
Grid Computing in Framework 6

Information Society Technologies DG Grids for Complex Problem Solving



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Grid Computing in Framework 6

R. Tirlor – Information Society Technologies DG

Sparse Days and Grid Computing at St. Girons - 12th June 2003



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Outline

- **Introduction**
- **Grid Computing in in IST FP5 (1992-2002)**
- **Framework Programme 6 (FP6)**
- **IST Programme in FP6**
- **Grid Computing in FP6 (2002-2006)**
- **IST - WP2003-2004**
- **Conclusion**



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The European Union



First pillar: the European Communities

EC

- Customs union and single market
- Agricultural policy
- Structural policy
- Trade policy

New or amended provisions on:

- EU citizenship
- Education and culture
- Trans-European networks
- Consumer protection
- Health
- Research and environment
- Social policy
- Asylum policy
- External borders
- Immigration policy

Euratom
ECSC

Second pillar: common foreign and security policy

Foreign policy

- Cooperation, common positions and measures
- Peacekeeping
- Human rights
- Democracy
- Aid to non-member countries

Security policy

- Drawing on the WEU: questions concerning the security of the EU
- Disarmament
- Financial aspects of defence
- Long-term: Europe's security framework

Third pillar: cooperation in justice and home affairs

- Cooperation between judicial authorities in civil and criminal law
- Police cooperation
- Combating racism and xenophobia
- Fighting drugs and the arms trade
- Fighting organised crime
- Fighting terrorism
- Criminal acts against children, trafficking in human beings

The EU Policy Framework

- **The Commission submits a proposal to the European Parliament and the Council**
- **Framework Programmes:**
 - Establish the scientific and technological objectives
 - Fix the maximum overall amount and rules for financial participation
 - Shall be implemented through specific programmes / priorities with annual workprogrammes
 - Shall be adapted or supplemented as the situation changes
- **Linking Research with Policy**

The Policy Framework

- **What are Framework Programmes**
 - Treaty Establishing the European Community (Articles 166 - 171)
 - A multi-annual framework programme shall be adopted by the Council
 - Establish the scientific and technological objectives
 - Fix the maximum overall amount and rules for financial participation
 - Framework programmes shall be implemented through specific programmes
 - The procedure (Article 251)
 - The Commission shall submit a proposal to the European Parliament and the Council.

The European Policy context

- **The Lisbon Strategy March 2000**
 - to become the strongest knowledge-based economy in the world by 2010
- **...based on 3 elements:**
 - A single market
 - A single currency
 - A single European approach for research
European Research Area (ERA)
- **Barcelona Council March 2002**
 - R&D Investments approaching 3% by 2010

Linking Research with Policy

The Vision: Ambient Intelligence

- **Cyber world = “multi-sphere” environment**
 - Different layers of communications
 - Always “best connected”; wireless in everything
 - Network of networks; Terminals become distributed
 - Away from the client-server model (more on the edges of networks)
- **From a Static (closed) to a Dynamic (Open) Environment**
- **Grid – Information Utility**
 - Available for research, industry, business and society



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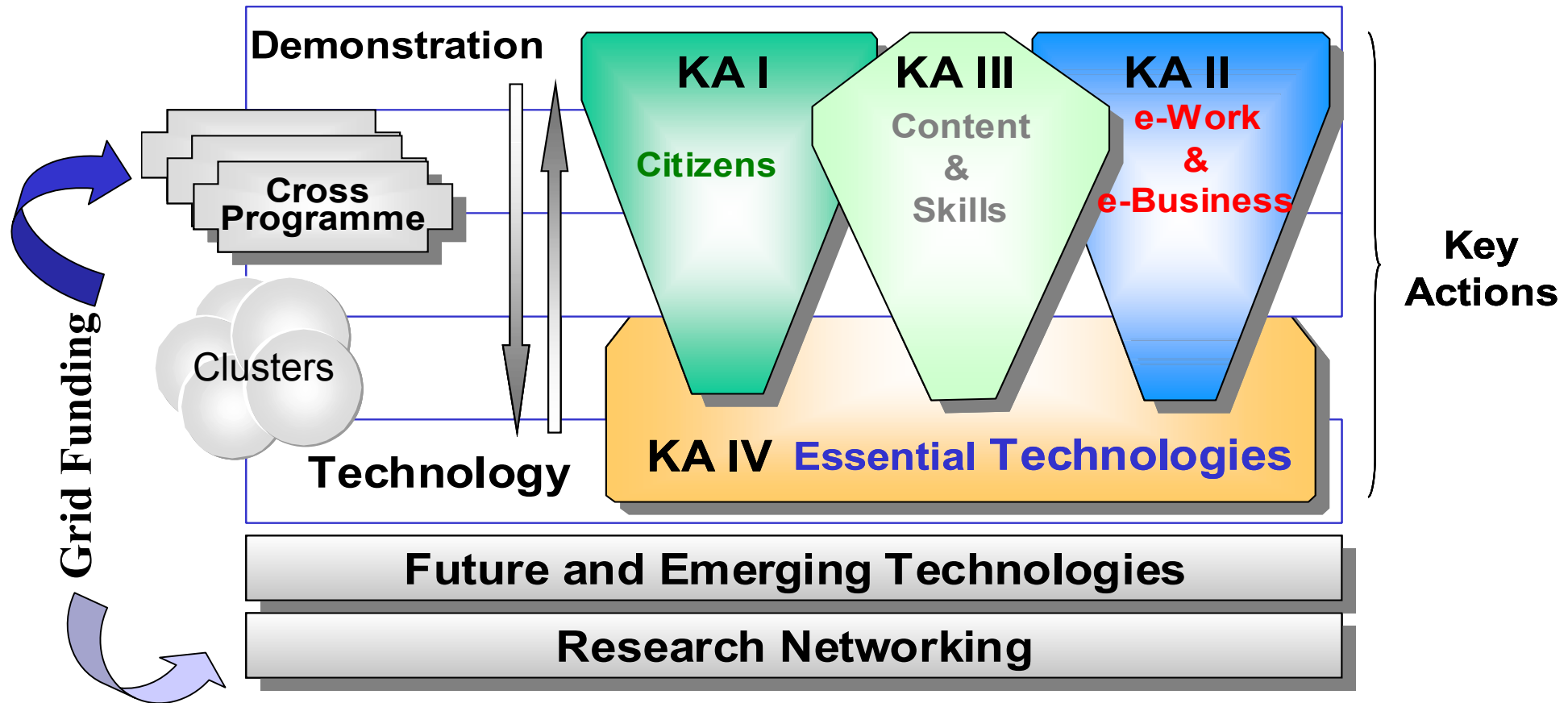


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Grid History - IST in FP5

- **ETAN Report - DG RTD (September 1999)**
 - Transforming European Science through Information and Communication Technologies: Challenges and Opportunities of the Digital Age
- **Research Networking: RN1 → GEANT**
 - Fill the Pipes – Metacomputing, DataGrids
- **Grid Workshops**
 - 22-23 June 2000 – DG IST (Update WP2001)
 - eScience Workshop - DG RTD June 2000
- **Research Networking: RN2 → Eurogrid, DataGrid**
- **WP 2001/2: CPA9 → Several Projects**

The IST Programme (FP5)



FP5 IST - Grid and P2P Projects

	Project name	Start date	Duration	Funding (€)
1	EUROGRID	01.11.2000	36	2,065,769
2	DATAGRID	01.01.2001	36	9,872,506
3	DAMIEN	01.01.2001	30	1,229,348
4	GRIA	01.12.2001	30	2,016,213
5	DATATAG	01.01.2002	24	3,980,826
6	GRIDLAB	01.01.2002	36	5,085,998
7	GRIP	01.01.2002	24	1,338,996
8	EGSO	01.03.2002	36	2,400,000
9	CROSSGRID	01.03.2002	36	4,860,001
10	MOSES	01.03.2002	30	1,505,604
11	MMAPS	01.03.2002	30	2,392,000
12	GRIDSTART	01.04.2002	36	1,449,066
13	GRASP	01.04.2002	30	1,955,455
14	WEBSI	01.05.2002	24	1,799,998
15	ASP-BP	01.05.2002	24	3,485,992
16	P2PEOPLE	01.07.2002	19	763,582
17	FLOWGRID	01.09.2002	24	1,099,120
18	OPENMOLGRID	01.09.2002	27	1,988,579
19	GRACE	01.09.2002	30	1,889,995
20	COG	01.09.2002	18	1,061,703
21	BIOGRID	01.09.2002	24	834,445
22	GEMSS	01.09.2002	30	2,626,611
23	MAMMOGRID	01.09.2002	36	1,899,938
24	SELENE	01.11.2002	12	283,000
	Total			57,884,745

Grid Project Portfolio

•Infrastructure

DataTag

•Computing

EuroGrid, DataGrid, Damien

•Tools and Middleware

GridLab, GRIP

•Applications

EGSO, CrossGrid, FlowGrid, BioGrid, OpenMolGrid, Moses, COG, GEMSS, Grace, Mammogrid, Selene

•P2P / ASP / Webservices

P2People, ASP-BP, WEBSI, MMAPS, Grasp, GRIA

•Clustering

GridStart



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FP5 Grid Projects – Short Summary (1)

- **Eurogrid**
 - will demonstrate the use of GRIDs in selected scientific and industrial communities, address the specific requirements of these communities, and highlight the benefits of using Grids;
 - will develop important GRID software components and integrate them into EUROGRID (fast file transfer, resource broker, interface for coupled applications and interactive access)
 - Unicore Middleware
- **Damien**
 - Will develop essential software so that the Grids can be used for industrial simulation and visualisation; will build on existing tools and libraries and develop a set of utilities which will enable developers to port their applications more easily to the Grids.
- **Datagrid**
 - will devise and develop scalable software solutions and testbeds to handle many PetaBytes of distributed data, tens of thousand of computing resources including processors, disks, other devices and thousands of simultaneous users from collaborating research institutes.
 - Will enable next generation scientific exploration which requires intensive computation and the analysis of shared, large-scale databases.
- **DataTag**
 - Will implement a network infrastructure for a truly high-speed interconnection between individual Grid domains both in Europe and the US. The project will incorporate the design & implementation of advanced network services for guaranteed data delivery, transport protocol optimisation, efficiency and reliability of network resource utilisation.



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FP5 Grid Projects – Short Summary (2)

- **GRIA**
 - will devise business models and processes that make it feasible and cost-effective to offer and use computational services securely in an open Grid marketplace.
- **GRIDLAB**
 - will develop software able fully to exploit dynamic resources.
- **GRIP**
 - will realise the interoperability of Globus and UNICORE.
- **EGSO**
 - will lay the foundations of a virtual solar observatory.
- **CROSSGRID**
 - will develop techniques for large-scale grid-enabled real-time simulations and visualisations.
- **MOSES**
 - MODular and Scalable Environment for the Semantic web.
- **GRIDSTART**
 - Grid Dissemination, Standards, Applications, Roadmap and Training.
- **GRASP**
 - will aim at studying, designing, developing and validating a new advanced system infrastructure for Application Service Provision (ASP) based on GRID technologies.



FP5 Grid Projects – Short Summary (3)

- **WEBSI**
 - will develop and demonstrate three suites of tools for developing data-centric Web applications in the ASP framework.
- **ASP-BP**
 - will constitute a framework in which 6 experiments regarding ASP technology-based applications applied in different industrial field will be realised.
- **FLOWGRID**
 - will establish a CFD Virtual Organisation, by setting up a GRID infrastructure and by deploying and sharing, software, computing resources and knowledge.
- **GRACE**
 - GRid search and Categorisation Engine.
- **OPENMOLGRID**
 - will address large scale molecular design problems
- **COG**
 - Corporate Ontology Grid.
- **BIOGRID**
 - will conduct a trial for the introduction of a grid approach in the biotechnology industry.
- **GEMMS**
 - will demonstrate how Grid technologies can be used to transform healthcare and enable Europe to lead that transformation. Grid-Enabled Medical Simulation Service.
- **SELENE**
 - will address Grid technologies for e-Learning.



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Framework Programme FP6 (2002-2006)

- **European Research Area (ERA) Concept**
 - **Common European Research policy**
- **Stronger link with National, Regional and other European Initiatives**
- **Three Specific Programmes**
 - **Integrating and Strengthening ERA**
 - **Priority 2: Information Society Technologies (IST Programme)**
 - **Structuring ERA**
 - **Research Infrastructures**
 - **Strengthening the Foundations of ERA**
- **Strategic Objectives**
- **New Instruments (Contract types)**

FP6 is not business as usual!

- **From “Project”-thinking to “Initiative”-thinking**
 - New instruments: “Integrated Projects” & “Networks of Excellence”
 - More strategic thinking
- **Develop Europe-wide approaches**
 - Making sure that Community funding helps aggregate EU, Member State & private funded effort(s)
 - It is not just supporting a particular RTD work...



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IST in FP6

- **Vision ‘Ambient Intelligence’ concept**

- Provides a vision of the Information Society where the emphasis is on greater user-friendliness, more efficient services support, user-empowerment, and support for human interactions
- Technology needs to be seamless with the ways we work, learn, interact with each other; we want technology to disappear from our consciousness
- Grid: Information Utility available for research, industry, business

- **Challenges and Objectives**

- Build the information and knowledge society for ALL - “people first”
- Support to infrastructure / service development
- Visionary, forward looking (longer term/high risk research)
- Scope of activities: Core technologies & “pull-through” applications

FP6 Budget Breakdown

Integrating & strengthening ERA

Genomics	2255 M€
IST	3625 M€
Nanotechnologies	1300 M€
Aeronautics and space	1075 M€
Food quality and safety	685 M€
Sustainable development	2120 M€
Citizens and governance	225 M€
Anticipation of S&T needs	
SMEs	430 M€
Specific INCO	315 M€
Anticipating needs	555 M€



Of which 50 M€
for GÉANT/Grid
Testbeds

Of which 125 M€
for Grid Research

Strengthening ERA foundations

320 M€

Structuring ERA

Research and Innovation	290 M€
Human resources	1590 M€
Research Infrastructures	655 M€
Science/Society	80 M€



Of which 200 M€
for GÉANT/Grid
Deployment

Joint Research Centre

760 M€

Total

16,270 M€



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Grids for complex problem solving

- **Mission**

- Contribute to the development of future generation Grid-type systems, applications, tool and services
- Contribute to the solution of complex problems in science, industry, business and society by using Grids

- **Strategic objectives for 2003/2004**

- To design and develop next generation Grid and Peer-to-Peer architectures
- To develop enabling application technologies for the solution of complex problems using Grid-based approach
- To foster co-ordination and integration of programme-wide, national and international developments in Grid



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Grid Research and Deployment (FP6) within DG IST

Grids for Complex Problem Solving

- Architecture, design and development of the next generation Grid
- Enabling application technologies

DG IST - F2

Research & Development

125 M€ (IST)

Technology-oriented strategic objectives
e.g. semantic web, software and services

R&D

Application-oriented Strategic Objectives
e.g. eBusiness, eGov, eWork, eHealth, risks management

R&D

Research Infrastructure

- Deployment of specific high performance Grids
- GÉANT Upgrade
- Research networking testbeds

DG IST - F3

Deployment

200 M€ RI



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Grids for Complex Problem Solving

Research Focus

Architecture, design and development of the next generation Grids

- **beyond extensions of existing technologies based on a meaning-oriented information model leading to**
 - open standards
 - including security built-in at all levels, programming environments, customisable middleware, resource management
 - economic and business models for new services
- **interoperability with existing GRID and Web services**

Enabling Application technologies

- **for solution of complex problems requiring a grid-based approach**
- **tools & environments for**
 - Modelling, simulation, visualisation, data mining,
 - process control, remote operation,
 - Collaborative work in dynamic virtual organisations
- **exploiting synergies across different application sectors**

A multi-disciplinary approach across the relevant levels of the value chain is required
Co-operation with research activities in the Member States is necessary for building critical mass



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Thinking outside the Box



“I was thinking way outside the box.”

Next Generation Grids – Why now?

- **Grids: form of distributed computing**
- **Present Grid technologies use “old, stand-alone” Operating Systems / Hosting Environments**
 - Roasting old chestnuts; the agent of change is the Internet
 - Need for a “network-centric OS”: OS that is ‘application aware’
- **Middleware becomes too complex**
 - Globus/OGSA not the “only game in town”
 - Semantics / Ontologies
- **Grid Enterprise Architecture**
 - Requirements for enterprise Grids; from ‘resource’ to ‘service’ sharing
 - Grid Business Models (B2Bi-Application Integration)
- **Europe has expertise and competence in the field**
 - Build critical mass, join forces, IPs and NoEs as enablers



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Next Generation Grid: Research Focus

- **Architecture, design and development of the Next Generation Grid**
 - **Beyond extensions of existing technologies based on a meaning-oriented information model leading to**
 - open standards
 - including security built-in at all levels, programming environments, customisable middleware, resource management
 - economic and business models for new services
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**A inter/multi-disciplinary approach across the relevant levels of the value chain is required
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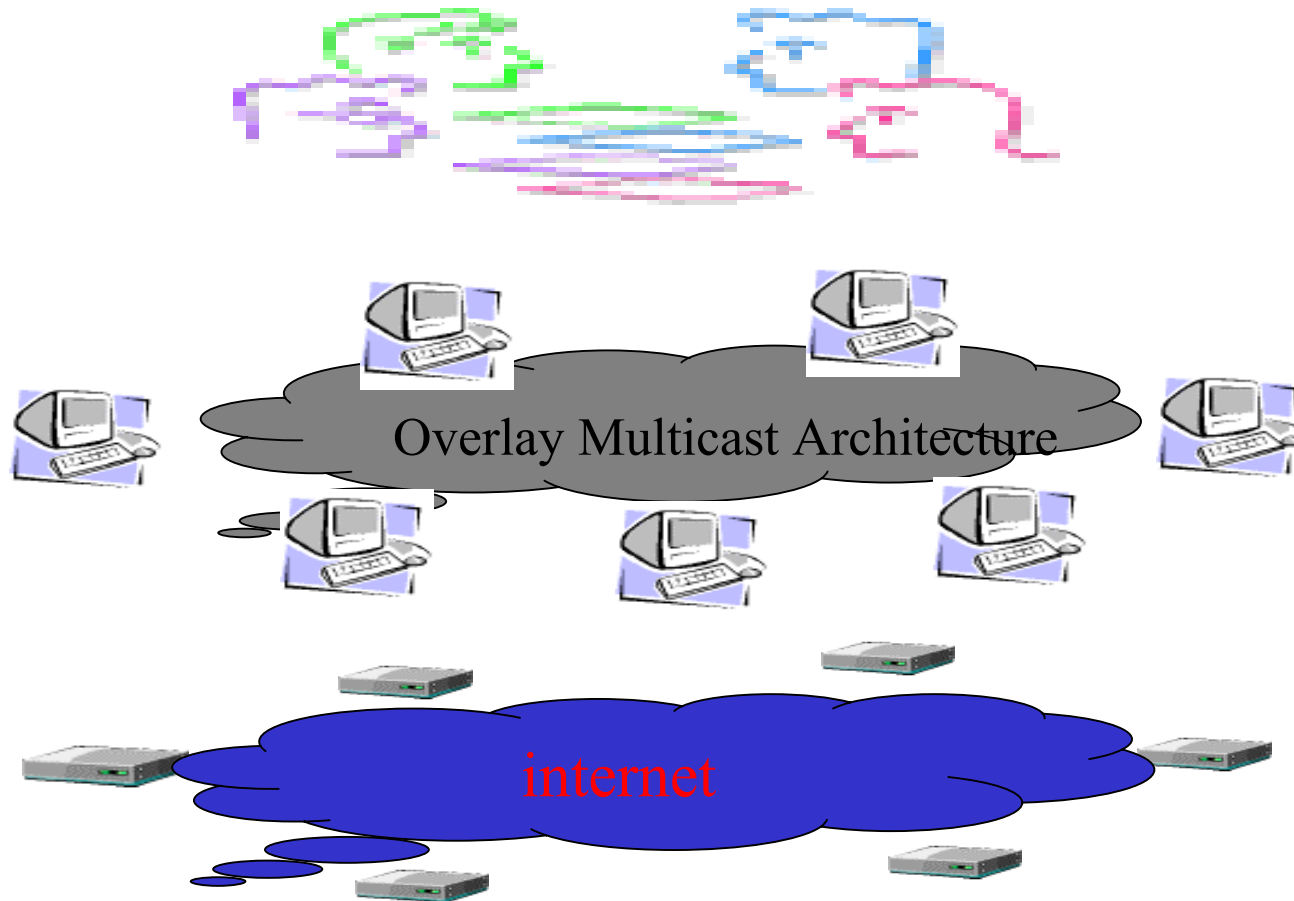
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Why is self-organization hard?

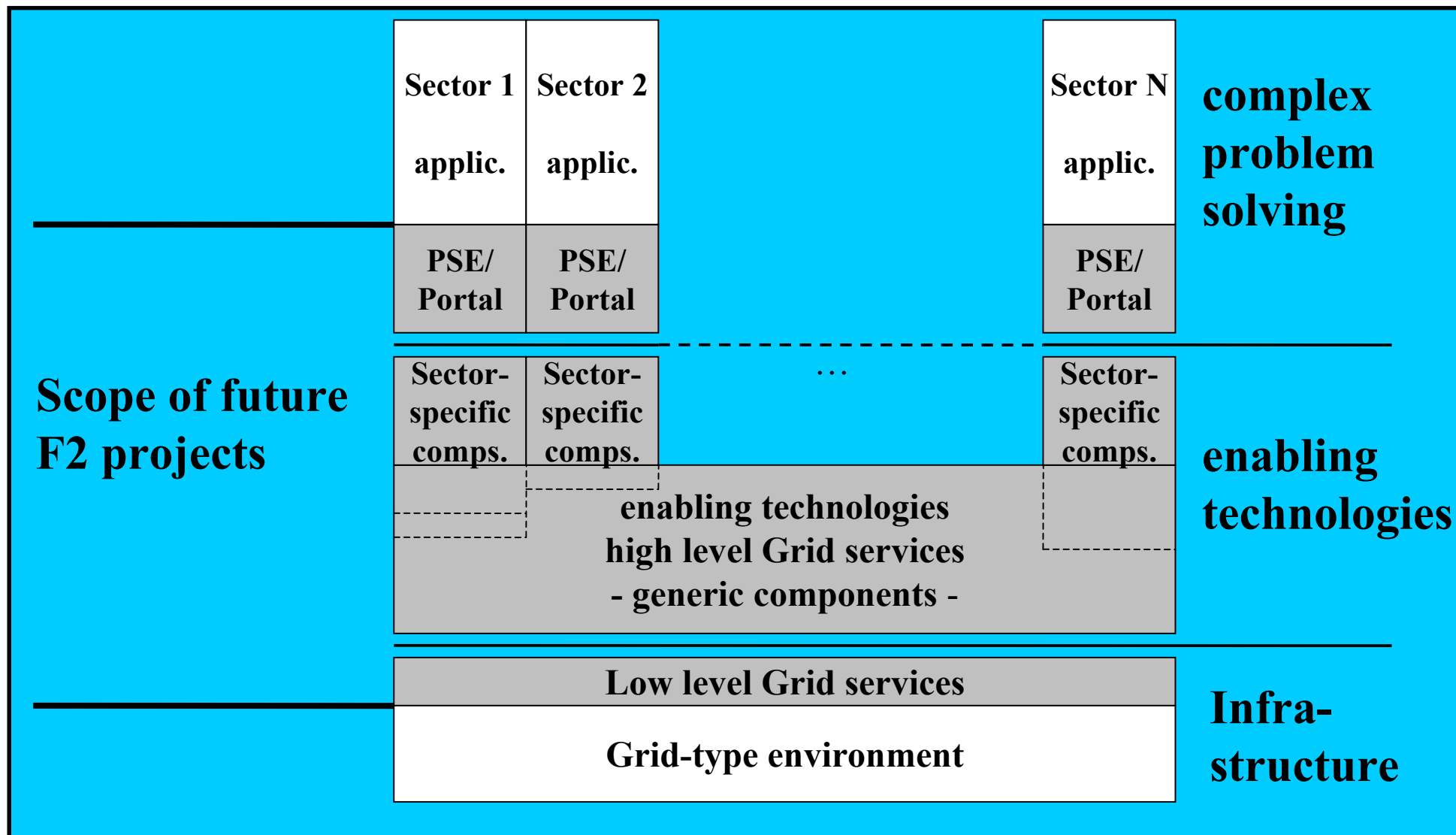
- **Dynamic changes in group membership**
 - Members join and leave dynamically
 - Members may die
- **Limited knowledge of network conditions**
 - Members do not know delay to each other when they join
 - Members probe each other to learn network related information
 - Overlay must self-improve as more information available
- **Dynamic changes in network conditions**
 - Delay between members may vary over time due to congestion



Overlay Structure



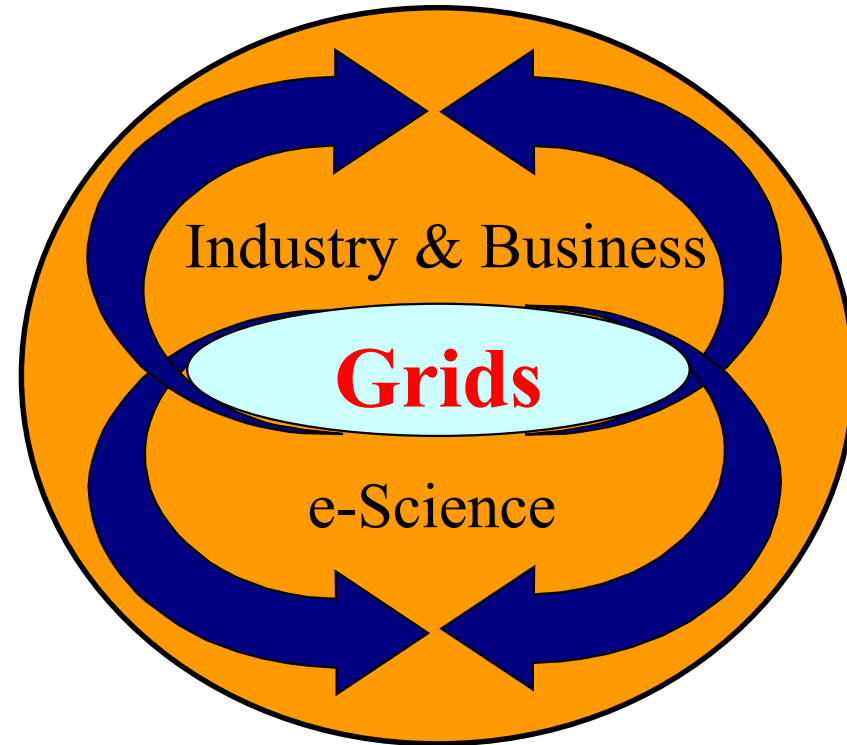
Generic Enabling Application Technologies



Moving Grid from e-Science to Industry

Promote Grid research to

- Solve complex problems with high economic and societal impact
- Exploit the potential of Grids beyond e-Science
- Ease access and use of Grids



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Links with e-Business

- **Business needs for Grid-based e-Enterprise Applications and Problem Solving Environments:**
 - engineering, development, testing, production, product data management, for full product life cycle optimisation
 - faster business analytics for finance markets, marketing analysis and intelligence, customer relationship management, etc
 - modelling, design, simulation in bio-technologies and life sciences
- **New opportunities for Grids enabled collaborative working and virtual organisations:**
 - integrated in enterprise complex IT infrastructures and / or implemented as virtual enterprise across the supply / valued added chain
 - transaction oriented applications, e-business, on-demand and utility service offering



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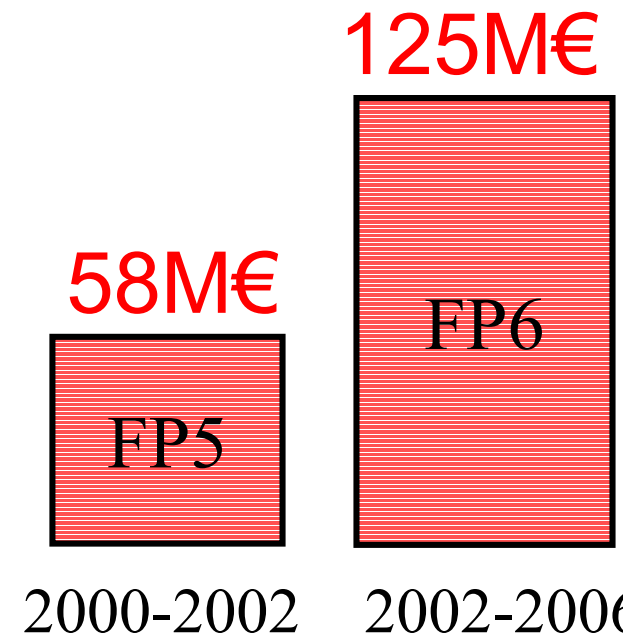


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IST-FP6 commitment to Grid research

- First actions launched in IST-FP5
- Grid research is a strategic objective
- New Unit dedicated to Grid research

**From FP5 to FP6
funding on Grid research
more than doubles**



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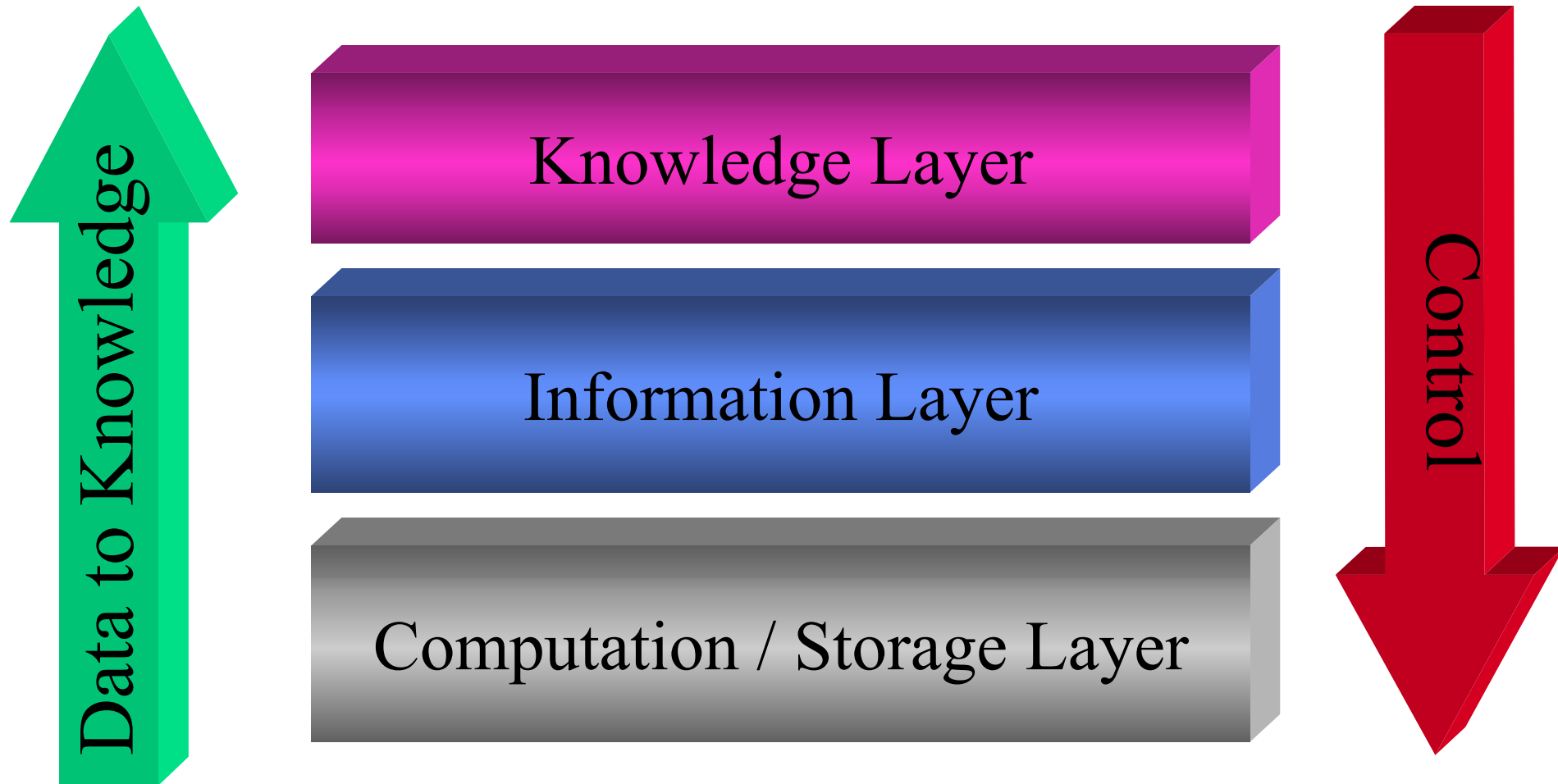


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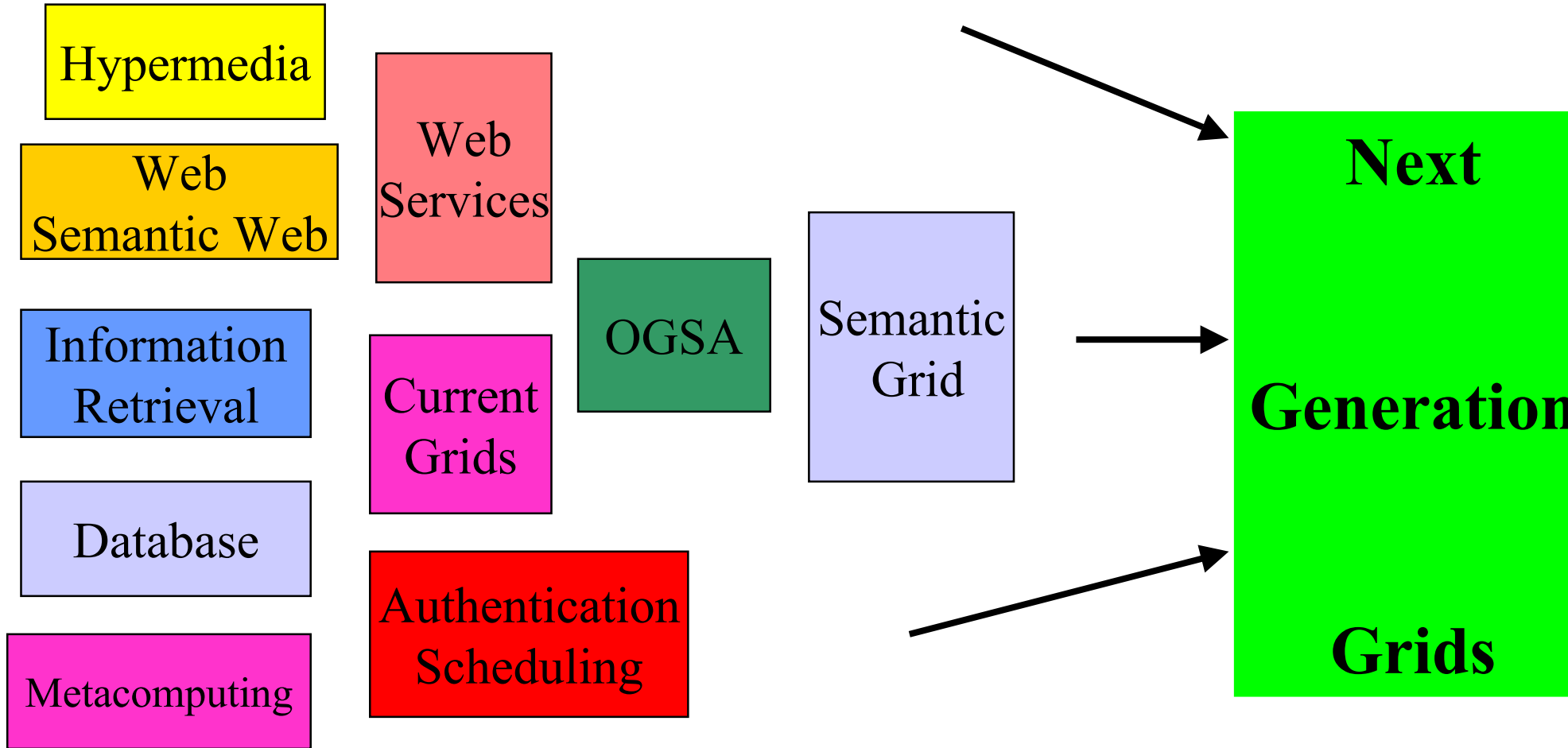
Main Grid WS Recommendations

- **Make inventory of present Grid research**
 - Technology re-use should be assured
 - Learn from 1st generation projects / Inventory by 'GridStart' Project
- **Set up a small group of 'visionary' experts to**
 - Identify research priorities for the next 5-7 years and propose pragmatic steps to be taken;
 - Propose a roadmap for the implementation of these steps (in view of upcoming calls for proposals);
 - Align technology priorities and means of implementation with policy objectives, e.g. ERA, European Centres of Excellence, etc.
 - Network/liaise and discuss findings with the Grid research community;
 - Propose actions to increase efficiency in international collaboration.
- **Workshop results: <http://www.cordis.lu/ist/grids/>**

A Taxonomy of Grids



The Challenge



Grid in Call 2 of IST WP2003-2004

- **Call 2 of IST/FP 6 (planned)**
 - expected opening: 17th June 2003
 - expected closure: 15th October 2003
- **Grids for Complex Problem Solving**
 - Indicative Budget: 45 M€
 - Instruments: IP, NoE, STREPs, CA, SSA
- **Indicative budget on Grids for Complex Problem Solving in FP6: 125 M€**
 - Links with other ‘Strategic Objectives’



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Call Call b.1: RI - (2002-2003)

- **Communication Network Development - Grids**
 - *Specific Programme* : Structuring the European Research Area
 - *Activity* : Support for Research Infrastructures
 - *Call title* : Communication Network Development - Grids
 - *Date of publication* : 17 December 2002
 - *Closure date(s)* : 6 May 2003 at 17h00 (Brussels local time)
- **Instruments: I3, CA, SSA**
- **Budget: 50 M€**

Conclusions

- **Grid is an emerging key priority in IST-FP6 supporting the evolution of ERA**
- **Call 2 addresses well-targeted and challenging objectives**
- **Specific CA or SSA actions should be promoted to create a more coherent landscape for Grid research in Europe**
- **Broadening of Grid constituency building is well under way**

IST & Grid Research - Sources of Information

IST on CORDIS: <http://www.eoi.cordis.lu/ist>

FP6 web main page: http://europa.eu.int/comm/research/fp6/index_en.html

New Instruments: <http://europa.eu.int/comm/research/fp6/networks-ip.html>

Model Contracts: http://europa.eu.int/comm/research/fp6/working-groups/model-contract/index_en.html

Frequently asked Questions: <http://europa.eu.int/comm/research/faq.html>

The European Research Area: http://europa.eu.int/comm/research/era/index_en.html

CORDIS RTD beyond 2002: <http://www.cordis.lu/rtd2002/>

FP6 on CORDIS: <http://www.cordis.lu/fp6>

Expressions of interest: http://www.cordis.lu/search_form.cfm

IST roadmap & workshops: <http://www.cordis.lu/fp6/calls.cfm>

Grids in IST-FP6: <http://www.cordis.lu/ist/grids/>

IST in FP6:

<http://www.cordis.lu/ist/fp6/fp6.htm>

<http://www.cordis.lu/ist/fp6/pcms.htm>

<http://www.cordis.lu/ist/fp6/workshops.htm>

Registration for FP6 database of experts: http://www.cordis.lu/experts/fp6_candidature.htm

Re-registration of FP5 experts for FP6: <http://candidature.cordis.lu/expert-evaluators/>

IST helpdesk

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