e-science applications
    - Virtual Lab E-Science project
  - Extending to possible e-business developments
- E-sciencepark Amsterdam a focal point for a nation wide programme
  - Combines infrastructure (SURFnet, SARA)
  - Computer Science environment
  - Large number of (potentially) advanced users

19-9-2002 19:00:00 19-9-2002 19:00:00 2

**SCIENCE PARK AMSTERDAM**  
University of Amsterdam, Vrije Universiteit Amsterdam

**The essential ingredients**

- Establish a framework in which grid producers and consumers interact
  - Understanding and educating the consumers
- Remove bandwidth as a limiting constraint by preparing for massive data transport
- Find balance between technology push and application pull
- Integrate networks and grids
- Differentiate infrastructure
  - Separate high-end-applications and Internet users

19-9-2002 19:00:00 19-9-2002 19:00:00 3

**SCIENCE PARK AMSTERDAM**  
University of Amsterdam, Vrije Universiteit Amsterdam

**The Dutch route**

	e-Science	e-Business
Industry applications		
Generic application services		
Grid Services	Virtual Laboratory for e-Science	GigaPort NG Applications
Network infrastructure	GigaPort NG Network	
Grid infrastructure		

19-9-2002 19:00:00 19-9-2002 19:00:00 4



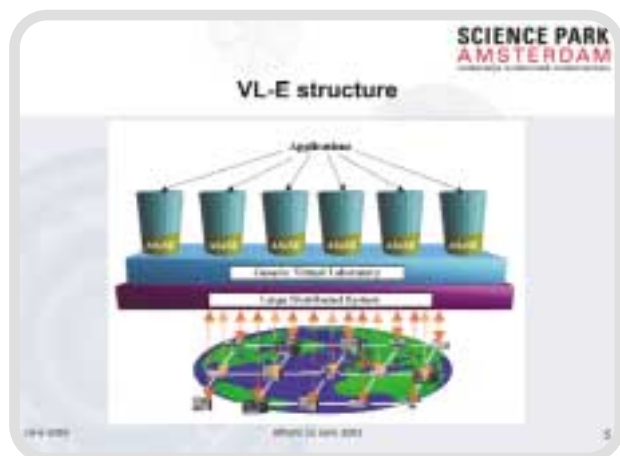
## Inds: a bottom-up approach

nents to form a virtual laboratory. Many typical e-Science applications will be supported. A key component of this framework will be the advanced networking research taking place in the Netherlands and focusing on the NetherLight Network, which is establishing an international lambda Grid.

In the long term a clear goal for the Grid should be its integration at the level of countries, disciplines, and academic and industrial users. This will require us to cope with different cultures and legal systems and in particular security issues. To establish a European Grid we may need to create a pan-European Grid service organisation but this will have to be different from such organisations in the networking context because with regard to the Grid there is clear value and ownership of local resources involved and control of resources is

much more distributed. We must focus on the issues of portals, markets and Grid economics.

It is clear that it is in the interests of the Member and Associated States of the EU to support the creation of a national and pan-European infrastructure for e-Science. Arising from this there are a wide range of policy issues to address including: resource sharing, regulatory frameworks, brokering and security. In terms of the appropriate administrative and support schemes it seems sensible to focus these on honouring the rights of resource owners, identifying clearly who is responsible for what and observing existing contractual and trust relationships. In this regard the NRENs could play a major role. We should also consider in the same way as ERA, the establishment of a European Education Area, linking not just universities but also schools.





**NetherLight Network: 2003**  
Emerging international lambda grid

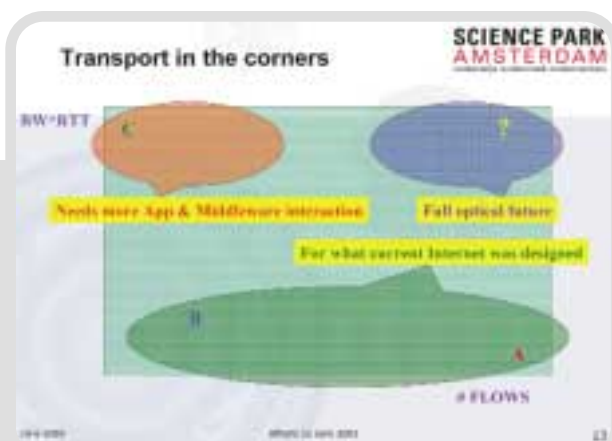
Diagram illustrating the NetherLight Network structure in 2003, showing an emerging international lambda grid. The central node is Amsterdam NetherLight, which is connected to several other nodes:

- Stockholm NetherLight (10 Gbps, 1000 km)
- jive (10 Gbps, 1000 km)
- Chicago NetherLight (10 Gbps, 6000 km)
- London NetherLight (10 Gbps, 1000 km)
- Golem GERN (10 Gbps, 6000 km)
- Pragati CenterLight (10 Gbps, 6000 km)

Legend:

- Operational 2003 (Solid line)
- Expected 2003 (Dashed line)

Logos for STORLIGHT, jive, and Golem GERN are also visible.



## A European GRID

- The GRID long term goal should aim for integration at the level of
  - Countries
  - disciplines
  - academic and industrial users
- Requires coping with
  - Different cultures and legal systems
  - Security (industry !)
- A Pan European GRID service organisation
  - But different from the national
    - Value in the local resources, there is the ownership
    - Distributed versus centralized control

19-4-2001

Wim de Kort

15

## Portals, Markets, GRID economics

- CPU's, storage, networks represent value
- Dynamic virtual organizations require brokers
- Invest in grid portals
- Grid exchanges
- Create grid markets
- Choose decentralized models (just as the web)

19-4-2001

Wim de Kort

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## Q&A

- Is it the interest of the Member and Associated States in Europe to support the creation of a Nation- and European-wide infrastructure in the extended ERA for e-Science?
  - I guess yes
- What are the necessary policy level decisions and actions to enable the effective cross institutional, cross border and cross scientific discipline sharing of resources? Regulatory framework?
  - brokering, security, e-banking

19-4-2001

Wim de Kort

17

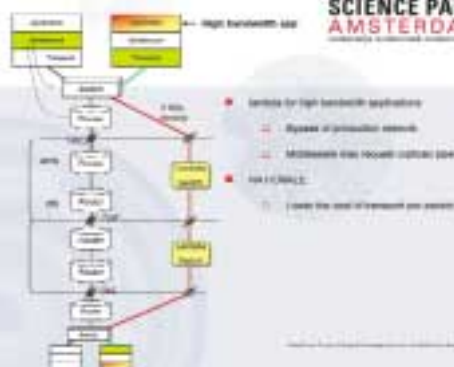
## Q&A

- What would be the appropriate administrative and operational support schemes in this case?
  - Honor the owner rights of the resource
  - Identify the people who would be responsible
  - Observe existing (contractual, trust) relationships
- What could be the roles for National legacy schemes (e.g. the NRENs)?
  - Trusted third party roles, portals, brokers for grid, grid search engines

19-4-2001

Wim de Kort

18



19-4-2001

Wim de Kort

19





## Aleksander Kusznir

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Born 1943 in Jaworze, Poland, 1968 – completion of the Faculty of Electrical Engineering of the Academy of Mining and Metallurgy (AGH) in Cracow, 1968-1972 - electronic engineer in the Institute of Physics of the Jagiellonian University, 1972-1974 – service engineer in the ELWRO Computer factory in Wroclaw, 1974 – service engineer in Lorenz Computer, Stuttgart, 1974-1975 - service engineer in the ICL Deutschland GmbH, Stuttgart, 1975-1980- specialist in the Computer Laboratory of the Institute of Nuclear Physics & Technique of the AGH, 1980 – 1986 deputy director & director of the Computer Centre of the AGH, 1986-1990 also 1994-2002 project deputy manager & manager in Egypt & Tanzania, 2003 – deputy director of the Academic Computer Centre CYFRONET AGH ( now University of Science & Technology ) in Cracow.





The Central European Grid Consortium (CEGC) is composed of partners from six central European countries: Austria, Czech Republic, Hungary, Poland, Slovakia and Slovenia and was formed in 2002 in direct response to the establishment of the EGEE proposal. There are 13 partners currently involved in the consortium. CYFRONET is typical of these partners, with over 400 Gflops of installed computing power connected to the local metropolitan area network and also GEANT.

The CEGC partners have extensive experience in a wide range of Grid research and European cooperation and are involved in wide range of EU funded projects including: DataGrid, CrossGrid, Grid-Lab, EUROGRID and GRIDSTART.

A typical CEGC project is the FloodGrid project, which is developing an interactive computing Grid aimed at the forecasting and management of flooding crises throughout Europe. This involves a cas-

**CEGC Composition**

**AUSTRIA**

1. University of Innsbruck
2. University of Linz

**CZECH REPUBLIC**

3. CESNET (Prague)

**HUNGARY**

- 4-8. SZTAKI, RMKI, BUTE, ELTE, NIFI (Budapest)

**POLAND**

9. ACC CYFRONET (Cracow)
10. ICM (Warsaw)
11. PSNC (Poznan)

**SLOVAKIA**

12. SAS (Bratislava)

**SLOVENIA**

13. J. Stefan Institute (Ljubljana)



## The Central European Grid Consortium

The CEGC is an association of 13 leading academic HPC and networking centres from Central Europe

CEGC partners have extensive experience in both Grid research and European cooperation, being involved in numerous EU-funded projects, including:

 <p>Tethys GRID</p>	 <p>eGrid</p>	 <p>EU-GRID</p>	 <p>e-Infrastructure</p>
<p>Trailblazing European Grid development project</p>	<p>European Grid for interactive applications</p>	<p>Grid application toolkit and testbed</p>	<p>European Unicon Grid application testbed</p>

Other projects: Pellucid, 6WINET, ProAccess, GRIP, etc.



Towards Integrated Networking and Grids Infrastructures - INFRA2, June 13, 2005




## regional and European perspective

cade of time-critical simulations (meteorological, hydrological and hydraulic) and requires substantial computing power in “burst-type” activity cycles. The results of the project are currently being deployed for the Vah river basin in Slovakia a part of the CrossGrid project.


With regard to EGEE, CEGC has agreed to develop and maintain a joint Central European Grid Operations Centre, providing computing and stor-

age resources as well as Grid access points and user services. A wide range of dissemination activities is also planned.


In FP6 the key for CEGC will be continued and expanded cooperation with partners from across Europe.



### FloodGrid: A Sample CEGC Project




From meteorological data...




...to flood forecasts

- Interactive computing Grid aimed at forecasting and management of flooding crises throughout Europe
- Involves a cascade of time-critical simulations (meteorological, hydrological and hydraulic)
- Requires substantial computing power in burst-type activity cycles
- Pilot project currently being deployed for the Vah river basin (Slovakia) as part of CrossGrid

Towards Integrated Networking and Grid Infrastructures - Athens, June 15, 2000



### CEGC Engagement in EGEE



- **Grid Operations Center**  
The CEGC Institutions have agreed to develop and maintain a joint Central European Grid Operations Center, providing computing and storage resources, as well as Grid access points and user services
- **Dissemination**  
A range of dissemination activities is planned within the EGEE framework, including presentations, user training and scientific contacts with other European Grid projects

Towards Integrated Networking and Grid Infrastructures - Athens, June 15, 2000





## Marcel Kunze

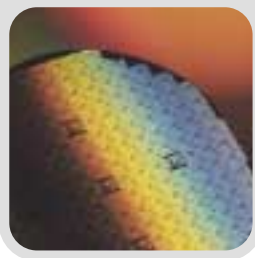
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Leading the department for Grid Computing and e-Science at Forschungszentrum Karlsruhe Dr. Marcel Kunze and his team work on the realization of Grid environments in the Helmholtz association, one of the most demanding projects being the participation to the LHC computing Grid.

He received a Diploma degree in Physics at Karlsruhe University in 1985. In the following years he was delegated to CERN to manage the construction of the trigger system and data acquisition for PS 197. After his graduation in 1990 he went to Bochum University where he started to work in the field of neurocomputing, in close collaboration with the institute for neuroinformatics. In 1996 he received his habilitation on the use of artificial neural systems in particle physics. As an associate professor he was teaching particle physics, informatics and software design. Besides particle physics activities at CERN and SLAC he has participated in projects for brain modeling and 3D television. In 2002 Dr. Kunze joined Forschungszentrum Karlsruhe.

He is member of the advisory committee of the ICANN and ACAT conference series and member of Deutsche Physikalische Gesellschaft, Deutscher Hochschulverband and the Global Grid Forum.

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### 4.4.7 Marcel Kunze – Perspectives of Grids and e-Science

One of the key problems with the Grid in Germany has been that networking costs are very high and have to be born by the end user, leading to minimization of bandwidth consumption. Furthermore, the federal nature of Germany complicates interoperation and makes common national access to resources difficult. Both of these issues have resulted in a slow start to the national Grid initiative in Germany.

The German Grid Initiative held its kickoff workshop in February 2003. The 15 research centres of the Helmholtz Association and DFN-Verein initially drove the initiative that is open to all interested partners in academia and industry. Funding for the initiative is planned to become available towards the end of 2003 and is expected to be of similar scale to the other national initiatives in Europe.

A number of strategic considerations have become apparent. As the Grid infrastructure will integrate resources from science and industry, standardisation of interfaces and components and the implementation of a backbone network with non-trivial quality of service have emerged as key issues. The current DFN backbone generally operates at 2.5Gbps with a first 10Gbps line between Leipzig and Frankfurt (the German GEANT PoP). The need for the deployment of a network of competence and coordination centres has also become apparent and a network of Grid Support Centres will undertake this. At the same time the implementation of generic and prototypical Grid applications in order to increase the user base is seen as crucial, and alongside this, the development of problem solving environments for e-Science and industry.

**Perspectives of Grids and e-Science in Germany**

Forschungszentrum Karlsruhe GmbH  
Hauptabteilung Informations- und Kommunikationstechnik  
Abteilung Grid Computing und e-Science  
Hermann-von-Helmholtz-Platz 1  
D-76344 Eggenstein-Leopoldshafen

Dr. Marcel Kunze

**A German Grid Initiative**

- Kickoff workshop in February 2003 (Wissenschaftszentrum Bonn)
- Initially driven by the research centers of the Helmholtz association and the DFN-Verein
- Open to all interested partners, in academia and industry
- Strategic program paper will be written until summer

**Strategic Considerations**

- Development of a common Grid infrastructure to integrate resources for science and industry
  - Standardization of interfaces and components
  - Stepwise extension of backbone network with non-trivial QoS
- Deployment of a network of competence and coordination centers for Grid computing
  - Deployment of Middleware and Coordination via Grid User Support Centres
- Implementation of generic and prototypical Grid applications
  - e-Science applications
  - e-Business models
  - Development of programming models, tools and application specific middleware for dynamic, scalable, autonomous and secure Grid applications
- Development of problem solving environments for e-Science
  - Applications in Science, Economy, Culture and Education
  - Knowledge based systems
  - Combine technical and scientific knowledge: Integration of economic knowledge
  - Work with available resources and existing values

**Building Grids: Technical Challenges**

- Building a Grid among friends**
  - All sites deploying similar hardware
  - Long history of collaboration among principals
  - System design not expected to scale to millions of participants
- Running a general public production Grid for e-Infrastructure**
  - System must be bullet proof, useful, usable
  - Heterogeneity in community and hardware: design must scale
  - Heterogeneity in programming models (real-time, on-demand, adaptive, etc.)
  - Provide programming environments and tools
    - How do we deploy a Grid program?



## nance in Germany

There are many technical challenges associated with building Grids and the approach has been taken of building a Grid “amongst friends” initially – with all sites deploying similar hardware and a long history of established trust. Of course, such a system will not scale and therefore thoughts are now turning to building a general public production eInfrastructure Grid. The key features of this include reliability and resilience, heterogeneity (in both hardware and programming models), and the provision of programming environments and tools for debugging Grid applications.

Building an international eInfrastructure will be even more difficult. A whole new range of issues will come to the fore including: logistical chal-

lenges – how do we maintain software, and enable accounting and billing across multiple administrative domains? Legal challenges – how do we deal with varying institutional policies and licensing models? Ideological challenges – how do we create a suitable framework to promote the development of stable persistent infrastructures? Can people make a profit from Grid services? Should Grids be centralised or distributed, free or charged, etc etc? Political challenges – including the integration of different cultures, the global, secure management of resources, decision making and enforcement and the provision of long-term stable funding to support the infrastructure. All of these issues must be answered over the next few years and this will not be easy.

**Building an international eInfrastructure**

- **Logistical Challenges**
  - Software maintenance
  - Accounting and billing over multiple administrative domains
  - Resource co-allocation over multiple sites
- **Legal Challenges**
  - Deal with varying institutional policies, open source policies, licensing policies, etc.
- **Ideological Challenges**
  - Organizational framework to promote development of stable, persistent infrastructure
  - Commercial vs. academic community - should someone make a profit?
  - Shared/private, free/charged for, centralized/distributed

GEB

**Building an international eInfrastructure**

- **Political Challenges**
  - Integration of different cultures: wrt administration of resources, operations, SW development and deployment
  - Global management of resources in a secure and dependable way
  - Decision making and enforcing
  - Mechanisms to select and support applications (equity)
  - Ensure stable, persistent, long-term, adequate funding

GEB





## Lennart Johnson

Dr Johnson is a professor of Numerical Analysis and Computer Science at the Royal Institute of Technology (KTH), Stockholm, and serves as the Director of PDC, the main provider of high-performance computing and visualization resources for the Swedish academic community. Dr Johnson serves as Chairman for the Strategic Technical Advisory Committee of the Swedish National Infrastructure for Computing. Dr Johnson is a Cullen Distinguished Professor of Computer Science, Mathematics and Electrical and Computer Engineering at the University of Houston and an Adjunct Professor of Computer Science at Rice University. Dr Johnson also serves as Director of the Texas Learning and Computation Center at the University of Houston and serves on the Executive Committees of the Los Alamos Computer Science Institute, the W.M Keck Center for Computational Biology in Houston, and the Boards of the Globus Alliance, the European Grid Support Center the Nordic Grid Consortium, and the High-Performance Computing Across Texas consortium. Dr Houston represents the University of Houston in the Internet2 consortium and the Texas Learning and Computation Center in the Coalition of Academic Scientific Computation. Dr Johnson also serves on the editorial boards of several journals and has served on numerous organizing and program committees for scientific conferences including the first GGF sponsored International Summer School on Grid Computing.

Dr Johnson has been involved with Grid research, deployment and infrastructure building since 1996. Jointly with Rice University and Baylor College of Medicine Dr Johnson established the Texas GigaPoP and was responsible for the first MPI applications for Globus demonstrated at SC97. He also led the effort at two of five institutions performing an interactive, distributed, collaborative VR demonstration at Alliance '98 that served as a great motivator for permanent Nordunet connectivity to the Abilene and vBNS networks. Dr Johnson actively contributed to establishing the European Grid Forum, has participated in the Grid Forum and is participating in establishing a Swedish Grid, SweGrid, in the GrADS project, in a Grid Security research effort and in the development of adaptive high-performance scientific software for Grids.

Prior to Grid related infrastructure, research and deployment activities Dr Johnson implemented one of the first commercial-strength sparse-matrix packages at ASEA (now part of ABB), and led the development of systems for real-time supervision, control, and optimization of electric utility network operations, and for industrial process control, a development that made the company a world leader within five years. At Caltech Dr Johnson introduced one of the first US courses on large-scale scientific and engineering computation on scalable parallel architectures. Revisions of this course were later introduced by Dr Johnson at Yale and Harvard Universities. At the University of Houston Dr Johnson has also introduced a course on Advanced Networking addressing issues in the design and use of high-performance networks. Some of the results of Dr Johnson's research on network routing influenced the definition of the primitives in the MPI standard, and were adopted by vendors such as Intel and IBM in implementing the standard, and heavily influenced the Connection Machine Run-Time System. At Thinking Machines Corp., Dr. Johnson led the design, development, and maintenance of the Connection Machine Scientific Software Library (CMSSL) and part of the Connection Machine Run-Time System (CMRTS). The CMSSL included several novel features, such as algorithm selection at run-time, and multiple-instance functionality for consistency with languages with array syntax.



### 4.4.8 Lennart Johnson – Grid deployment and support - the NGC, EGSC and SweGrid initiatives

The Nordic Grid Consortium was initiated a year ago and involves KTH, PDC and CSC who in this context act as service providers to the Nordic Grid community. Because each of the Nordic countries has a relatively small population, the aggregation of resources that is made possible is very important. One major issue that has arisen is how to share software – software licensing needs to catch up with the Grid concept.

The Consortium is basing its work on the need for a common security infrastructure and the need for a portal for job submission. Issues arising include the need for good security, appropriate resource sharing, new licensing models and data management middleware. The infrastructure is being built on top of regional networking initiatives, such as NORDUNET, which are already in place. While working in the area of Grids over the past 5 years, it has been interesting to see how Grid demonstrators have driven the need for network upgrades, from the then high bandwidth of 34Mbps to the 2.5-10Gbps networks we see today.

The NORDUGRID project is also an important

Nordic activity. This project is based around the Nordic High Energy Physics community and has created strong links between this community and the DataGrid project. This has also led to the establishment of the Nordic DataGrid facility and the creation of the European Grid Support Centre in collaboration with PDC, CERN and CCLRC from the UK.

In Sweden the Government has been very slow to commit funding to the Grid. The SWEGRID project was funded at the end of last year and involved six Swedish Centres. It creates a Grid with nodes at each site consisting of around 100 PCs and 20 Tb of data storage. Clustered around this project are a series of Grid research projects focussing on resource management, distributed databases and security.

In the wider context, the real challenges for the Grid in Europe centre on the issues of authorisation, authentication and accounting – the “three As”. The concept of regional clusters, which had been mentioned several times earlier in the meeting, was also strongly supported.

*Team members:*

Mehran Ahsant, Graduate student (KTH)  
 Harald Barth, Systems Engineer (PDC)  
 Fredrik Hedman, Assoc Dir (PDC)  
 Perna Khosla, Graduate student (University of Houston)  
 Bo Liu, Graduate student (University of Houston)  
 Lars Malinowski, Senior Systems Engineer (PDC)  
 Rosalinda Mendez, Assoc Dir. (Texas Learning and Computation Center)  
 Olle Mulmo, Engineer (PDC)  
 Mitul Patel, Graduate student (University of Houston)  
 Thomas Sandholm, Graduate Student (KTH)  
 Björn Torkelsson, Engineer (PDC)  
 Gian-Luca Volpato, Engineer (PDC)  
 Per Öster, Assoc Dir (PDC)



## Hans F. Hoffmann

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Dr. Hans F. Hoffmann is 60 years old, of German nationality and works as physicist since 1972, mostly at CERN, the European Organisation for Nuclear Research.

His main areas of activity are accelerators, large experimental apparatus in multinational collaborations, and positions in the DESY (Deutsches Elektronen Synchrotron/Hamburg) and CERN directorates.

His present position is Director for Technology Transfer, Outreach and Scientific Computing in the CERN directorate, responsible for establishing Technology Transfer and Outreach at CERN and also responsible for the Computing Infrastructure for the LHC experimental programme, the LHC Computing Grid. He has helped to launch several EU-FP5 projects, for example the EU DataGrid, Crossgrid and DataTAG and is involved in the preparation for the new round of FP6 proposals, in particular in EGEE.

He has been member of ESTA, the “European Science and Technology Assembly” during its existence.





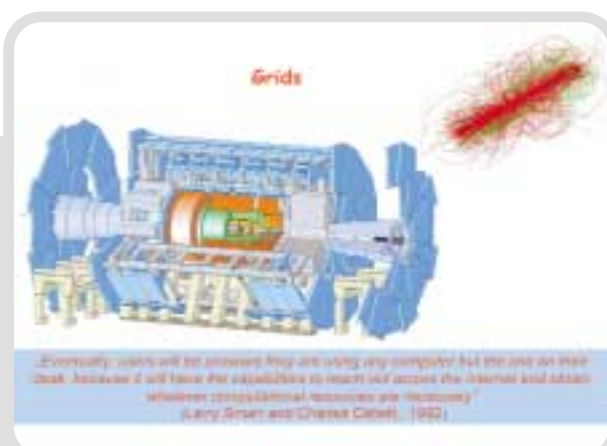
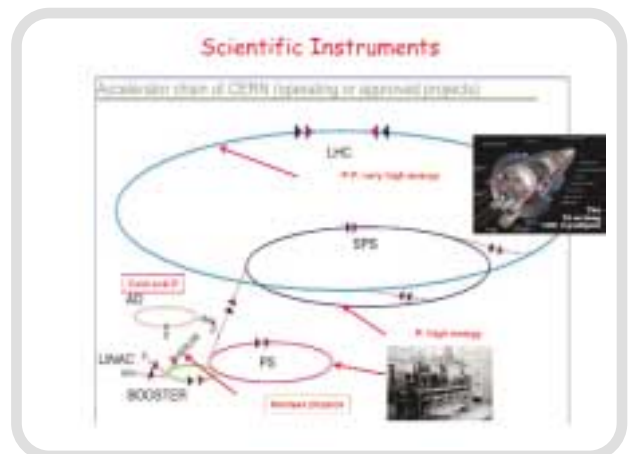
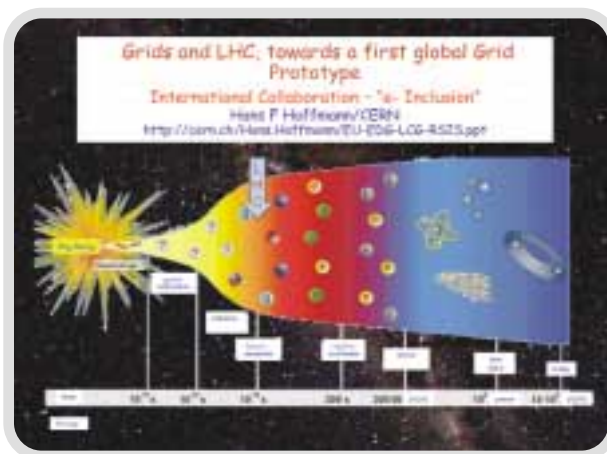
## 4.5.1 Hans Falk Hoffmann – Grids and LHC: towards a first

The challenges of Particle Physics over the next decade are key drivers for the development of the Grid. The Large Hadron Collider (LHC) will generate unprecedented amounts of data that will be analysed by researchers distributed throughout the world. Each of the four experiments located on the collider will generate multiple petabytes of data and in total nearly 500 institutes and over 5000 scientists will work together to analyse the data.

The Grid has been foreseen for some time. In 1992 Larry Smarr and Charlie Catlett wrote that “Eventually, users will be unaware they are using any computer but the one on their desk, because it will have the capabilities to reach out across the

Internet and obtain whatever computational resources are necessary”. We are now beginning to see the realisation of that vision.

In the context of CERN, the EU DataGrid project has been key to the organisation’s involvement in the Grid. From the starting point of DataGrid a number of other projects have developed and formed around it. These include DataTag, Cross-Grid and most recently the LHC Computing Grid project (LCG). The central goal of LCG is to prepare and deploy the necessary computing environment to enable the experiments to analyse the data coming from their detectors. In Phase I (2002-2005) the common applications, libraries and frameworks will be developed alongside a pro-



## 4.5 Session 5: Application initiatives

### First global Grid prototype

prototype environment that will involve the operation of a pilot-Grid service. In Phase 2 (2006-2008) the project will acquire build and operate the LHC computing service. The first prototype, LCGI, will be available from July 2003 and will be built from components of the DataGrid project, and VDT (which includes Globus and Condor). This prototype will provide low functionality but will be a real 24\*7 service.

In the international context of LCG, FP5 and FP6 have been and are of the utmost importance. Likewise the UK e-Science programme has been very important in its commitment to Grids for Particle Physics and support of CERN – it has set the scale for other national initiatives to aspire to. LHC is a global resource and links to other national initiatives in the Nordic countries, Italy, Germany, France, Central Europe and South East Europe are also very important. Likewise links to, and support from, the US through the NSF Cyber Infrastructure and DoE Global Science Infrastructure programmes have been vital.

Recently, Paul Messina has proposed the concept of a Global Grid Middleware Institute. The mission of such an Institute will be to produce and main-

tain standards compliant and interoperable Grid middleware. It has been proposed that this Institute be a virtual organisation funded by the EU, European countries and several US Federal agencies, perhaps also involving the Asia Pacific region and industry. Its goal will be to ensure that Grid middleware becomes production strength and acquires sufficient functionality quickly enough to meet the needs of emerging Grid middleware user communities.

The EU set itself the goal at the Lisbon summit in 2000 of becoming "... the most competitive and dynamic knowledge-based economy in the world ...". If Europe is serious about this goal then it will require considerably more funding and effort than is currently being expended. We need to up the ante.

In Geneva in December 2003 a world summit on the Information Society will be held. Currently this summit only involves Government and Business. This is a missed opportunity for the Science community. To redress the balance somewhat, a conference will be held at CERN on the 8th and 9th December, before the summit, to focus on the contribution of Science to the Information Society.

Create a Grid infrastructure

In the CERN WWW tradition: useful also for other sciences, industry and the people





## 4.5 Session 5: Application initiatives

### 4.5.1 Hans Falk Hoffmann – Grids and LHC: towards a first global Grid prototype



#### Goal of the LHC Computing Grid Project - LCG

To prepare and deploy the LHC computing environment to help the experiments' analyse the data coming from the detectors

##### Phase 1 – 2002-05

development of common applications, libraries, frameworks, **prototyping of the environment**, operation of a pilot (grid-)computing service

##### Phase 2 – 2006-08

acquire, build and operate the LHC computing service

Source: <http://www.lcg-project.org/>



#### Initial set of Middleware for 1<sup>st</sup> prototype, LCG1, July 2003 24\*7 service

##### Components from:

European DataGrid – EDG – includes replica catalogue, resource broker, replica management tools, gatekeeper, testbed experience

VDI – includes components from several different US projects, including Globus and Condor

Lower functionality than was expected to be available at this time, additional components will be added as they become available and demonstrate sufficient reliability

Source: <http://www.lcg-project.org/>



#### Centres taking part in the LCG prototype service (2003-05)



around the world → around the clock

Source: <http://www.lcg-project.org/>



#### International Context

- EU: Grid Research and Deployment (FP6)
- UK: e-Science  
"e-Science is about global collaboration in key areas of science, and the next generation of infrastructure that will enable it."  
John Taylor
- Other European national initiatives: NordicGrid, I, F, DE, Central Europe, S-E Europe (GR)
- US: Cyber - Infrastructure (NSF) – Global Science Infrastructure (DOE)

Source: <http://www.lcg-project.org/>



#### Cyberinfrastructure



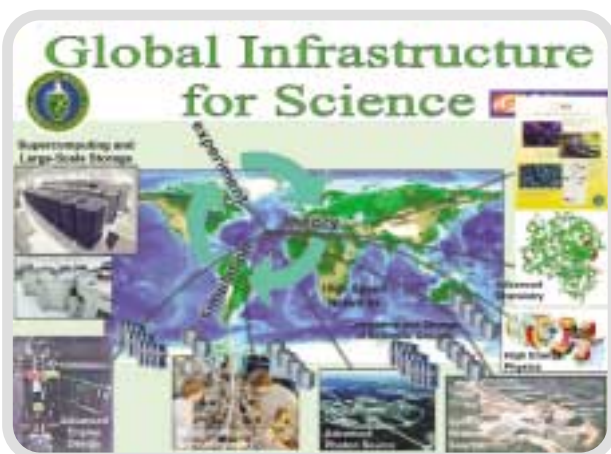
Source: <http://www.nsf.gov/>



#### Five Principles

[R] The scale and complexity of 21 <sup>st</sup> Century Science requires the creation of advanced and coherent global infrastructure (information infrastructure).	(global cost sharing)
[V] The construction of a coherent Global Infrastructure for Science requires definition and drivers from Global Applications (that will also communicate with each other).	(applications give benefits that justify expense)
[2] Further, forefront Information Technology must be incorporated into this Global Infrastructure for the Applications to reach their full potential for changing the way science is done.	(Frontiers & Global for real changes)
[3] LHC is a near-term Global Application requiring advanced and un-invented infrastructure and is ahead in planning compared to many others.	(LHC is a frontier)
[4] U.S. agencies must work together for effective U.S. participation in Global scale infrastructure and the successful execution of the LHC program in a 4-way agency partnership, with international cooperation in view.	(national then global)





**Global Grid Middleware Institute** (Paul Messina) 

- What would GMI be?  
International organization (an Institute) sponsored by the EU, European Countries and several US Federal agencies (and Asia Pacific, Industry?)
- Mission  
Produce, maintain standard conforming and interoperable grid middleware.
- Goal  
ensure that Grid middleware becomes production-quality and acquires sufficient functionality quickly enough to meet the expectations of the emerging grid user communities
- Implementation of the institute would be in a distributed/virtual organization

Integration: 2000-05-10 11:00

**An ambitious strategic goal for EU in the next decade**

"...to become the most competitive and dynamic knowledge-based economy in the world..."

(Lisbon Summit 2000)

 **The Role of Science in the Information Society (RSIS)**  
An Event of the World Summit on the Information Society

**1.5-day conference, on December 8 and 9, at CERN**

- Governments, scientific policy agencies
- Scientists, heads of institutes



 **Why is it important?**

Science is a key public good that underpins the information society. The fundamental scientific and technological components of the Information Society have been driven by the search for fundamental knowledge and solutions to specific problems. The Information Society tools, from electricity and radio waves to the World Wide Web and browsers, were all discovered or invented in scientific and academic laboratories.

Scientific research and technology drive today's economies and serve as twin pillars of progress for advances in knowledge for all humankind. Scientific knowledge often has international applicability. Information and communication technologies have the capacity to increase accessibility to scientific knowledge worldwide.

Science brings the peoples of the world together, contributes to education, health, economic development in a sustained environment and can help to overcome the digital divide.









## Fabrizio Gagliardi

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Fabrizio Gagliardi has a rich and lifelong experience in computing applied to particle physics experiments.

Since he joined CERN in 1975, after graduating in Computer Science at the University of Pisa in Italy, he has held several technical and managerial positions in this field, including:

- leader of the European Union funded project GPMIMD2 (1993-1996). This project developed a MPP supercomputer, which was used to prototype the, by now, CERN standard Central Data Acquisition (CDR) system
- leader of the Data Management services of the Information Technology division (1996-1999)
- responsible of the CERN participation in the EU project Eurostore (1998 – 2000)

Since January 2001, Fabrizio Gagliardi is the leader of the EU DataGrid project, a collaboration of 21 international scientific institutes and industry. As part of this activity, he has become one of the most active proponents of the Global Grid Forum of which he is cofounder and now member of its International Advisory Committee.

Over the last year he has been very active in building an international consortium to propose to the EU a project to build a wide international Grid infrastructure to support production applications for the European Research Area.

He is now leading the same consortium in the negotiation of the EGEE (Enabling Grids for Escience in Europe) proposal.

His activity is not limited to Europe. Since March 2001, he is member of the External Advisory Committee of the US NSF GriPhyN project (the largest US Grid project of this kind), and he is an IEEE member since 1982.

Thanks to this broad experience, Fabrizio Gagliardi is a computing expert to the EU IST programme, and in that role reviewer of EU projects and members of working groups on Grid technology and distributed computing.



## 4.5.2 Fabrizio Gagliardi – Towards a common European

The Grid vision is conceivable now because of the advanced state of computer and networking technology today. As a result, several software toolkits – Globus, Condor and Unicore – have been developed to achieve this vision and these are continuing to mature. A number of projects have demonstrated real early successes in various aspects of Grids. Europe has achieved a prominent position in this field in particular through the success of the European DataGrid project.

The DataGrid project was established in 2001 for three years with funding of 19.8 million and overall costs of approximately double this. A total of 21 partners are involved from research and academic institutes as well as industrial companies. Around 90% of the funding is allocated to the production of middleware for applications in the areas of High Energy Physics, Earth Observation and Genomic Exploration. The user community is continuing to grow and embrace new applications areas. Since last year the project has focussed on software quality (EDG 1.4.3 is the most stable release so far) and considerable increases in the number of geographical distribution of sites involved in the DataGrid testbed. The core testbed now consists of 12 sites from five countries who contribute a total of 1,075 CPUs and 15Tb of disk space. The testbed has made considerable use of the GEANT network, which has demonstrated excellent performance and is a major achievement for the EU.

A number of EU funded Grid projects have links to DataGrid and these include: CrossGrid, DataTag, Grace and GRIDSTART. DataGrid also has excel-

lent links to a number of national initiatives such as the UK e-Science Programme, INFN-Grid and NorduGrid. However, as yet there are no real production quality Grids that can offer continuous, reliable Grid services to a range of scientific communities.

In the context of eInfrastructures, our vision must be to integrate current national, regional and thematic Grid efforts in order to create a seamless European Grid infrastructure. To exploit the Grid expertise that has been generated by EU supported projects and national Grid initiatives. To provide European researchers in academia and industry with a common market of computing resources enabling round-the-clock access to major computing resources, independent of geographical location. To provide a unique tool for collaborative, compute-intensive science (“e-Science”) in the European Research Area. Finally, to provide interoperability with other Grids throughout the world, including the US NSF Cyberinfrastructure – contributing to efforts to establish a worldwide Grid infrastructure.

Many obstacles lie in our way. In terms of technical challenges: current Grid middleware is often not interoperable – although a number of ongoing activities are seeking to remedy this situation; local site policies do not take Grids into account – security policies are not uniform, accounting procedures are specialised and not interoperable, and authentication and access policies do not allow for single sign-on. We need more uniform site policy standards.



## European market for computing and data management

In terms of political challenges: there are no business models to motivate industry – although all major IT companies are making strong statements and showing growing interest; the perception among traditional computer centres is that Grid technology could eventually undermine their market; the role of the commercial telecommunications operators and NRENs needs to be better understood; and standards for seamlessly connecting to the Grid, publishing information and bidding for resources are still emerging.

It is possible to make an analogy between the current state of Grid development and the emergence of the Internet. Early networks were largely incompatible. NFSNET (US) and JANET (UK) decided to provide network connectivity to their combined user bases. This large user base exposed security holes and helped define common and acceptable use rules. From this the network we now know as the Internet emerged.

The EGEE project – Enabling Grids for e-Science in Europe – has as its central goal the creation of a production quality infrastructure built on top of the current and future EU research network infrastructure. It will build on the EU and Member States major investments in Grid technology and seek to build on international connections with the US and Asia Pacific regions. It will build on several pioneering projects – most notably DataGrid – and involve an established Grid development team of 60 people. Its overall approach will be to leverage current and planned national and regional Grid programmes (for example LCG) and work

closely with relevant industrial Grid developers, NRENs and worldwide projects. EGEE will have a major societal impact. For example: an international network of scientists will be able to model a new flood on the Danube in real time using meteorological and geological data from several centres around Europe; a team of engineering students will be able to run the latest 3D rendering programs from their laptops using the Grid; a geneticist at a conference, inspired by a talk she hears, will be able to launch a complex bio-molecular simulation from her mobile phone. Access to a production quality Grid will change the way science and much else is done in Europe.

There is also a political context to EGEE. The current Grid research and development projects will all complete within the next 18 months. The EGEE partners have already made major progress in aligning national and regional Grid research and development efforts in preparation for EGEE. Launching EGEE now will preserve the current strong momentum of the European Grid community and the enthusiasm of the hundreds of young European researchers already involved in EU Grid projects.

The key actions for Europe are: to establish a large production European Grid to support a Common European Market for computing and data management; to create an international board of senior stakeholders including representatives of resource providers, regulatory agencies and major user communities; to use this board to monitor and support the creation of an adequate regulatory framework for the Grid.

**European DataGrid (EDG) project**

- 9.8 M Euros EU funding over 3 years (twice as much from partners)
- 90% for middleware and applications (High Energy Physics, Earth Observation, Genomic Exploration)
- Total of 21 partners: research and academic institutes as well as industrial companies
- Three year phased developments & demos (2001-2003)

More and more scientists begin to use the EDG middleware and testbed, relying on Grid technology to solve huge data challenges.

**EDG Application Testbed**

Site	Country	CPU	Storage
CC-IN2P3	FR	633	100 GB
CDMS*	CH	138	1311 GB
CHM*	IT	48	1300 GB
Scale Poly	FR	9	220 GB
Imperial Coll.	UK	52	450 GB
Liverpool	UK	2	10 GB
Manchester	UK	9	15 GB
NIKHEF*	NL	142	410 GB
Delphi	UK	5	30 GB
Padova	IT	11	860 GB
RAL*	UK	5	332 GB
SARA	NL	0	10000+ GB
<b>TOTAL</b>	<b>8</b>	<b>1075</b>	<b>34800 GB</b>

\*Not in table: 100 TB including data



### 4.5.2 Fabrizio Gagliardi – Towards a common European market for computing and data management

**EDG Application Testbed**

- Connections made possible by the EU-funded **GEANT project**
  - connecting more than 30 countries across Europe
  - speeds of up to 10 Gbit/s
  - high data throughput
  - quality of Service

**EDG and GEANT:** the first major production quality tests of the network

**European Grid Initiatives**

- EU DataGrid and many EU funded projects and activities (CrossGrid, DataTAG, Grace, GRIDSTART, ...)
- National Grid initiatives such as UK e-Science, INFN Grid, Nordugrid, ...

**However**

as yet, there are no real production-quality Grids that can offer continuous, reliable Grid services to a range of scientific communities

**The Vision**

- Integrate current national, regional and thematic Grid efforts, in order to create a seamless European Grid infrastructure
- Exploit Grid expertise that has been generated by EU supported Grid projects and national Grid initiatives
- Provide European researchers in academia and industry with a common market of computing resources, enabling round-the-clock access to major computing resources, independent of geographic location
- Provide a unique tool for collaborative compute-intensive science ("e-Science") in the European Research Area
- Provide interoperability with other Grids around the globe, including the US NSF Cyberinfrastructure, contributing to efforts to establish a worldwide Grid infrastructure

**The Obstacles: technical challenges**

- Current Grid middleware is often not interoperable
  - Several ongoing activities to remedy this situation:
    - GGT defines standards
    - Community standards (GUE for HEP)
    - OGSA framework (GGT activity) should allow for easier interoperability
- Local Site policies do not take Grids into account
  - Security policies not uniform and sometimes not flexible enough to accommodate wide area Grid computing (e.g. strict firewalls)
  - Accounting procedures specialised and not interoperable
  - Authentication and Access policies do not allow for 'single-sign-on'
  - Lack of more uniform site policies results in middleware customised to some sites and not deployable at others
  - Need more uniform site policy standards

**The Obstacles: political aspects**

- No business models to motivate industry, although all major IT companies are making strong statements and showing growing interest
- Perception among traditional computer centres that Grid technology could eventually undermine their customer market
- Role of commercial Telecom operators and national NRENs?
- Standards for seamlessly connecting to the Grid, publishing and bidding for resources are still emerging

**Historical Analogy: the Internet**

- Early networks closed and largely non compatible, NFSNET (US) and JANET (UK) decided to provide network connectivity to all organizations that:
  - provided network connections
  - made it available to ALL qualified users
- Large user base exposed security holes and helped define common and acceptable use rules

Need for co-operation and standardization in defining levels of security for VO, finding accounting solutions, managing competing communities

**Data GRID** The EU eInfrastructure Initiative 4.2 June 2003, Madrid

### EGEE: Enabling Grids for E-science in Europe

- **Goal**
  - Create a wide European Grid production quality infrastructure on top of present and future EU R&N infrastructure
- **Build on**
  - EU and EU member states major investments in Grid Technology
  - International connections (US and AP)
  - Several pioneering prototype results
  - Large Grid development teams (>50 people)
- **Approach**
  - Leverage current and planned national and regional Grid programmes (e.g. UCG)
  - Work closely with relevant industrial Grid developers, NRENs and US-AP projects



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**Data GRID** The EU eInfrastructure Initiative 4.2 June 2003, Madrid

### Why EGEE? The Societal Impact

- *An international network of scientist will be able to model a new flood of the Danube in real time, using meteorological and geological data from several centers across Europe.*
- *A team of engineering students will be able to run the latest 3D rendering programs from their laptops using the Grid.*
- *A geneticist at a conference, inspired by a talk she hears, will be able to launch a complex biomolecular simulation from her mobile phone.*





Access to a production quality GRID will change the way science and much else is done in Europe

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**Data GRID** The EU eInfrastructure Initiative 4.2 June 2003, Madrid

### Why EGEE? The Political Context

- Current Grid R&D projects run out within 18 months
- The EGEE partners have already made major progress in aligning national and regional Grid R&D efforts, in preparation for EGEE
- Launching EGEE now will preserve the current strong momentum of the European Grid community, and the enthusiasm of the hundreds of young European researchers already involved in EU Grid projects (>150 in EDG only)



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**Data GRID** The EU eInfrastructure Initiative 4.2 June 2003, Madrid

### The Actions

- Establishment of a large production European Grid to support a Common European Market for computing and data management
- Creation of an "international board" of senior representatives of all stakeholders:
  - resource providers
  - regulatory national and international agencies
  - major user communities
- This board should discuss, monitor and support the creation of an adequate regulatory framework

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## Mark Parsons

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Dr Mark Parsons, graduated from The University of Dundee in 1989 with a BSc (Hons) in Physics and Digital Microelectronics. Moving to The University of Edinburgh he gained an MSc in IT: Parallel Systems Engineering before completing a PhD in Particle Physics in 1994 based on work undertaken on the LEP accelerator at CERN in Geneva.

He joined EPCC (formerly known as Edinburgh Parallel Computing Centre) in 1994 as a software developer working on several industrial contracts before becoming the Centre's Commercial Manager in 1997 and latterly the Commercial Director. With direct responsibility for industrial project development for EPCC he has generated projects with over 30 companies in the past 3 years. Since 2000 he has been central to the success of EPCC's Grid strategy and has led the production of the large portfolio of Grid projects that are currently being undertaken by the Centre.

In 2001 EPCC successfully bid, with The University of Glasgow, to establish the UK National e-Science Centre in Edinburgh. In August 2001, whilst continuing in the role of EPCC Commercial Director, Dr Parsons was appointed to the role of Commercial Director of NeSC.



### 4.5.3 Mark Parsons – The Grid: challenging HPC infras

Making large nationally funded High Performance Computing resources available on a European Grid infrastructure raises many issues for HPC providers. We must address these issues, which are largely of a political and policy nature now, if we intend to meet the vision of ERA and construct a real infrastructure for Europe.

EPCC, the supercomputing centre at The University of Edinburgh, has run major, nationally funded HPC systems for over a decade. From the early Transputer based Meiko Computing Surfaces, via the Cray T3D and T3E systems of the mid to late 90's to the Sun E6800 and E15000 systems and most recently the 1,280 processor IBM p690 based system (HPCx) which is currently Europe's largest HPC system for academic and research use.

Since 1993 access to these machines has been made available on an ad-hoc basis to over 400 EU visitors via our Training and Research in Advanced Computing Systems projects (TRACS). This project is funded by DG RESEARCH via the Access to Research Infrastructures action of the Improving Human Potential Programme. While the programme focuses predominately on access to large scale facilities, and in its latter incarnations has

focussed exclusively on access, we have always provided support to our visitors to enable them to make best use of our systems and to learn transferable skills on their return to their home institutions. Throughout the project we have realised that the funding available is not enough to buy large-scale access to our HPC systems. These systems are not owned or paid for by the EU; UK funding has been used to purchase them to benefit UK scientific research. EPCC has made access available to these systems from its own time allocation on the machines, which has generally been of the order of a few percent of the total machine capacity. In the context of HPCx this means over 50 users will get total access of around 0.5% of the machine. At the same time, visitors are only granted access to these systems for a limited period of time on return to their home institution – a key focus of our work has therefore been to ensure their codes are made or remain portable.

In general large HPC systems are bought to study problems infeasible on smaller systems, to focus on major scientific and engineering challenges. Crucially, they are not batch system replacements for workgroup servers. Access to these systems via the Grid poses many challenges including: authenti-

epcc

The Grid –  
challenging HPC infrastructure  
provision in Europe

Dr Mark Parsons

Commercial Director  
EPCC and NeSC

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epcc

history

EPCC has run major national systems for over a decade

- 1990 Meiko Computing Surface
- 1994 Cray T3D – 512 processors
- 1997 Cray T3E – 344 processors
- 2000 Sun E6800 – 56 processors
- 2002 Sun E15000 – 52 processors
- 2002 IBM p690 (HPCx) – 1280 processors

we have also made these systems available on an ad-hoc basis to over 400 EU visitors since 1993 via our TRACS programme

## Infrastructure provision in Europe

cation and authorisation issues; accounting software in the Grid context is in its infancy; there is currently no way to “trade” cycles; and security holes in rapidly changing software are a clear issue. The European Research Area complicates matters still further.

It is instructive to consider HPCx as an example. The UK taxpayer has purchased the HPCx system for UK scientists to use and thereby to benefit the UK economy. If, for instance, a German researcher wishes to buy time on HPCx because her problem won't fit on her IBM p690 system, they can offer cycles on their machine in exchange for access to HPCx. However, this is not a good deal for HPCx as the system was bought to solve large problems – UK users may not want their job migrated onto the German machine because it is too small for their needs or their work is confidential. Alternatively, money could be paid for access. Again, this is not a good deal for UK researchers as their access has been reduced to the machine and the amounts of money will be quite small – it would take a long time to save enough money for even one extra node for instance.


If the EU is serious about ERA they have several options. The EU could purchase an HPC system

for researchers across Europe – helping to solve a common “chicken and egg” problem of only small numbers of non-UK users requesting access to our large systems because their availability is always so limited. Alternatively the EU could engage with national procurement projects. For example at the next UK procurement the EU could add 10% to the total funding therefore enabling a machine 10% larger to be bought. This approach would benefit everyone – it would give access to the machine to users across Europe without harming national investment and UK users would benefit by getting access to a 10% larger machine for 10% larger problems. Costs for this approach would be of the order £7-10 million. Finally, national governments could work together to purchase a system for Europe.

In summary, access to HPC resources over the Grid is a big challenge. The issues go well beyond technical matters and some of them go to the heart of what we mean by the European Research Area. The benefits to national user communities of ERA need to be much more clearly articulated by the EU. Many of these issues can only be discussed and resolved at an intergovernmental level facilitated by the EU.

 **TRACS – training and research in advanced computing systems**

- ★ **funded by DG-RESEARCH**
  - via Access to Research Infrastructure action of the Improving Human Potential Programme
- ★ **why training and not just access to systems?**
  - long running debate with European Commission
  - funding not enough to buy large amount of access to HPC systems
  - systems not owned or paid for by EU – UK funding used to purchase them to benefit UK researchers
  - access made available from EPCC allocation on machines
  - generally a low % of total machine capacity
  - focussing on training allows us to give train people to use their own systems on return to their institute

 **HPC systems and the Grid**

- ★ **large HPC systems are bought to**
  - study problems infeasible on smaller systems
  - focus on major science and engineering challenges
  - they are not batch system replacements for workgroup servers
- ★ **access via the Grid poses many challenges**
  - authentication and authorisation
  - accounting software is in its infancy
  - there is currently no way to “trade” cycles
  - security holes in rapidly changing software are a clear risk
  - etc etc
- ★ **ERA complicates things even further**



### 4.5.3 Mark Parsons – The Grid: challenging HPC infrastructure provision in Europe

epccERA

▶ HPCx as an example:

- UK taxpayer has purchased HPCx system for UK scientists to use and thereby to benefit UK economy
- a German researcher wants to buy time on HPCx because his problem won't fit on his IBM p690 system – they offer cycles on their machine in return via the Grid
- this is not a good deal for HPCx
  - system bought for large problems
  - users may not want their job migrated to German machine
- alternatively money could be paid for cycles
  - again not a good deal
  - availability of machine has been reduced for UK researchers
  - what use is the money? – takes a long time to save for a node

epccERA (continued)

▶ some thoughts

- if EC is serious about ERA they have several options
- purchase of HPC system for researchers from across Europe
  - realistic option – gives scientists in poorer countries access to enabling tools – surely what ERA is about
- engagement with national procurement projects
  - for example at next UK procurement, EC could add 10% to total costs thereby buying 10% of machine for pan-European access
  - gives access to machine without harming national investment
  - UK researchers benefit by getting a machine 10% larger for 10% larger problems
  - costs would be around €7-10 million
- national governments could work together to purchase a system for Europe

epccconclusions

- ▶ access to HPC resources over the Grid is big challenge
- ▶ issues go well beyond simple technical matters
- ▶ some issues go to heart of what we mean by "European Research Area"
- ▶ considerable concern voiced about what effect ERA will have on EU science
  - benefits need to be articulated much more clearly
- ▶ believe this can only be discussed/resolved at inter-governmental level