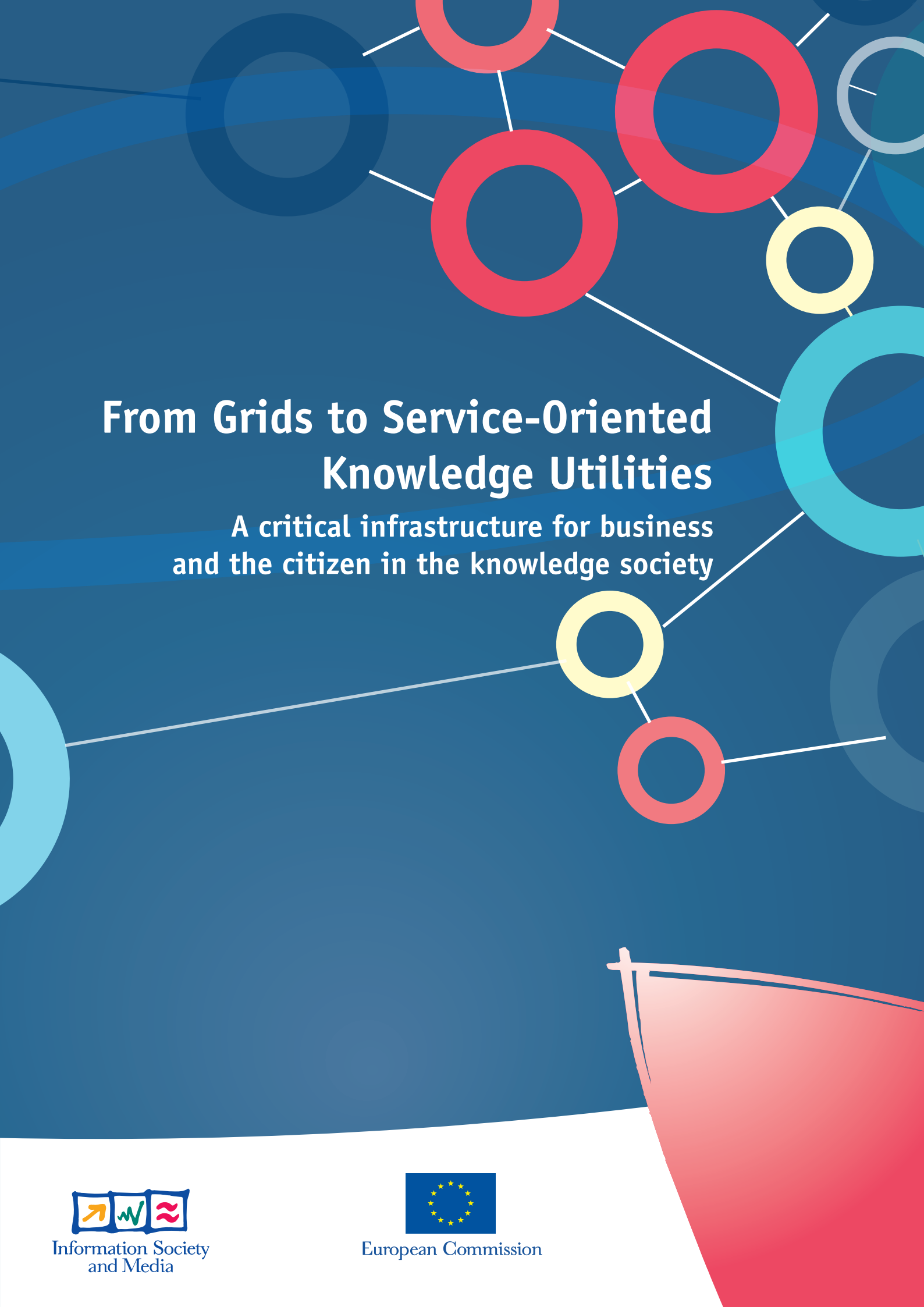




From Grids to Service-Oriented Knowledge Utilities

A critical infrastructure for business
and the citizen in the knowledge society



Information Society
and Media



European Commission

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In a Grid-enabled service infrastructure your PC or PDA suddenly becomes a gateway to any type of resources, including communication, computing and knowledge power, but you only pay for what you need, when you need it.

What is a Grid?

More rapidly than any previous technology revolution, the Internet has come to play a central role in our daily lives at work and at play. From desktop PCs to mobile phones, getting rapid access to information on the web whenever and wherever we want it has become second nature. The Internet has become a utility much like the electricity grid we already take for granted.

In the knowledge-based economy that Europe must become if it is to prosper in the 21st century we need a **new Grid: a global infrastructure that supplies access to secure, dynamic, networked services that provide information and knowledge for anyone, anywhere and anytime.** Such a Grid must be available, affordable and dependable and must provide access to computing, data and sensor resources through sophisticated applications built around cooperating services.

Grid-enabled service-oriented architectures add a new dimension to the Internet — facilitating its transformation from an information utility to a knowledge utility. Over the next decade such architectures will be a key enabler of the knowledge economy in Europe.

The Grid works by invisibly connecting a network of diverse resources, such as computers, data repositories, software programs, scientific instruments and more. Connecting such resources together, in itself, is not revolutionary — after all, every time you look up a page on the web you are connecting your PC to a computer somewhere else in the world.

A Grid, however, allows you, for example, to tap into that computer's processing power, rather than simply look at some of its files. Now add the power of a thousand other computers spread across a region, a country, or the globe. You choose how much power you want to use — your computational Grid parcels the job and shares it out to computers connected to

it. Suddenly your PC has become a gateway to an invisible computing service infrastructure provided through the network and you only pay for the service you need, when you need it.

But you have much more than that — you can also access massive amounts of data, whether they are stored in dedicated data storage devices or flowing from scientific instruments and or smart sensors. They are all attached to your data Grid which — thanks to the computing service infrastructure available in the network — can both process and store these data easily, using a whole range of software designed to make the most of the Grid's computing power and distributed data.

And more still — Grid services enable new sorts of software to become possible. Instead of huge amounts of data coming, for instance, from a web search, you now get access to knowledge, generated by semantic analysis software running on your knowledge Grid. A new generation of knowledge services that reach beyond the capabilities of today's search engines will help you understand and process these data, providing you with instant access to answers to queries from across the world. Irrespective of whether your team is designing cars, creating animated films, seeking new medicines or modelling the Earth's atmosphere, the basic principle is always the same: your Grid supplies all the resources, such as computing, storage, software, data and knowledge you need in one integrated service package, and helps project teams work more effectively together.

The convergence between Grids, web services, semantic technologies and emerging service-oriented architectures will enable the provision of computing, data, information, and knowledge capabilities as utility-like services, thus fostering the emergence of service-oriented knowledge utilities in the 21st century.



The evolution of Grids

Grids were originally conceived for tackling problems involving large amounts of data or compute-intensive calculations, so it is not surprising that the first Grids were developed for global-scale scientific projects. These so called **computational Grids** collect distributed computing resources and aim at achieving higher aggregate computational power than any single computer. The benefit is faster, more efficient processing of compute-intensive jobs, while utilising existing resources spread throughout the world's universities, research centres and high-tech companies. Today, however, Grids are entering completely new waters as they begin to connect businesses across the supply chain and, in some instances, are already directly supporting consumers. Grids can be found in all sizes, ranging from just a few machines in a department to groups of thousands or millions of machines distributed across the world.

Grids currently exist in many different forms, for example as **data Grids** (users and applications can access simultaneously various database systems or warehouses of information in a manner similar to a single database access) or as **storage Grids** (aggregating the spare storage resources and providing users with transparent and secure access to storage services). The **enterprise Grid** is expected to evolve as the information and communication technology (ICT) backbone of the modern enterprise in the knowledge society providing on-demand services to support technological innovation, cooperative teamwork, and decision support. Lastly, many Grid developers dream of a future '**World Wide Grid**', which would replace the World Wide Web, offering an interconnected environment which enables machines and people to capture, publish, share and manage ICT and knowledge resources anywhere and at any time.

Grid technologies are a 'strategic objective' within information society technologies (IST) research, funded under the EU's sixth framework programme (FP6) (2002–06) for research and technological development. This brochure outlines why and how EU research in FP6 is helping Europe take Grids out of the research lab and into industry — a critical step in ensuring Europe becomes a leading knowledge society.

Promoting a new service paradigm:
Grids will evolve to **Service-Oriented Knowledge Utilities (SOKU)**, which will provide a new flexible, powerful and cost-efficient service infrastructure for the knowledge society.

The Grid vision for 2010 and beyond: From Grids to Service-Oriented Knowledge Utilities (SOKU)

Future Grids will evolve towards a general purpose infrastructure enabling and supporting complex business processes and workflows across virtual organisations spanning multiple administrative domains.

Grids enable the dynamic sharing of heterogeneous computing, data, information, sensor and instrument resources across multi-domain organisations. They are used to improve production processes, decrease the costs of IT infrastructures and solve complex problems in science, business and engineering. The combination of resource virtualisation with novel architectural concepts such as service-oriented architectures makes today's Grids easier to program, deploy and use, thus enabling the emergence of a new generation of Grid-enabled IT services and innovative business models. These are providing European industry with a unique opportunity to become more competitive in the global market.

To date, the power and capabilities of Grids have been demonstrated in a variety of 'big' scientific and industrial applications in domains such as biotechnology, pharmaceuticals, automotive, aerospace, finance and media but the ultimate commercial benefits derive from their use in the business and public administration sectors. Here they are being increasingly deployed as a new IT infrastructure to reduce costs of ownership and management and to make processes more scalable, interoperable and agile.

In the past few years, EU Grid research efforts have started to feed into concrete technologies and products, enabling new and more demanding applications and services which go beyond the borders of scientific labs. However, further research and the support and early adoption by industry are crucial to transform Grids from their pioneering phase to widespread use by industry, business and society.

The SOKU vision identifies a flexible, powerful and cost-efficient way of building, operating and evolving IT intensive solutions for use by businesses, science and society. It builds on existing industry practices, trends and emerging technologies and provides the rules and methods for combining them into an ecosystem that promotes collaboration and self-organisation. The benefits are increased agility, lower overhead costs and broader availability of useful services for everybody, shifting the balance of power from traditional ICT players towards intermediaries and end-consumers of ICT. The SOKU vision is driven by the necessity of effectively bringing knowledge and processing capabilities to everybody. Thus it underpins the emergence of a

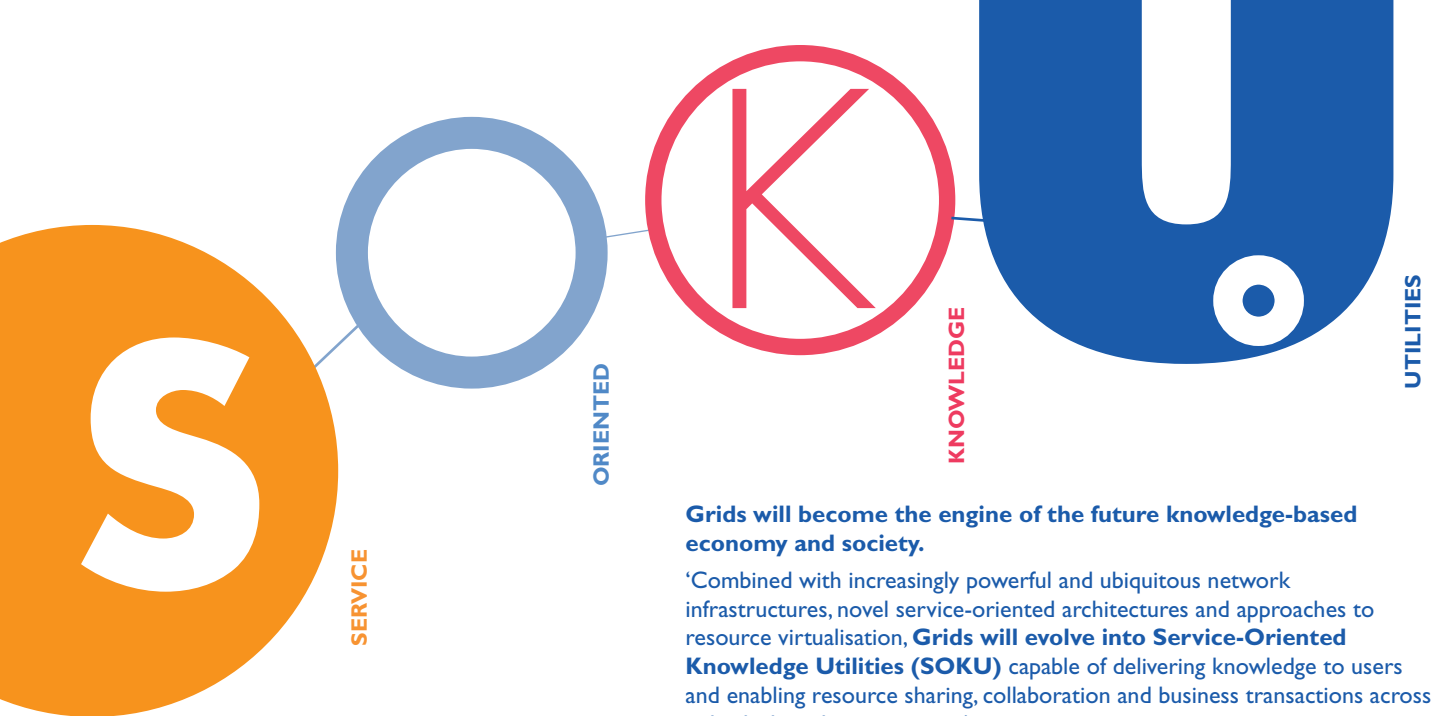
THIRD REPORT OF THE NEXT GENERATION GRID EXPERT GROUP (2006)



During the sixth framework programme, a group of high-level experts, named the Next Generation Grid (NGG) Expert Group, developed a vision that has emerged as the European vision for Grids. Driven by the need and opportunity of bringing Grid capabilities to business and citizens, the NGG vision underpins the evolution of the Grid from a tool to solve compute- and data-intensive

problems towards a general-purpose service-based infrastructure enabling complex business processes and workflows to be built across virtual organisations (VOs) spanning multiple administrative domains. The convergence of the evolving NGG vision with the service-oriented vision of major European industrial stakeholders led the NGG group to define, in their third report published in 2006, the scientific and technological requirements necessary to evolve Grids towards the wider and more

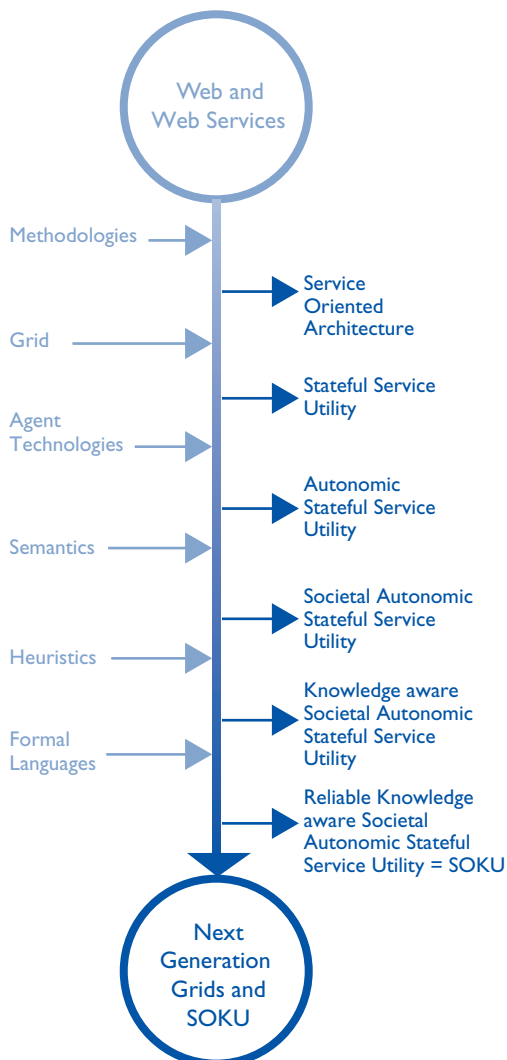
ambitious vision of **Service-Oriented Knowledge Utilities (SOKU)**. The SOKU vision builds on wide support by the European research and industrial community. For example, it is a cornerstone of the strategic research agenda of the industry-led European Technology Platform NESSI (Networked European Software and Services Initiative). The NGG vision has evolved into the vision for Grid-empowered service infrastructures for the seventh framework programme (2007–13).



Grids will become the engine of the future knowledge-based economy and society.

‘Combined with increasingly powerful and ubiquitous network infrastructures, novel service-oriented architectures and approaches to resource virtualisation, **Grids will evolve into Service-Oriented Knowledge Utilities (SOKU)** capable of delivering knowledge to users and enabling resource sharing, collaboration and business transactions across individuals and organisations.’

(NGG3 report)



Source: NGG3 Expert Group.

competitive knowledge-based economy. The SOKU vision captures three key notions.

- **Service oriented** — The architecture comprises services which may be instantiated and assembled dynamically; hence the structure, behaviour and location of software applications are changing at run-time.
- **Knowledge** — SOKU services are knowledge-assisted (‘semantic’) to facilitate automation and advanced functionality; the knowledge aspect is reinforced by the emphasis on delivering high-level services to the user.
- **Utility** — A utility is a directly and immediately useable service with established functionality, performance and dependability, illustrating the emphasis on user needs and issues such as trust.

The primary difference between the SOKU vision and earlier approaches is a **switch from viewing a networked application as a hierarchically layered piece of software to a group of cooperating services**, using the same core technologies to communicate and work together.

Future SOKUs will have a tremendous economic impact as they will boost the transition towards a market of ICT-enabled services where European industry can play a leading role. SOKUs will be the engine of the future knowledge-based economy and society. They will become as indispensable as telephony and electricity have been in the past century, enabling much more sophisticated applications and services than those created on the Internet or the web today.

Grid benefits and examples

THE E-SCIENCE GRID

Research infrastructure projects like EGEE (Enabling Grids for e-science) and DEISA (Distributed European Infrastructure for Supercomputing Applications) are providing academia and research labs with access to major computing and data resources as well as a myriad of applications from various scientific domains, including earth sciences, high energy physics, bioinformatics and astrophysics. Grid technologies are on their way to become the key enabler for a future e-infrastructure for scientists around the world. ■

BENEFITS ON TAP FOR SMALL FIRMS

Before the Grid, the only organisations that could afford sophisticated information and communication technology (ICT) infrastructures with high-performance computing capacities and expensive application software were those with large budgets, large IT teams, and permanently large computing needs. Grids, however, enable 'ICT services on tap' — organisations pay for the resources and computing power they need, when they need them. For example, small firms can use sophisticated 3D image rendering or numerical simulation software packages, applications that require the kind of computing power hitherto available only from supercomputers.

Small and medium-sized enterprises (SMEs) will have at their fingertips application services and collaboration platforms that were previously unthinkable, due to the high costs involved. SMEs can now rapidly collaborate and share resources, sell their products and services and buy services in the emerging service-oriented knowledge economy.

The Grid will meet the infrastructure needs of application service providers (ASPs) providing central ICT and application services on demand to SMEs and others who cannot afford to buy and maintain their own ICT infrastructure. Furthermore, the Grid can also enable new business opportunities by facilitating dynamic short-term collaborations with other companies or integration into a new supply chain. ■

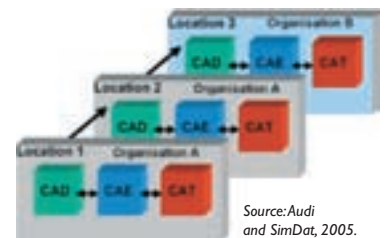
Through its implementation as a utility, the Grid will offer all kinds of ICT services on demand, thereby reducing total cost of ownership and making ICT business infrastructures more flexible and agile.

THE INDUSTRIAL DESIGN AND ENGINEERING GRID

Designing and engineering of a new car is no trivial task. A car manufacturer needs to orchestrate the work of designers, engineers, computer experts, test experts and business managers from potentially hundreds of different and sometimes competing suppliers, located around the world. Using the Grid to integrate data, processes and applications, virtual working groups can be formed between the car manufacturers and their suppliers to work on common product development and reduce the number of full-scale prototypes and tests through virtual prototyping. By enabling new generations of knowledge discovery and data mining

as well as multi-scale modelling and simulation tools, the Grid boosts the potential for creativity of the designer and engineer.

In other industrial and service sectors, application profiles and requirements for Grid-based integration and collaboration are similar, though each sector, manufacturer or service provider has its own peculiarities. Industry is starting to experiment with and invest in Grid technologies. **The Grid will reinforce Europe's strengths of delivering innovative, high-quality products and services at competitive prices.** ■



Source: Audi and SimDat, 2005.

For product development in the automotive industry, the potential of the Grid lies in the integration of different disciplines like computer-aided design, engineering and testing (CAD, CAE, CAT) across different locations and organisations, while respecting legacy environments as well as organisational security policies. Such complex data and application integration across virtual organisations will pave the ground for new generations of knowledge discovery and data mining as well as modelling and simulation tools.



Disciplines to be integrated in CAE in the automotive industry

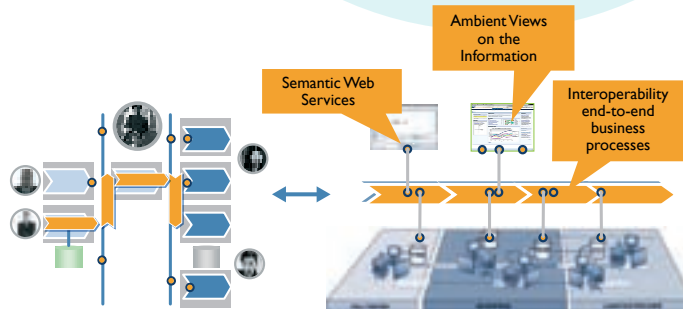
Source: Audi and SimDat, 2005.

'While service-oriented architectures may be the currently agreed upon direction to tackle the enterprise ICT challenges conceptually, Grid technology is likely to be the best contender for an agreed upon strategy for managing the underlying ICT infrastructure.'
(NGG3 report)

THE ENTERPRISE GRID

Enterprise applications are heavily tailored to reflect companies' business strategies, business models and business processes. The ability of businesses to respond quickly to market changes, by changing business strategies and adopting new business models, is becoming a critical factor of their competitive advantage. The growing interconnectedness of business processes forces constant evolution and change in the ways that companies manage their ICT infrastructure and software, and hence in the business knowledge that is built into them.

While service-oriented architectures are tackling this challenge conceptually,



Grid technology is likely to be the best strategy for managing the underlying ICT infrastructure — making Grids the ICT backbone of business in the knowledge society. Instead of assigning fixed resources to individual enterprise services supporting individual business functions, and painstakingly reassigning

these resources as requirements and load patterns shift, the Enterprise Grid of the future will clearly separate resources and resource consumption, by making all assignments dynamic. ■

Services architecture and scalable Grid-like infrastructures to deliver future enterprise applications

Source: SAP and the NGG Expert Group, 2006.

THE MOBILE EMERGENCY RESPONSE GRID — BENEFITING THE CITIZEN

In times of crisis — be it a natural disaster, terrorist attack or infrastructure failure — mobile workers need to act together in time-critical and dangerous situations. Real-time access to information and knowledge, powered by Grids, will help save lives.

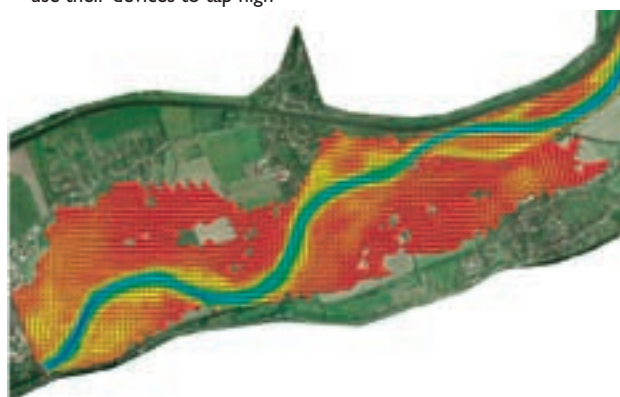
Crises are complex situations, often requiring large numbers and diverse groups of mobile workers — medical and rescue teams, police, fire fighters and other security personnel — on the spot, and at very short notice. These different teams come from different organisations, and generally have incomplete or even contradictory knowledge of the crisis situation. Finally, many of the sophisticated tools

they bring with them — from infrared cameras to find victims in the rubble to decision-support systems for planning evacuations — will probably not interconnect with anyone else's.

Grid technologies could help bridge this gap, by enabling workers to work more effectively both as individuals and as members of highly complex teams. All mobile teams will be supplying information to and accessing information from the Grid, allowing diverse emergency resources and teams to share knowledge and improve collaboration and planning.

While current mobile equipment has limited computational and storage resources, a Grid set up to help handle the disaster could allow workers to use their devices to tap high-

performance computing resources, when needed. For example, the Grid can handle data from thousands of sensors already scattered through river basins, on mountain tops and even in orbit. This Grid can be used to analyse, model and compare data in real time to predict the risk of emergencies: flooding, avalanches or — when the basic science is ready — earthquakes and volcanic eruptions. When a disaster strikes the team could then use the Grid to predict how the danger will spread, and to optimise resource allocation. Grid technologies can provide ad hoc the sort of data storage, processing power and communications required at the prices emergency response teams can afford. ■



Grids assist in predicting the impact of floods in river basins and coordinating emergency response teams

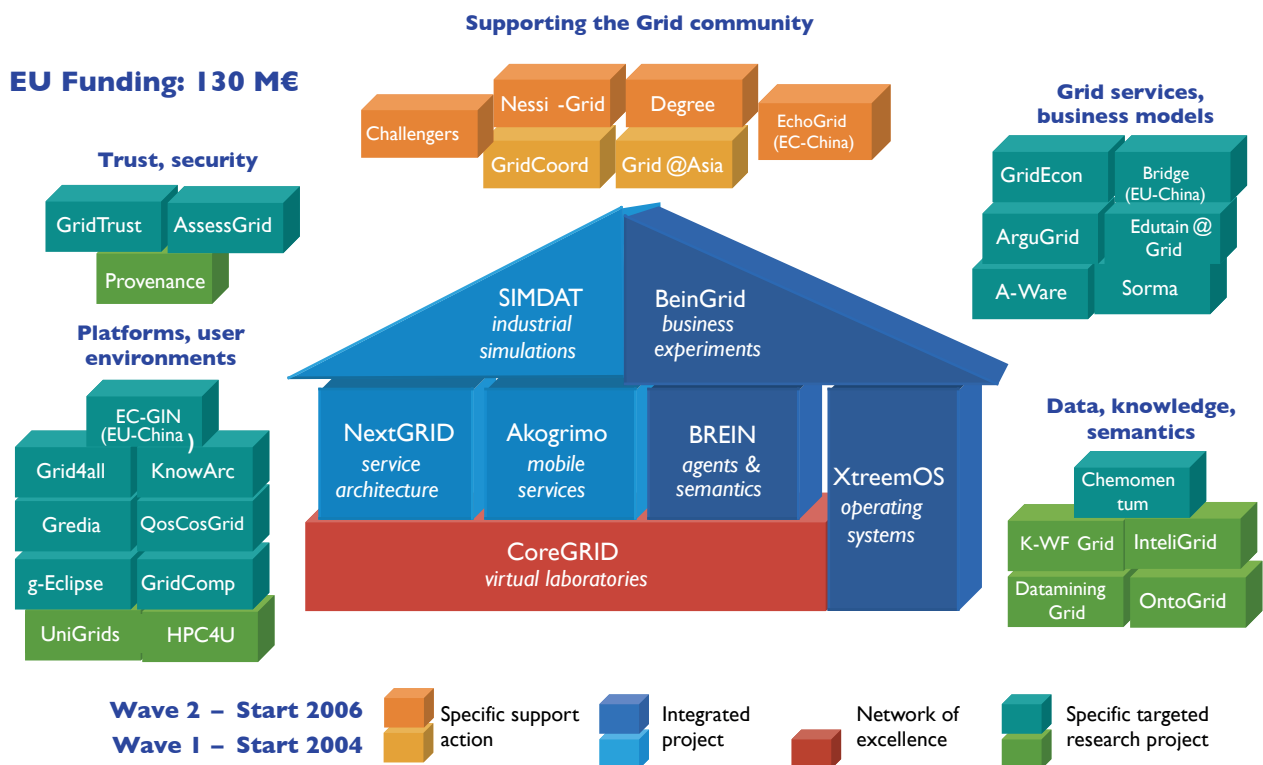
Source: CROSSGRID.

The IST portfolio of Grid research projects under FP6: delivering the next generation Grid for industry and business

Thanks to substantial investments and numerous initiatives launched at Member State and European levels, Europe has established a globally competitive position in Grid technologies and applications. The European Commission has been financing Grid research since early 2000, when the first EU projects were launched under the fifth research framework programme (FP5). The Grid research projects under FP5 received EUR 58 million in EU funding and were focused on technology development and application pilots. In FP6 (2002–06), a twofold approach of **technology push** and **application pull** for Grid research has been pursued resulting in two major waves of projects, the first wave starting in 2004 and the second one starting in 2006, with a total EU funding of EUR 130 million.

Among the 36 FP6 IST Grid research projects launched since the summer of 2004 are seven major projects each benefiting from an average funding of EUR 10.5 million. These are creating a 'critical mass' of expertise and resources from across Europe, covering the complete value chain from technology and services provision to industrial use, as described below.

Grid research project portfolio in sixth framework programme

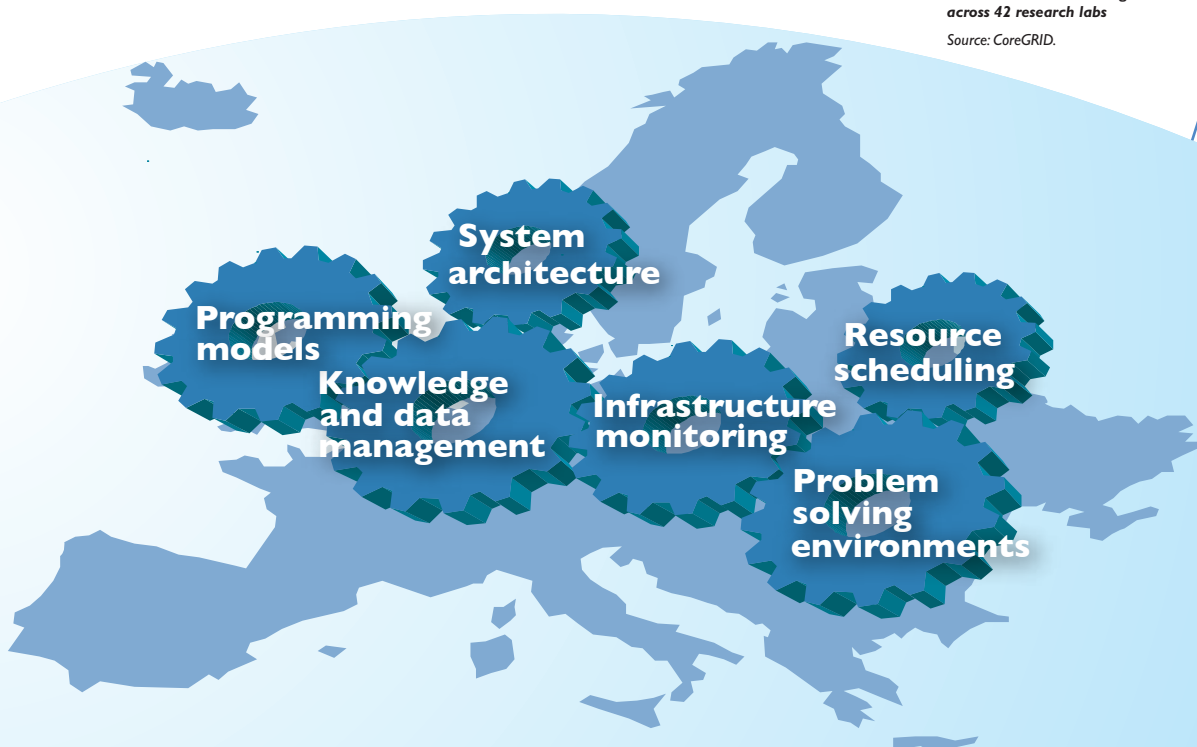


Technology-driven Integrated Projects and Networks of Excellence

- The **CoreGRID** network of excellence is addressing longer term Grid research, creating the foundations for next generation Grids towards 2010 and beyond. Starting in 2004, the project has brought together existing Grid research communities of more than 40 research establishments by creating a single European research laboratory structured into six focused institutes. CoreGRID is opening up academic research agendas in order to identify business-oriented research priorities, leading to the spin-off of new CoreGRID virtual research institutes, as being done for service-oriented architectures and systems.
- The **NextGRID** integrated project is focusing on the underlying technologies of the next generation Grid, aiming to deliver a new Grid architecture by the end of the decade. Since 2004, the project has been addressing, inter alia, security and business models, taking into account requirements from sectors such as finance, media and supply chain management. The primary exploitation mechanism for NextGRID is the partners' strong contributions to international standardisation bodies, European Grid middleware developments, and community forums.
- The **Akogrimo** integrated project is developing mobile Grid architectures and services. Building on Europe's strengths in mobile communications, the project will demonstrate a vision of 'dynamic virtual organisations' in pilot applications in e-health and e-learning. Since 2004, Akogrimo has integrated selected Grid components with enhanced mobility-supporting features and has validated these based on their initial implementation of their mobile Grid reference architecture.
- The **XtreemOS** integrated project (launched 2006) aims to develop new services to be added to the kernel of the Linux operating system extending it towards the Grid — thereby offering native support for virtual organisations on PCs, clusters and mobile devices. These integrated Grid capabilities will be demonstrated in a large range of industrial applications from enterprise resource management to industrial manufacturing. The major exploitation route is through leading Linux distributors, who are participating in the project as partners.
- Building on Grid, semantic web and multi-agent technologies, the **BREIN** integrated project (launched 2006) aims to enable individuals and business entities to provide their services in a controlled environment that allows intelligent and optimal management of the respective resources according to the individual business goals/ constraints. The approach will be validated in application scenarios for virtual engineering design and airport management.

CoreGRID: six highly focused research institutes cutting across 42 research labs

Source: CoreGRID.



Grid technology is on a critical path towards wider adoption by business and enterprise. European ICT service providers are the major drivers for industrial take-up of Grid technologies and for Europe to capitalise on its research investments under FP6.

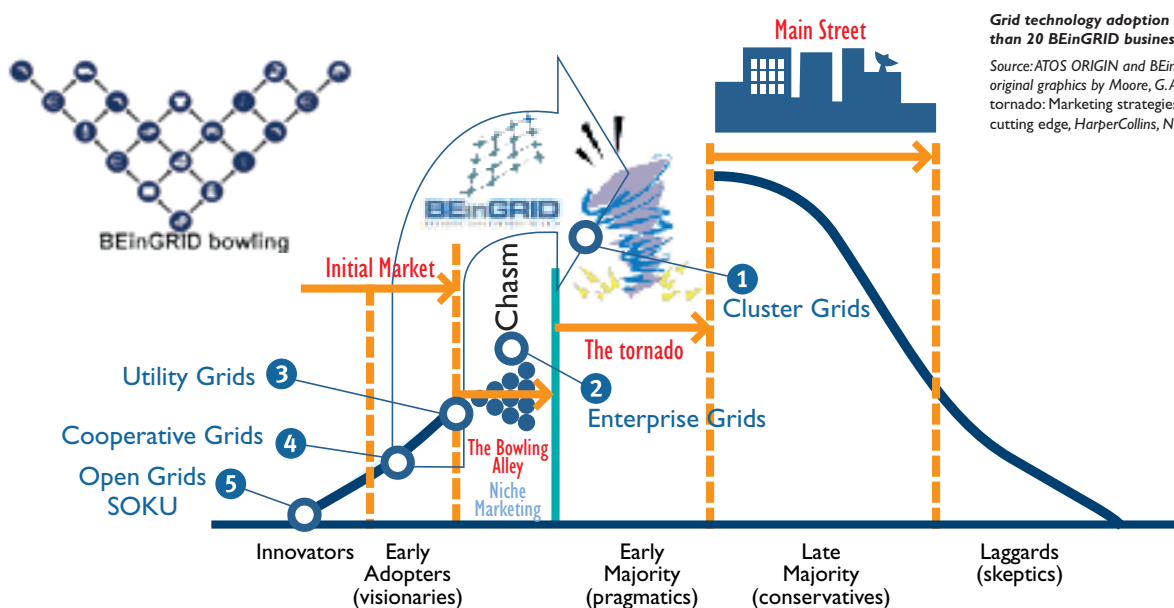
User and service provider-driven Integrated Projects

- The **SIMDAT** integrated project is developing Grid solutions for complex problems in industry. The major focus is on: Grid-enabled data integration across administrative domains; Grid-powered collaboration across manufacturers and suppliers; and novel analysis and knowledge discovery services exploiting Grid connectivity. Since it was launched in 2004, SIMDAT has successfully installed Grids, including integrated access, to distributed data repositories in seven industrial prototypes in the aerospace, automotive, pharmacology and meteorology sectors. The ongoing Grid technology development on collaboration across administrative domains will be deployed in the next phase prototypes. One of the first SimDat prototypes has already fed into a new product: a Grid-based integration environment for the automotive industry, which was decided to be deployed at a large European car manufacturer in 2007.
- Being largely driven by European ICT service providers who want to pave the ground for broad industrial take-up of Grid technologies, the **BEinGRID** integrated project (launched 2006) aims at maturing the Grid and demonstrating its value to industry and commerce. The partnership in each of the 20 targeted business experiments, in sectors such as entertainment, finance, engineering, gaming, retail, and textile, is cutting across the full value chain, from technology and service providers to several levels of users. Each experiment will assess the benefits from their use of Grid solutions related to productivity,

competitiveness and profitability gains. A repository of Grid middleware components and best practices will make the project results sustainable, thereby stimulating further take-up of Grid solutions by European business. To minimise redevelopment of components, BEinGRID is deploying innovative Grid solutions using existing Grid components from across the European Union and beyond.

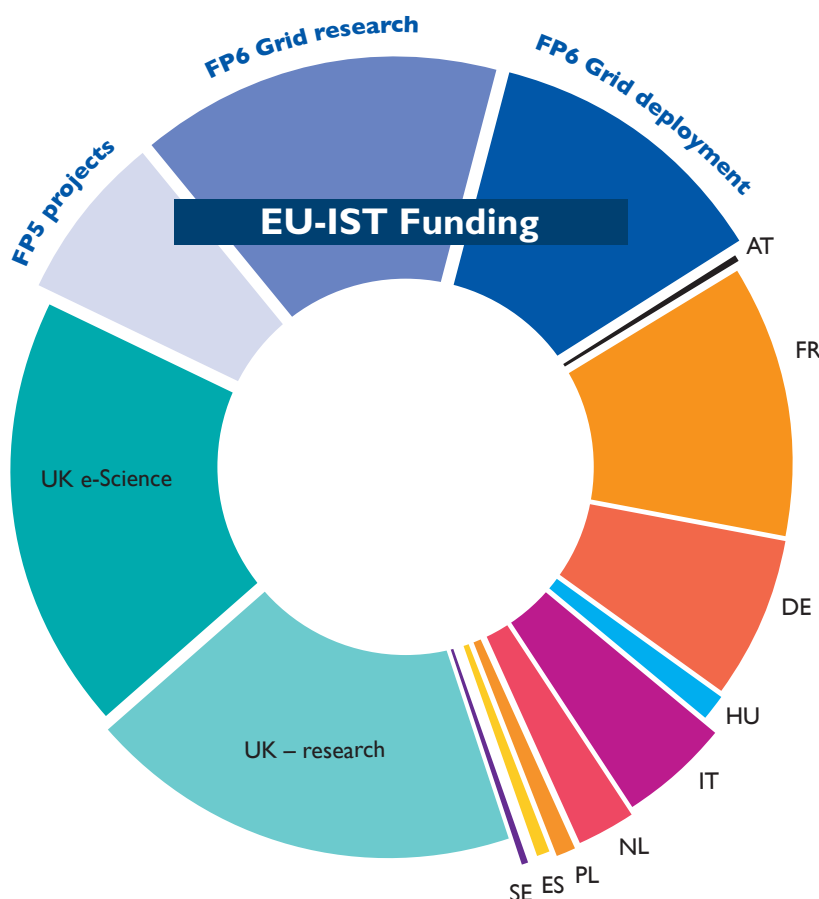
These large initiative-like research and development projects are complemented by 23 smaller Specific Targeted Research Projects (STREPs) which explore specific and highly innovative research areas such as trust and security, programming models, user environments, service level agreements (SLA) negotiations, knowledge and data sharing in Grid environments, adaptive enterprise service Grids, distributed resource publishing and retrieval, Grid economies and business models, licensing schemes for the Grid, etc.

Finally, six Specific Support Actions (SSAs) are addressing the coordination among relevant research activities and collaboration among researchers in national and EU Grid programmes in the research policy context on the creation of the European Research Area (GridCoord, DEGREE), the coordination with industry-led Grid initiatives (NESSI-Grid), the development of European Grid visions and research agendas (CHALLENGERS), as well as the international cooperation context (Grid@Asia, EchoGrid).



Creation of a European Research Area for Grids and service-oriented architectures

Apart from the EU's Information society technologies' (IST) programme, many EU Member States fund Grid-related research at national and regional levels. Coordinating these activities across Europe helps to pool Europe's resources, and to create a 'critical mass' of expertise which strengthens Europe's competitiveness in Grid research. EU programmes have an important strategic role towards the creation of a 'European Research Area' (ERA). The Grid technologies programme acts as a catalyst for the coordination of activities between National Grid funding programmes. It leverages national Grid investments and enables the transfer of expertise across the EU. Thereby it establishes European centres of excellence for Grid technology and applications.



**Approximate Funding
(2002-2006)
by EU-MS and EU-IST
-research and deployment-
(million EUR)**

Countries	million EUR
AT	2.7
FR	98.3
DE	58.8
HU	8.6
IT	40.7
NL	20.0
PL	9.1
ES	4.5
SE	2.3
UK-research	155.0
UK e-science	158.0
FP5 projects	58.0
FP6 Grid research	125.0
FP6 Grid deployment	100.0
Total	841.0

Source: GridCoord.

NESSI – the European Technology Platform shaping a service-oriented economy for the 21st century

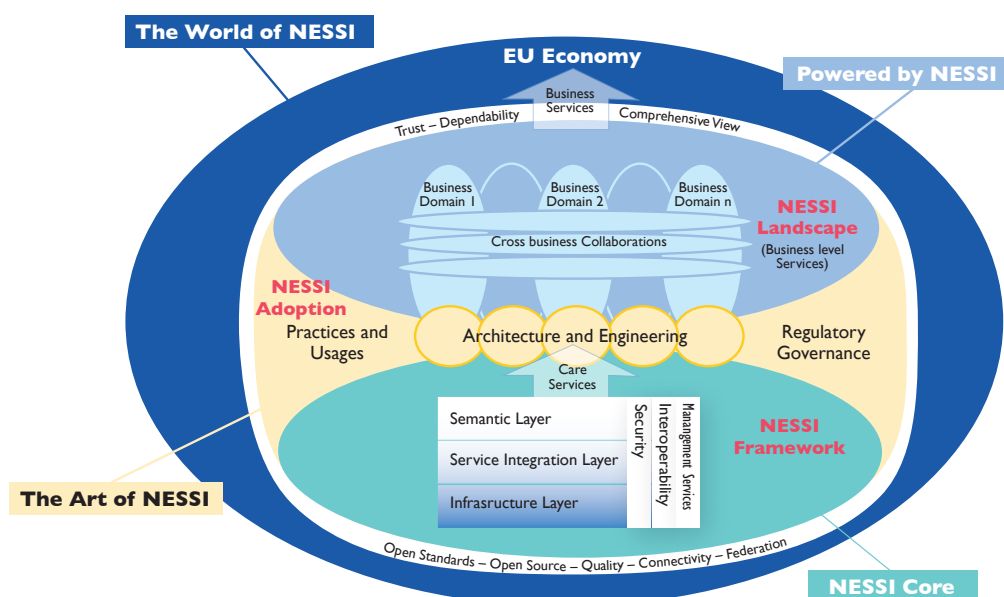


Industrial and academic research communities often pursue their research without paying sufficient attention to the coordination of their activities. The consequence is that sometimes research results emerging from academic institutions may not tightly align with the changing needs of industry, thereby limiting significantly the industrial exploitation potential of the research results. Conversely, industry may not always follow closely enough the latest technological research in academia, thereby hampering its own innovation potential. With a view to improving coordination of their research activities and agendas, with support from the European Commission, a number of leading ICT companies in Europe launched in September 2005 a 'European Technology Platform' (ETP) for the area of software, Grids and services called the 'Networked European Software and Services Initiative' (NESSI).

The NESSI initiative aims at shaping a vision for the emergence of a service-oriented economy in Europe and building an ecosystem that supports it. NESSI's ambition is to develop a visionary strategy driven by a common strategic research agenda (SRA), where innovation and business strengths are reinforced. The NESSI SRA covers technologies for secured and trusted service architectures,

software and Grid infrastructures, in addition to trustworthy policies to boost the development of software and service-oriented architectures in Europe.

The specific support action NESSI-Grid serves and helps implement the objectives of the NESSI technology platform. In particular, it focuses on the next generation Grid technologies that will foster the provision of IT services as utilities. From an industrial perspective, NESSI-Grid will develop further the SOKU (Service-oriented Knowledge Utility) concept as defined by the Next Generation Grid Expert Group. It will help industry, research organisations, public authorities, financial institutions and other stakeholders across the EU to join forces and facilitate coordination of their actions for the implementation of NESSI's strategic research agenda. NESSI-Grid will also address related structural, educational and regulatory matters (standards, intellectual property rights, research infrastructure, and training). For example, it will promote efforts towards standardisation and interoperability, enabling flexible use of service components and the underpinning ICT infrastructures across different domains in cross-business collaborations.



The NESSI holistic view
Source: NESSI.



Grids and the i2010 initiative

In June 2005, the Commission adopted the 'i2010: European information society 2010' initiative to foster growth and jobs in the information society and media industries. i2010 is a comprehensive strategy for modernising and deploying all EU policy instruments to encourage the development of the digital economy: regulatory instruments, research and partnerships with industry. It proposes to do this by focusing on three policy priorities: to create an open and competitive

single market for information society and media services within the EU; to increase EU investment in research on information and communication technologies (ICT); and to promote an inclusive European information society.

In the first annual report for i2010, Grid technologies and service-oriented architectures are identified as key enabling technologies for new service architectures that allow the integration of business

processes within companies and across networks of companies. Grid-powered service-oriented ICT infrastructures are becoming the future backbone of the competitive European enterprise in the knowledge society.

International cooperation on Grid research — Europe and Asia setting the pace together

The Grid is about breaking organisational boundaries, sharing resources and facilitating collaboration between distant teams and organisations. The Grid research community has always contributed to the Grid developments independently of their country of origin, and many European teams are collaborating with teams in other regions as well as with international forums like the Open Grid Forum (OGF), or previously the Global Grid Forum (GGF).

To complement these activities and taking into account the growing importance of Asia in Grid research and applications, the European Commission has supported a number of initiatives that aim at deepening the

collaboration between European and key Asian Grid research communities. The ultimate objective is to promote collaboration at the level of large Grid initiatives and programmes in both regions, and to set up a framework for sustainable cooperation.

Starting with the Grid@Asia project, since 2005, the Commission supports collaboration between the Grid research communities in the EU and east Asia. The EchoGrid project deepens the collaboration between the EU and China by developing short-, mid-, and long-term visions in the field, relying on European and Chinese experts, both from academia and

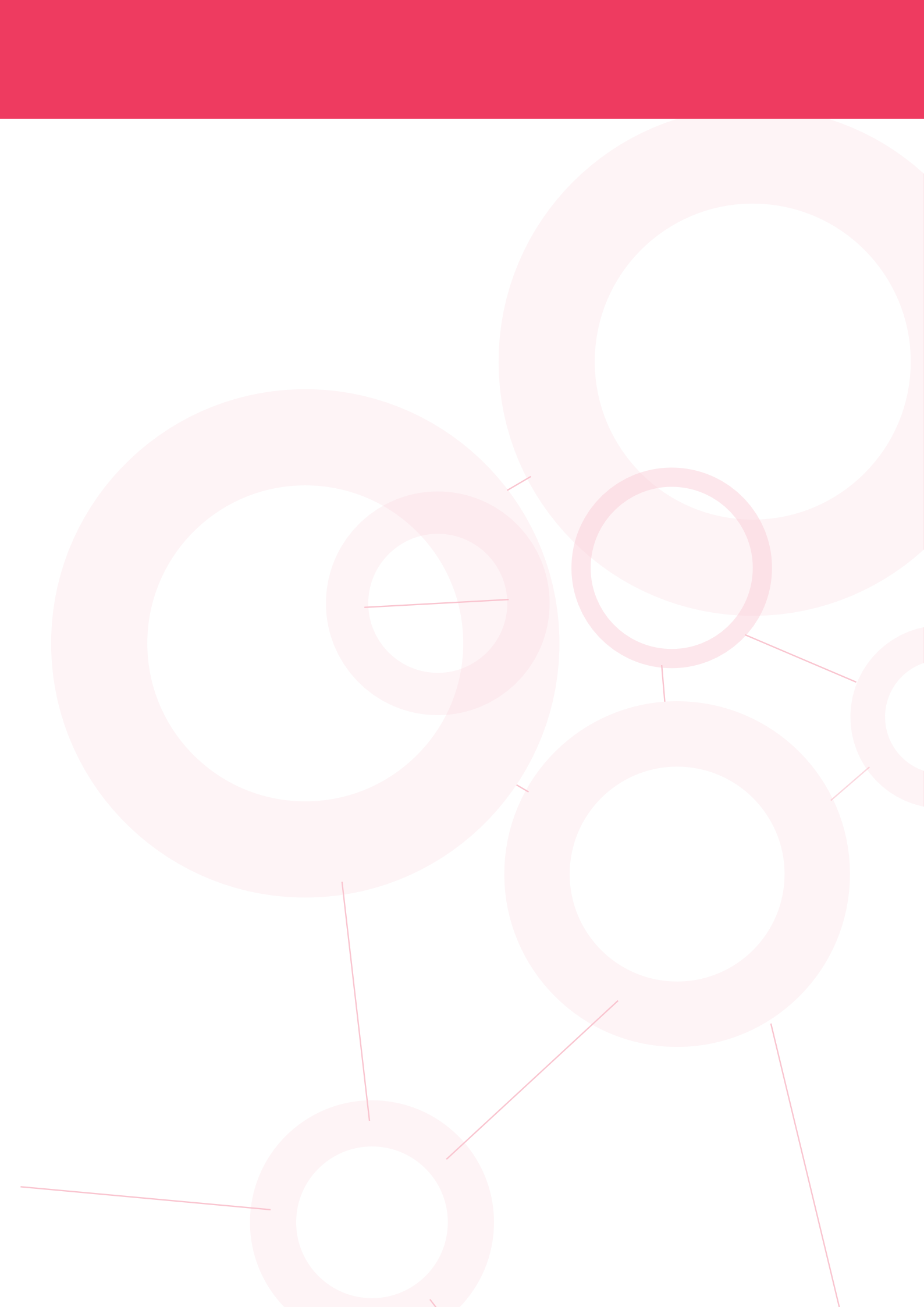
industry. It also promotes cross-fertilisation between Grid-related projects and initiatives in Europe (e.g. NESSI, CoreGRID, NGG3) and China (e.g. the '863 high-tech programme'), thereby stimulating lasting cooperation on Grid research, Grid open standards, and Grid middleware and applications interoperability. Additionally, a number of research projects are implementing this collaboration with Asian partners and initiatives. They address core technological challenges as well as industrial Grid applications.





Interim achievement sheets of the Grid Research projects launched in 2004

15	Akogrimo	41	K-Wf Grid
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Access to knowledge through the Grid
in a mobile world

Akogrimo



Scope

The convergence of mobile networks with the Internet enables new kinds of applications. Imagine the case of a German citizen travelling in a rural area of Spain. Suddenly, his health monitoring equipment detects a potential heart attack. In order to safeguard this person, an emergency procedure needs to be started which requires different organisations, authorities and individuals across Europe to share data and information and to work collaboratively so as to react as quickly as possible to the situation. For making this scenario possible, an agreement to collaborate, including multimedia communications (for example, a voice link between the patient and a medical expert) that consider the context of the users, needs to be setup. This collaboration, which has not been possible so far, must take place in a very short time. The EU-funded research project Akogrimo is realising a reference architecture and a framework that both allow the creation of such mobile dynamic virtual organisations, thus opening possibilities for new applications far beyond the current three targeted application sectors of e-health, e-learning and disaster handling / crisis management.

Innovation and functionality

Akogrimo aims to deliver a framework that enables the application of Grid technologies as a general service provision platform for telecom operators and service providers on next generation networks. The goal of showing the benefits of adapting existing infrastructures, for example for identity management or cross-organisational accounting, has already been proven by an integrated prototype demonstrating Grid technologies as a tool for pervasive and context-aware applications.

Existing Grid solutions targeting a specific application domain or area, such as high-performance computing, contain the risk that the developed solutions do not include business models that support a sustainable deployment on future more commercially oriented networks. Akogrimo addresses this risk through integration at the Grid and network layers and more importantly by a holistic view on the value network of business roles involved in such a value-added service provision infrastructure.

The **Akogrimo mobile Grid reference architecture** and its instantiation into the **Akogrimo framework** define innovative solutions for combining Grid services with SIP-based applications, context awareness, enactment of Service Level Agreements in fast changing environments, characterised by session and device mobility and pervasiveness amongst many other aspects.

Positioning in a global context

Akogrimo is a leading project in the sense that it has successfully demonstrated the deployment of Grid services in a mobile IPv6 environment. Furthermore, as a forerunner, it has looked into the tight integration of infrastructure services at the network level (for example,

Contract number

004293

Type of project

Integrated project

Project coordinator

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Project website

<http://www.mobilegrids.org>

Maximum Community contribution to project

EUR 7 000 000

Project start date

1 July 2004

Duration

39 months

for identity management or cross-organisational accounting) and successfully integrated them into a framework.

Akogrimo has also pioneered the work on business models defining a framework for cooperation between telecom operators and service providers providing mutual benefit.

Contribution to standardisation and interoperability issues

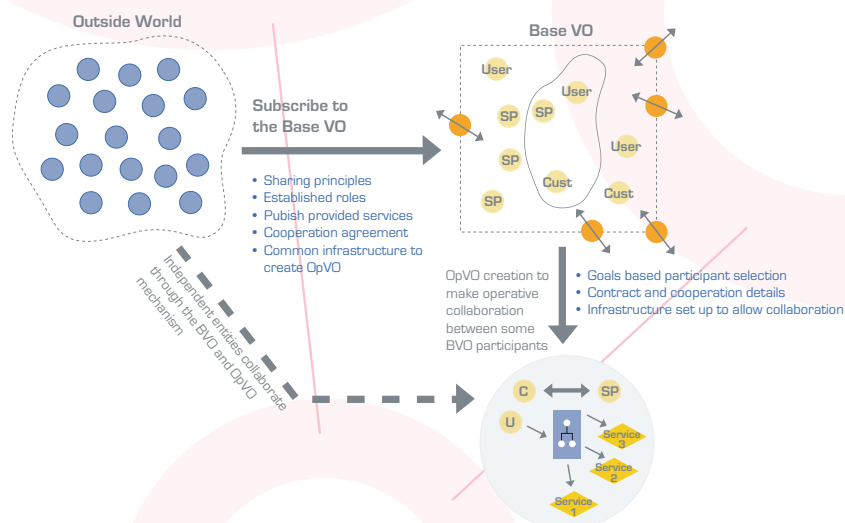
The project is actively working to influence the TelCo-CG and GRAAP group at OGF and has in particular already contributed its business modelling framework defining the role of TelCos in Grids.

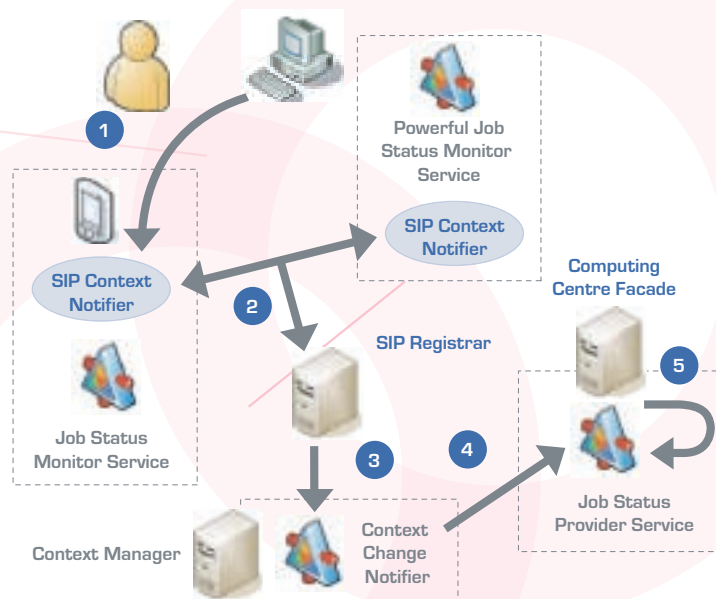
The **Akogrimo framework** is in line with standards on the Grid but also, more importantly, with developments in the area of networks allowing a deployment of the framework on the Internet of tomorrow based on mobile and secure IPv6.

Target users and sectors in business and society

In order to validate the project achievements, three application scenarios, targeting different users and sectors, are being targeted:

- **a medical emergency response system:** realisation of a pervasive Grid application combining, in a single workflow, human actors, local and global ICT resources and services;
- **a mobile learning scenario:** creating an environment where collaboration between people in the field and global Grid resources can be combined;
- **a disaster handling and crisis management system:** demanding the combination of local and global Grid resources to enable quick reactions to fast-changing conditions and environments.





Overall benefits for business and society

For a wide take-up of Grids, it is necessary to have an open framework where, in particular, small and medium-sized enterprises can plug in their services. As of now, Grid solutions are either extended cluster solutions for intra-organisational use or require significant investment in infrastructure rather than with application integration. Such an investment needs the support of large infrastructure providers such as telecom operators with business models that allow all stakeholders in the value network to achieve benefits. The research performed within Akogrimo is the initial step towards this goal.

Example of a business scenario

The main business objective of the testbed in e-health is the early recognition of heart attacks (or apoplectic strokes) and the proper treatment of patients as fast as possible by combining patient monitoring, emergency detection and the subsequent rescue management. This scenario validates the key properties of cross-organisational service provisioning by ambulances, medical experts, hospitals, network operators, application services providers and police services. Also validated are the mobility of patient monitoring and diagnosis equipment, mobile and stationary knowledge services provided by cardiologists and decision support systems, as well as the integration of traditional telecom services such as voice and video communications with value-added IT services.

Achievements to date and anticipations

The major achievement to date was the successful demonstration of the integrated prototype spanning about 20 different machines, and comprising network, Grid infrastructure and application services running on a mobile IPv6 infrastructure, at the first Akogrimo public workshop. The prototype has been realised using the Globus Toolkit 4 and the WSRF.NET toolkit working together to realise an initial version of the medical emergency response system.

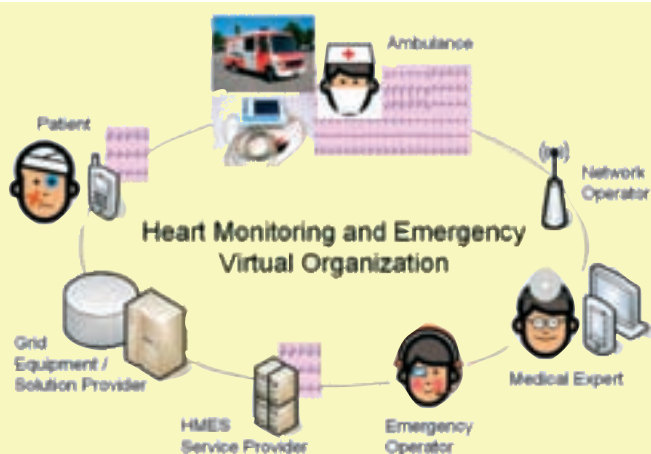
This was clearly made possible by other project achievements such as the overall reference architecture outlining the interaction between

network, Grid and application level services and the corresponding detailed design of the components. The interaction between the components was validated and simulated before being implemented to prevent problems during integration.

The overall architecture that has been developed has not only been derived from preset validation scenarios but also took into consideration early results arrived at, such as the study of market and regulatory environment and, most importantly, the business modelling framework.

From a technical viewpoint, these preliminary achievements, besides typical areas such as workflows, service level agreements, virtual organisations and execution management, have

focused on integrating network and Grid level services. Within Akogrimo, the following unique activities have been performed, amidst many others: the integration of Grid toolkits with identity and accounting network infrastructures; the tight integration of Grid services and SIP-based applications; the virtualisation of network resources to enable quality of service demands to be communicated from applications to the network, communicating context information, such as device capabilities, to the service provision layers; and the realisation of session and device mobility.



Project partners

Organisation name and country

TELEFONICA INVESTIGACION Y DESARROLLO SA UNIPERSONAL	ES
UNIVERSITAET STUTTGART	DE
UNIVERSIDAD POLITECNICA DE MADRID	ES
ATOS ORIGIN SA	ES
CENTRO DI RICERCA IN MATEMATICA PURA ED APPLICATA – CONSORZIO	IT
BOC ASSET MANAGEMENT GMBH	AT
INSTITUTO DE TELECOMUNICACOES	PT
UNIVERSITAET ZUERICH	CH
COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS	UK
TELENOR ASA	NO
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
DATAMAT S.P.A.	IT
UNIVERSITAET HOHENHEIM	DE
QINETIQ LTD	UK
UNIVERSITY OF SOUTHAMPTON	UK

European research network on foundations, software infrastructures and applications for large-scale distributed, Grid and peer-to-peer technologies

CoreGRID



Scope

Over the last 10 years European Grid researchers have gained a considerable international reputation for their excellence in advancing knowledge and state-of-the-art in Grid technologies. Much of this excellence has been, however, in the hands of diverse European academic and research organisations that have been working independently on similar topics and challenges, often in a fragmented and uncoordinated manner.

The CoreGRID Network of Excellence is tackling the problem of research fragmentation by bringing together leading research teams from 42 institutions across the continent. The network is operated as a single European Research Laboratory structured into six highly-focused 'Institutes', each of which will focus on specific scientific and technological themes that today presents a challenge for advancing Grid and peer-to-peer technologies. This will be achieved by structuring research activities and further advancing scientific excellence in such fields as distributed systems and middleware, programming models, tools and environments, system architectures and infrastructure monitoring. CoreGRID's long-term vision (spanning over the next 10–15 years) requires that CoreGRID must be sustainable and must evolve autonomously when initial EU funding will cease.

CoreGRID has already laid the foundations for realising its very ambitious goals of durable integration and excellence. In the years to come, the network is committed to further advancing towards sustainable integration by actively involving industrial stakeholders in jointly defining the roadmaps and strategies to achieve economic impact.

Innovation and functionality

The network fosters the emergence of strong research-innovation links through its Institutes. Two examples of valuable results already emerging from these Institutes are:

- The Institute on *Programming Models* has defined a set of advanced features to be included in an innovative component based programming model (the Grid Component Model) facilitating the work of Grid programmers, thus underpinning the realisation of the 'invisible Grid'.
- The Institute on *Resource Management and Scheduling* developed a joint research roadmap to create a coordinated scheduling model for the architectural and algorithmic perspective of Grids.

In addition to the individual Institutes' activities, the network is addressing research fragmentation by working on the following horizontal tasks:

- A trust and security reference framework to ensure a common understanding and approach to the various issues related to trust and security in Grid environments.
- A reference specification for Grid testbeds providing requirements, procedures and recommendations for the operation of testbeds to be used for research assessment.

Contract number
004265

Type of project
Network of excellence

Project coordinator
GEIE ERCIM

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Project website:
<http://www.coregrid.net>

Maximum Community contribution to project
EUR 8 200 000

Project start date
1 September 2004

Duration
48 months

- A comprehensive programme for researcher mobility within and across Institutes, facilitating the exchange of skills and research experiences around focused research tasks.

Positioning in global context

The project is committed to making the European Research Laboratory internationally recognised, acting as a single entity vis-à-vis the ICT industry, other European and national/regional projects, institutions, programmes and initiatives. By talking to international counterparts with a single voice, European Grid researchers can spread their messages more effectively and make their research achievements more visible in an international context, both at academic and industrial levels.

Contribution to standardisation and interoperability issues

Although the CoreGRID Network of Excellence is addressing long-term foundational aspects of Grid not necessarily bound to ongoing standardisation processes, the project has identified the need to closely follow and contribute to pre-standardisation activities. The network is a member of the Global Grid Forum, where it plays an important role as a European-scale research institution. The network also has links to the European Telecommunication Standards Institute (ETSI) where several partners are participating in the undergoing Grid standards and interoperability test activities.

Target users/sectors in business and society

The CoreGRID network targets two types of users/sectors:

- The academic/research community: the excellent scientific results generated through the network are spread across the research community within and outside Europe in order to foster collaboration and consolidate the European leadership in Grid technologies and foundations.
- The industry/business community: CoreGRID has set strong links with the European ICT industry in order to stimulate the early adoption of innovative technologies by industrial stakeholders and maximise the economic impact of Grid research.

Overall benefits for business and society

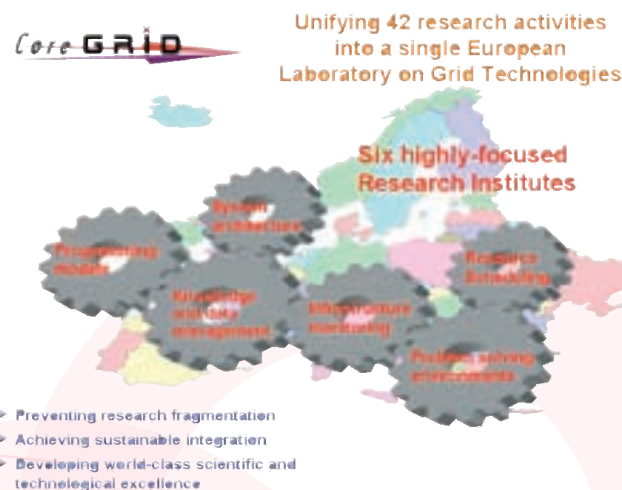
The main communication link between CoreGRID and industry is an Industrial Advisory Board (IAB), composed of about 20 representatives of major European industrial organisations. The IAB main goals are:

- to identify long-term technology needs and challenges that are relevant to industry;
- to provide the network with Grid research validation cases;
- to identify the market sector(s) to be addressed within the Grid-user community, in order to ensure a quick adoption of research results;
- to feed the network with recommendations on commercially-relevant research objectives.

The IAB regularly advises the different Institutes about market trends, emerging requirements and challenges to be addressed, giving recommendations on the most relevant research objectives and strategies that could increase the impact of the researchers' work in the future.

Further example(s) of business scenario(s) or use case(s)

The IAB has defined a 'Grid' as a virtualisation layer enabling new business roles for a number of exploitation players, including physical



resources providers, hosted application system providers, common functionality providers (authorisation, accounting...), as well as application and task oriented virtual organisations. The identified players are expected to experience the benefits compared to a vertically integrated model such as:

- better use of physical resources;
- flexible deployment and management of applications;
- standardised support functions for easier/faster development and integration;
- lower initial cost for application users and flexible upgrade plans.

Achievements to date and anticipated

The first CoreGRID achievements towards the construction of a sustainable European 'Grid Lighthouse' are:

- Increase of visibility of Grid research community in the international ICT and Grid research context through the active sponsorships of Global Grid Forum as well as the support of highly-reputed international conferences, such as HPDC and EuroPar.
- Opening up academic research agendas in order to identify business-oriented research priorities, leading to the spin-off of new CoreGRID activities, for example in service oriented architectures and systems.
- Development of new ideas to anticipate technological trends and promote commercially relevant and promising research in such areas as next distributed Operating Systems.
- Active involvement of industrial stakeholders to help identifying take-up opportunities beyond public-funded programmes, thus stimulating the investment of industrial stakeholders in CoreGRID institutes.
- Delivery of more than 40 joint technical reports and papers accepted in peer-review conferences, workshops and journals, including three highly reputed CoreGRID series volumes, thus advancing European excellence.
- Increasing integration between partners through the organisation of summer schools, mobility programmes, fellowship programme and researcher exchange programme.

In the years to come, the CoreGRID results will contribute to further increase the competitiveness and expertise of the European industry in the exploitation of Grid technologies.

Project partners*Organisation name and country*

GEIE ERCIM	FR
CENTRE D'EXCELLENCE EN TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BE
INSTITUTE FOR PARALLEL PROCESSING — BULGARIAN ACADEMY OF SCIENCES	BG
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	FR
TECHNISCHE UNIVERSITEIT DELFT	NL
ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE	CH
FRAUNHOFER GESELLSCHAFT E.V.	DE
FORSCHUNGSZENTRUM JUELICH GMBH	DE
UNIVERSITAET STUTTGART	DE
FOUNDATION FOR RESEARCH AND TECHNOLOGY — HELLAS	EL
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	UK
ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN)	IT
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	FR
KUNGLIGA TEKNISKA HOEGSKOLAN	SE
MASARYKOVA UNIVERZITA V BRNE	CZ
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS	UK
SICS, Swedish Institute of Computer Science AB	SE
MAGYAR TUDOMANYOS AKADEMIA SZAMITASTECHNIKAI ES AUTOMATIZALASI KUTATO INTEZET	HU
THE QUEEN'S UNIVERSITY OF BELFAST	UK
WESTFAELISCHE WILHEMS-UNIVERSITAET MUENSTER	DE
UNIVERSITA DEGLI STUDI DELLA CALABRIA	IT
THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UK
UNIVERSITY OF WALES, CARDIFF	UK
UNIVERSIDAD DE CHILE	CL
FACULDADE CIENCIAS E TECNOLOGIA DA UNIVERSIDADE DE COIMBRA	PT
UNIVERSITY OF CYPRUS	CY
UNIVERSITAET DORTMUND	DE
UNIVERSITA DEGLI STUDI DI LECCE	IT
UNIVERSITE CATHOLIQUE DE LOUVAIN	BE
THE UNIVERSITY OF MANCHESTER	UK
THE UNIVERSITY OF NEWCASTLE UPON TYNE	UK
UNIVERSITAET PASSAU	DE
UNIVERSITA DI PISA	IT
HAUTE ÉCOLE SPÉCIALISÉE DE SUISSE OCCIDENTALE	CH
UNIVERSITY OF WESTMINSTER	UK
UNIVERSITAT POLITECNICA DE CATALUNYA	ES
VRIJE UNIVERSITEIT AMSTERDAM	NL
VALTION TEKNILLINEN TUTKIMUSKESKUS	FI
KONRAD-ZUSE-ZENTRUM FUER INFORMATIONSTECHNIK BERLIN	DE
AKADEMICKIE CENTRUM KOMPUTEROWE CYFRONET	PL

Data-mining tools and services for grid computing environments

DataMiningGrid



Scope

The quality management department of an automotive industry operating worldwide seeks to detect at an early stage the possible faults of their new luxury car. It needs to monitor and adjust performance parameters managed in complex, distributed networked computing environments. To facilitate this, the company employs data-mining tools to analyze computer logs (e.g. of all the on-board units or of the diagnostic computer managed by its globally distributed service centres). The results of the DataMiningGrid project will facilitate the implementation of such a grid-enabled data mining scenario.

Emerging complex problem-solving environments (e.g. business intelligence environments) are characterised by increasing amounts of digital data and rising demands for coordinated resource sharing across geographically widely dispersed sites. *Data mining* and *Grid computing* are the key technologies to address these challenges. The DataMiningGrid project is developing generic and sector-independent data mining tools and interfaces for the Grid. The solutions are evaluated on the basis of a selected set of representative demonstrator applications from different sectors.

Innovation and functionality

To facilitate data mining in Grid computing environments, the project has designed a novel and standard-compliant systems architecture that integrates the following key technology components:

- Grid middleware functionality provided by the Globus Toolkit software;
- a resource broker;
- a workflow manager and editor;
- grid-enabled data access and integration services; and
- a workload management component for compute-intensive applications.

Contract number

004475

Type of project

Specific targeted research project

Project coordinator

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Project website

<http://www.datamininggrid.org>

Maximum Community contribution to project

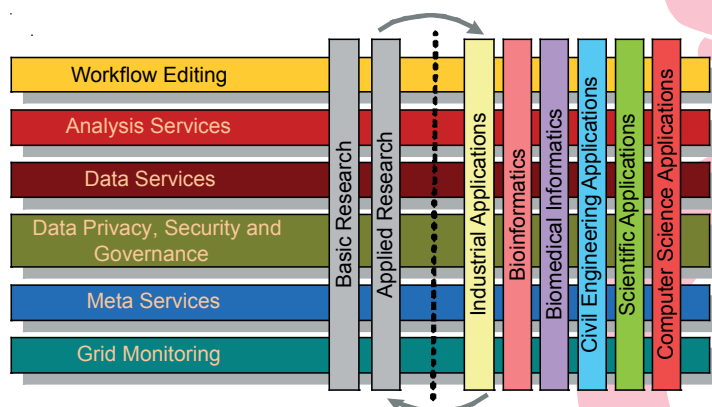
EUR 1 883 000

Project start date

1 September 2004

Duration

27 months



On the basis of the DataMiningGrid systems architecture, the project is developing three components critical to building and deploying data mining solutions in Grid computing environments: grid-enabled:

- Data-mining data interfaces and services that allow users to identify (locate), access, integrate and interface distributed data sources and data-mining programmes in a flexible way;
- Data-mining workflow management tools facilitating the composition, execution and management of data-mining workflows;
- Text-mining components enhancing grid-based problem-solving tasks, including distributed text mining and passage retrieval, automatic ontology construction, and distributed kernel methods for text mining.

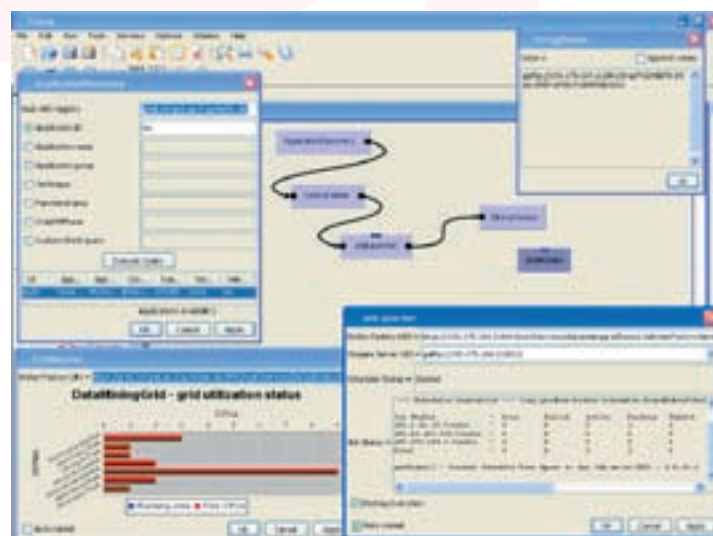
Positioning in global context

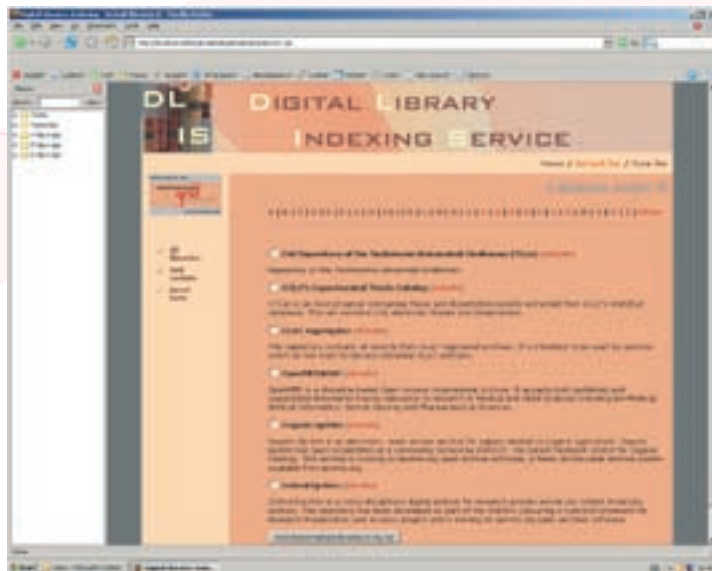
Many emerging Grid solutions require data mining in some form. The DataMiningGrid project is one of the first that is making a serious attempt at developing a conceptual and technical framework for data mining in grid-computing environments.

Contribution to standardisation and interoperability issues

The project has identified the need for standardisation in a number of areas critical to data mining in Grid computing environments. These include:

- Exchange formats for data and data mining models to be used in grid-enabled data mining environments.
- Mechanisms and formats for formulating pre-processing operations in a platform-independent manner useful in Grid computing environments.





Currently, the DataMiningGrid project has joined forces with other EC-funded projects to explore standardisation in these areas.

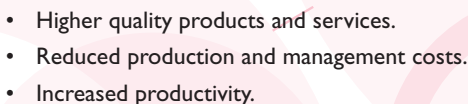
Target users/sectors in business and society

All users and sectors employing data-mining techniques could potentially benefit from the project results. Target users for DataMiningGrid project results can be classified in four groups:

- End users with in-house need of high-quality, grid-enabled data-mining applications (e.g. car manufacturers).
- Software service providers that develop customised, grid-enabled data-mining applications for industry.
- Software vendors seeking to improve their products by adding grid-enabled data mining components.
- Research organisations, universities and communities could benefit from the DataMiningGrid in research and education areas.

Overall benefits for business and society

In today's business world, rational decision-making is fundamentally dependent on having the right information at the right time and place. Maximising the exploitation of large amounts requires intelligent knowledge filters which provide fast and easy ways for extracting useful information from ubiquitous data resources. The DataMiningGrid technology facilitates the development of business intelligence applications that enable the industry to make informed decisions based on their data. This ultimately leads to:



In the health sector, we are looking at a grid-enabled and privacy-preserving analysis of geographically widely distributed medical patient records. If successful, this use case will demonstrate various advantages gained from employing Grid technology for this type of task.

Achievements to date and anticipated

- Validated specification/design of DataMiningGrid components and systems architecture; and
- Implementation of an early prototype.

Project partners

UNIVERSITY OF ULSTER	UK
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
DAIMLERCHRYSLER AG	DE
TECHNION – ISRAEL INSTITUTE OF TECHNOLOGY	IL
UNIVERZA V LJUBLJANI, FAKULTETA ZA GRADBENISTVO IN GEODEZIJO, D.O.O.	SI

Advanced Grid research workshops through European and Asian cooperation

Grid@Asia



Scope

The Grid@Asia project is **fostering collaboration** between the European Union and Asia in the field of Grid research and technologies. This initiative is focusing on stimulating scientific cooperation with China and South Korea, before potentially expanding its geographical coverage to reach out to other Asian countries.

To this end, Grid@Asia activities are relying on **three major steps**:

1. Identification of the Chinese and South Korea key players in Grid research and technologies.
2. Organisation of focused workshops around EU/Asia research and industrial agendas.
3. Establishment of sustainable cooperation and dissemination activities.

This initiative builds on the local support of the Asian partners to ensure on-site organisation, links to the national Grid programmes, enhanced visibility in Asia and the participation of high-profile industrial and scientific Grid delegations.

Innovation and functionality

Grid@Asia promotes innovative Grid-related technologies in both China and Korea, with the objective to facilitate the integration of Asian teams within strategic EC funded projects. Relying on a core of leading European Grid research institutes, Grid@Asia is **defining a joint research agenda to address international Grid priorities**.

Positioning in the global context

By strengthening cooperation between both communities, Grid@Asia is building strong links with the Grid community in the two Asian countries involved, and is preparing the first steps towards a solid foundation for sustainable and long-term collaboration.

The first workshop organised in Beijing focused on Grid research activities and allowed for the establishing of contacts and exchange information among European and Asian teams in the field. A second workshop in Shanghai focused on building collaborations among the main EU and Asian Grid initiatives, with a particular emphasis on concrete and exploitable Grid applications.

By weaving additional links between European and Asian Grid research communities, Grid@Asia supports long term international cooperation, in particular through the collaboration between the main Asian Grid programmes with leading European Grid initiatives (such as networks of excellence, integrated projects, STREPS,...), both within FP6 and the forthcoming FP7.

Contract number

I5994

Type of project

Specific support action

Project coordinator

GEIE ERCIM

Contact person

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Project website

<http://www.gridatasia.net>

Maximum Community contribution to project

EUR 300 000

Starting date

1 April 2005

Duration

18 months

Contribution to standardisation and interoperability issues

The sharing of scientific experience between European and Asian projects facilitated by Grid@Asia actions and the extensive use of open source software, is contributing to the joint definition and adoption of Grid standards. This supports the European Grid community in efforts to disseminate its technology and promotes the adoption of common Grid standards worldwide.

Achievements to date and anticipated

Relying on three core players in Asia (Beihang University and the Shanghai Jiao Tong University in China, and the Korea Institute of Science and Technology Information, KISTI Supercomputing Center), Grid@Asia has been rapidly federating and associating many of the leading Chinese Grid stakeholders in its activities, as well as the main Grid programmes.

Grid@Asia has also promoted joint collaborations in calls for proposals in the EU's IST FP6 programme. In particular, the IST Call 5 on Grid technologies resulted in a first group of projects with joint collaborations with Chinese partners, while the IST Call 6 that specifically addressed international cooperation on Grid technologies with China, has received a large number of proposals for collaborations between major EU and Chinese Grid initiatives.

Next steps

Grid@Asia is preparing the organisation of a third and final workshop, to be held in Korea before the end of 2006. It is expected to bring together more than 150 participants from research and industry. The workshop programme will focus on Grid applications. It will display Grid demonstrations and showcases, while promoting the launch of FP7 and supporting its new strategic priorities.

Project partners

Organisation name and country

GEIE ERCIM	COORDINATOR	FR
ERCIM MEMBERS CONTRIBUTING TO THE PROJECT		
INRIA		FR
CNR		IT
FHG		DE
ASIAN PARTNER INSTITUTES		
BEIHANG UNIVERSITY		CN
KISTI		KR
SHANGHAI JIAO TONG UNIVERSITY		CN

ERA pilot on a coordinated Europe-wide initiative in Grid research

GridCoord



Scope

In Europe, major Grid activities started in the beginning of this decade, both at national and EU level. At EU level, funding for Grid projects came from framework programmes 5 and 6. Today, the EU, with its Member States, is a leading player in Grid research and has the strength to capitalise on its expertise by playing a world leadership role in Grid technologies and applications. However, if Europe wishes to compete with leading global players, it must better coordinate its various, fragmented efforts towards achieving critical mass and the potential for a more visible impact at international level. The above considerations are the motivation behind the EU funded GridCoord project, an ERA (European research area) pilot initiative on coordinated Grid research in Europe.

This objective of a European research area for Grid research combines three related and complementary concepts: the creation of an 'internal market' in research, an area of free movement of knowledge, researchers and technology, with the aim of increasing cooperation, stimulating competition and achieving a better allocation of resources; a restructuring of the European research fabric, in particular by improved coordination of national research activities and policies, which account for most of the research carried out and financed in Europe; the development of a European research policy which not only addresses the funding of research activities, but also takes account of all relevant aspects of other EU and national policies.

Building such a European research area for Grid research is a long term goal, which can only be reached if all European players from strategist to researchers, from academia to industry, from regional to national and EU programmes subscribe and contribute to it. Complementary to other projects and initiatives like, for example, the network of excellence CoreGrid, the specific support action GridCoord is to be considered as the first step towards better coordination of huge but fragmented national and EU efforts.

Towards better coordination of national and EU efforts

As a baseline to improve coordination, GridCoord has carried out a survey of European Grid research activities in universities and research labs and one of European funding bodies. They show that significant differences exist in the approaches that are currently utilised in the various countries, each one having its intrinsic strengths. This multinational character of Grid research in Europe is a valuable source of innovation. The surveys illustrate that the GridCoord countries have a prestigious research tradition in the areas that contributed 'to build' the Grid technology: high-performance computing, parallel and distributed processing, networking infrastructures, software engineering in objects/components platforms, database and knowledge discovery, cooperative computing, as well as in the scientific application sectors: computational physics, high-energy physics, computational chemistry, life sciences, genomics, medicine, astrophysics, geophysics, earth observation systems,

Contract number

511618

Type of project

Specific support action

Project coordinator

Universiteit van Amsterdam

Contact person

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Project website

<http://www.gridcoord.org>

Maximum Community contribution to project

EUR 960 000

Project start date

1 July 2004

Duration

24 months

weather prediction. Some significant applications with industrial impact are also emerging in engineering, telecommunications, drug design, data mining, e-banking, and supply chain management.

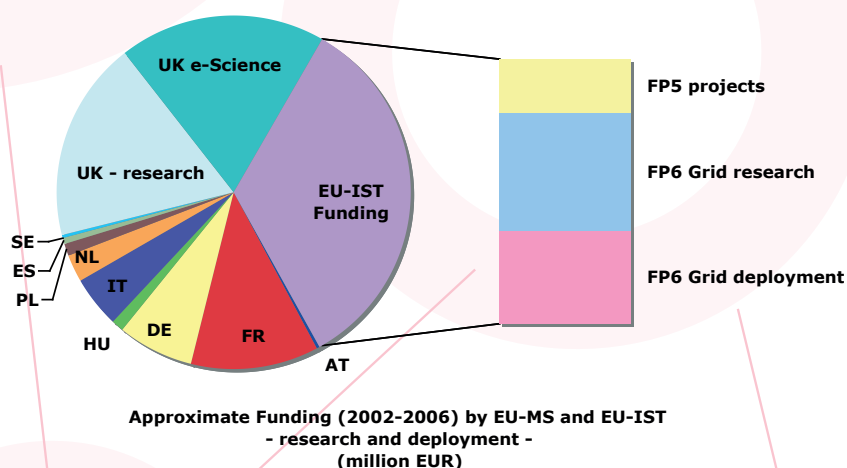
In addition to an industrial and several more technology and interoperability oriented workshops, GridCoord organised **two policy workshops**. Both provided a forum at which participants from national funding authorities and leaders of national Grid initiatives met to individuate and share common interests and synergies. Because of the necessity of broadening the use of Grid technologies beyond e-science, towards their use in business and industry, participants from industry and business participated. GridCoord suggests to the European Union that it continues the dialogue on a regular basis by holding such policy workshops also in the future. GridCoord has created a dialogue and it is now up to the Member States and the Commission to take up the issue and ensure the further promotion of the basic idea.

Grid R&D vision and roadmap

The Grid vision embraces technology issues, human factors and administrative issues, all of which have to be addressed by a Grid roadmap. The ultimate goal of the Grid vision is that of an ecosystem where resources can be used, shared and traded and where the evolution of the Grid is the backbone ICT infrastructure for research, commerce and industry. This vision is usually referred to as a **service economy** with the sharing and trading of resources via services.

Vision definition: A world-leading Grid utility of resources, tools and applications that is a key enabler for European research, industry and commerce. In order to provide such a Grid utility, adequate services for

Countries	million EUR
AT	2,7
FR	98,3
DE	58,8
HU	8,6
IT	40,7
NL	20,0
PL	9,1
ES	4,5
SE	2,3
UK - research	155,0
UK e-Science	158,0
FP5 projects	58,0
FP6 Grid research	125,0
FP6 Grid deployment	100,0
Total	841,0



science and business require strong European middleware with broad interoperability.

Roadmap: To realise the Grid vision, a roadmap is proposed to establish the European Union as:

- the centre of excellence in Grid middleware research technologies and tools in the short to medium term and thereby creating an EU Grid technological base [short term is regarded as within 2 years, medium term within 2 to 5 years and long term beyond 5 years];
- the centre of excellence in Grid applications design, development, deployment, hosting and use in the medium term and thus developing the EU Grid technological base and laying the foundation for widespread use of Grid technological exploitation; and
- having a world-leading Grid service utility for the research community, industry and commerce in the medium to long term that is the means by which the EU can trade resources and services across the EU and globally.

The project suggests considering the following global recommendations towards establishing the vision and implementing the roadmap, for which EU programmes should act as an enabler:

- Creation of Grid research, development and education programmes in all Member States tailored to the needs of each Member State and across the EU in the short term and thus creating a Grid service technology culture across Member States and laying the scientific and technological foundations for widespread Grid deployment.
- Establishment of global standards-based and interoperable middleware technologies in the short to medium term and thus enabling national programmes to develop their strengths and let the EU pool its expertise and take advantage of national strengths.
- Development of a virtual service economy for trading resources and services in the medium to long term and thus establishing the EU as the centre for service economy technologies, applications and business processes with consequent benefits to EU research, business and commerce.

EU programmes have an important strategic role across Member States. In particular they act as a catalyst for the coordination of activities between national Grid funding programmes in the short to long term, they leverage the national Grid investments and they enable the transfer of expertise across the EU, thereby establishing the EU as the centre for Grid technology and applications.

These above recommendations provide the potential themes and actions for EU programmes and associated MS programmes in the short, medium and long term.

Project partners*Organisation name and country*

UNIVERSITEIT VAN AMSTERDAM, INSTITUTE OF INFORMATICS, FACULTY OF SCIENCE	NL
UNIVERSITÀ DI PISA, DIPARTIMENTO DI INFORMATICA	IT
DEPARTMENT OF COMMUNICATION, COMPUTER AND SYSTEM SCIENCES, UNIVERSITY OF GENOA	IT
UNIVERSITÄT STUTTGART, HLRS	DE
QUEEN'S UNIVERSITY BELFAST	UK
ENERGY AND PHYSICAL SCIENCES RESEARCH COUNCIL (UNTIL 31.12.2005)	UK
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET AUTOMATIQUE	FR
UNIVERSITÉ DE NICE	FR
KONRAD-ZUSE-ZENTRUM FÜR INFORMATIONSTECHNIK BERLIN	DE
COMPUTER AND AUTOMATION RESEARCH INSTITUTE, HUNGARIAN ACADEMY OF SCIENCES	HU
UNIVERSIDAD POLITECNICA DE MADRID	ES
POZNAN SUPERCOMPUTING AND NETWORKING CENTER	PL
VINNOVA	SE
THE UNIVERSITY OF SOUTHAMPTON	UK
JOHANNES KEPLER UNIVERSITÄT LINZ (FROM 1 JANUARY 2006)	AU

Highly predictable cluster for Internet Grids

HPC4U



Scope

Imagine a weather forecast service that needs to provide several updated forecasts on a daily basis to be used by anyone from families planning trips to air traffic controllers directing commercial aircraft. The weather centre may well use a state-of-the-art high performance computing facility to run complex high resolution models using input data from sources as diverse as aircraft, balloons, satellites and ground observations. In order to be able to guarantee that a result is available on time, the analysis may be run in parallel in two separate computing environments in case a fault (such as a machine failing) should occur. This not only complicates an already complicated task, but it is also inefficient and costly. However, thanks to new technology developed by HPC4U, such a weather forecast could, in future, be run on one computing environment with a guarantee of a timely result.

HPC4U is developing innovative mechanisms to alleviate such business challenges. The project's integrated solution incorporates features such as fault tolerant operation, dynamic application relocation as well as a sophisticated resource management system. The software package implements fault tolerant capabilities for networking, message passing hardware and software, storage subsystems and servers.

Any organisation or enterprise with business critical projects that depend on computational resources but that also need to guarantee they can meet tight deadlines will benefit from a HPC4U-based solution.

Innovation and functionality

The HPC4U project is the first to yield a reliable, predictable, SLA-aware Grid middleware through innovative software technology. Innovation leads to key benefits for users, including:

- **Resilience:** HPC4U's technology offers this assurance for a critical project, whether commercial or for research, that a job will finish as expected regardless of system failures in the IT infrastructure.
- **Affordability:** The HPC4U software base blends the flexibility and cost advantage of open source software components with that of enterprise features provided in fully supported commercial components.
- **Modularity:** Components are built as modular units rather than one monolithic code base. This means that users can integrate only the features needed without affecting operation of the software.
- **Transparent usage:** The HPC4U features are implemented in a **transparent manner for applications**, enabling them to benefit from HPC4U features without the need to write specific code or recompile the software.

Contributions to standardisation and interoperability issues

- **Standards compliant:** In the HPC4U framework users can integrate any checkpointing mechanisms, storage and networking

Contract number

511531

Type of project

Specific targeted research project

Project coordinator

IBM FRANCE

Contact person

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Project website:

<http://www.hpc4u.eu>

Maximum Community contribution to project

EUR 1 700 246

Project start date

1 June 2004

Duration

36 months

modules. The top layer API interfaces will be **OGSA-compliant** ('open Grid service architecture') for Grid middleware software. To ensure this compatibility, the HPC4U partners are working in the related standardisation bodies.

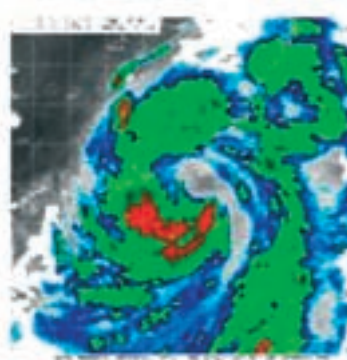
Target users/sectors in business and society

HPC4U will address those market segments with requirements to protect and optimise the usage of the Grid infrastructure for critical computational jobs such as industrial organisations which use computation for **product design** (aerospace, pharmaceutical, biotechnologies, automotive...) and other market segments who use computational power for **decision-making** (finance, insurance, weather forecasting, etc.).

Overall benefits

HPC4U can provide user organisations with a **better ROI** (return on investment) for their computational resources. Moreover, improved reliability and availability of IT resources paves the way for **shortened time to market**, particularly for companies using computational jobs in the product development process.

Example of business scenario



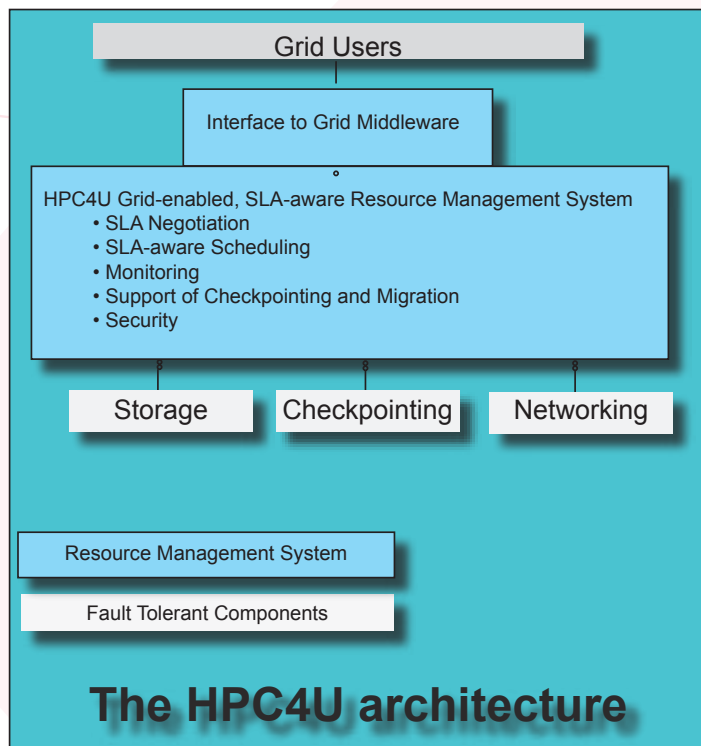
The Swedish Meteorological and Hydrological Institute (SMHI) runs daily weather forecasts using the Hirlam (high resolution limited area model) forecast model. The main forecast runs every 6 hours and the **time window** to ensure the result of the forecast is about one hour. The input data comes from several sources including: aircraft, balloon, satellite and ground observations.

To guarantee that a result is available on time, the weather forecast is run in parallel on two separate computers, one onsite and one offsite.

With HPC4U, the weather forecast will now only be run once. A timely **result will be guaranteed** due to the combination of software features such as checkpointing and migration with alternative hardware resources.

Achievements to date & anticipated results

After its first two years of research the HPC4U project has successfully completed implementation and testing of the 'proof of concept' phase.



This phase has resulted in an integrated solution that supports jobs on a single node with fault tolerant components. A non-commercial open source **HPC4U freeware stack** is already available for **evaluating and demonstrating** the benefits of the HPC4U software capabilities.

The final phase will realise two distinct solutions:

- **First solution:** The HPC4U Grid middleware is based on the **SLA-aware resource management system**, and interfaces to the virtualisation of the computational nodes with networking and storage. The solution will be made available using GNU Lesser General Public License.
- **Second solution:** A vertically **integrated and ready-to-use HPC4U middleware package**, which contains all necessary fault-tolerance mechanisms and leverages commercial components of several HPC4U project partners. This solution will be available via a commercial licence and will demonstrate the functionality and the performance of HPC4U technologies for demanding real-world scenarios.

Project partners*Organisation name and country*

IBM FRANCE	FR
FUJITSU SYSTEMS EUROPE LIMITED	UK
SEANODES SAS	FR
DOLPHIN INTERCONNECT SOLUTIONS AS	NO
SCALI AS	NO
UNIVERSITAET PADERBORN	DE
CENTRE D'EXCELLENCE EN TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BE
LINKOEPINGS UNIVERSITET	SE

Interoperability of virtual organisations on a complex semantic Grid

InteliGrid



Scope

European large-scale engineering industries — like many other sectors — face daily challenges in orchestrating the work of numerous organisations and experts towards a common goal. The design of a building, a bridge or an aeroplane requires a huge number of experts across Europe to cooperate, using a wide range of software tools and collaboration platforms. For example, a building that will be built in Germany may be designed by a Dutch architect, engineered by a French structural engineering consultancy, the construction works may be managed by British construction management experts, and when built it may be operated by a Spanish facility management organisation. In various stages even more specialists may need to get temporarily involved with the project, for example Greek earthquake engineering experts or Italian soil mechanics specialists. They constitute a **dynamic virtual organisation (VO)**. VOs need to share a common item of work — the virtual building — the data about the to-be-built and the as-built facility.

InteliGrid is developing a Grid infrastructure that provides, for the first time, a common platform to such dynamic virtual organisations. By leveraging the superior security, scalability and performance characteristics of **Grid technology** this platform provides specialists with the ability to rapidly collaborate and share resources. The true innovation of InteliGrid, however, lies in its focus on offering support for rich **semantics** in the infrastructure. The vision is make the Grid a 'semantic Grid', one where the infrastructure has the ability to dynamically 'manage the meaning' of data and where there is 'awareness' of the topic for which data is being used.

Innovation and functionality

Using **Grid technology** and **semantic interoperability** in a context of **dynamic virtual organisations** is a unique multidisciplinary area that the project is working in, combining the advantages of each area into a common collaboration platform. The platform itself must be aware of the domain concepts (e.g. car, airplane, skyscraper) that the virtual organisation is addressing. Such understanding of a resource is common in engineering. The Grid needs to be aware of (agree with and implement) the process and product ontologies of the domain and not only the ontology of IT resources.

Central to the technical solution developed within the InteliGrid consortium are the **ontology services** and the **semantic information management services** — handling the semantically-rich information both about the business domain (e.g. aerospace) as well as about the IT infrastructure (including the Grid) that is used to support the business processes. These services are then used by other InteliGrid developments which include:

- the InteliGrid platform with portal, document management, business object services, directory services and infrastructure services;

Contract number

004664

Type of project

Specific targeted research project

Project coordinator

Univerza v Ljubljani

Contact person

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Project website

<http://www.inteliGrid.com>

Maximum Community contribution to project

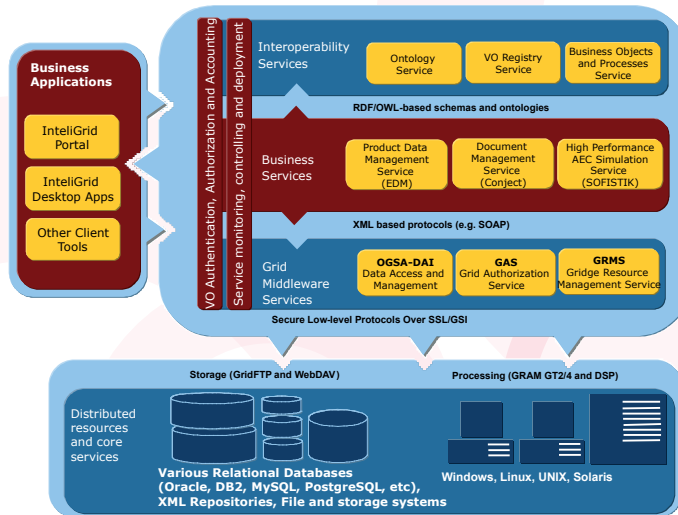
EUR 2 122 000

Project start date

1 September 2004

Duration

30 months



- platform compliant applications (several existing engineering design tools, engineering data management tools, facility management software, structural dynamics and rendering applications which will be made IntelGrid compliant);
- software libraries such as extensions to the Globus Application Toolkit (GAT) and other code.

Positioning in the global context

IntelGrid is the world-leading Grid project in the architecture, engineering and construction context. Using **Grid technology** and **semantic interoperability** in a context of **virtual organisations** is a unique multidisciplinary area that the project is working in. Contrary to other similar developments worldwide, IntelGrid is focusing on semantic collaboration among businesses, not high performance computing collaboration among laboratories. IntelGrid is one of the first projects (and the only Grid project) to implement the information delivery manual, a key technology that makes structured information exchange work for the construction industry.

Contribution to standardisation and interoperability issues

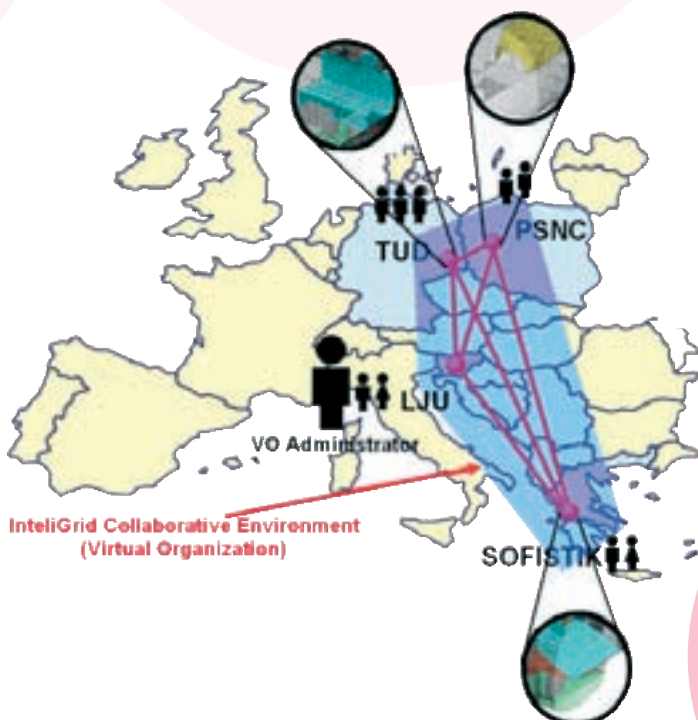
Engineering interoperability is a key issue in IntelGrid because it leads to more efficient collaboration, increased agility of the VO and reduced overhead costs that the VO is incurring. The project is working closely with the ISO-STEP efforts and the International Alliance for Interoperability (IAI) where members of the consortium have leading positions. Project partners are also involved in the Global Grid Forum (GGF), Simple API for Grid Applications (SAGA-RG), Semantic Grid (SEM-RG) and OGSA-DAI forums. In the latter, IntelGrid was qualified as a 'success-story'.

Target user groups/sectors in business and society

The direct target group of the InteliGrid project are the system integrators specialised in the engineering domain, developers of engineering software and providers of engineering services on the Internet, particularly those dealing with project information services. It is they who will (a) use the InteliGrid infrastructure to plug their software into and (b) who will be offering InteliGrid-like platforms and services. InteliGrid has set up an Industrial Advisory Board where the target users meet and influence the directions that the project is taking towards creating relevant solutions and addressing real world problems.

Overall benefits for business and society

InteliGrid platform will lower the entrance barrier to grid-based collaboration infrastructures and allow **SMEs** users to get access to capable third party collaboration infrastructures which they cannot afford themselves. It will also allow SME service providers to market their software and services. InteliGrid delivers a dynamic, secure, scalable, semantic infrastructure for collaboration of the VO on the Grid. Indirectly, InteliGrid targets the business processes in complex engineering domains, allowing them to make better and safer designs faster. While InteliGrid is focusing mainly on the architecture engineering and construction (AEC) sectors its developments are generic solutions and are therefore not restricted to use in other economically important sectors.



Example of business scenario or use case

The IntelGrid usage scenarios include:

- **Building lifecycle:** The IntelGrid platform provides coordinated resource and competency sharing to the different organisations involved in the design, construction and use of facilities. IntelGrid provides a semantic interoperability level on top of international standards such as the ISO-STEP and IAI-IFC.
- **Civil safety:** The IntelGrid infrastructure provides engineers with both functional and computational power to analyse a much broader spectrum of solutions leading to better, safer, more long lasting, and low cost infrastructures (i.e. buildings, bridges, dams, power supplies, etc.).
- **Aerospace:** Data sharing and information management for the collaboration in the design, simulation and production of complex products such as the Euro-fighter or an Airbus is an extremely complex task and subject to security and integrity concerns. The IntelGrid platform provides secure access to object-oriented validated data in such collaborative environments, using Grid standards.

Achievements to date and anticipated

The project defined a generic service-based architecture, synthesised the requirements into the '5S's' (security, simplicity, stability & standards, scalability and semantics) and has initial prototypes up and running.

So far the IntelGrid project has released a beta version of the **IntelGrid Middleware**. Major IntelGrid components that are released as open source include the **Portal**, the **Ontology Service**, the **Document Management Service**, the **Directory Service**, the **Grid Broker Service**, and the **Computing Provider**. They allow businesses to quickly join the a VO, discover resources on the Grid, make use of them and share results with others, combining the scalability and security of the Grid with intelligence enabled by semantics built into the platform's middleware.

The project also formed an industrial advisory board (IAB) that includes companies such as Fiat, TXT e-solutions and Airbus. The IAB is currently being expanded to include organisations from other industrial sectors. Already, an SME partner, Sofistik AG, which specialises in numerical modelling, is benefiting from IntelGrid technology as it enables them to offer faster computation as an online service to its users, allowing them to perform analyses faster and to a higher degree of accuracy.

Project partners

Organisation name and country

UNIVERZA V LJUBLJANI, FAKULTETA ZA GRADBENISTVO IN GEODEZIJO, D.O.O.	SI
TECHNISCHE UNIVERSITAET DRESDEN	DE
TECHNICAL RESEARCH CENTRE OF FINLAND	FI
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
OBERMEYER PLANEN+BERATEN PLANUNGSGESELLSCHAFT FUER BAU, UMWELT, VERKEHR UND TECHNISCHE AUSRUESTUNG MBH	DE
SOFISTIK HELLAS S.A.	EL
CONJECT AG	DE
ESOCE NET (EUROPEAN SOCIETY OF CONCURRENT ENGINEERING)	IT
EPM ENGINEERING AND PROJECT MANAGEMENT TECHNOLOGY AS	NO

Knowledge-based workflow system for Grid applications

K-Wf Grid



Scope

Often in industry and science a set of predetermined sequential tasks — known as a workflow — need to be completed by different people or resources in order to achieve a necessary result. In today's Grid environment, developers of Grid applications need also to go through a set of sequential structured operations in order to access in a timely fashion the most appropriate Grid resources or services — in other words workflow is vital for Grid application development. Today however the execution of such sequential tasks in Grid environments is done manually and requires input of human expertise in each step. Workflow systems for Grids are essential in order to facilitate the full cycle of Grid application development. Most importantly, efficiencies in development efforts could be increased if, instead of being manually constructed, Grid workflows could be dynamically composed from various Grid services without having a dependency on expert knowledge.

K-Wf Grid is undertaking research that attempts to use the latest in **Grid** and **semantic web** technologies to facilitate the **dynamic construction and execution of knowledge-based workflows in Grid environments**.

Innovation and functionality

K-Wf Grid defines '**workflow**' as '**the automation of distributed IT processes — in whole or part — during which documents, information or tasks are passed from one participant to another for action, according to semantic description of available resources and information gathered by their monitoring**'.

K-Wf Grid is developing technology to **compose Grid workflows automatically** on the basis of the desired output and of the description

Contract number

511385

Type of project

Specific targeted research project

Project coordinator

Fraunhofer Gesellschaft (FIRST)

Contact person

Dr Steffen Unger
Kekuléstrasse 7
D-12489 Berlin
Steffen.Unger@first.fraunhofer.de

Project website

<http://www.kwfggrid.eu>

Maximum Community contribution to project

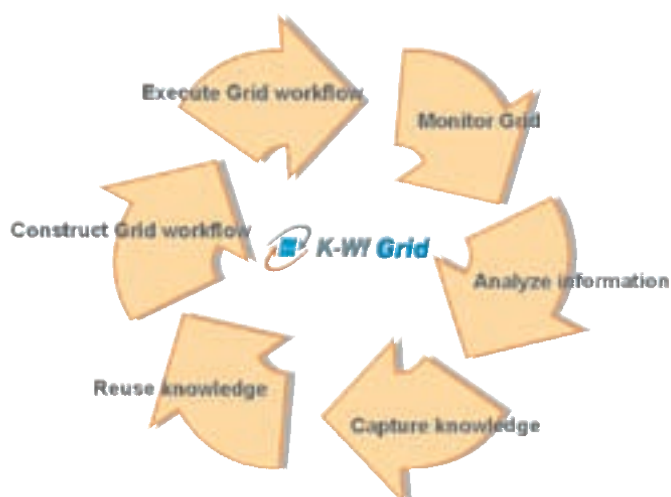
EUR 1 746 822

Project start date

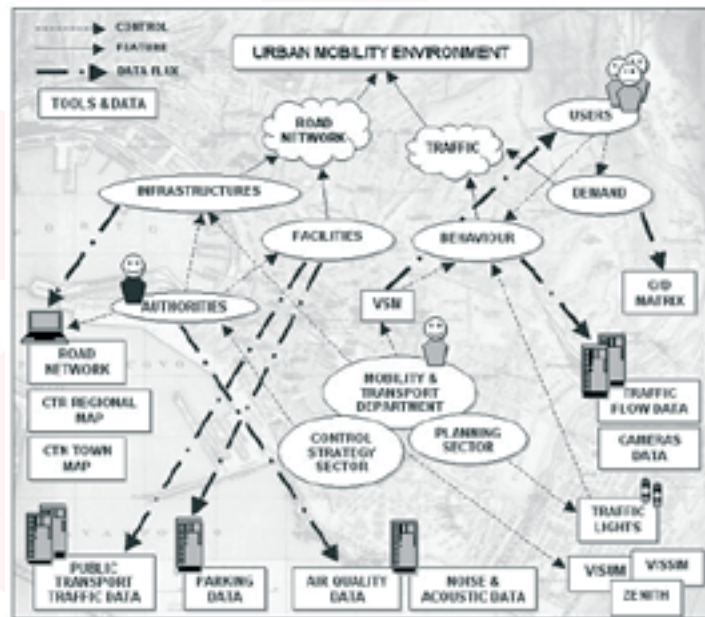
1 September 2004

Duration

30 months



continued overleaf ▶



of Grid resources available: services are invoked in the correct order and fed with the correct data so that the results are compliant with the specification and that only the most optimal resources are used.

Petri net theory has been used to model workflows, described by a **new** XML-based language called **Grid Workflow Description Language** (GWorkflowDL).

The innovation of K-Wf Grid comes from the merging of different technologies (Petri net theory, semantic web, web services and Grid) to provide services able to change radically the way grid-based scientific research and business solutions are managed today.

Positioning in global context

K-Wf Grid is the only initiative which exploits the power of the Grid, the flexibility of workflows and the expressiveness of semantic web in one integrated system.

Contribution to standardisation and interoperability issues

The project has developed a new XML-based language (named GWorkflowDL — Grid Workflow Description Language) that has the potential to become a de facto industrial standard for describing and modelling workflows on the basis of Petri net theory. The K-Wf Grid system has potential to be interoperable with other knowledge-management systems compliant with the W3C 'OWL' specification

Target users/sectors in business and society

K-Wf Grid provides a framework to assist users in building complex workflows on the Grid. Two categories of users can be identified:

- **application developers**, i.e. IT technicians who develop Grid applications;
- **application users**, i.e. private/public organisations that use complex distributed applications managing different sets of data.

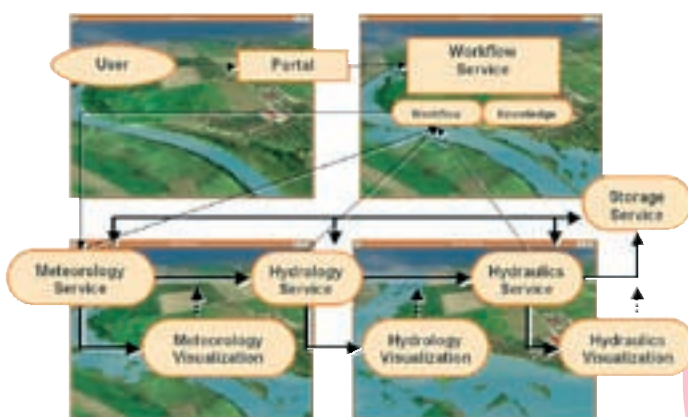
Overall benefits for business and society

K-Wf Grid technology has the potential to improve the working conditions: Grid application developers are provided with a self-monitoring system that is able to control its own behaviour; in other words, controlling which resources work better and faster and thus plan automatically their use. The formalisation of this monitoring knowledge makes any K-Wf Grid-based application a learning system, which improves its performance during each usage. The consequence is greater agility in the workplace to adapt to fast changing business environments, allowing for products to get more quickly to the market.

Example of business scenario or use case

Coordinated traffic management: If a car crash takes place in a downtown street at peak rush hour a number of steps need to be followed to manage the dynamic situation. A K-Wf Grid-enabled traffic management workflow system will be able to identify similar requests that were previously fulfilled and then — without the need for human intervention — identify the best services and data matching the new request. The workflow identified as the most relevant to the current scenario will then be executed.

Flood forecasting: The computation of a flood prediction is usually a collaborative effort requiring creation of a virtual organisation (VO) of



continued overleaf ►

relevant experts and authorities. K-Wf Grid makes VO creation simpler and service operation easier. K-Wf Grid enables intuitive collaboration not only by an automated exchange of experience, but also by incorporation of humans into the designed application.

Enterprise Resource Planning: K-Wf Grid provides a Chief Operations Officer of a global company with the ability to build a workflow by combining simple services to accomplish a complicated task like, for example, the computation of the number of items in stock in all of the company's warehouses across the globe.

The user can choose optimisation criteria (execution time, communication cost) and will then be able to run the same or similar Grid workflows every time the same job is needed, without having to worry about what specific ERP service to run.

Achievements to date and anticipated

K-Wf Grid has already designed and implemented an innovative, knowledge-based system, to model, compose and execute workflows of operations, helping Grid application developers to exploit distributed services and resources in a very effective, time-saving way, possibly even making migration to advanced technology a painless process.

In advance of a fully integrated system, a beta version of the **K-Wf Grid middleware** has been released with major components demonstrating core functionalities of the whole system.

Developed components include the **Grid Workflow Description Language**, the **performance monitoring framework (GEMINI, DIPAS)** and various **ontology transformers and translators (WSRF2OWL-S, OWL2OWL, CIM2OWL and OWL2TEX)**. They will be released as part of the whole system and also as stand alone tools under an open source licensing scheme.

Project partners

Organisation name and country

FRAUNHOFER GESELLSCHAFT E.V.	DE
USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED	SK
LOGICDIS S.A.	EL
SOFTECO SISMAT S.P.A.	IT
LEOPOLD FRANZENS UNIVERSITAET INNSBRUCK	AT
AKADEMICKIE CENTRUM KOMPUTEROWE CYFRONET	PL

The next generation Grid

NextGRID



Scope

The Grid has the potential to make a significant advance beyond the Internet, by turning it from a passive information medium into an active tool for creating and exploring new knowledge and fuelling business and industry. Today, this potential is not fully realised, and without far more cost-effective and universally applicable technology, will remain so.

The goal and primary output of the NextGRID project is to define the architecture that will lead to the emergence of the next generation Grid — one that goes beyond the academic roots of the Grid and prepares the way for the mainstream use of Grid technologies.

In addition to developing new architectural solutions, NextGRID is contributing to key middleware components, application support mechanisms, know-how and standards that underpin the next generation Grid.

Innovation and functionality

The project aims to break down the barriers to adoption of current Grids and enable them to go beyond their current, largely scientific, niche. NextGRID is defining principles for a service-oriented infrastructure, based on Grid technologies, which is as ubiquitous and transparent as the web is today and provides support for commercial, public sector and scientific applications.

Early Grid infrastructures relied on software technologies that were difficult to deploy, manage and use. Over the past few years, the Grid has moved to a web services approach and enormous benefits from using this technology have accrued. The basic web services that are required to build Grids are rapidly being standardised. NextGRID is looking beyond these services to understand the architectural designs required to enable large collections of Grid services to work together. NextGRID is designing and studying innovative solutions to challenges involving business models, service level agreements, adaptive workflow enactment, intrusion detection, and resource brokering amongst many others.

Positioning in global context

The NextGRID project is currently the only Grid research project worldwide that is specifically focused on driving forward the architecture of the next generation of Grid services.

Contributions to standardisation and interoperability issues

The project is actively working with standards bodies and groups including W3C, IETF, GGF and OASIS. NextGRID also chairs and manages the European Grid Standards Coordination Group (GSCG). Through NextGRID's work with these bodies and groups it has provided input into several aspects of OGSA, and has influenced the unified resource model framework.

Contract number

511563

Type of project

Integrated project

Project coordinator

EPCC — University of Edinburgh

Contact person

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Edinburgh EH9 3JZ
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Project website

<http://www.nextgrid.eu/>

Maximum Community contribution to project

EUR 11 000 000

Project start date

1 September 2004

Duration

36 months

NextGRID: Architecture for Next Generation Grids

Grid computing is a new computing paradigm. It offers access to significant computing and data resources on demand in the same way that the electricity grid provides power.

Grids are going to revolutionise computing as profoundly as e-mail and the Web revolutionised communications. Grids are now moving out of the laboratory, following the route taken by e-mail and the Web, and are set to change the way business is structured and how people work, learn and indeed live.

NextGRID is part of a major initiative to ensure that Europe is a world leader in this technology, central to the new knowledge-based economy.



Target users/sectors in business and society

To guide and inform the work in NextGRID, business applications are being used to test and validate the project's new ideas in the following business sectors:

- Finance — developing fast Grid services to calculate market volatility and offer this service to customers.
- Multimedia — creating brokered computational and storage services for 3D animation.
- Supply chain management — planning and optimisation for logistics leading to faster results and greater information for decision-making

These and many other business-focused experiments are being used to validate the applicability of the architectural developments arising from the project which are being designed to have wide application across the many business sectors that can benefit from Grid technologies.

Overall benefits for business and society

NextGRID is supporting the transformation of the Grid from a key technology for scientists to a vital tool to support business interaction and collaboration. It is a key step towards realising the broad vision of the Grid and to make it as ubiquitous as the web is today. A key success so far has been to engage European businesses much more closely in the development of Grid technologies, such as service level agreements, which are of direct relevance to them. Commercial Grid services and solutions will result from the technical advances that NextGRID is making today.

Example of business scenario or use case

The financial sector currently depends heavily on process and data intensive computations to deliver competitive advantage. The calculation of implied volatility is an example of this, as is analysing the risk of a portfolio of stocks and bonds. At present, such tasks are largely performed onsite within a closed network. Secure on-demand provisioning of implied volatility and risk management capabilities represents a real and valuable next step for the EU financial services industry.

NextGRID's implied volatility application experiment takes the form of exploiting many of the NextGRID architectural components for secure provision of on-demand calculations within the financial sector. This is only one example of a task that can be exploited as a service — implied volatility is being used to prove the concept.

Initial results from this experiment are promising and it is anticipated that the project partners involved in this experiment will go on to develop a set of Grid services to be sold to potential customers, i.e. banks. The primary business benefit of such services is the ability to perform calculations in real-time, taking advantage of short-term market opportunities.

Achievements to date and anticipated

Activities within the NextGRID project span a very wide collection of Grid technologies. The architecture activity, which drives much of the project, has identified over 30 **facilities** or areas of research interest for the project to study. These have been split into three categories: resources, management and infrastructure.

In terms of Grid resources, work is ongoing with regard to authorisation, data integration, quality of service, service discovery, service level agreements (SLAs) and workflows. In particular NextGRID's proposals with regard to SLAs and Grid services have formed a key achievement of the project to date where it is leading global research in this area. Grid management is also a key area of research where the project is focusing on intrusion detection, trust, licence management, execution management, accounting and virtual organisations.

Many of the basic Grid infrastructure facilities are now stable such as Grid service addressing, authentication, notification, resource access and service descriptions. This is thanks to recent standardisation successes (such as NextGRID's input to the overall OGSA architecture, Grid authorisation, OGSA naming and OGSA data scenario standards and influence on several aspects of the unified resource model framework). Work is ongoing with regard to data access, data transport, naming and unified resource models. In the future the project anticipates looking at semantic service descriptions where it will focus on the OWL-WS specification and ensure that implementation experience is disseminated to the various semantic Grid initiatives.

In each of these areas, NextGRID is identifying opportunities for standardisation. Due to the time taken to bring a technological advance through the standards process, many of the project's key achievements will be realised subsequent to its completion. However, NextGRID's current research will ensure that the next generation Grid becomes a reality in the years to come and delivers long-term value for business and society.



Project partners*Organisation name and country*

UNIVERSITY OF EDINBURGH	UK
UNIVERSITY OF SOUTHAMPTON	UK
BRITISH TELECOMMUNICATIONS PLC	UK
DATAMAT S.P.A.	IT
FUJITSU LABORATORIES OF EUROPE LIMITED	UK
FORSCHUNGSZENTRUM JUELICH GMBH	DE
GRID SYSTEMS S.A.	ES
UNIVERSITAET STUTTGART	DE
KUNGLIGA TEKNISKA HOEGSKOLAN	SE
EUROPAEISCHES MICROSOFT INNOVATIONS CENTER GMBH	DE
NEC EUROPE LTD.	UK
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
THE QUEEN'S UNIVERSITY OF BELFAST	UK
SAP AG	DE
T-SYSTEMS INTERNATIONAL GMBH	DE
UNIVERSITEIT VAN AMSTERDAM	NL
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
FIRST DERIVATIVES PLC	UK
KINO ANON COMPANY OF CINEMA AND TV MOVIES	EL
HEWLETT PACKARD ITALIANA SRL	IT



Paving the way for knowledgeable
Grid services and systems

Ontogrid



The European car insurance industry — like many other sectors — faces daily challenges in processing huge amounts of data from different companies, in diverse formats and in different languages. For example, imagine having to resolve an insurance claim for a French man who crashes his car into an Italian truck while on holiday in Germany — this requires many different companies, individuals and authorities to come together, share data and reach agreement before a claim can be settled. Today this is inefficient and time-consuming for all parties. However, thanks to the Ontogrid project a technological solution to such a problem is emerging.

Scope

Ontogrid is developing a technology framework using state of the ICT technologies (such as the semantic web and Grids) to simplify and streamline the sharing of such diverse information as it arises. In the example case of the insurance sector, the potential benefits for European insurance companies — and insurance policy holders — of these developments are considerable in terms of reducing processing time, paperwork, misunderstanding and the potential for fraud.

Positioning in global context

In a global society in which a knowledge revolution is today taking place, the strategic aim of Ontogrid is to lead Europe's scientific and technological position in IT on the international scene in the field of transparent resource and service provisioning. Through the development of semantic Grid technologies and advanced applications, Ontogrid will strengthen Europe's industry, especially SMEs, and their position in today's knowledge economy.

Innovation and functionality

Grid and knowledge technologies are being combined in order to provide a suitable testbed of solutions, which allow for new business

Contract number

511513

Type of project

Specific targeted research project

Project coordinator

Universidad Politécnica de Madrid,
Facultad de Informática

Contact person

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Project website

<http://www.ontogrid.net>

Maximum Community contribution to project

EUR 2 638 940

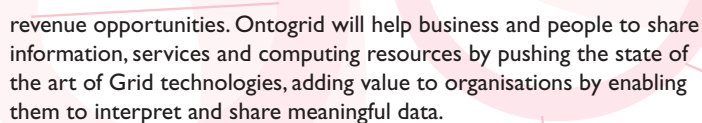
Project start date

1 September 2004

Duration

36 months





From a business perspective, companies will be more agile in finding solutions to particular problems, especially in sectors where actors are distributed and heterogenous. The enhanced information aggregation, consolidation, and exchange provided by Ontogrid also offer other benefits to business sectors where decision-making is based on the ability to access complete and accurate data sets.

It is also the case in the space sector, where Ontogrid is helping the space industry to reliably, securely and transparently collect large data streams from different organisations, and aggregate them for different purposes such as weather analysis or crop assessment. Additionally, adoption of Grid systems today entails large upfront costs for companies. Ontogrid aims at producing Grid technology with the maturity necessary to drive down these costs by several orders of magnitude. This effort will deliver in the long term in terms of increased productivity and lower costs for industries leveraging such technologies.

The target users of Ontogrid are financial, e-business organisations and, in general, organisations with a need to access data transparently independent of its location or its nature, and to do so without losing track of how information is transformed in the process. Additionally, Ontogrid provides support to create complex, aggregated services which need to virtualise and automatically use a series of resources (such as in the insurance sector). Ontogrid will enable users in business and

academia to overcome the complexity, which has been so far inherent to their fields of experience, providing solutions for the specific needs of today's knowledge society.

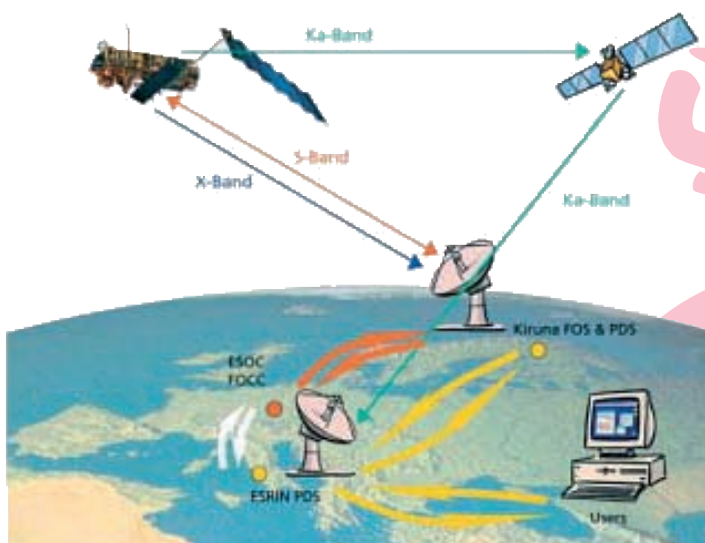
Contribution to standardisation and interoperability issues

The semantic Grid architecture proposed by Ontogrid is compliant with the most important established Grid standards. Ontogrid will influence embryonic, upcoming standards and is participating in a large number of collaboration, dissemination, and cross-fertilisation activities, with other EU-funded and national Grid projects. Other initiatives are being adapted, like the 'Semanticgrid café'. Inspired by CERN's gridcafe.org, the website <http://www.semanticgridcafe.org> aims to provide information to IT professionals interested to know more about how Ontogrid can help them improve their business.

Achievements to date and anticipated

Ontogrid has produced flexible and configurable middleware in the form of an open source toolkit. This **Ontogrid toolkit** has allowed the first demonstrator of the technology to be built, which has been shown at the Global Grid Forum, integrating the capabilities of all its components.

The Ontogrid technology has reached an initial level of maturity and cohesion, which allows for more significant challenges to be faced. Currently, it is being applied to solve real world problems in the domains of the European car insurance and space industry, the initial results of which were completed in summer 2006.



Project partners*Organisation name and country*

UNIVERSIDAD POLITECNICA DE MADRID	ES
UNIVERSITY OF LIVERPOOL	UK
INTELLIGENT SOFTWARE COMPONENTS S.A.	ES
Y'ALL	NL
NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS	EL
UNIVERSITY OF MANCHESTER	UK
DEIMOS SPACE S.L.	ES
BOYD INTERNATIONAL B.V.	NL

Enabling and supporting provenance in Grids
for complex problems

Provenance



Scope

The concept of Provenance is already well understood in the study of fine art where it refers to the trusted, documented history of some work of art. Objects that do not have a trusted, proven history may be treated with some scepticism by those that study and view them. This same concept of Provenance may also be applied to information generated within a computer system; particularly when the information is subject to regulatory compliance and verification.

The scope of the Provenance project is to provide a framework that allows information created within a computing environment to be proven and trusted. By this we mean that the information's history is documented in a way that can be inspected, validated and reasoned about by authorised users that need to ensure that information controls have not been altered, abused or tampered with.

Innovation and functionality

The Provenance project is delivering an architecture, methodology and set of draft standards to support the use of Provenance in a distributed computing environment. In addition, the architecture is supported by a set of tools to navigate, query and reason over the Provenance documentation captured and stored in a database. The architecture is tested by developing a reference implementation and deploying two test applications for aerospace component simulation and organ transplant management.

Positioning in global context

Provenance as a research activity has so far been confined to academic projects; particularly in e-science. The aim of this project is to move the work from its research base into industrial and business sectors where benefits can be achieved in terms of ROI, reduced cost and increased agility for IT applications developed to operate in an environment that is increasingly regulated by governmental, industrial and other external organisations.

Contribution to standardisation and interoperability issues

The Provenance project is developing a set of draft standards for submission to an open standards body. The project has defined a preliminary set of nine specifications including a methodology, glossary and architectural description. These specifications detail the Provenance data model, recording and querying interfaces, linking between Provenance stores, securing Provenance documentation and a documentation style for transforming information within a Provenance store.

By proposing a set of standards for Provenance, the results of the project become available to a wide community of users within all sectors of industry, business and academia. A major objective of the project is to

Contract number

511085

Type of project

Specific targeted research project

Project coordinator

IBM UK Ltd

Contact person

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Maximum Community contribution to project

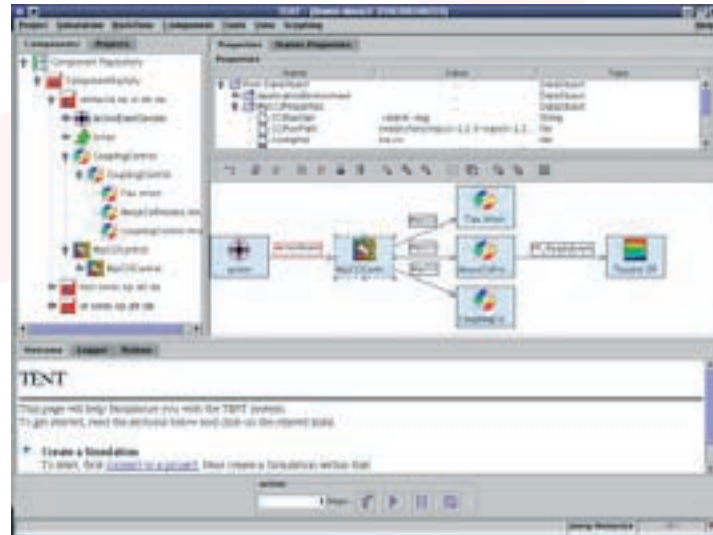
EUR 1 981 996

Project start date

1 September 2004

Duration

27 months



lower the cost of adopting and implementing Provenance-aware applications in all of the identified sectors. Standardisation allows Provenance to become a reusable, interoperable component in distributed IT systems, thereby lowering the cost of its adoption.

Target users/sectors in business and society

Users benefiting from the results of the Provenance project are:

1. **Individuals and user and consumer associations** will benefit from increased trust in electronic information generated on their behalf.
2. **Regulatory authorities** will benefit from a standards based architecture that allows regulatory compliance to be verified.
3. **Research communities** will benefit from a common understanding of Provenance that will allow results shared between research groups to be verifiably reproduced based on a common architecture.
4. **System developers, designers and suppliers** will be motivated to see Provenance as a business enabler and to integrate its concepts and solutions into their systems and products.

Overall benefits for business and society

Businesses operate in a regulated environment that is intended to prevent malpractice and protect the consumer. Regimes of corporate governance define the control processes that businesses must follow in order to meet their statutory obligations. Provenance provides a framework to let business show that these processes have been complied with.

Current mechanisms for regulatory compliance adopted by businesses involve closed, proprietary solutions that are not transparent and interoperable between different companies, business sectors or technologies. By developing an open, standardised architecture, the Provenance project provides businesses with the flexibility to develop open and interoperable solutions to meet their regulatory obligations.

Examples of business scenarios

The Provenance project is testing the architecture in two application areas:

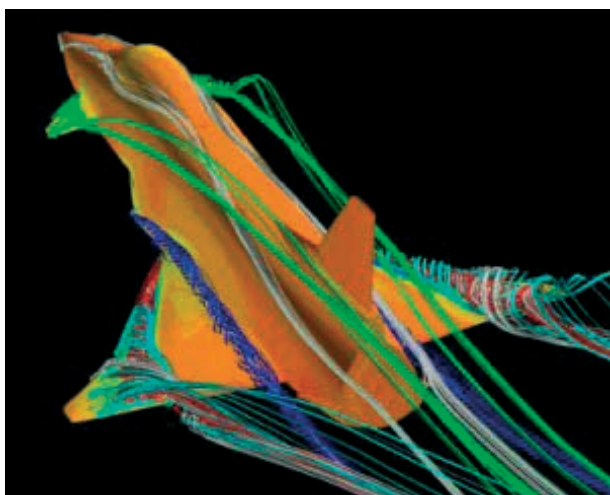
1. The management of aerospace component simulation data.
2. A proof of concept application for managing organ transplants and compliance with national healthcare regulations.

In addition to these applications, the project anticipates the use of the architectural framework in other business sectors not being investigated as part of the project such as:

1. Regulation of financial markets and services.
2. Submission of pharmaceutical information for drug approval.
3. Compliance with import/export regulations in distributed supply chains.
4. Compliance with rules of evidence in legal IT systems.
5. Traceability of ingredients in food chains.

Achievements to date and anticipated

All public results including published papers and architectural descriptions are available from the project website <http://www.gridprovenance.org> including early versions of the reference





implementation and descriptions of the two application scenarios. By the end of the project, the draft standards specifications and final reference implementation will be available together with all other public deliverables.

Project partners

Organisation name and country

IBM UNITED KINGDOM LIMITED	UK
THE UNIVERSITY OF SOUTHAMPTON	UK
DEUTSCHES ZENTRUM FUER LUFT- UND RAUMFAHRT E.V.	DE
CARDIFF UNIVERSITY	UK
UNIVERSITAT POLITECNICA DE CATALUNYA	ES
MAGYAR TUDOMANYOS AKADEMIA SZAMITASTECHNIKAI ES AUTOMATIZALASI KUTATO INTEZET	HU

**SIMDAT- data Grids for process and product
development using numerical simulation
and knowledge discovery**

SIMDAT



Scope

Distributed virtual product development enables improved product quality, faster time to market as well as reduced cost and risk. It constitutes, however, a complex task. Data and processes have to be shared and integrated within distributed departments and locations of a company, within different disciplines or across all partners participating in the product development. At the same time confidential data areas need to be kept hidden. Grid technology promises to reduce substantially the complexity.

The project SIMDAT contributes to an optimisation of the distributed product and process development by Grid technology in industry and service sectors such as the automotive, aerospace, pharmaceutical and meteorological sector. SIMDAT results will allow for a seamless transition of advanced Grid technologies also in other industrial sectors.

Innovation and functionality

SIMDAT will enable for collaborative process and product design by, e.g.

- Federated (grid-enabled) versions of problem solving environments (like MSC.SimManager, ESI simulation database, LMS Tec.Manager, SRS).
- Grid-enabled versions of analysis services (like ESI PAM-CRASH, MSC.Nastran).
- Grid technology services.
 - Grid support of workflow and ontologies (prototypes)
 - Grid-enabled version of the WEKA data mining tool
 - Prototypes for grid-enabled model development (LMS.OPTIMUS)
- Enhancement to Grid infrastructure software (e.g. to GRIA and OGSA-DAI).

Target users/sectors in business and society

SIMDAT targets end-users in industry and service sectors who consider or intend to use Grid technologies.

Contract number

511438

Type of project

Integrated project

Project coordinator

Fraunhofer Institute SCAI

Contact person

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Project website

<http://www.simdat.eu>

Maximum Community contribution to project

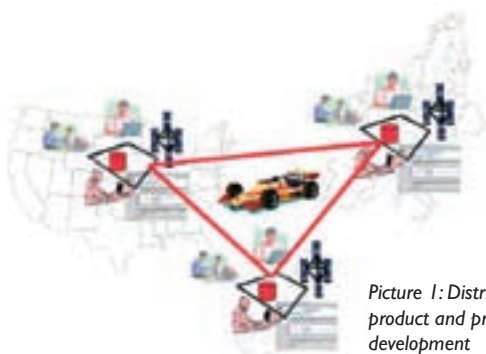
EUR 11 000 000

Project start date

1 September 2004

Duration

48 months



Picture 1: Distributed
product and process
development

In particular, companies, together with its suppliers and consultants, are addressed in which:

- data and processes have to be shared and integrated within distributed departments and locations of the company or across external partners;
- different disciplines collaborate;
- design, simulation and physical test have to be integrated and correlated.

Overall benefits for business and society

SIMDAT will improve collaborative design processes and increase the competitive advantage in strategic European industrial sectors. Specific benefits expected are, e.g. the improvement of car safety, reduction of noise and vibrations in cars, low-noise aircraft requesting only short runways, enhancement of drug discovery and development, enhancement of weather and climate prediction.

Example(s) of business scenario(s) or use case(s)

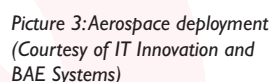
In the **automotive** and **aerospace** sector, engineers in multiple sites as well as external suppliers work together, forming virtual organisations. They want to use the same set of data and share the same processes, independent of their physical location or even organisation.

Moreover, different development disciplines have to be integrated, e.g. computer aided design, simulation, and physical test in the automotive industry, or fluid dynamics, structural mechanics, and acoustics in aircraft.

A further typical engineering scenario is that a supplier of, e.g. an automotive OEM (original equipment manufacturer), designs a part of the product and is provided with the correspondingly selected data. It is desirable to provide him with access to the complete data set while allowing him only a local view of his part.



Picture 2: Integration of distributed organisations and development disciplines in the automotive industry (Courtesy of MSC.Software GmbH and AUDI AG)



The **World Meteorological Organisation** has identified a need for global information service centres which offer a virtual and consistent view to the vast amount of data distributed geographically and within the meteorological community.

Main project achievements to date are the definition and implementation of prototypes using advanced Grid technology modules:

- continued overleaf 

Project partners*Organisation name and country*

AUDI AG	DE
BAE SYSTEMS LIMITED	UK
DEUTSCHER WETTERDIENST	DE
EUROPEAN AERONAUTIC DEFENCE & SPACE COMPANY	DE
ESI GROUP	ES
EUMETSAT	DE
EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS	INT
FRAUNHOFER AIS	DE
FRAUNHOFER SCAI	DE
GLAXOSMITHKLINE RESEARCH AND DEVELOPMENT LTD.	UK
IBM UNITED KINGDOM LIMITED	UK
IDESTYLE TECHNOLOGIES	FR
INFORSENSE LIMITED	UK
INTEL GMBH	DE
INPHARMATICA	UK
BIOWISDOM SRS LTD. (FORMERLY LION BIOSCIENCE LTD.)	UK
LMS INTERNATIONAL N.V	BE
NOESIS SOLUTIONS (THIRD PARTY)	BE
MÉTÉO FRANCE	FR
MSC. SOFTWARE GMBH	DE
NEC EUROPE LTD.	UK
ONTOPRISE GMBH	DE
ORACLE DEUTSCHLAND GMBH	DE
RENAULT	FR
UK MET OFFICE	UK
UNIVERSITÄT KARLSRUHE	DE
UNIVERSITÉ LIBRE DE BRUXELLES	BE
UNIVERSITY OF SOUTHAMPTON	UK

Uniform interface to Grid services

UniGrids



Scope

Grid computing evolved from a research topic to the most fascinating development in computer science and information technology of the last years. Users now benefit from increasing computing power at reduced costs. Several user communities started to develop different Grid software that suits their needs. The result is a number of Grid middleware systems that cannot work together.

The guiding principle of the UniGrids project is to get the different Grid systems to work together.

The UniGrids project developed a Grid service infrastructure compliant with the open Grid services architecture (OGSA), the de facto standard framework for Grid middleware that combines the advantages of web services and Grid technology. The UniGrids infrastructure is based on the Unicore Grid software initially developed in the German Unicore and Unicore Plus projects and extended in the EU funded Eurogrid and GRIP projects.

The UniGrids project aims at providing seamless interoperability between OGSA-compliant Grid systems. To achieve interoperability between Grid systems it is necessary to translate the models used for advertising, requesting and providing the resources in all Grid systems. The mechanisms for authentication, authorisation, and cooperation with site security policies need to be reconciled and the services and port types offered by the Grid systems must be translated to each other.

Innovation and functionality

Instead of developing a set of interfaces for every two Grid systems the UniGrids project developed an interoperability layer called the UniGrids atomic services. The UniGrids atomic services provide all the basic functionality for file and job management that has to be available on a Grid. They allow the exchange of data and job information between different Grid systems and give a single client access to different Grid infrastructures. The UniGrids atomic services allow for the development of Grid applications independent of the underlying Grid infrastructure.

Positioning in global context

The UniGrids atomic services are based on the widely accepted specifications, such as job submission description language (JSDL), web services resource framework (WSRF) and the open Grid services architecture. The UniGrids atomic services can be implemented at little overhead for any Grid infrastructure.

Contribution to standardisation and interoperability issues

The standardisation of the UniGrids atomic services is promoted by partners of the UniGrids consortium in the Global Grid Forum and the design is discussed with the developers of the Globus Toolkit. Within the

Contract number

004279

Type of project

Specific targeted research project

Project coordinator

Forschungszentrum Jülich GmbH

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Project website

<http://www.unigrids.org>

Maximum Community contribution to project

EUR 1 916 162

Project start date

1 July 2004

Duration

24 months

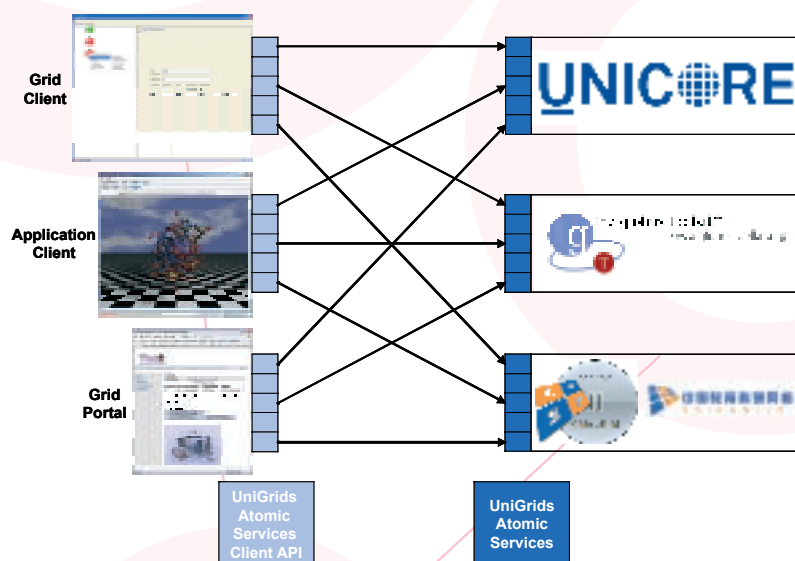
UniGrids project this will achieve interoperability between Unicore and Globus based on the implementations of the UniGrids atomic services for both systems. In addition, an implementation for the ChinaGrid support platform (CGSP) is developed.

Target users/sectors in business and society

The UniGrids atomic services are beneficial for all companies deploying Grid infrastructures that need to be interoperable with other Grid systems. Grid application developers will profit from the application development interface that makes them independent of changes to the underlying Grid infrastructure.

Overall benefits for business and society

Through the introduction of the UniGrids atomic services the development of Grid applications is independent of the underlying Grid infrastructure. While formerly an application had to be adapted for each Grid system the developer now builds only one module for the UniGrids atomic services that allows the exploitation of all available Grid systems. The reduced development work protects the effort and investment in the development of Grid applications. On the other hand the access to different Grid systems enables users to choose the most suitable infrastructure for their applications and providers can assign jobs to systems based on economical decisions, thus boosting the productivity of the users as well as the utilisation of the infrastructure.



Examples of business scenarios or use cases

Application service providers can exploit resources that are managed by different Grid infrastructures while getting independent of changes to the Grid software managing the systems. Users who are participants of several virtual organisations that deploy different Grid infrastructures will be able to access the resources of all their virtual organisations with one client thus gaining more time for their tasks while losing less time for familiarising with and customising of different clients.

Achievements to date and anticipated

Within the UniGrids project the UniGrids atomic services were implemented for the two most widely used Grid infrastructures, namely Unicore and Globus Toolkit 4. In addition, an implementation for the ChinaGrid support platform (CGSP) is being developed. On the user side, beta versions of a Grid client and a portal solution based on the UniGrids atomic services are already available as prototypes to the user partners. The software is available as open source under the BSD license at <http://unicore.sourceforge.net>. All software will be production-ready by the end of the project in June 2006.

Project partners

Organisation name and country

FORSCHUNGSZENTRUM JÜLICH GMBH	DE
CONSORZIO INTERUNIVERSITARIO PER LA GESTIONE DEL CENTRO IT DI CALCOLO ELETTRONICO DELL'ITALIA NORD-ORIENTALE	IT
FUJITSU LABORATORIES OF EUROPE LIMITED	UK
WARSAW UNIVERSITY	PL
INTEL GMBH	DE
THE UNIVERSITY OF MANCHESTER	UK
T-SYSTEMS SOLUTIONS FOR RESEARCH GMBH	DE





Fact sheets of the Grid Research projects launched in 2006

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73	BEinGRID	103	GridCOMP
81	BREIN	105	GridEcon
83	Bridge	107	GridTrust
85	Challengers	109	KnowARC
87	Chemomentum	111	NESSI-Grid
89	Degree	113	QosCosGrid
91	EC-GIN	115	SORMA
93	EchoGRID	117	XtreemOS
95	Edutain@Grid		



ARGUmentation as a foundation for the semantic Grid

ArguGrid



Grid computing is concerned with the development of tools for the sharing, selection, and aggregation of distributed, ubiquitous, heterogeneous resources and services, as required by a wide range of applications, from e-science to e-commerce. ArguGrid aims to develop a new model for programming the Grid at a 'semantic', knowledge-rich level, enabling the fulfilment of requirements from requestors and providers, thus better supporting and enabling applications.

In order to provide this semantic, knowledge-rich Grid, ArguGrid aims at using argumentative agents technology. Agents are associated with service and resource requestors and service providers on the Grid. They are responsible for decision-making and are equipped with methods for negotiation with other agents. With the support of argumentation processes, they decide which services can be used for fulfilling the demands of users and the constraints posed by providers, taking into account their preferences and the utilities they assign to situations, and evolving and using a notion of trust to 'filter' their interactions with other entities. Argumentation is also used to support 'virtual organisations', understood as societies of agents, to compose individual services into more complex ones and return executable workflows. The project focuses on e-business application scenarios.

ArguGrid's objectives are:

- to provide a grid-based model for argumentative agents, controlling and requiring access to services/resources, capable of deciding rational plans of actions and negotiating and arguing with other agents;
- to provide a new model and methodology for the specification, creation, operation and dissolution of virtual organisations, formed by individuals or institutions controlling resources/services in the Grid and represented in ArguGrid as agent societies;
- to design an architecture for the Grid based on the use of communicating agents and built on top of standard Grid middleware and web service standards, to support the evolution of virtual organisations and the operation of argumentative agents;
- to develop a grid-based platform to support the implementation of the models, and allowing to study the viability and usefulness of the proposed ArguGrid formal approach;
- to experiment with and evaluate the models, methodology, service-oriented architecture and platform in the context of concrete application scenarios for e-business.

ArguGrid plans to achieve these objectives by using:

- logic-based argumentation techniques for agents and interaction amongst them, extended with decision-theoretic techniques;
- contracts and workflows as part of the representation of virtual organisations; welfare economics for the evolution of virtual organisations as agent societies;
- web service architectures to provide a semantic services composition environment;

Contract number

035200

Type of project

Specific targeted research project

Project coordinator

Imperial College London, UK

Contact person

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Project web site URLwww.argugrid.org**Maximum Community contribution to project**

EUR 1 999 000

Project start date

1 June 2006

Duration

36 months

- peer-to-peer computing and overlay networks for the Grid infrastructure.

Projects Partners*Organisation name and country*

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	UK
ROYAL HOLLOWAY AND BEDFORD NEW COLLEGE	UK
UNIVERSITA DI PISA	IT
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
ASIAN INSTITUTE OF TECHNOLOGY	TH
INFORSENSE LIMITED	UK
GMV S.A.	ES
COSMO-ONE HELLAS MARKET SITE SA	EL

Risk assessment and management for Grids

AssessGrid



As Grid technologies are in their early stage of commercialisation, Grid actors have to face ethical and commercial issues. Therefore its *adopters* are concerned about the core shortcomings related to security, trustworthiness, and dependability of the Grid.

Based on the market state, the AssessGrid project addresses the following issues:

- *Users* require priority and quality processes to be reinforced while they negotiate service level agreements (SLAs).
- *Providers* are still cautious on agreeing SLAs as it is considered as a business risk. They investigate in risk assessment methods as decision support to foresee external and internal factors such as system failure, or operator unavailability to avoid an SLA violation and resulting image damage and penalty fees.

Grid end-users and brokers confidently evaluate the risk information for provider selection and fault tolerance.

By integrating these requirements into Grid technologies the final result of AssessGrid will be an efficient architecture answering the need of the Grid actors.

The **objectives** of AssessGrid:

- AssessGrid will address the risk awareness and consideration in SLA negotiation, self-organising fault-tolerant actions and capacity planning.
- AssessGrid will develop and integrate methods for risk assessment and management in all Grid layers.

Approach:

The cornerstones of AssessGrid are different risk management scenarios reflecting the perspective of Grid end-users, brokers and providers. Subsequently, the results will support all Grid actors by increasing the transparency, reliability, and trustworthiness as well as providing an objective foundation for planning and managing Grid activities. The resulting quality will be demonstrated in provider environments and in close interaction with end-users.

The AssessGrid development will be in a Grid context and will produce generic, customisable, and interoperable open-source software for risk assessment, risk management, and decision support in each Grid layer.

Innovation:

Commercial providers of resources and services should be the driving forces for large-scale Grid deployment. By adapting the AssessGrid software, providers will profit from:

- **Objective indicators** to evaluate their infrastructure in respect to Grid jobs and current utilisation.
- **Risk estimation** for different situations which helps to decide on incoming SLAs and to set up penalty fees corresponding to the risk of failure.

Contract number
031772

Type of project
Specific targeted research project

Project coordinator
Paderborn University

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Project website
<http://www.assessgrid.org/>

Maximum Community contribution to project
EUR 1 971 000

Project start date
1 April 2006

Duration
33 months

- **Decision support** for system development, management and planning.
- **Self-organising fault tolerance mechanisms** using certain risk indicators as thresholds to increase the reliability.

AssessGrid aims to supply next generation Grids with additional innovative and required components to close the gap between SLAs as a concept and an accepted tool for commercial Grid uptake.

Project partners

Organisation name and country

UNIVERSITAET PADERBORN	DE
ATOS ORIGIN SAE	ES
CENTRE D'EXCELLENCE EN TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BE
ABO AKADEMI	FI
UNIVERSITY OF LEEDS	UK
WINCOR NIXDORF INTERNATIONAL GMBH	DE

An easy way to access Grid resources

A-WARE



One of the main factors hindering the full exploitation of current Grid technologies is that advanced system management and programming skills are required in order to install, configure and execute Grid middleware to support applications and services. Moreover, the business potentials of today Grid middleware could be consistently increased through user-friendly graphical interfaces based on widely accepted standard approaches such as web portals.

The **A-WARE** project offers public and private organisations a fully integrated, standard-compliant and user-centric solution to **simplify access to Grid resources**.

The A-WARE project has the following objectives:

- To develop innovative Grid technology, namely A-WARE, composed by a workflow orchestrator service; a workflow design application to monitor the workflow execution and to interact with the workflow orchestrator; and a store manager of workflow objects.
- To develop a technology able to easily broaden the adoption of Grid technology via a web thin-client approach based on user-friendly interfaces, hiding the complexity of the underlying Grid to occasional as well as frequent users.
- To simplify the deployment of the Grid under typical industrial scenarios, such as Intranet security, single-sign-on systems, etc.
- To test the A-WARE technology on real industrial applications: the project developments will be validated in the computational fluid dynamics industrial domain with some test cases that belong to the simulation of aeroplane components; such test beds will be built according to mainstream industrial requirements and could be easily adapted for other components that require simulations over a distributed amount of resources.
- To promote A-WARE as a reference implementation of the related OGSA components, thus influencing the relevant standards bodies, such as IETF, GGF, W3C, or OASIS, especially with respect to the evolution of the standards addressing workflow and Grid business processes.

The A-WARE technology will **fill in the gap between existing Grid middleware and portals**, through a set of user-oriented services and interfaces designed to better manage complex processes and workflows; this will give the users a better perception of the Grid as a transparent and seamless technology easily adaptable to their needs.

Through the A-WARE technology, users can concentrate their attention on solving their own real problems rather than on technical issues. The technology developed is based on **EnginFrame**, a Grid portal technology adopted by a wide number of Grid technology and service providers worldwide, which is compatible with most Grid middleware available today.

Contract number

IST-034545

Type of project

Specific targeted research project

Project coordinator

CINECA

Contact person

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Project website<http://www.a-ware-project.eu>**Maximum Community contribution to project**

EUR 870 000

Project start date

1 June 2006

Duration

24 months

Project partners*Organisation name and country*

CONSORZIO INTERUNIVERSITARIO PER LA GESTIONE DEL CENTRO DI CALCOLO ELETTRONICO DELL'ITALIA NORD-ORIENTALE	IT
FORSCHUNGSZENTRUM JUELICH GMBH	DE
FUJITSU LABORATORIES OF EUROPE LIMITED	UK
NICE S.R.L.	IT
AIRBUS FRANCE SAS	FR

Business experiments in Grid

BEinGRID



Grid technology is at a critical transition as it moves from research and academic use to wider adoption by business and enterprise. The use of Grid technology brings many benefits such as the optimisation of IT resources and increased business flexibility with consequent reductions in overall cost and risk for end-users. Grid enables large complex systems to be utilised effectively, allows the sharing of networked resources and also supports new business processes across distributed administrative domains.

The lack of business reference cases to persuade potential users to explore the business benefits of this important new technology is leading to weak commercial exploitation of Grid solutions across the EU. Increased general deployment of Grid technologies into the market will strengthen the EU's competitiveness and leadership in this key area.

The mission of BEinGRID is to establish effective routes to foster the adoption of Grid technologies across the EU and to stimulate research into innovative business models.

The **strategic objectives** of BEinGRID are:

- To understand the requirements for Grid use in the commercial environment, involving software vendors, IT integrators, service providers and end-users.
- To enable and validate the adoption of Grid technologies by business.
- To design and build a Grid toolset repository with components and solutions based on the main Grid software distributions including: the Globus Toolkit, gLite, Unicore, Gria and basic web service specifications.
- To develop and deploy a critical mass of grid-enabled pilots, embracing a broad spectrum of economic sectors with different needs and requirements in terms of technological Grid challenges.

To meet these objectives, BEinGRID will undertake a series of targeted **business experiments** (BEs) designed to implement and deploy Grid solutions across a broad spectrum of European business sectors (entertainment, financial, industrial, chemistry, gaming, retail, textile, etc). Eighteen business experiments are planned at the outset of the project with a second competitive call (EURO 2 million) for proposals in the latter stages.

The **overall result** of the project will be a collection of key middleware components, Grid solutions and successful case studies resulting from the real-world pilots and the best-practice guidelines derived from the Grid pilot experiences. The creation of the **toolset repository** that gathers high-level services, new tools and innovative Grid application solutions will result in a 'Grid marketplace' enabling individuals and organisations to create, provide and use Grid technologies to meet their business challenges.

It is well known that the point of greatest peril in the development of a market for new technology, such as the Grid, lies in making the transition from an early market dominated by a few visionary customers to a

Contract number
034702

Type of project
Integrated project

Project coordinator
Atos Origin

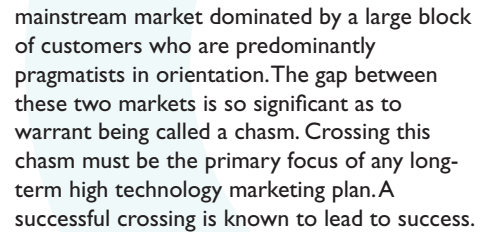
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Project Website
www.beingrid.eu

Maximum Community contribution
EUR 15 700 000

Project start date
1st June 2006

Duration
42 months



The project's wide variety of business experiments will expose a set of successful and innovative business models to demonstrate to potential early adopters the opportunities and

To minimise redevelopment of software components, BEinGRID will deploy innovative Grid solutions using existing Grid components from across the European Union and beyond.

The partnership in each business experiment pilot cuts across the full value chain of the targeted economic sector; from technology providers to different levels of users. Involvement of end users and service providers in the vertical pilots is considered crucial in order to derive successful case studies that support the transition of Grid technologies from an academic context to widespread enterprise adoption by building on the success of the early adopters of Grid solutions.



End user	Application provider/integrator	Grid solution/service provider
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Colour legend for participants in following table

BE1 — Computational fluid dynamics and computer aid design This pilot will grid-enable a CFD application and deploy it on a new computational & data intensive and collaborative platform. CFD techniques allow virtual optimisation of designs before manufacture and testing allowing global cost reductions. It is relevant to the aerospace & automotive sectors.	Gria and GridSphere		
	ICON	OPENCDF	NTUA
BE2 — Business workflow decision-making Focussing on the media sector, the purpose of this business experiment is to apply data access and integration techniques based on Grid middleware to support and optimise workflow in the creative industries — primarily in the digital film production/post production areas.	OGSA-DAI and GT v4		
	JDC	Hat Factory	EPCC
BE3 — Visualisation & virtual reality The objective of this pilot is to dramatically increase the performance of 3D rendering applications without expensive additional hardware investment using distributing rendering services based on Grid technologies. Sectors addressed include architecture, digital animation advertising.	GTv4 and DIET		
	Art&Build	FPMS	Mental
BE4 — Financial portfolio management The pilot aims to develop an application, running simulations on a Grid infrastructure, to support financial institutions in strategic decisions of financial portfolio management problems. According to a predefined level of risk, the tool will calculate the portfolio with the best performances.	GTv4 and other comp.		
	MPSF	Finnat	Unical
BE5 — Retail management Current management solutions in the retail sector suffer from performance problems and are often not affordable by SMEs. This BE addresses retail management applications to manage the sale of goods and products at the point of sale. It will consider 'sales forecasting patterns', 'product assortment planning' and 'goods replenishment optimisation' using Grid services.	ASSIST Grid and GTv4		
	TXT	Unipisa	ATOS Italy

BE6 — Groundwater modelling The main goal is the realisation of a large scale multidisciplinary computer Grid, enabling end-user cooperation to generate cost-effective and optimised solutions for water management, addressing both business and societal aspects in the sector of environmental engineering.	Unicore/GS
	
LINEG BHRI WASY Siegen HLRS	
BE7 — Earth observation The objective is the implementation of the DUE GlobAEROSOL service on Grid technology. This is an example of a class of services which require large and near real time data access and complex processing. The products are global earth coverage products that respond to emerging science and institutional environmental needs.	European DataGrid-LCG2.3, InfernoGRID
	
CMR-ISAC GMV ATOS Terradue ESA-ESRIN	
BE8 — Integration of engineering and business processes in metal forming This pilot addresses the increasing complexity of production processes in the automotive supplier industry. It has a special focus on SME's coping with sheet metal forming who need to optimise their engineering processes and hence lower their time to market for new products.	Unicore/GS
	
Fiuka Siegen SCAI CO.COM T-Systems	
BE9 — Distributed online gaming The experiment aims to build and assess a distributed application hosting environment that enables network-centric application service providers to deploy and manage their services in secure and accountable way. The leisure and entertainment sector and in particular internet-based interactive multi-player gaming has been chosen as the targeted application area.	GRASP, Open WS-*
	
Andago ATOS CRMPA BT	
BE10 — Collaborative environment in the supply chain management of pharmaceuticals The purpose of this pilot is to validate a grid-based collaborative environment in the area of supply-chain management in the pharmaceutical sector. The goal is to standardise the management of the complete, start to finish, pharmaceutical supply chain.	Gria and GridSphere
	
Farmar Wyeth BE NTUA	
BE11 — Risk management This pilot tackles a Grid solution in the financial sector. Financial institutions face computational time and resource challenges in the risk analysis of investment portfolios etc. These real-time financial algorithms, which use stock market and trading desk data, impose real-time processing constraints which are a major challenge for the Grid.	gLite and GTv4
	
AXA CRSA Fininfo TID	

BE12 — Sales management system The aim of this pilot is the application of DAIS Grid technologies to the field of sales management systems (SMS) and customer relationships management (CRM) services, the latter focused on the tourism sector. Although both fields, SMS and CRM, are quite different for their business implications within SMEs, the technological challenges are similar.	OGSA-DAI & open WS-*
Pizzanew Eden Tecnocassa Grande ENEA CINECA	
BE13 — Textile Grid portal This pilot aims to build a virtual laboratory to provide textile firms with advanced 'grid-enabled' computing services ranging from production planning to advanced textile design. This will give SMEs from this industry the opportunity to access high level services at a low cost.	Unicore & OGSA-DAI
Colombo Marchi ENEA Domina	
BE14 — New product & process development This experiment addresses the integrated environment required to develop new products and processes in the chemistry sector. This implies the parallel execution and coordination of multiple heterogeneous and widely distributed resources (databases, computer models, property and cost data, technical reports, and images) achieved by the combination of two outstanding Grid tools.	GRID superscalar, GridWay on GTv4
LIKAT UNIS UCM BSC	
BE15 — Virtual engineering workplace for financial e-services This BE will develop a virtual engineering workplace for financial e-services enabling the combination of traditional services (banking, insurance, etc) with travel services, entertainment, healthcare, etc. Users will be able to configure and deliver financial services to consumers. The BE will focus on accounting and charging mechanisms for the services which are delivered as a utility.	Boinc and Globus enriched with WS
Rabobank Erasmus Almeregrid Logica	
BE16 — Ship building European shipyards concentrate on high quality and complex engineering developments to face the pricing pressure from Asian competitors. This pilot will develop Grid technology for the early design phase (first 1–2 months) of a ship building project to reduce technical and economic risks.	Unicore
FSG CMT DLRSISTEC SCAI T-Systems	
BE17 — Logistics & distribution optimisation The main objective is to show how to integrate industrial enterprise resource planning systems (ERPs) with efficient scheduling/planning systems on open Grid middleware. The BE will focus capture and solution of a real-world transport and logistics problem.	Unicore and OGSA-DAI
Felicetti Fornara SOGEA ENEA UNIBO CINECA	

BE18 — Seismic imaging & reservoir simulation				gLite, EGEODE, Genius
The aim of the experiment is to validate the technical and economic viability of geoscience processing on the Grid by consolidating the EGEODE (expanding geosciences on demand) virtual organisation which is focused on the oil & gas application domain.				
TNO	Petrosoft	CGG	NICE	

Project partners

Organisation name and country

ATOS ORIGIN SAE	ES
BRITISH TELECOMMUNICATIONS PLC	UK
THE UNIVERSITY OF EDINBURGH	UK
CENTRE D'EXCELLENCE EN TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BE
LOGICACMG NEDERLAND B.V.	NL
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
T-SYSTEMS SOLUTIONS FOR RESEARCH GMBH	DE
UNIVERSITAET STUTTGART	DE
TELEFONICA INVERSTIGACION Y DESARROLLO SA UNIPERSONAL	ES
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS — RESEARCH CENTER	EL
CENTRO DI RICERCA IN MATEMATICA PURA ED APPLICATA	IT
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
CENTRALE RECHERCHÉ S.A.	FR
ENTE PER LE NUOVE TECNOLOGIE L'ENERGIA E L'AMBIENTE	IT
KATHOLIEKE UNIVERSITEIT LEUVEN	BE
UNIVERSITAT ST GALLEN	CH
GRANDE SERVICE SRL	IT
ICON COMPUTER GRAPHICS LIMITED	UK
OPENCDF LIMITED	UK
JOE DUNTON & COMPANY LIMITED	UK
THE HAT FACTORY LIMITED	UK
ART & BUILD ARCHITECTS S.A.	BE
FACULTE POLYTECHNIQUE DE MONS	BE
MENTAL IMAGES GMBH	DE
INNOVA S.P.A.	IT
UNIVERSITA DELLA CALABRIA	IT
SOUTHERN PARTNERSHIP FOR ADVANCED COMPUTATIONAL INFRASTRUCTURES	IT

BANCA FINNAT EURAMERICA S.P.A.	IT
MPS FINANCE BANCA MOBILIARE S.P.A.	IT
ATOS ORIGIN ITALIA S.P.A.	IT
UNIVERSITA DI PISA	IT
TXT E-SOLUTIONS SPA	IT
UNIVERSITAET SIEGEN	DE
WASY GESELLSCHAFT FUER WASSERWIRTSCHAFTLICHE PLANUNG UND SYSTEMFORSCHUNG MBH	DE
LINKSNIEDERRHEINISCHE ENTWASSERUNGS-GENOSSENSCHAFT	DE
GMV SA	ES
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
EUROPEAN SPACE AGENCY	FR
CO.COM CONCURRENT COMPUTING GMBH	DE
FISCHER & KAUFMANN GMBH & CO. KG	DE
ANDAGO INGENIERIA SL	ES
BUSINESS EXCHANGES AE	EL
FAMAR ANONYMOS BIOMIKANIKI ETAIRIA FARMAKON KAI KALLYNTIKON	EL
WYETH HELLAS AEBE FARMAKEYTIKON PROIONTON	EL
AXA FRANCEVIE	FR
EDEN VIAGGI SRL	IT
PIZZA NEW S.P.A.	IT
CONSORZIO INTERUNIVERSITARIO PER LA GESTIONE DEL CENTRO DI CALCOLO ELETTRONICO DELL'ITALIA NORD-ORIENTALE	IT
TECNOCASSA SRL	IT
LANIFICIO LUIGI COLOMBO S.P.A.	IT
FILATURA MARCHI GIOVANNI S.P.A.	IT
DOMINA S.R.L.	IT
BARCELONA SUPERCOMPUTING CENTER — CENTRO NACIONAL DE SUPERCOMPUTACION	ES
UNIVERSIDAD COMPLUTENSE DE MADRID	ES
THE UNIVERSITY OF SURREY	UK
LEIBNIZ-INSTITUT FUR KATALYSE E.V. AN DER UNIVERSITAET ROSTOCK	DE
FININFO SA	FR
COOPERATIVE CENTRALE RAIFFEISEN-BOERENLEEN BANK B.A.	NL
ERASMUS UNIVERSITEIT ROTTERDAM	NL
FLENSBURGER SCHIFFBAUGESELLSCHAFT M.B.H. & CO. KOMMANDITGESELLSCHAFT	DE
DEUTSCHES ZENTRUM FUER LUFT UND RAUMFAHRT E.V.	DE

CENTER OF MARITIME TECHNOLOGIES E.V.	DE
SOGEA SRL	IT
ALMA MATER STUDIORUM — UNIVERSITA DI BOLOGNA	IT
PASTIFICIO FELICETTI DI FELICETTI VALENTINO & C. SAS	IT
FORNARA E MAULINI S.P.A.	IT
COMPAGNIE GENERALE DE GEOPHYSIQUE	FR
NETHERLANDS ORGANISATION FOR APPLIED SCIENTIFIC RESEARCH — TNO	NL
PETROSOFT SPOL S.R.O.	CZ
NICE S.R.L.	IT
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
GRID SYSTEMS S.A.	ES
STICHTING ALMEREGRID	NL
BEIJING HYDRAULIC RESEARCH INSTITUTE	CN
TERRADUE SRL	IT

Business objective driven reliable and intelligent Grids for real business

BREIN



A major uptake of the Grid infrastructures by businesses is inhibited by their high complexity, making it difficult for business entities to offer and maintain their services within a Grid environment.

Ideally, the Grid should not only support business collaborations by realising a reliable transaction infrastructure, but also, even more importantly, enable them to dynamically adapt their business processes to ever-changing technical as well as organisational requirements.

For example, imagine those responsible for running a busy international airport. On a daily basis they have to deal with a dynamic environment that includes — for example — 100s of planes arriving and departing, movement of tens of thousands of passengers, liaising with international air traffic controllers, interfacing with dozens of airlines, facilitating scores of onsite contractors and service providers, fulfilling increasingly demanding security requirements, and so on. Such a dynamic environment involves a huge flow of data from diverse sources that needs to be quickly and confidently assessed for making quick decisions. The complexity is considerable. The latest information technologies — such as Grids — that can help business environments such as airports manage and process data relating to such complex and dynamic situations are not yet being fully leveraged. The EU-funded research project — BREIN — is however adapting Grid technologies that have proved their worth in academic environments for real-world challenges, such as those seen by airports in a world where demand for air travel is increasing.

The main objective of the BREIN project is to enable individuals/business entities to provide their services in a controlled environment that allows intelligent and optimal management of the respective resources according to the individual business goals/constraints. For that purpose BREIN will significantly reduce complexity in using Grid services.

The BREIN approach thus aims at extending today's Grid to a Grid for business by:

- enabling autonomy and automation with the combination of the flexibility and stability of Grid technologies with the strength of methods for business modelling;
- enhancing the Grid with the intelligence and adaptability of multiagents;
- facilitating the configuration, control and realisation of business processes by aligning and negotiating individual goals to fulfil the overall business tasks;
- merging Grid, semantic web and multiagent technologies to enable intelligent and autonomous adaptation to environmental changes during mid-execution (e.g. upcoming performance problems of the services, etc);
- closely linking the design and implementation process of the BREIN framework to the expertise of industrial partners acting as business experts;
- building its developments on top of existing results of relevant projects to build a base set for Grid, semantic web and agent

Contract number
034556

Type of project
Integrated project

Project coordinator
Telefónica Investigación y Desarrollo

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Project website
<http://www.gridsforbusiness.eu>

Maximum Community contribution to project
EUR 6 599 0122

Project start date
1 September 2006

Duration
36 months

technologies and to be up to date on technologies in the three main domains.

The validation of the approaches will be performed according to two scenarios with the development of a set of demonstrators that will be shown at the end of the project:

- **Virtual engineering on the Grid** — describing the formation and management of the resources of a virtual organisation formed for the purpose of performing virtual engineering design. Stakeholders for this scenario are ANSYS and the University of Manchester.
- **The airport management scenario**, which core elements are organisational and logistics process in the airport domain. Stakeholder for this scenario is the Flughafen Stuttgart.

BREIN will deliver the following main results:

- The **BREIN core platform**, consisting of a toolset of middleware modules building the basis for enabling secure and complex applications. During this project, the platform will be successfully deployed and validated by the chosen challenging scenarios. Additionally, it will be demonstrated to provide a new level of productivity and possibilities.
- **A reference architecture for business Grids** that goes far beyond solutions such as proposed by the Enterprise Grid Alliance that have been delivered to the community leading to a consolidation of approaches to enable interoperable solutions.
- Fusion of core concepts from the **agent** domain, **semantic web** technologies and **Grids**. BREIN will provide an infrastructure that integrates the capabilities of the three research domains into a unified view, thus bringing the three communities closer in working together.
- Integration of current research results from related projects. BREIN will take up, validate and extend results from research projects in the Grids, agents and semantic web area.
- A big step towards the 'knowledge Grid' will be made through BREINs usage of ontologies to form abstract interfaces understandable by humans. With this advancement of decreased complexity in the interaction with the BREIN framework, the uptake of Grid technology in business will be strengthened.

Project partners

Organisation name and country

TELEFONICA INVESTIGACION Y DESARROLLO SA	ES
THE UNIVERSITY OF MANCHESTER	UK
UNIVERSITAET STUTTGART	DE
ADEI CONSULTORIA SL	ES
FLUGHAFEN STUTTGART GMBH	DE
ANSYS EUROPE LTD	UK
ATOS ORIGIN SOCIEDAD ANONIMA ESPANOLA	ES
BOC ASSET MANAGEMENT GMBH	AT
BARCELONA SUPERCOMPUTING CENTER — CENTRO NACIONAL DE SUPERCOMPUTACION	ES
CENTRO DI RICERCA IN MATEMATICA PURA ED APPLICATA — CONSORZIO	IT
DATAMAT S.P.A.	IT
EUROPAISCHES MICROSOFT INNOVATIONS CENTER GMBH	DE
UNIVERSITY OF SOUTHAMPTON	UK
MAGYAR TUDOMANYOS AKADEMIA SZAMITASTECHNIKAI ES AUTOMATIZALASI KUTATO INTEZET	HU
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
UNIVERSITAET HOHENHEIM	DE

Bilateral research and industrial development enhancing and integrating Grid-enabled technologies

Bridge*



The Bridge project aims at demonstrating the benefits of Grid technology for international cooperation, in particular between Europe and the target country, China.

The EU and China have put great efforts on research and development of Grid technology. Simdat, one of the IP projects supported by the EU FP6 programme, has made significant progress in developing Grid technologies for data intensive and industrial applications. CNGrid, a key project of the China national high-tech R&D programme has also supported extensive research activities on Grid middleware and scientific and industrial applications such as aviation manufacture and new drug discovery.

By joint research efforts of European and Chinese research teams, the Bridge project aims at enhancing the Grid technology for both scientific and industrial applications. Bridge will be based on the previous research and development achievement of Simdat and CNGrid and try to address major technical issues which result from the far distance of the collaboration partners as well as from the conflicting goal of intense collaboration and protection of intellectual property rights.

The objectives of this project can be clarified as follows:

- To demonstrate the benefits of Grid technology for international cooperation.
- To develop, enhance and interconnect European and Chinese Grid middleware technology.
- To set up an integrated Grid test bed using European and Chinese middleware components for application demonstration.
- To set up joint application show cases using distributed workflow and data access technology.
- To disseminate the results of the project to industrial and academic communities.
- To provide a software platform supporting distributed product and process developments, respecting and protecting intellectual property rights.

CNGRID and Simdat are major ongoing projects in China as well as in the European Community. Both projects aim at the improvements of existing Grid infrastructures driven by concrete application use cases. Bridge will develop an interoperability interface between the CNGRID and Simdat infrastructure, which allows, in particular, the execution of distributed workflows as well as access to distributed data repositories. Remote access to specific analysis services will allow the actual and controlled usage of these analysis services for product and process development without disclosing all details.

Three application scenarios will be used to demonstrate cooperative design, simulation and data access between European and Chinese partners.

Contract number
045609

Type of project
Specific targeted research project

Project coordinator
Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V.

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Project website
To be defined

Maximum Community contribution to project
EUR 1 700 00

Project start date
Last quarter of 2006

Duration
24 months

* provisional information

Application scenario 1: Simulation and design in aerospace industries

Implementation of a distributed optimisation workflow for multidisciplinary helicopter cabin designs using simulation modules from EADS and AVIC II.

Application scenario 2: Environmental disaster prediction

The scenario is a distributed retrieval system for weather prediction results. The project should provide some resources for mutual access of a database repository containing simulation results.

Application scenario 3: Drug discovery

The scenario is a distributed docking workflow involving docking tools from Chinese participants as well as docking tools from European participants aiming at an improved result by combining results of several docking tools for the same targets.

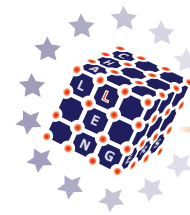
Project partners

Organisation name and country

FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
LMS INTERNATIONAL	BE
UNIVERSITY OF SOUTHAMPTON	UK
EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS	UK
DEUTSCHER WETTERDIENST	DE
EADS CENTRE COMMUN DE RECHERCHE	FR
INFORSENSE LIMITED	UK
COMPUTER NETWORK INFORMATION CENTER, CHINESE ACADEMY OF SCIENCES	CN
BEIHANG UNIVERSITY	CN
CHINA AVIATION INDUSTRY CORPORATION II SCIENCE & TECHNOLOGY COMMITTEE	CN
NATIONAL METEOROLOGICAL INFORMATION CENTER, CHINA	CN
SHANGHAI INSTITUTE OF MATERIA MEDICA, CHINESE ACADEMY OF SCIENCES	CN
NEOTRIDENT TECHNOLOGY LTD	CN

Support action on Challenges in Grids

Challengers — 'Against mainstream research'



CHALLENGERS

Senior executives in industry today need to foresee the medium to long term future of the ICT marketplace in order to make the right decisions for their company's needs. However, executive level decision-makers in industry face considerable challenges in following the constant and often complex changes of the technology landscape, especially in terms of powerful but still evolving technologies such as Grids and service oriented architectures. The EU-funded project, Challengers, is set to provide foundational and pragmatic insight for decision-makers into such technologies and the shifting landscape that surrounds them. The project will also address relevant socio-economic and business drivers, providing an analysis of a holistic, multidimensional nature.

Grids have already evolved from specialised supercomputing systems to much more general computer platforms: research now aims to develop further towards 'service-oriented knowledge utilities'. This vision, first articulated by the 'Next Generation Grid — NGG' expert group*, demonstrates Grids' natural position at the forefront of the clear trend of ICT convergence. But achieving this vision requires fragmented and often incompatible technologies serving a narrow spectrum of needs to be replaced by a unified, holistic technology. In essence, ICT itself must become knowledge-oriented at the technological level, and service-oriented at the user level. Challengers will explore the landscape of these challenges taking into account the needs of real-world business environments.

Challengers will do so by considering in depth multiple facets of the technical, social and business aspects. The constant integration, consolidation and cross-fertilisation of these analyses will be central to the project's approach. Business foresight will be tempered with technological reality. Technological foresight will be guided by socio-economic needs. Social foresight will be informed by the practical realities that influence society.

Challengers provides the organisational and administrative framework for the body of relevant experts who will undertake this work. The project will bring together many renowned Grid experts from several research and business communities. The selection of experts will emphasise practical experience, participation in decision-making that shapes the future of ICT and deep technological knowledge. The project pursues a 'down-to-earth' approach; its goals include dispelling illusions in addition to discerning real trends.

Challengers will achieve the following tangible results:

- **Increased awareness** among industrial decision-makers and researchers **of the challenges/opportunities/barriers facing Grids in the next decade.**
- **Development of a research agenda and a roadmap of prioritised technology challenges**, to function as the 'guiding tool' supporting the realisation of Grid and service-oriented knowledge utilities vision.

Contract number

034128

Type of project

Specific support action

Project coordinator

ICCS/NTUA — Institute of Communications and Computer Systems of the National Technical University of Athens

Contact person

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Project website
<http://www.challengers-org.eu>
Maximum Community contribution to project

EUR 746 000

Project start date

1 June 2006

Duration

30 months

* ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3_eg_final.pdf

- **Address the requirements of Grid-enabled critical infrastructures**, namely security, telecommunications, utilities and transportation infrastructures in terms of public safety, security applications and improvement of quality of life.

Project partners

Organisation name and country

INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
ATOS ORIGIN SAE	ES
COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS	UK

Grid services based environment
to enable innovative research

Chemomentum



Grid technologies are starting to realise their large potential to provide innovative infrastructures for complex scientific and industrial applications. To make Grids more useful for knowledge-oriented applications such as decision support systems and risk assessment, more effort in the areas of semantics, metadata and knowledge management in distributed, heterogeneous environments are needed.

The Chemomentum project aims to fill these gaps by taking up and enhancing state-of-the-art Grid technologies and applying them to real-world challenges in **computational chemistry** and related application areas. It will help drive the transformation of computing paradigms in these areas towards collaborative research and Grid computing.

The objectives of Chemomentum are to:

- Provide an **integrated Grid solution for workflow-centric, complex applications with a focus on data management and knowledge**. Enabling the end users to use powerful tools in a natural and transparent fashion will be a key focus of the project.
- Provide Grid-enabled applications, data services and knowledge management solutions, offering integrated decision support services for risk assessment, toxicity prediction and drug design.
- Set up and operate a stable pilot installation, accessible to external users. Proactively gather and evaluate feedback from these users. Simplify administration and management of the Grid.
- Spread awareness of the Chemomentum aims, approach, results and success stories in relevant industries and communities. Ensure maximum exploitation of the services and possible products developed in Chemomentum.
- Test-drive the developed services in the context of the European regulatory initiative 'Registration and Evaluation of Chemicals' (REACH), promoting the REACH initiative aimed at reducing animal testing, by developing *in silico*, Grid-based tools.

Specifically, the **Chemomentum system** will be used in the context of evaluation and risk assessment of chemicals: substances that have to be carefully evaluated and assessed for possible risks to human health and the environment prior to marketing and distribution. This requires massive efforts in terms of time, money and testing of animals.

The Chemomentum system has the potential to boost time-effectiveness and reduce the need for animal testing in this area by providing powerful solutions for the computational, '*in silico*', testing of chemicals. This concretely supports the European REACH (registration and evaluation of chemicals) initiatives aimed at optimising risk assessment strategies.

Contract number
033437

Type of project
Specific targeted research project

Project coordinator
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Project website
<http://www.chemomentum.org>

Maximum Community contribution to project
EUR 2 590 809

Project start date
1 July 2006

Duration
30 months

Project partners*Organisation name and country*

UNIwersYTET WARSZAWSKI	PL
FORSCHUNGSZENTRUM JUELICH GMBH	DE
UNIVERSITY OF TARTU	EE
TECHNISCHE UNIVERSITAET DRESDEN	DE
UNIVERSITY OF ULSTER	UK
ISTITUTO DI RICERCHE FARMACOLOGICHE 'MARIO NEGRI'	IT
UNIVERSITAET ZUERICH	CH
BIOCHEMICS CONSULTING SAS	FR
TXT E-SOLUTIONS SPA	IT

Dissemination and Exploitation of GRids in Earth science

Degree



Degree is a specific support action (SSA) project which aims to promote Grid throughout a large and diverse **earth science (ES) community**, in order to increase the awareness and uptake of Grid technology and infrastructure by EU earth science (ES) industry and research communities. It aims to do this **by developing and driving home convincing arguments on the considerable benefits of using Grid technology and infrastructures for large scale ES processing, e-collaboration and research.**

Although several earth science applications have been ported on Grid infrastructures since 2000, Grid technology is still undergoing development and the earth science community is very reluctant to deploy their applications on it. Therefore, Degree also seeks to address the barriers which stand in the way of a wider uptake of the technology, such as perceived complexity of the middleware, insufficient support for important ES functions and vital additional services.

The Degree **objectives** are:

- Disseminate, promote uptake of Grid in the wider ES community
- Reduce the gap between ES users and Grid technology
- Explain and convince ES users of Grid benefits and capability to tackle new and complex problems.

A major **challenge** for Degree is to build a bridge linking the ES and Grid communities throughout Europe, focusing in particular on the EGEE-II project. An ES applications panel with a range of candidate applications suitable for porting to Grid will make sure key ES requirements for porting and deployment on the Grid middleware are identified, communicated and discussed within the Grid community. At the same time the DEGREE SSA will ensure the ES community is informed and up to date on Grid developments and potential benefits.

The **results** will provide feedback to the Grid community and dissemination in the ES community will increase awareness of and involvement with Grid developments.

In order to ensure that ES requirements are taken into account in the next Grid generation, DEGREE will initiate different collaborations; at short, medium and long term via EU horizontal collaborations, specific collaboration with Grid projects and participation in the e-Infrastructure Reflection Group (e-IRG).

Contract number
034619

Type of project
Specific support action

Project coordinator
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Project website
<http://www.eu-degree.org>

Maximum Community contribution to project
EUR 1 000 000

Project start date
1 June 2006

Duration
24 months

Project partners*Organisation name and country*

USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED	SK
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	FR
KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT	NL
UNIVERSITE DE NEUCHÂTEL	CH
CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA SOCIETÀ A RESPONSABILITÀ LIMITATA	IT
EUROPEAN SPACE AGENCY	INT
COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE	FR
DUTCH SPACE BV	NL
FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
GÉOPHYSICAL CENTER OF THE RUSSIAN ACADEMY OF SCIENCES	RUS

Europe-China Grid InterNetworking

EC-GIN*



The Internet communication infrastructure (the TCP/IP protocol stack) is designed for broad use; as such, it does not take the specific characteristics of Grid applications into account. This one-size-fits-all approach works for a number of application domains, however, it is far from being optimal — general network mechanisms, while useful for the Grid, cannot be as efficient as customised solutions. While Grids are slowly emerging, the underlying network infrastructure is still in its infancy. Thus, based on a number of properties that make Grids unique from the network perspective, the EC-GIN (Europe-China Grid InterNetworking) project will develop tailored network technology in dedicated support of Grid applications. These technical solutions will be supplemented with a secure and incentive-based Grid services network traffic management system, which will balance the conflicting performance demand and the economic use of resources in the network and within the Grid.

Resulting from a collaboration between European and Chinese partners, EC-GIN parallels previous efforts for real-time multimedia transmission across the Internet that have special network requirements and show a special behaviour from the network perspective. However, while research into network support for multimedia applications has flourished, leading to a large number of standard protocols and mechanisms, the research community has neglected network support for Grid computing up to now. By filling this gap and appropriately exploiting/disseminating the project results, EC-GIN will, as a consequence, cause a 'snowball effect' in the European and Chinese networking and Grid computing research communities.

Technically, EC-GIN will make Grids work, operate, and communicate better. By appropriately utilising the underlying network, Grid resources in general will be used more efficiently, which either means greater productivity (because less time is wasted in waiting for results from Grid applications) or less financial investment (because today's efficiency can be attained with cheaper resources) and, therefore, amplifies the impact of Grid computing on the society and economy of Europe and China.

EC-GIN will make use of special Grid characteristics, mainly addressing the highly important ones listed above **for enhancing the communication capabilities of Grid applications**.

Since both the Grid and the Internet are under the control of humans, purely technical solutions that do not take human needs (demands of users and their applications) into account, have inevitable limitations. Therefore, EC-GIN mechanisms will be supplemented with a **secure incentive-based Grid service and network traffic management system**, which will balance the inherently conflicting interests of high performance (user need) and economic resource usage (service provider).

To summarise, the four major **objectives** of EC-GIN are the following:

- I. Development of Grid-specific network management mechanisms that enable Grid applications to use their resources more efficiently or in other words, **'make the Grid faster'**.

Contract number
045256

Type of project
Specific targeted research project

Project coordinator
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Project website
To be defined

Maximum Community contribution to project
EUR 2 200 000

Project start date
1 November 2006

Duration
36 months

* provisional information

2. Promote global adoption of Grid environments and tools particularly in a pan-European and pan-Chinese environment to achieve a **realistic and long-distance demonstrator case**.
3. Exploring Internet-based distribution of high-performance computing in China is highly important due to a practical and potentially large Chinese market. **EC-GIN will benefit** networking, sensor, large-scale database, data warehouse, information sharing, and expert knowledge sharing and will introduce necessary innovation and **novel technologies into the Chinese and European Grid systems**.
4. Cause a 'snowball effect' in the European and Chinese research community, convincing other networking/Grid computing researchers to jump on the bandwagon. This is a typical effect that happens when a crafty team of researchers focuses on a new research topic and accordingly disseminates its results.

EC-GIN will work towards achieving the four major objectives above; along the way, a number of tangible outcomes will be produced. The four most significant ones are:

- **Mathematical** models for generating Grid-like traffic in network simulators, and **Grid traffic generation code** for the 'ns-2' network simulator.
- **Prototype implementations** of network management enhancements for the Grid along with performance evaluation reports.
- A well-focused **implementation of key mechanisms** developed in the project; this will take the form of an extension to an open source operating system such as Linux.
- **Improved research collaborations** between China and Europe in Grid computing.

Project partners

Organisation name and country

UNIVERSITÄT INNSBRUCK	AT
UNIVERSITY OF ZÜRICH	CH
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE EET AUTOMATIQUE	FR
UNIVERSITY OF LANCASTER	UK
JUSTINMIND	ES
EXIS IT LTD — ELECTRONIC SYSTEMS AND INFORMATION TECHNOLOGY & TELECOMMUNICATIONS SOLUTIONS	EL
UNIVERSITY OF SURREY	UK
BEIJING UNIVERSITY OF POSTS AND TELECOMMUNICATIONS	CN
INSTITUTE OF SOFTWARE, CHINESE ACADEMY OF SCIENCES	CN
CHINA TELECOMMUNICATION TECHNOLOGY LABS	CN
BEIJING P&T CONSULTING AND DESIGN INSTITUTE CO.,LTD.	CN

European and Chinese cooperation on Grid

EchoGRID*



EchoGRID will foster collaboration between the EU and China in Grid research and technologies by developing short-, mid-, and long-term visions in the field.

The project will:

- establish a common Grid research agenda, relying on European and Chinese experts, both from academia and industry;
- consolidate this vision and promote cross-fertilisation between Grid-related projects and initiatives in Europe (e.g. NESSI, CoreGRID, NGG3) and China (e.g. the '863 high-tech programme');
- exchange experiences and best practices by selecting Grid open standards for Grid middleware and applications interoperability and by promoting the identification of guidelines for building a standard quality assurance process;
- support lasting cooperation and establish tangible partnerships in the field through support activities and tools, ranging from a mobility programme for researchers to a dedicated partner search engine.

EchoGRID will organise a set of thematic workshops on strategic Grid-related topics defined by the group of experts. These workshops will be open to researchers and engineers from both academia and industry to define a better view of the research and development activities both in China and Europe. A research exchange programme and a fellowship programme will also be set up to encourage exchange of personnel across countries and institutions.

The major outcomes the project will deliver are:

- 3-, 5- and 10-year roadmaps developing a shared European and Chinese vision of future Grid research perspectives for both the research and industrial communities; this joint vision will establish a clear technological and research agenda on which both sides may collaborate;
- a series of conferences and workshops open to both European and Chinese participants from research, industry, government, SMEs and user communities;
- EU-China interoperability grid plugtests to test and improve interoperability mechanisms of Grid middleware;
- a collaborative multilingual portal for grid-related resources;
- support of long-term collaborations between key Grid initiatives in the EU and China.

Contract number
045520

Type of project
Specific support action

Project coordinator
GEIE ERCIM

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Project website
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Maximum Community contribution to project
EUR 1 600 000 (to be confirmed)

Starting date
Last quarter of 2006

Duration
24 months

* provisional information

Project partners*Organisation name and country*

GEIE ERCIM	FR
NATIONAL TECHNICAL UNIVERSITY OF ATHENS	EL
ATOS ORIGIN SAE	ES
ENGINEERING INGEGNERIA INFORMATICA	IT
THALES SERVICES	FR
BEIHANG UNIVERSITY	CN
INSTITUTE OF COMPUTING TECHNOLOGY, CHINESE ACADEMY OF SCIENCES	CN
COMPUTER NETWORK INFORMATION CENTER, CHINESE ACADEMY OF SCIENCES	CN
NATIONAL UNIVERSITY OF DEFENSE TECHNOLOGY	CN
HUAWEI TECHNOLOGIES CO.	CN

A scalable QoS-enabled business Grid environment for multi-user real-time online interactive applications

Edutain@Grid



Online gaming is characterised by the high rate of interaction between users, requiring very fast updates of information being passed from one computer to another. The faster the updates, the more immersive the game becomes and consequently adds significantly to the whole gaming experience. At present, online games run in a static way that is dependant upon tight coupling of inflexible computer resources to fluctuations in the number of players. Users are very sensitive to interrupted game play, affecting their decision to play and ultimately their decision to purchase.

The Edutain@Grid project seeks to meet these challenges through development of a **Grid-based framework allowing responsive and interactive applications** to exploit technology that has previously been applied to 'big science'.

The distinctive **features** of the Edutain@Grid framework will be:

- Huge, stable user concurrency, that allows thousands of players to participate in highly dynamic online gaming not currently offered in the market place.
- Responsive real-time interaction among collaborating, competing, and cheating users.
- Easy to develop, sophisticated interactive real-time applications.
- Resilient and robust quality of service.
- Novel business-to-consumer market models.
- Easy to configure, user-friendly security models.

The **Edutain@Grid framework** will offer to the end-users unprecedented freedom of action, entertainment, adventure, training, etc. in a virtual world of unique dimensions on top of scalable and dynamic use of computer Grid resources. Facilitating rapid uptake of Edutain@Grid, the technology will be designed to be generic, scalable, and secure in nature. This will be achieved by providing sophisticated **Grid middleware services, distributed real-time computation, and easy to configure user portals**.

The aim will be to allow both established Grid users and new applications developers to make use of this new technology at minimal cost. At present this has not been achieved in the marketplace and therefore has the potential to stimulate a whole new community of developers, service providers and end-users.

Within the Edutain@Grid project **two demonstrator applications** will be developed and validated including an **online multi-player game** and a **multi-user e-learning application** in counter pollution (natural environment).

The project shall seek to meet the broader market needs through two user groups that will help define the requirements. Membership will be selected from a range of organisations that represent key potential user groups.

Contract number

034601

Type of project

Specific targeted research project

Project coordinator

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Project website

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Maximum Community contribution to project

EUR 2 498 000

Project start date

1 September 2006

Duration

36 months

Project partners*Organisation name and country*

LEOPOLD-FRANZENS-UNIVERSITAET INNSBRUCK	AT
WESTFAELISCHE WILHELMS-UNIVERSITAET MUENSTER	DE
UNIVERSITY OF SOUTHAMPTON	UK
JOHANNES KEPLER UNIVERSITAET LINZ	AT
DARKWORKS S.A.	FR
BMT CORDAH LTD.	UK
AMIS LTD.	SI

An integrated, Grid-enabled workbench tool for Grid application users, Grid developers and Grid operators based on the Eclipse platform

g-Eclipse



In recent years many Grid projects were initiated on a national and European level. But they focus mainly on building infrastructure and middleware rather than on supporting users, developers and administrators. There is still a **lack of a uniform toolbox to serve as an entry point to the Grid** and to provide a one stop Grid access for different user activities. Currently, most of the Grid tools are stand-alone applications that address one specific problem or application-domain on the Grid. Consequently, Grid application development is hindered by the lack of common, generic Grid-based environments and tool kits that can easily integrate existing stand-alone tools. Such toolsets must have the potential of being adopted by a broad range of application-developer, operator, and end-user communities.

The **g-Eclipse framework** will be the future workbench bringing new applications, new users and new Grid resource providers together in the European research area. It will provide an integrated Grid environment for Grid users, Grid operators and Grid developers, bringing together expertise from the academic Grid community and from the Eclipse community.

The strategic **objectives** of the g-Eclipse project are the following:

- Develop an **integrated tool** for Grid application development and deployment based on the Eclipse platform.
- Develop a **general framework** that can be used by Grid users, Grid developers and Grid operators. g-Eclipse will provide integration support to enable other FP6 projects to integrate their Grid tools into this framework.
- Integrate into the framework many **existing Grid tools** that have been developed and are contributed by consortium partners such as the **Migrating Desktop (MD)**, the **Grid Visualisation Kernel** and the **GridBench** from the FP5 EU-funded **CrossGrid** project (<http://www.crossgrid.org>).

The g-Eclipse integrated Grid environment will allow for **user-friendly access to Grid resources** by making the increasing complexity of the Grid invisible.

The **architecture** of the g-Eclipse framework will be made for reuse and extensibility in order to allow easy adaptation and adoption by new Grid applications.

g-Eclipse addresses **three major groups** in the Grid domain: **Grid users** will benefit from the desktop-like access to Grid resources; **Grid operators** and resource providers will be able to reduce the time-to-service by the Grid management and Grid site configuration tools; and **Grid application developers** will reduce the time-to-market for new Grid applications by accelerating the development and deployment cycle.

The g-Eclipse framework will be built on top of the **open source Eclipse framework** which is the most successful open-source integrated development environment (IDE) nowadays.

Contract number
034327

Type of project
Specific targeted research project

Project coordinator
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Project website
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Maximum Community contribution to project
EUR 1 960 000

Project start date
1 July 2006

Duration
24 months

Project partners*Organisation name and country*

FORSCHUNGSZENTRUM KARLSRUHE GESELLSCHAFT MIT BESCHRAENKTER HAFTUNG	DE
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
JOHANNES KEPLER UNIVERSITÄT LINZ	AT
UNIVERSITY OF CYPRUS	CY
INNOOPRACT INFORMATIONSSYSTEME GMBH	DE
THE UNIVERSITY OF READING	UK

GRid enabled access to rich mEDIA content

Gredia*



Grid technology has achieved significant advances in the past few years, thanks in part to a significant number of prominent organisations who have contributed to Grid middleware. This has opened horizons for new exploitation opportunities; however, this potential exploitation has not yet fully materialised in terms of the emergence of new applications for industry. Use of **Grid technology is still confined mainly within scientific applications**, developed by scientific organisations, who have the necessary expertise in Grid principles. Many organisations developing IT applications for industry have been reluctant to leverage Grid technologies and concepts, due to perceived complications in their use and deployment.

Gredia will address this problem with the provision of a **Grid application development platform**, a tool which will provide high level support for the development of Grid business applications through a completely graphical user interface. Central to the business applications that Gredia is targeting are (a) the concept of a **virtual organisation** and (b) the demand for **access and sharing of large quantities of distributed annotated numerical and multimedia content**.

The potential effects of the platform will be validated through two **pilot applications servicing news and banking organisations**, demonstrating secure access to distributed multimedia content in the first case and numerical annotated data in the second. Mobile terminals will also be explicitly addressed, with **advances proposed in the Symbian operating system** relating to extensions that will facilitate mobile devices to exploit Grid technologies in a seamless way.

The objectives of Gredia are to provide:

- **a Grid application development platform** — The main goal of Gredia is to design, implement and validate a reliable platform with high-level support for the design, development and operational deployment of secure Grid business applications;
- **Grid middleware** — The platform will make use of existing and new middleware which will be built to service business applications in need of secure access to distributed rich media content;
- **mobile services** — The platform will support services that will be built to allow mobile devices to participate in the Grid virtual organisation;
- **a security framework** — The platform data and transaction will be protected at all levels through a dedicated security framework that will be developed for these purposes;
- **two pilot Grid business applications** — The platform will be validated by producing two pilot Grid applications to service the domains of media and banking.

To achieve these objectives a multi-disciplinary international consortium has been assembled that includes key technology providers, user

Contract number
034363

Type of project
Specific targeted research project

Project coordinator organisation
Athens Technology Center SA

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Project website
Not available yet but plan to apply for
www.GREDIA.eu

Maximum Community contribution to project
EUR 2 410 895

Project start date
Last quarter of 2006

Duration
30 months

* provisional information

organisations and leading academic institutions from seven European countries along with a world-renowned partner in the area of semantic Grid research from China.

Project partners*Organisation name and country*

ATHENS TECHNOLOGY CENTER S.A	EL
SYMBIAN SOFTWARE LIMITED	UK
DEUTSCHE WELLE	DE
THE ACADEMIC COMPUTING CENTRE CYFRONET AGH	PL
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
CITY UNIVERSITY OF LONDON	UK
UNIVERSIDAD DE MALAGA	ES
INSTITUTE OF COMPUTING TECHNOLOGY, CHINESE ACADEMY OF SCIENCES	CN
EKDOTIKOS OIKOS DIAS DEMOSIA LTD	CY

Self-Grid: dynamic virtual organisations for schools, families, and all

Grid4All



Grid4All embraces the vision of a **'democratic' Grid** as a ubiquitous utility whereby domestic users, small organisations and enterprises may draw on resources on the Internet without having to individually **invest** and **manage** computing and IT resources.

Internet and its services are central to European life — at work and at home, indoors and outdoors. The next logical step is to provide the possibility to plug-and-upgrade personal computing capacity and to secure collaborative edutainment space on the fly through **managed** sharing of IT resources over the Internet. Grid4All will enable Grid services to evolve from high performance computing niche markets to a multipurpose service for anybody.

Grid4All — by leveraging the large base of broadband users — is aiming to advance the pervasiveness of Grid computing across society.

Grid4All will achieve the following **objectives** for the Grid community:

- Alleviate administration and management of large scale distributed IT infrastructure — by pioneering the application of component based management architectures to self-organising peer-to-peer overlay services.
- Provide self-management capabilities — improve scalability, resilience to failures and volatility, thus paving the way to mature solutions enabling deployment of Grids on the wide Internet.
- Widen the scope of Grid technologies by enabling on-demand creation and maintenance of dynamically evolving scalable virtual organisations, even short lived.
- Apply advanced application frameworks for collaborative data sharing applications executing in dynamic environments.
- Capitalise on Grids as revenue generating sources to implement utility models of computing but using resources on the Internet.

Grid4All will help to bring global computing to the **broader society** beyond that of academia and large enterprises by providing an opportunity to small organisations and individuals to reap the cost **benefit** of resource **sharing** without, however, the burdens of management, security, and administration.

The consortium will demonstrate this by applying Grid4All in **two different application domains**: collaborative tools for e-learning, targeting schools and digital content processing applications targeting residential users.

Contract number
034567

Type of project
Specific targeted research project

Project coordinator
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Project website
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Maximum Community contribution to project
EUR 2 900 000

Project start date
1 June 2006

Duration
30 months

Project partners*Organisation name and country*

FRANCE TELECOM SA	FR
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	FR
KUNGLIGA TEKNISKA HOGSKOLAN	SE
SICS, SWEDISH INSTITUTE OF COMPUTER SCIENCE AB	SE
INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	EL
UNIVERSITY OF PIRAEUS RESEARCH CENTER	EL
UNIVERSITAT POLITECNICA DE CATALUNYA	ES
REDEDIA SL	ES

GRID programming with COMPONENTs: an advanced component platform for an effective invisible Grid

GridCOMP



Information technologies require standards for interoperability; they are a true catalyst for scientific and business development. The GridCOMP project will define and implement a Grid component model (GCM) for the IT sector. Standard Grid components will make it possible to seamlessly compose applications and services deployed on large scale infrastructures, e.g. several thousand machines all over the world.

The GridCOMP **main goal** is the design and implementation of a component based framework suitable to support the development of efficient Grid applications. The framework will implement the '**invisible Grid**' concept: abstract away Grid-related implementation details (hardware, OS, authorisation and security, load, failure, etc.) that usually require high programming efforts to be dealt with.

The **objectives** of the GridCOMP project are the following:

- Interoperate with existing standards, such as web services, WSRF, Unicore, EGEE gLite;
- Become a 'de facto' standard for big industry and SMEs, specifying and implementing all the features usually expected from an actual Grid programming framework;
- Address both scientific computing and enterprise computing;
- Reach a worldwide audience thanks to the involvement of non-European partners from South America, Australia and China.

GridCOMP will take the **Grid component model** (GCM, NoE CoreGRID) as a first specification, and use the ObjectWeb ProActive open source implementation as a starting point. **ObjectWeb ProActive Grid middleware** ensures interoperability with other standards: EGEE gLite, Unicore, NorduGrid, Globus, web services.

Coordination with the NESSI initiative is also a strong priority, with the involvement of ObjectWeb, Atos Origin, IBM.

Expected **results** in the scientific domain are significant accelerations in developing new simulations, and, as such, new discoveries.

The **impact** on the EU economy can be foreseen by analogy to the GSM standard. GSM has changed the way mobile telecommunication infrastructures were built, bringing the EU to the leading edge of the technology. Similarly, GCM should stimulate the domain of IT infrastructure management and application development, reinforcing Europe leadership in the sector.

Contract number
034442

Type of project
Specific targeted research project

Project coordinator
Scientific coordinator —
Mr Denis Caromel (INRIA).
Administrative and financial coordinator —
Bruno Le Dantec (ERCIM).

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Project website
<http://gridcomp.ercim.org>

Maximum Community contribution to project
EUR 1 750 000

Project start date
1 June 2006

Duration
30 months

Project partners*Organisation name and country*

GEIE ERCIM	FR
INRIA (INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE)	FR
UNIVERSITA DI PISA	IT
THE UNIVERSITY OF WESTMINSTER	UK
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
GRID SYSTEMS S.A.	ES
IBM RESEARCH GMBH	CH
TSINGHUA UNIVERSITY	CN
THE UNIVERSITY OF MELBOURNE	AU
UNIVERSIDAD DE CHILE	CL
ATOS ORIGIN SAE	ES

Grid economics and business models

GridEcon



Recent developments in service technologies (e.g. web services) and Grid technologies hold the promise that the next-generation Grid could develop to be a rich economic or commercial arena where a wide variety of computational services and utilities are bought and sold. Therefore, unless the next generation of Grid technology provides the means for Grid participants to operate in this economics-aware environment and to resolve those economics problems, Grid will not realise its full potential and its commercial adoption will be in jeopardy.

GridEcon will provide an infrastructure that allows end-users not only to consume but also to sell services and resources on the Grid, therefore, creating a **new economy** in which all end-users can actively participate.

The GridEcon consortium envisages the Grid as being more than just a large distributed system, which provides virtualised services to its users and enables computing on demand on a best-effort basis at zero cost (free resources). Instead, GridEcon expects the Grid to offer services that span many economically independent enterprises that make independent decisions, forming a real economy. The Grid is expected to evolve into an infrastructure, allowing the resolving of differences in service preferences of participants and the expression of their utility through interaction in an economy (in markets). This **economics-aware Grid** will create additional value for its participants by fully exploiting the economic value of the resources and providing the basis for developing creative, new business models.

The overall **goal** of the GridEcon project is to advance the functionality of existing Grid technology with respect to its capability to allow the **economics-aware operation of Grid applications**. GridEcon will propose the necessary solutions and extensions to this technology, so that new **Grid business models** can be implemented.

The specific **objectives** that will be pursued are:

- Analyse economic issues that arise in the current and emerging Grid business models by using representative scenarios of Grid computing in different potential market sectors (general public, SME, large enterprises, and academia).
- Analyse new paradigms of revenue generation, accounting and settlement in the utility services mode.
- Design markets for services at various levels of service provisioning, from basic utility services to web services where buyers can express preferences for quality and reliability.
- Validate these findings by implementing specific Grid components, that allow the economics-aware operation of Grid applications. Integrating them with existing Grid middleware will have an **impact** on the design and development of new technology for Grid economics and Grid business models.

The long-term **benefits** of GridEcon technology to the end-user include:

- The ability to generate income by selling services or sharing resources, and the capability of choosing the appropriate level of service by paying the appropriate price.

Contract number

033634

Type of project

Specific targeted research project

Project coordinator

International University in Germany

Contact person

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Project website:<http://www.gridecon.eu>**Maximum community contribution to project**

EUR 2 350 000

Project start date

1 July 2006

Duration

30 months

- A reduced participation risk by deploying well defined SLA's that are appropriate for the Grid environment.
- The capability to collaborate in an environment that extends across individual organisation boundaries without losing control of his own resources, where there is an economically fair sharing of costs and generated value.

The GridEcon initiative is unique, well timed and truly innovative and essential for Europe to take the lead in the definition and development of **Grid economics and business models**.

Project partners

Organisation name and country

INTERNATIONAL UNIVERSITY IN GERMANY BRUCHSAL gGmbH	DE
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS — RESEARCH CENTER	EL
ERNST & YOUNG EUROPEAN INCENTIVES ADVISOR MSC	BE
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	UK
LOGICACMG NEDERLAND B.V.	NL
GIGASPACE TECHNOLOGIES LTD	IL
REAL TIME ENGINEERING LIMITED	UK
ATHENS TECHNOLOGY CENTER S.A.	EL
THE 451 GROUP LIMITED	UK

Trust and security for next generation Grids

GridTrust*

Grid trust and security are vital areas for moving towards the next generation Grids. Security and trust are key issues for creating more effective routes for industrial exploitation by translating research results into economic benefits. They are also considered vital for making Europe a world-leading force in Grid research. However, current Grid capabilities need to be advanced in order to move the Grid from e-science to businesses. More generally, trust and security in Grids are key challenges for building a global service-oriented market that can provide software services that can be trusted by its users (service-oriented knowledge utilities). Trust and security are also important issues for services architectures and software infrastructures for driving the knowledge economy.

The overall objective of the GridTrust project is to develop the technology to manage trust and security for the next generation Grids (NGG). GridTrust will take a vertical approach in tackling issues of trust, security and privacy (TSP) from the user requirements level down to the application, middleware and foundation levels. The emphasis is on models and tools to assist in reasoning about trust and security properties along the NGG architecture.

The project has the following specific objectives:

- 1. Analyse trust, security and privacy requirements in virtual organisations.** The project will develop a methodology and a tool that allow formal analysis of TSP requirements, highlighting the impact of TSP on particular virtual organisation (VO) business models. TSP requirements will be refined into policies for usage control of Grid resources.
- 2. Support reasoning about trust and security properties in dynamic virtual organisations.** GridTrust will investigate the composition of Grid services taking into consideration trust and security properties as well as non-functional properties such as quality of service. Further, it will develop techniques and tools to verify that the general properties of a VO are respected by all VO participants along the VO life cycle. It will produce an interactive execution environment that allows users to adapt their composition to changes in trust and security properties, discovery and inclusion of services; selecting the best execution path in complex compositions.
- 3. Provide autonomic security management models centred on trust-based policies for continuous usage control.** GridTrust aims at developing a novel model of resource access based on the continuous usage control for Grid computational services. It encompasses new methods for dynamic monitoring and runtime enforcement of security properties, extended with trust-based approaches such as reputation systems.
- 4. Develop a reference implementation and validate the approach in several application scenarios.** The project will build a reference implementation of a trust and security management system, applying the models and techniques developed. Such reference

* provisional information



GridTrust

Contract number
033817

Type of project
Specific targeted research project

Project coordinator
Centre d'Excellence en technologies de l'information et de la communication

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Project website
<http://www.gridtrust.org>

Maximum Community contribution to project
EUR 2 200 000

Project start date
1 June 2006

Duration
36 months

implementation will be validated on several scenarios in the domains of telecommunication and business.

Expected result of project: the end result of the project, i.e. the development of a **generic** GridTrust framework integrated in the **OGSA** architecture, will allow Grid users to define and operate virtual organisations that are governed by trust, security and privacy policies.

The GridTrust framework will consist of: (1) a **methodology** and an interactive execution **environment** that will help Grid service requestors and providers to express and reason about **trust, security** and **privacy** properties for different kinds of **virtual organisation** (VO) topologies, taking into account aspects such as self-organisation, self-management, self-adaptation and evolvability; (2) a reference Grid security architecture, including an **autonomic** policy management for fine **grained usage control** of Grid resources; and (3) an open source reference implementation of trust and security management systems, validated by scenarios in the business domain.

The resulting tools will be validated on innovative business applications from different application sectors. The three business application domains are **(1) distributed knowledge management, (2) supply chain and product management, and (3) distributed authoring.**

Case study (1) will experiment with different VO models ranging from centrally managed to fully distributed. Different possible combinations of centrally managed VO policies vs. usage control policies locally defined by the node will be investigated. Granting or denying resource usage based on several criteria including the role of the requesting client, trust information, usage monitoring from previous interactions, will be investigated.

Case study (2) involves a federation of organisations, and requires that participating organisations can regulate access to their resources by other organisations in a way that ensures their individual policies for information sharing are honoured.

Case study (3) emphasises service composition such that security and trust properties can be guaranteed.

Project partners

Organisation name and country

CENTRE D'EXCELLENCE EN TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BE
COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS	UK
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
VERENIGING VOOR CHRISTELIJK HOGER ONDERWIJS, WETENSCHAPPELIJK ONDERZOEK EN PATIENTENZORG (VRIJE UNIVERSITEIT AMSTERDAM)	NL
INTERPLAY SOFTWARE SRL	IT
HEWLETT PACKARD ITALIANA SRL	IT
ISTITUTO GEOGRAFICO DE AGOSTINI S.P.A.	IT
APIF MOVICQUITY S.A.	ES

Grid-enabled know-how sharing technology based on ARC services and open standards

KnowARC



KnowARC

Grid computing benefits have been successfully exploited in many dedicated projects, proving that Grids can increase productivity and lead to an efficient use of computer resources when it comes to collaboration among several partners who do not share the exact same computational infrastructure. However, Grids are currently used mainly by the Grid experts themselves, and often in narrow communities, such as high energy physics. Relatively few organisations outside of the scientific Grid community benefit from the technology.

A major reason for the low acceptance of Grids among non-Grid experts is the serious shortcomings of existing Grid software. Common problems are that most Grid software is very difficult to operate and use, is not portable, is insufficiently stable, and is not standardised. Most Grid solutions on the market have never been intended to be a ready-to-use software, being research vehicles instead, often in a prototype state.

A typical problem that slows down wide Grid acceptance is absence of a user-friendly interface.

KnowARC develops Grid middleware ready to be used by non-Grid experts in a variety of application areas.

The principle **objectives** of KnowARC are:

- To create a novel, powerful next generation Grid middleware, widely respected for its simplicity, non-invasiveness and cost-efficiency.
- To promote Grid standardisation and interoperability.
- To contribute to Grid technology take-up, bridging the gaps between business and academia in Grid development.

KnowARC develops a high quality **production-ready Grid software** on the base of the current ARC (Advanced Resource Connector) Grid solution. It will meet the requirements of a production-quality software in terms of stability, low operational costs, ease of use, portability, and performance.

KnowARC, being simple in installation and usage, has the **potential to** foster higher acceptance of Grid software in areas outside of the current Grid community, in business and society for example.

Contract number
032691

Type of project
Specific targeted research project

Project coordinator organisation
University of Oslo

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Project website
<http://www.knowarc.eu>

Maximum Community contribution
EUR 2 899 494

Project start date
1 June 2006

Duration
36 months

Project partners*Organisation name and country*

UNIVERSITETET I OSLO	NO
LUNDS UNIVERSITET	SE
KOEBENHAVNS UNIVERSITET	DK
UPPSALA UNIVERSITET	SE
NEMZETI INFORMACIOS INFRASTRUKTURA FEJLESZTESI IRODA	HU
UNIVERSITE DE GENEVE	CH
UNIVERZITA PAVLA JOZEFA SAFARIKA V KOSICIACH	SK
UNIVERSITAET ZU LUEBECK	DE
SCIENCE + COMPUTING AG	DE
SUN MICROSYSTEMS MAGYARORSZAG SZAMITASTECHNIKAI KFT	HU

Networked European software and services initiative-Grid

NESSI-Grid*



NESSI-Grid – contributing to NESSI

The concept of technology platforms is now recognised as a means to launch technology initiatives at the European scale to address research in the major RTD priority areas in support of European industrial policy. In this context, **NESSI** (Networked European Software & Services Initiative) objectives are to identify a technological vision based on shared priorities and the definition of a common strategic research agenda to create the competences and open software and services solutions for Europe to become the most competitive knowledge economy and society in the world.

NESSI-Grid's **objective** is to contribute to the activities of the NESSI technology platform with a specific focus on the next generation Grid technologies that will foster the provision of IT Services as utilities.

The NESSI-Grid project will help industry, research organisations, public authorities, financial institutions and other stakeholders across the EU to join forces and coordinate their actions for the contribution of Grid and service architecture strategies to NESSI's strategic research agenda (SRA) and their implementations. While the SRA contribution constitutes a key component of NESSI-Grid, the project will also address related structural, educational, and regulatory matters (standards, IPR, research infrastructure, training).

The main **goals** and **activities** pursued by NESSI-Grid are to:

- actively assist and support those working groups initiated by the NESSI European technology platform that will elaborate, maintain and monitor a common target SRA, contributing to the technology pillar of 'Software, Grids, Security and Dependability' as defined in the seventh research framework programme;
- involve SMEs and link with current ERA-Net initiatives and with the international scientific community, thereby gathering experts in the domain and promoting participation of new players;
- investigate the requirements, in both technical and business domains, for large research infrastructures in Europe;
- support the development of Grid and IT utilities business domains, investigating user needs and ways of satisfying them in close cooperation with the Grid, service oriented architectures and IT utilities stakeholders;
- promote, in cooperation with NESSI and with existing bodies, the required standardisation actions as business drivers, especially in the field of regulations, to support business process interoperability.

The **SOKU** (service oriented knowledge utilities) concept as defined by the Next Generation Grid experts group¹ concept, will be an important aspect covered by NESSI-Grid and, in this way, the project will help to develop and further implement this concept.

* provisional information

¹ 'Future European Grids: GRIDs and Service Oriented Knowledge Utilities (SOKU)' report from the Next Generation Grid experts group (<http://cordis.europa.eu/ist/grids>)

Contract number
033638

Type of project
Specific support action

Project coordinator
Telefónica Investigación y Desarrollo

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Project website
Under construction,
by now <http://www.nessi-europe.com>

**Maximum Community
contribution to project**
EUR 1 202 231

Project start date
1 May 2006

Duration
30 months

Project partners*Organisation name and country*

TELEFONICA INVESTIGACIÓN Y DESARROLLO	ES
ATOS ORIGIN SA	ES
BRITISH TELECOMMUNICATIONS PLC	UK
ENGINEERING INGEGNERIA INFORMATICA	IT
IBM BELGIUM	BE
INRIA/ObjectWeb	FR
NOKIA OYJ	FI
SAP AG	DE
SOFTWARE AG	DE
THALES GROUP	FR

Quasi-opportunistic supercomputing for complex systems in Grid environments

QosCosGrid*



The understanding of physical, biological and social systems is changing as the scientific community has come to appreciate the broad relevance of complexity in these systems.

Complex systems are systems with interdependent parts. This interdependence means that one cannot predict a system's behaviour by just considering the sum of its parts. Instead one must consider how the interrelationships between the parts affect the behaviour of the whole. In the study of natural systems such as bio-molecular interactions, ecology or stellar dynamics, complexity is posing a challenge to understanding.

Many of the key problems today such as global warming, and ecological deterioration have to do with human activities that failed to appreciate the complexity of these respective systems. The design failure of man-made systems such as processors, medical drugs or even the failure of political systems can also be attributed to large system complexities.

The methodologies used to understand the properties of these complex systems involve modelling and simulation, which require considerable and expensive computational resources.

The QosCosGrid project will provide a **Grid infrastructure for the simulation of complex systems**. It will enable users to develop modelling applications without the need to access supercomputers. By harnessing the available Grid resources in a better than opportunistic way, it will be possible to provide a service solution to systems science that is computationally comparable to a supercomputer, at a greatly reduced cost.

The **objectives** of the project that will facilitate this system include:

- To provide a system that will exploit available Grid resources and provide a computational alternative to a supercomputer service.
- To provide the means for systems science users to develop complex systems applications which have supercomputing requirements.
- To provide a problem-solving environment for users that will intuitively represent the modelling paradigms.
- To provide computing power that will be more economical, though of a somewhat lesser quality of service than a supercomputer.
- By addressing the semantics of the user application, it will match the target resources with the needs of the complex system.
- With the functionality for end to end provisioning, the simulation will perform better than a pure opportunistic Grid approach.

The **areas of research** of this project that will be required for the attainment of these objectives are:

- Semantic and agent technologies for intelligent resource brokering and management.
- Dynamic composition and orchestration of ubiquitous Grid services.

Contract number
033883

Type of project
Specific targeted research project

Project coordinator
School of Biomedical Sciences
University of Ulster

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Project website:
<http://www.QosCosGrid.org>

Maximum Community contribution to project
EUR 2 800 000

Project start date
1 September 2006

Duration
30 months

* provisional information

- Negotiation for the provision of necessary resources.
- Fault tolerant protocols for Grid middleware aware communication.
- Non-trivial parallelisation of the complex system simulation and data-processing applications.
- Adaptation of the complex system algorithms to the quasi-opportunistic supercomputing environment.

To evaluate this quasi-supercomputing Grid technology, the project will provide a **test bed** for nine complex system-modelling applications. The applications will represent a range of modelling paradigms from a variety of research domains.

Project partners

Organisation name and country

UNIVERSITY OF ULSTER (UU)	UK
THE UNIVERSITY OF QUEENSLAND	AU
TECHNION — ISRAEL INSTITUTE OF TECHNOLOGY	IL
CRANFIELD UNIVERSITY	UK
UNIVERSITAT POMPEU FABRA	ES
COLLEGIUM BUDAPEST EGYESULET	HU
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	FR
INSTYTUT CHEMII BIOORGANICZNEJ PAN W POZNANIU	PL
UNIVERSITEIT VAN AMSTERDAM	NL
PLATFORM COMPUTING SARL	FR
AITIA INTERNATIONAL INFORMATIKAI ZARTKORUEN MUKODO RT	HU

Self-organising ICT resource management

SORMA

**Description**

In recent years, the cost of ICT infrastructure has greatly increased as a result of several factors including the 'one-application-one-platform' approach to software development. This has also been accompanied by low **system utilisation**, which results in **wasting the available hardware resources**. This is demonstrated by the examples, identified in various studies:

- Many corporate data centres only utilise 10 % to 35 % of their available processing power.
- The average utilisation rates of desktop computers are as low as 5 %.
- Between 50 % and 60 % of a typical company's data storage capacity can often be wasted.

Recently, ICT has undergone a shift from being an asset that companies own (e.g. computers, software) to being a service that companies purchase from service (and/or utility) providers. The full impact of this shift will not be known for a while, but some of the technical building blocks have already started to appear on the market. This shift has also seen the emergence of **utility computing** as a business model. Within such a model, a service provider makes computer resources and infrastructure management available to the customer on-demand, and **charges** them for **specific use**. This new business model relies on service-oriented architecture, and is believed to be one way to drive down costs and complexity by effectively providing plug & play service provisioning of ICT infrastructure.

The virtualisation of ICT infrastructure and services requires technical solutions that facilitate the reasonable allocation strategies for these resources. **Marketplaces** are, in particular, well suited for **resource allocation mechanisms**, as they can set the right incentives to match supply and demand adequately. However, the methods and tools required for this currently do not exist. In light of this, the EU-funded research project SORMA is focusing on the development of methods and tools for establishing the means to enable the efficient market-based allocation of resources.

The objectives of SORMA are:

- The delivery of a platform that allows **dynamic trading of ICT resources 'on-demand'**. Additionally, this platform will provide access to the previously purchased ICT resources to the buyers (fulfilment).
- The **alignment and integration** of the resulting Grid market with **emerging Grid standards and infrastructure**.
- The development of **economically sound, sustainable and customisable business models for Grids**.
- The conceptualisation and **implementation of a toolset** that facilitates trading over Grid markets.
- The delivery of a **demonstrator** that showcases the workings of the Grid market.

Contract number

034286

Type of project

Specific targeted research project

Project coordinator

Universität Karlsruhe (TH)

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Project website<http://www.sorma-project.org/>**Maximum Community contribution to project:**

EUR 2 700 000

Project start date

1 August 2006

Duration

36 months

By bringing the Grid and economic principles closer together, SORMA will pave the way for a **wider adoption** of Grid and related technologies to the larger community. In particular, it will thus exploit the potential that the Grid offers. The widespread use of the Grid will reduce the IT costs of companies considerably. It is believed that outsourcing activities will allow better products and services to be produced, as well as cheaper or better-organised internal processes.

Project partners

Organisation name and country

UNIVERSITAET KARLSRUHE	DE
FORSCHUNGSZENTRUM INFORMATIK AN DER UNIVERSITAET KARLSRUHE	DE
CARDIFF UNIVERSITY	UK
SICS, SWEDISH INSTITUTE OF COMPUTER SCIENCE AB	SE
BETRIEBSWIRTSCHAFTLICHES FORSCHUNGSZENTRUM FUER FRAGEN DER MITTELSTAENDISCHEN WIRTSCHAFT E.V. AN DER UNIVERSITAET BAYREUTH	DE
UNIVERSITAT POLITECNICA DE CATALUNYA	ES
THE UNIVERSITY OF READING	UK
THE HEBREW UNIVERSITY OF JERUSALEM	IL
SUN MICROSYSTEMS PTE LTD	SG
CORRELATION SYSTEMS LTD	IL
TXT E-SOLUTIONS SPA	IT
BARCELONA SUPERCOMPUTING CENTER — CENTRO NACIONAL DE SUPERCOMPUTACION	ES

Building and promoting a Linux-based operating system to support virtual organisations for next generation Grids

XtreemOS



The emergence of Grids enables the sharing of a wide variety of resources for solving computational and data intensive problems in science, engineering and business, enabling complex workflows and dynamic collaborations across multiple administrative domains. While much progress has been achieved in building Grid middleware on top of existing operating systems, little has been done to extend the underlying operating systems for enabling and facilitating Grid computing, for example by embedding some important Grid functionalities (e.g. Grid resource scheduling) directly into the operating system kernel.

The XtreemOS project aims to develop new services to be added to an existing operating system to build Grid infrastructure in a simple and cost-effective way.

The **main objectives** of the XtreemOS project are:

- To build a **reference open source Grid operating system** based on **Linux** for PCs, clusters and mobile devices.
- To provide a **simple Grid API compliant with Posix** while adding new functionality and supporting Grid-aware applications.
- To identify fundamental functionalities to be embedded in Linux for secure application execution in Grid environments.
- To develop a set of **self-healing** OS services for secure resource management in **very large dynamic** Grids.
- To aggregate cluster resources into powerful Grid nodes by **integrating single system image mechanisms in Linux**.
- To build an XtreemOS flavour for mobile devices enabling **ubiquitous access to Grid resources**.
- To **validate** the design and implementation of the XtreemOS Grid operating system with a set of **real use cases** in scientific and business domains on a large Grid testbed.
- To **promote** XtreemOS software and **create communities of users and developers**.

XtreemOS targets the widely-accepted Linux open source operating system, extending it towards Grid with native support for virtual organisations.

One of the most important **challenges** in XtreemOS is the identification of the fundamental functionalities that are to be embedded in the Linux kernel.

A set of operating system services, extending those found in the standard Linux distribution, will provide Linux users with all the Grid capabilities associated with current Grid middleware, but fully integrated into the OS, thus significantly enhancing the performance of today's middleware-based solutions. The underlying Linux OS will be extended as needed to support virtual organisations spanning across many machines and to provide appropriate interfaces to Grid OS services.

Installed on each participating machine (personal computer, cluster of workstations, mobile device), the XtreemOS system will provide for the

Contract number
033576

Type of project
Integrated project

Project coordinator
Caisse des dépôts et consignations

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Project website
<http://www.XtreemOS.org>

Maximum Community contribution to project
EUR 14 199 895

Project start date
1 June 2006

Duration
48 months

Grid what a traditional operating system offers for a single computer: **abstraction from the hardware and secure resource sharing between different users.** It will thus considerably ease the work of users belonging to virtual organisations by giving them the illusion of using a traditional computer, and releasing them from dealing with the complex resource management issues of a typical Grid environment.

By integrating Grid capabilities into the Linux kernel, XtreemOS will also provide a more robust, secure and easier to manage infrastructure for system administrators. This will be experimentally demonstrated with a set of real applications, provided by well known industrial partners, that covers a large spectrum of application fields.

Project partners

Organisation name and country

CAISSE DES DEPOTS ET CONSIGNATIONS	FR
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	FR
COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS	UK
CONSIGLIO NAZIONALE DELLE RICERCHE	IT
EADS CCR EUROPEAN AERONAUTIC DEFENCE AND SPACE COMPANY	FR
ELECTRICITE DE FRANCE SERVICE NATIONAL	FR
EDGE-IT	FR
NEC HIGH PERFORMANCE COMPUTING EUROPE GMBH	DE
SAP AG	DE
BARCELONA SUPERCOMPUTING CENTER — CENTRO NACIONAL DE SUPERCOMPUTACION	ES
UNIVERSITAET ULM	DE
VERENIGING VOOR CHRISTELIJK HOGER ONDERWIJS, WETENSCHAPPELIJK ONDERZOEK EN PATIENTENZORG (VRIJE UNIVERSITEIT AMSTERDAM)	NL
XLAB RAZVOJ PROGRAMSKE OPREME IN SVETOVANJE D.O.O.	SL
KONRAD-ZUSE-ZENTRUM FUER INFORMATIONSTECHNIK BERLIN	DE
T6 SOCIETA COOPERATIVA	IT
INSTITUTE OF COMPUTING TECHNOLOGY, CHINESE ACADEMY OF SCIENCES	CN
RED FLAG SOFTWARE CO., LTD.	CN
TELEFONICA INVESTIGACION Y DESARROLLO SA UNIPERSONAL	ES

Sources of further information



Website of the 'Grid technologies' unit of DG Information Society and Media (the European Commission service responsible for monitoring Grid research activities in the EU Framework Programmes):

► <http://cordis.europa.eu/ist/grids>

The 3rd report of the Next Generation Grids Expert Group: Future for European Grids: GRIDs and Service Oriented Knowledge Utilities, published in January 2006:

► ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3_eg_final.pdf

The NESSI (Networked European Software and Services Initiative) Technology Platform:

► www.nessi-europe.com/index.htm

Other major Grid-related projects funded under FP6 (2002 – 2006)

<i>Project</i>	<i>Project title</i>	<i>Project website</i>
EGEE II	Enabling Grids for E-sciencE.	www.eu-egee.org/
Deisa	Distributed European infrastructure for supercomputing applications.	www.deisa.org
OMII-Europe	Open Middleware Infrastructure Institute for Europe.	www.omii-europe.com
ICEAGE	International Collaboration to Extend and Advance Grid Education.	www.iceage-eu.org
Trustcom	Trust, security and contract management in dynamic virtual organisations.	www.eu-trustcom.com
DBE	Digital business ecosystems.	www.digital-ecosystem.org
ASG	Adaptive service Grid.	www.asg-platform.org
DIP	Data, Information, and Process Integration with Semantic Web Services.	http://dip.semanticweb.org
eLegi	European learning Grid infrastructure.	www.elegi.org

Grid-related projects funded under FP5 (1988 – 2002)

<i>Project</i>	<i>Focus of project</i>	<i>Project website</i>
ASP-BP	Development of a framework for 6 experiments regarding ASP-based applications applied in different industrial fields.	www.asp-bp.org
BIOGRID	Trial for the introduction of a Grid approach in the biotechnology industry.	www.bio-grid.net
COG	Demonstration of the applicability of Grid technologies to industry.	www.cogproject.org
CROSSGRID	Development of techniques for large-scale Grid-enabled real-time simulations and visualisations.	www.eu-crossgrid.org

continued overleaf ►

<i>Project</i>	<i>Focus of project</i>	<i>Project website</i>
DAMIEN	Development of essential software so that the Grid can be used for industrial simulation and visualisation.	www.hlr.de/organization/pds/projects/damien
DATAGRID	Development of techniques supporting the processing and data-storage requirements of next generation scientific research.	www.edg.org
DATATAG	Development of techniques to support reliable and high-speed collaboration across widely distributed networks.	http://datatag.web.cern.ch/datatag
EGSO	The European Grid of Solar Observations (EGSO) will lay the foundations of a virtual solar observatory.	www.egso.org
EUROGRID	Development of core Grid software components.	www.eurogrid.org
FLOWGRID	On-demand CFD (Computational Fluids Dynamics) simulation and visualisation using Grid computing.	www.unizar.es/flowgrid
GEMSS	Development of new Grid-enabled tools for improved diagnosis, operative planning and surgical procedures.	www.ccrl-nece.de/gemss
GRACE	Development of a search and categorisation engine for flexible allocation of computational and data storage resources in Grids.	www.grace-ist.org
GRASP	Development of architecture and business models for delivering ASP services over the Grid-enabled networks.	www.eu-grasp.net
GRIA	Development of business models and processes for offering and using computational services securely in an open Grid marketplace.	www.gria.org
GRIDLAB	Development of software capable of fully exploiting dynamic resources.	www.gridlab.org
GRIDSTART	Accompanying measure with objective of maximising the impact of EU-funded Grid and related activities through 'clustering'.	www.gridstart.org
GRIP	Interoperability of Globus and UNICORE, two leading software packages central to the operation of the Grid.	www.grid-interoperability.org
MAMMOGRID	Application of Grid technology to develop a European-wide database of mammograms and to support effective co-working between EU healthcare professionals.	http://mammogrid.vitamib.com
MOSES	Establishment of a virtual organisation for computational fluid dynamics.	www.hum.ku.dk/moses
OPENMOLGRID	Development of tools for molecular design based on UNICORE enabled distributed computing environments.	www.openmolgrid.org
SELENE	Identification of technologies for managing, syndicating and personalising online education resources.	www.dcs.bbk.ac.uk/selene
WEBSI	Data-centric web services integration to support the development and deployment of ASP-based business applications.	www.ib-ia.com/websi

Facts sheets detailing the achievements of most of the above FP5 projects are available on

► <http://cordis.europa.eu/ist/grids/pub-report.htm>

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