**SIXTH FRAMEWORK PROGRAMME**
**Research Infrastructures**
**Communication network Development**

**Contract for:**

## INTEGRATED INFRASTRUCTURE INITIATIVE

# *Annex I - "Description of Work"*

Project acronym: **EGEE**
Project full title: **Enabling Grids for E-science in Europe**
Proposal/Contract no.: INFSO-RI-508833

Related to other Contract no.:

Date of preparation of Annex I: **27 January 2004**
Date of first Amendment: **2nd August 2004**

Start date of contract: 1st April 2004

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# 1 Project Summary

## Abstract

EGEE (Enabling Grids for E-Science in Europe) aims to integrate current national, regional and thematic computing and data Grids to create a European Grid-empowered infrastructure for the support of the European Research Area, exploiting unique expertise generated by previous EU projects (DataGrid, CrossGrid, DataTAG, etc) and national Grid initiatives (UK e-Science, INFN Grid, Nordugrid, US Trillium, etc).

The EGEE consortium involves 70 leading institutions in 27 countries, federated in regional Grids, with a combined capacity of over 20000 CPUs, the largest international Grid infrastructure ever assembled.

The EGEE vision is to provide distributed European research communities with a common market of computing, offering round-the-clock access to major computing resources, independent of geographic location, building on the EU Research Network Geant and NRENs. EGEE will support common Grid computing needs, integrate the computing infrastructures of these communities and agree on common access policies. The resulting infrastructure will surpass the capabilities of localised clusters and individual supercomputing centres, providing a unique tool for collaborative computer and data intensive e-Science. EGEE will work to provide interoperability with other major Grid initiatives such as the US NSF Cyberinfrastructure, establishing a worldwide Grid infrastructure.

EGEE is a two-year project in a four-year programme. Major implementation milestones after two years will provide the basis for assessing subsequent objectives and funding needs. Two pilot applications areas have been selected to guide the implementation and certify the performance of EGEE: the Particle Physics LHC Grid (LCG), where the computing model is based exclusively on a Grid infrastructure to store and analyse petabytes of data from experiments at CERN; Biomedical Grids, where several communities are facing equally daunting challenges to cope with the flood of bioinformatics and healthcare data, such as the proposed HealthGrid association.

The project objectives will be achieved by the aggregation of the human and computing resources of regional Grid federations established by EGEE, by a complete re-engineering of the middleware, and by a pro-active program of outreach and training to attract and support the widest possible variety of scientific communities in the ERA.

**Table 1: List of participants**

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|---|---|---|
| 1 | European Organization for Particle Physics, Geneva, Switzerland | CERN | 1 | 24 | Largest particle physics laboratory in the world; inventor of the WWW; long tradition of collaboration with industry. Experience in international projects (LHC Computing Grid, EU DataGrid, OpenLab). Focus on grid operations, middleware re-engineering and integration, HEP application interface plus overall EGEE management.<br>EGEE roles:<br>**NA1**: Coordinating partner responsible for overall project management<br>**NA4**: Lead partner for High energy physics applications interface<br>**NA5**: Lead partner for establishment of international cooperation in domains such as policy agreements<br>**SA1**: Overall responsibility for grid operations hosting grid operations centre<br>**JRA1**: Lead partner for middleware re-engineering and host of the data management service and integration and testing engineering clusters |
| 2 | Johannes Kepler Universität Linz, Institut für Graphische und parallele Datenverarbeitung, Austria | GUP | 1 | 24 | Main operator for the eastern part of Austria, major academic HPC and networking center, participant of EU research projects.<br>EGEE Roles:<br>**SA1**: Local support center for Austria and interface to Regional Operations Center in Poland.<br>**NA2**: Contribution to dissemination efforts in Austria.<br>**NA3**: Organization of training for prospective users of Grid technologies, including EGEE-specific issues. |
| 3 | Institut fuer Informatik der Universitaet Innsbruck- Innsbruck Austria | UNIINNSBRUCK | 1 | 24 | More than 10 years of history in developing tools, compilers, and programming environments for parallel and distributed computing. Leading role in performance monitoring, analysis and prediction of parallel and distributed applications in Europe. Much experience in international projects (Esprit, IST, NFS, Darpa). EGEE roles:<br>**SA1**: Responsibility for grid operations hosting grid operations centre at the University of Innsbruck, Austria. We will install and maintain the Grid operating software developed within EGEE and provide a Grid site to be used by the EGEE Grid testbed.<br>**NA3**: Organization of training for prospective users of Grid technologies, including EGEE-specific issues. |
| 4 | CESNET, Prague Czech Republic | CESNET | 1 | 24 | Institution responsible for operation and development of the Czech NREN, research and development of advanced network technologies and applications, including grid infrastructure. CESNET operates international lambda service to Amsterdam, maintains national grid infrastructure, runs national academic CA, participates in developing grid middleware etc. CESNET takes part in many EU research projects (e.g. GEANT, 6NET, SCAMPI, EU-DataGrid).<br>**SA1**: Local support center for the Czech Republic, direct application support<br>**NA3**: Assistance to the Hungarian major dissemination and training CE center esp. with training for prospective users of Grid and EGEE technologies<br>**NA4**: Provision of a local helpdesk for the Czech Republic<br>**JRA1**: Responsibility of the logging service and security internals of the EGEE work load mgmt system |
| 5 | Budapest University of Technology and Economics - Budapest, Hungary | BUTE | 1 | 24 | BUTE is the largest and oldest technical university in Hungary. BUTE is a funding member of Hungarian Grid Competence Centre. It participates in different Hungarian supercomputing and metacomputing projects.<br>EGEE roles:<br>**NA2**: Participate in exchange and dissemination of good practice.<br>**NA3**: Produce training and course material. |

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| 6 | Eotvos Lorand University Budapest, Hungary | ELUB | 1 | 24 | ELUB is one on the largest and oldest university in Hungary, with a background of a large scale of computational applications in natural sciences from the Faculty of Sciences, the Department of Information Systems is the coordinator of Grid applications of the University. It will organize conferences, meetings; perform performance analysis; participate in Exchange and dissemination of good practices.<br>General: Eötvös Loránd University is one on the largest and oldest university in Hungary.<br>With a background of a large scale of computational applications in natural sciences from the Faculty of Sciences, the Department of Information Systems is the coordinator of Grid applications of the University.<br>Role:<br>ELTE will Organize conferences, meetings; Perform performance analysis; Participate in Exchange and dissemination of good practice following and collaborating with MTA SZTAKI and KFKI RMKI experiences.<br>Activities:<br>**NA2**: Support partner for dissemination and outreach in the Central European Region start: 7 end: 24<br>**NA3**: Support partner for user training and induction in the Central European Region start: 1 end: 24 |
| 7 | KFKI Research Institute for Particle and Nuclear Physics, Budapest-Hungary | KFKI RMKI | 1 | 24 | The leading laboratory of Hungary in particle physics, collaborator in particle physics experiments at CERN, Geneva; GSI, Darmstadt and Brookhaven. Significant theoretical and experimental activity in heavy ion physics, biophysics, plasma physics, solid state physics and space research. Serious commitment in education: leading scientists are teaching at universities all over Hungary.<br>Operating GRID station.<br>Expected **SA1** activity: Joining CERN in preparing for LHC physics (CMS and ALICE experiments), enhancing GRID applications in theoretical computations (lattice QCD, biophysics, gravity) in Hungary. |
| 8 | Magyar Tudomanyos Akademia Szamiastecnikai es Automatizalasi Kutato Intezet, Budapest, Hungary | MTA SZTAKI | 1 | 24 | SZTAKI is the leading Grid centre in Hungary. EU Centre of Excellence in Information Technology and member of ERCIM. It participates in the DataGrid and GridLab projects. It leads the Grid Performance WG of the APART-2 EU project. It will become the Central European Regional Dissemination Centre in EGEE.<br>Activities:<br>**NA2**: Lead partner for dissemination and outreach in the Central European Region<br>start: 7 end: 24<br>**NA3**: Lead partner for user training and induction in the Central European Region<br>start: 1 end: 24<br>**NA4**: Support partner for KFKI-RMKI in particle physics applications<br>start: 1 end: 17<br>**SA1**: Support partner for KFKI-RMKI to run the Hungarian Operations Center start:1 end: 24 |
| 9 | Office for National Information and Infrastructure Development-Budapest, Hungary | NIIF | 1 | 24 | NIIF as a GEANT member is key non-profit service provider to the Hungarian academic community. The provided services range from network services to supercomputing facilities such as the supercomputer cluster of the Hungarian Supercomputing Center or the country-wide grid infrastructures: the ClusterGrid and the SuperGrid. NIIFI has extensive experience in both national and international projects and is the coordinator of several national grid projects.<br>EGEE roles:<br>**SA1**: to set up and coordinate the Hungarian local support center; to provide the core grid infrastructure involving clusters and supercomputers; to make certain amount of the resources available for EGEE use (both testing and production); to install EGEE middleware on to the main "gateways" between national and international resources. |

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| 10 | Akademickie Centrum Komputerowe CYFRONET akademii Gorniczo-Hutniczej im.St. Staszica w Krakowie- Cracow Poland | CYFRONET | 1 | 24 | One of the largest Polish HPC centers, also a major networking center, MAN provider for the city of Cracow, active academic research center, manager and participant of numerous EU research projects<br>**SA1**: In EGEE, it will interface to the EGEE Core Infrastructure Center(s) and Operations Management; it will also consult with local centers operating within CEGridIt will share responsibility for setting up and operating a Regional Operations Center for the CEGrid, together with PSNC and ICM<br>Role<br>- ROC - organization definition, contacts with CERN and CEGC partners;<br>- supporting middleware validation & deployment to the Resource Centre; assist the latter to deploy Grid middleware;<br>- participation in the development and deployment at Regional Centre the technical and operational procedures to become part of the Grid - including the distribution of the operational monitoring and authorization & accounting tools to the Resource Centre;<br>- together with the applications validate new middleware releases and documentation provided by the integration team;<br>- collaboration in producing release notes for the services and middleware.<br>(It is assumed, that other two ROC members will provide:<br>- main user & administrator support including call<br>center, to deal with technical problems from local users and Resource Centre;<br>- the Grid operations training for staff at Resource<br>Centre.) |
| 11 | Warsaw University Interdisciplinary Centre for Mathematical and Computational Modelling- Warszawa - Poland | ICM | 1 | 24 | Major HPC centre in Poland, operator of university network in Warsaw, country wide provider of scientific software, participant of numerous scientific and computing projects: national and international, including EC-funded and commercial, educational centre.<br>EGEE specific:<br>**SA1**: Infrastructure operations, support and services for ROC<br>**NA3**: Dissemination and feedback for potential commercial grid users |
| 12 | Institute of Biorganic Chemistry PAN, Poznan Supercomputing and Networking Center - Poznan Poland | PSNC | 1 | 24 | MAN operator for the Poznan area, of the POL34/622 network; Polish link to the GEANT research network, major academic HPC and networking center, manager and participant of numerous EU projects. Certified by Sun Microsystems Inc. as a Center of Excellence for New Generation Networks, Grids and Portals. It will share responsibility for setting up and operating a Regional Operations Center. It will be responsible for operating the link to the GEANT and for network resource provision. It will organize the regional support helpdesk and interface to local helpdesks of other countries.<br>**SA1**: We will share responsibility for setting up and operating the ROC. We will be responsible for operating the link to GEANT and for network resource provision. We will organize the regional support helpdesk and interface to local helpdesks of other countries |
| 13 | Ustav Informatiky, Slovenska Akademia vied - Bratislava Slovakia | II-SAS | 1 | 24 | SAS is the leading Grid center in Slovakia. Participation in international projects (CROSSGRID, Pellucid). EGEE roles:<br>**NA3**: II SAS will organize training for prospective users of Grid technologies, including EGEE-specific issues.<br>**SA1**: II SAS will become the local support center for Slovakia and will interface to the Regional Operation Center. |
| 14 | Jozef Stefan Institute - Lyubljana, Slovenia | JSI | 1 | 24 | The leading Slovenian National Science Institute, including computing research, Grid research and service provision to academic partners. Longstanding collaboration in HEP projects with CERN, DESY and KEK.<br>**SA1**: JSI will become the Local Support Centre for Slovenia and will interface to the CEG Regional Operations Centre located in Poland. |

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| 15 | The Provost Fellows and Scholars of the College of the Holy and Undivided Trinity of Queen Elizabeth near Dublin, Ireland | TCD | 1 | 24 | TCD manages Grid-Ireland, which is the national grid for Ireland, see http://www.grid-ireland.org/. It has experience in monitoring, security and testbeds in both DataGrid and CrossGrid.<br>Its role in EGEE is:<br>**SA1**: Regional Operations Centre (ROC) for Ireland |
| 16 | Council for the Central Laboratory of the Research Councils, Oxfordshire - UK | CCLRC | 1 | 24 | Multi-disciplinary laboratory providing many facilities for the UK science community. Hosts the UK Grid Support Centre, co-ordinates development of the UK eScience Grid and active in a number of grid projects, in particular GridPP - the largest UK grid project building a grid for particle physics.Hosts the UK Tier-1 Centre for the LHC project and a major contributor to the EU DataGrid project (in particular Grid Testbeds, Grid Information Services , Network Monitoring and Grid Storage Integration). EGEE roles.<br>**SA1** : One of four Core Infrastructure Centres (CIC) and the Regional Operations Centre (ROC) for UK/Ireland Region.<br>**JRA1** : Middleware re-engineering with responsibility for Information Collection & Retrieval |
| 17 | The University of Edinburgh-Edinburgh, UK | NESC (UEDIN) | 1 | 24 | UK National e-Science Centre is a collaboration between the Universities of Edinburgh and Glasgow; it is the leading training and education centre for Grid researchers in the UK; it leads a wide ranging programme of internationally recognized Grid research.<br>**NA2**: Partner providing key support for Dissemination and Outreach<br>**NA3**: Lead partner with overall responsibility for User Training and Induction<br>**NA4**: Partner providing support for Application Identification and Support |
| 18 | Particle Physics and Astronomy Research Council, Swindon, UK | PPARC | 1 | 24 | PPARC directs and co-ordinates funding of national & international research in particle physics, astronomy, cosmology and space science. PPARC promotes Public Understanding of Science and works with industry to maximise UK involvement in pan European and international projects. PPARC will focus on regional coordination, management, dissemination & outreach. PPARC will provide coordination between the UK participants in the project and contribute funding towards the matched effort. |
| 19 | University College of London | UCL | 1 | 24 | The UCL group is the UK e-Science centre of excellence in networking. It is involved in many successful projects including EDG, DATATAG, MB-NG, 6NET. UCL has a research programme in high performance data transport, QoS, Internet2-PiPES, pervasive monitoring for the Geant/NREN core, migration to OGSA and optical networking and bandwidth on demand.<br>**JRA4**: Activity management and lead partner in bandwidth allocation. |
| 20 | Commissariat à l'Energie Atomique, Direction des Sciences de la Matière, Paris-France | CEA/DSM | 1 | 24 | CEA is a very large public body in charge of all nuclear related matters France, covering both civilian and military aspects. CEA has a department of fundamental research, DSM, studying nuclear and particle physics, astrophysics, solid state and plasma physics, biology and climate. Experience in grid middleware and deployment through the DataGrid project.<br>**SA1**: Will operate a resource center in CEA and work in close connection with CNRS to operate the Core Infrastructure Center located in Lyon. |
| 21 | Compagnie Générale de Géophysique, Massy, France | CGG | 1 | 24 | Leader service company in Geophysical data acquisition and processing. Handle very large production cluster of PC (16000+) in a commercial, industrial environment. Participation in EGEE:<br>**SA1**: Brings its expertise in very large distributed computing resources, focusing in Operational tools, monitoring tools and operational support in one Regional Operations Center. |

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| 22 | Centre National de la Recherche Scientifique, Paris- France | CNRS | 1 | 24 | Largest research organization in Europe, covering all fields of sciences. Played a major role in DataGrid and leader of national Grid efforts in France. Leader of the French EGEE effort.<br>Participation in EGEE:<br>**NA4**: Overall responsibility for applications coordination. Lead partner for biology/health applications interface.<br>**SA1**: Responsible for the operation of one Core Infrastructure Center. Responsible for the operation of one Regional Operation Center.<br>**SA2**: Leader of this service activity related to network operation.<br>**JRA2** : Participation to ensure QA in tools , processes and software<br>**JRA4**: Participation in the EGEE network team for tools development. |
| 23 | CS Système d'Information Communication & Systèmes, Clamart -France | CSSI | 1 | 24 | CS is a well known service provider company acting as a key player in the integration and operation of secured intercommunicating IT infrastructures and in the development of scientific, technical and embedded applications. CS is responsible of GEANT network operation, with expertise in deployment, quality, operation and security issues.<br>CS participation in EGEE will be:<br>**SA1**: Under the lead of CNRS, participation to the operation of one Regional Operation Center.<br>**JRA2**: Responsible for the organization of the quality insurance activity on the project (QA manager). **NA4**: Participation to the Verification and Validation activity. |
| 24 | Centrale Recherche S.A, Chatenay-Malabry-France | CRSA | 1 | 24 | The Applied Mathematics Laboratory of Ecole Centrale Paris is specialized in the design and simulation of complex industrial systems and associated information systems architectures. In the domain of GRID technology it has general agreements with IBM and CS-SI. It is involved in national and European projects (OPEN PLAST, RUGBI, LEGE-WG, etc.)<br><br>Specific role in EGEE : Dissemination , industry Forum , Generic applications<br>**NA4**: generic application provider |
| 25 | Deutsches Elektronen Synchrotron - Hamburg Germany | DESY | 1 | 24 | DESY is the national German laboratory for particle physics and synchrotron radiation; long tradition in the development of data management software; one of the first laboratories introducing Linux as standard OS, large HEP and Synchrotron application pool. Great experience in EU Projects and international collaborations. Focus on data handling middleware, grid operations and HEP applications.<br>Role in EGEE<br>**SA1**: Partner of the German ROC |
| 26 | Deutsches Klimarechenzentrum GmbH, Hamburg, Germany | DKRZ | 1 | 24 | Provides state-of-the-art supercomputing, data service and other associated services to the national and international scientific community to conduct top of the line Earth System and Climate Modeling.<br>Role in EGEE<br>**NA4**: Identification and adaptation of early user applications from earth system research |
| 27 | Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.V., Muenchen, Germany | FhG | 1 | 24 | Fraunhofer-Gesellschaft is the leading organization of institutes of applied research and development in Europe. The employees carry out research and development projects on a contract basis on behalf of industry, the service sector and government. Future-oriented strategic research commissioned by the government and public authorities are carried out with the aim of promoting innovations in key technologies with an economic and social relevance in the next five to ten years.<br>Role in EGEE<br>**NA4**: FhG/SCAI will work together with the Partners of NA4 to identify and migrate general and new industrial relevant applications for use on the EGEE Infrastructure<br>**SA1**: Support Centre, CPU and Storage provision; Involvement of FhG/SCAI and FhG/ ITWM |

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| 28 | Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany | FZK | 1 | 24 | Largest non-commercial science and engineering research institution in Germany; application-oriented activities from basic research to pre-product development. Large international projects: Tier-1 centre for LHC computing grid and other HEP experiments. Important integrating role for Grid activities and e-Science in Germany. Focus on grid user support and integration of e-Science applications.<br>Role in EGEE<br>**SA1**: Lead partner of the German ROC<br>**NA2/NA3:** Regional Grid user support centre |
| 29 | Gesellschaft für Schwerionenforschung mbH, Darmstadt, Germany | GSI | 1 | 24 | GSI operates an accelerator complex for all elements from hydrogen to uranium. Best known findings are the discovery of six new chemical elements with atomic number 107-112 and the development of a tumor therapy with heavy ion beams. Focus on building a Tier-2 centre for the LHC Alice experiment.<br>Role in EGEE<br>**SA1**: Partner of the German ROC |
| 30 | DATAMAT S.p.A., Roma, Italy | DATAMAT | 1 | 24 | Among Italian ICT industry leaders, developing and providing software applications, internet solutions, ICT and online services for vertical market segments. Involved in Grid projects spanning from application requirements and related prototyping activities (ESA SpaceGrid) to middleware implementation and re-engineering (EU DataGrid and EU CrossGrid).<br>EGEE role:<br>**JRA1**: Partner for middleware re-engineering/development for the Resource Brokering and Accounting services |
| 31 | Istituto Nazionale di Fisica Nucleare, Frascati (Roma), Italy | INFN | 1 | 24 | Large Italian public Research Institution: long experience in distributed computing: running Condor pool covering 20 sites all over Italy since several years. Experience in international projects (LHC Computing Grid, EU DataGrid, EU DataTAG and GLUE activities).<br><br>EGEE roles:<br>**NA2**: dedicated tutorials and training sessions, demo test bed equipped with the GENIUS portal for the Italian community.<br>**NA3**: Application developer training for the Italian community.<br>**NA4**: Lead Partner for general applications interface (not HEP and Biology).<br>**NA5**: Involved in eInfrastructure reflection group<br>**SA1**: Overall responsibility for EGEE ROCs and grid operations in Italy. Host of a Core Infrastructure Center (CIC).<br>**JRA1**: Responsibility for the middleware re-engineering cluster taking care of Resource Access, Resource Brokering and Accounting. |
| 32 | Trans-European Research and Networking Association, Amsterdam-The Netherlands | TERENA | 1 | 24 | TERENA promotes and participates in the development of a high-quality international information and telecommunications infrastructure for the benefit of research and education. TERENA will take lead responsibility for the dissemination activities (**NA2**) running the external web server, mailing lists and web based collaborative tools. TERENA will also coordinate the four project conferences that will take place during the two years of this project |
| 33 | Vrije Universiteit Brussel, Brussels, Belgium | VUB | 1 | 24 | The ELEM/Helios group has many years of experience in valorisation and information dissemination of several European ICT projects. It is presently active in the Belgian Grid Initiative.<br>EGEE role:<br>**NA2**: Coordination of dissemination in NEG |

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| 34 | Faculty of Science University of Copenhagen, Copenhagen, Denmark | KU-NATFAK | 1 | 24 | The faculty of science hosts among other disciplines IT-research and particle physics. Danish activities on Grid development and deployment are centred at the Niels Bohr Institute (NBI) and Institute for Informatics (DIKU). NBI has been instrumental in the creation of the NorduGrid project and in the development and deployment of the toolkit. DIKU is responsible for the newly established DK-GRID which will be the future organiser of Danish Grid development, deployment and contacts to industry.<br>**NA3**: KU-NATFAK participates, as the representative for the Northern European Grid (NEG) consortium, in the development of training material and in the creation of training programmes at all levels. |
| 35 | University of Helsinki, Helsinki, Finland | UH HIP | 1 | 24 | Finnish national research institute of physics and computer science. UH.HIP has managed the security task in European DataGrid project and is member in the Liberty Alliance consortium.<br>Role in EGEE:<br>**JRA3**: Contributor to UserID, Authentication service re-engineering tasks and overall Security Architecture and Design |
| 36 | Foundation for Fundamental Research on Matter, Utrecht, Netherlands | FOM | 1 | 24 | NIKHEF is the national institute for subatomic physics in The Netherlands, in which the funding agency FOM and the Universities of Amsterdam, Nijmegen and Utrecht participate. NIKHEF is principle partner in the DataGrid project and participates in the DataTag project; it houses a large grid infrastructure and hosts the Dutch CA service and other essential general services for the DataGrid testbed.<br>**NA4**: Application identification and support centre for the countries in the Northern European Grid (NEG) consortium<br>**SA1**: The grid operations and support centre for southern countries in NEG. The other one is in Stockholm. This action will be shared with the academic computer centre of Amsterdam SARA which is in the same building as NIKHEF and has a slightly more service oriented focus.<br>**JRA3**: Security expertise from the role NIKHEF played in the site access control architecture and implementation for the DataGrid project. A continuation of the Certification Authority role it is already playing as well the definition of policies to coordinate mutual trusts between CAs. This action will be shared with the University of Amsterdam network and security group which is in the same building as NIKHEF in Amsterdam. |
| 37 | Stichting Academisch Rekencentrum Amsterdam, Amsterdam, Netherlands | SARA | 1 | 24 | Dutch National High Performance Computing and Networking Center. Supports science and businesses with processing of large-scale calculations and visualization of complex data. Responsible for housing and system management of Dutch national supercomputer. Housing for several other supercomputers of Dutch universities. Responsible for technical and operational management of the national research network Surfnet. Associate partner in EU DataGrid project.<br>Role in EGEE<br>**SA1**: Responsible for one of Regional Operations Centers in Northern region, level-2 support. |
| 38 | Universiteit van Amsterdam, Amsterdam, Netherlands | UvA | 1 | 24 | The Informatics Institute of the University of Amsterdam (UvA) coordinates the Virtual Laboratory project in The Netherlands and is one of the leading institutes on network research. It is principal partner in the DataTag project and leads the optical network research. It is active in the IRTF Authorization, Authentication and Authorization Architecture Research Group where one member is co-chair of this group. It is active in both in the board and in working groups at the Global Grid Forum, in particular in the area of Authorization.<br>**JRA3**: Expertise on security architectures, network security and AAA. This action will be shared with the NIKHEF network and security group which is in the same building as UvA. |
| 39 | University of Bergen, Norway | UiB | 1 | 24 | University of Bergen operates one of the national supercomputing centres in Norway and has a long track record within parallel and distributed computation, with many 'firsts' to their credit within the field.<br>**JRA3** - Participation in security architecture definition and development. |

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| 40 | Vetenskapsrådet, the Swedish Research Council, Stockholm, Sweden | VR | 1 | 24 | VR is hosting the Swedish National Infrastructure for Computing (SNIC) which is a meta centre including the 6 major HPC centres in Sweden and is serving academic and commercial users. These centres have proven track records in build and operation of large scale PC-clusters and storage systems, Middleware for GRID Security, Portals for HPC systems. It operates the SweGrid production test bed and is providing resources to LCG and NorduGrid.<br>Role in EGEE<br>**SA1**: Hosting the Northern Regional Operations Center |
| 41 | Institute of High Energy Physics - Protvino Moscow Region Russia | IHEP | 1 | 24 | Largest particle collider center in Russia. Participation in LCG and EDG; Traditions in international cooperation. Expertise in GRID deployment and GRID applications.<br>EGEE roles:<br>**NA2**: Translation of the main EGEE documents in Russian; Preparation and support of WEB site;<br>To attract some scientific organizations of Ministry for Atomic Energy o joint EGEE.<br>**NA3**: Training of the users for GRID Middleware; Prepare the course material and support distributed courses;<br>**NA4**: Testing of the Grid software for LCG - 1.<br>**SA1**: Support on 24 x 7 basis Region Operation Center at IHEP; Responsibility for grid operations centre; Resource Centre. |
| 42 | institute of Mathematical Problems of Biology of Russian Academy of Sciences, Pushchino, Moscow Region Russia | IMPB RAS | 1 | 24 | Leading organization in Russia in the field of bioinformatics and computational biology. Close cooperation with many foreign research institutions in EU and US. Participation in Russian Human Genome project.<br>EGEE roles:<br>**NA2**: operate the dissemination Web site, based on the existing Joint Center for Computational Biology and Bionformatics. Support of computational and information databases in biology and metabases on Internet bioresources. Involve other biological institutions in the RDIG EGEE infrastructure.<br>**NA3**: Produce training and course materials on GRID in biology. Training and induction of users in biology.<br>**NA4**: Support of pilot applications in the fields of biomolecular structure reconstruction, molecular dynamics and E-cell project.<br>**SA1**: Support of 24x7 specified functions of Region Operation Center for biology, specialized in bioinformatics. Resource Center, starting from 2nd year of the project. |
| 43 | Institute of Theoretical and Experimental Physics, Moscow Russia | ITEP | 1 | 24 | Large HEP and Nuclear center with long traditions in international cooperation (in particular, participation in LEP and LHC). Participation in EDG and LCG projects, expertise in GRID deployment and applications.<br>EGEE roles:<br>**NA2**: Support mail lists. Partner for dissemination in scientific institutions of Russian Ministry for Atomic Energy; operate the corresponding Web site, organization of showcases and presentations in this area;<br>**NA3**: Produce training and course material, training of users from Russian nuclear centers.<br>**NA4**: Management of LHCb and ALICE VOs in Russia, Support of ATLAS and CMS pilot applications; Identify early users; Introduction of new user communities.<br>**SA1**: Provide some 24x7 basic functions of ROC, also remote backup function for Russian CIC and ROC. Resource Center from 2nd year of the project. |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
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| 44 | Joint Institute for Nuclear Research, Dubna Russia | JINR | 1 | 24 | International intergovernmental organization for nuclear research, with activities incorporating fundamental research of the structure of matter, development and application of high technologies, and university education in the relevant fields. JINR has at present 18 Member States including Russia, CIS countries and some European countries and has long traditions in international collaboration. Participation in LCG and EDG projects, expertise in GRID deployment and HEP applications.<br>EGEE roles:<br>**NA2**: Lead partner for CIS research centers involvement in the EGEE activities. Operate the corresponding dissemination Web site, organize presentations and showcases for JINR Member states. Organize RDIG-EGEE meetings and conferences on distributed computing in science and education in Russia and CIS countries.<br>**NA3**: Organize the Grid tutorials, training and education for EGEE user community in CIS countries. Support of distributed courses on the project.<br>**NA4**: Support ATLAS, ALICE, CMS and LHCb pilot applications; Identify early users; Introduction of new user communities.<br>**SA1**: Support of some 24x7 basic functions of Russian ROC. Support of Grid services and users in CIS countries. Grid monitoring and control. Middleware deployment and resource induction. Resource Center, starting from 1st year of the project. |
| 45 | Keldysh Institute of Applied Mathematics of Russian Academy of Sciences Moscow – Russia | KIAM RAS | 1 | 24 | Lead Computer Science institution in Russia. Long expertise in metacomputing, Globus toolkit and GRID, and corresponding applications in Applied Mathematics. Experience in higher education in these fields.<br>EGEE roles:<br>**NA2**: Lead partner for dissemination in the area of Computer Science and Applied Mathematics, in particular, in Russian Academy of Sciences. Production of introductory and advanced papers on architecture, common services and other basic GRID services, and its dissemination by means of the Russian public computer press. Translation of basic Grid technologies papers into Russian and making them widely available through Internet. Education of young specialists from Moscow State University for work in the field of Grid technologies. GRID services training courses organization.<br>**SA1**: Provide some functions of Russian CIC (adaptation of MW to local environments, recommendations for improvements of GRID infrastructure). Resource Center from 2nd year of the project. |
| 46 | Petersburg Nuclear Physics Institute of Russian Academy of Sciences - Gatchina, Leningrad district - Russia | PNPI | 1 | 24 | Largest Nuclear Physics institute in the St.-Petersburg region. Long tradition in international cooperation. Experience in GRID middleware deployment (EDG, WP4/Install), participation in LCG project<br>EGEE roles:<br>**NA2**: Support Web site and Web-based tools for dissemination in institutions in St-Petersburg region, organize presentations and showcases for St-Petersburg region.<br>**NA3**: Provide user training and GRID tutorials for St-Petersburg region.<br>**NA4**: Support HEP pilot applications (ATLAS, CMS, ALICE, LHCb) for St-Petersburg region, identification of early users.<br>**SA1**: Provide 24x7 basic functions of Russian ROC for St-Petersburg region. Resource Center from 2nd year of the project. |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|---|---|---|
| 47 | Russian Research Centre "Kurchatov Institute",Moscow Russia | RRC KI | 1 | 24 | Lead governmental organization for Nuclear research in Russia. Participating in many nuclear experiments and projects over the world. Largest network operation center in Russia, provide international links for Russian NREN.<br>EGEE roles:<br>**NA2**: Operate the dissemination Web site in the nuclear physics and energy area in Russia, support mail lists, organize presentations and show cases in this area.<br>**NA3**: Training of the users for CA and Security, prepare training and course material, support distributed course on these topics.<br>**NA4**: Support of ALICE pilot applications. Lead partner for Nuclear Fusion GRID applications in Russia. Identification of early users. Introduction of new user communities.<br>**SA1**: Provide some Core infrastructure services: GRID monitoring and control. Resource Center from 2nd year of the project.<br>**SA2**: Lead Russian partner for collaboration with RN GEANT and NRENs in realizing SLRs, Modelling, SLSs, SLAs, Policies. Support of CA and Security services. |
| 48 | Skobeltsyn Institute of Nuclear Physics of Moscow State University - Moscow Russia | SINP-MSU | 1 | 24 | Leading HEP and Nuclear institution in higher education area in Russia. Participates in LHC experiments (ATLAS and CMS). Participation in EDG and LCG projects (currently provides CA and core GRID services for Russia). Experience in GRID deployment and dissemination.<br>EGEE roles:<br>**NA2**: Organize presentations and showcases for Higher Education area; Organize RDIG-EGEE management meetings and conferences, Publication of dissemination materials and support of corresponding Web site. Organization and support of distributed education courses on GRID.<br>**NA4**: Management of CMS VO in Russia; Support of ATLAS, ALICE and LHCb pilot applications; Introduction of new user communities.<br>**SA1**: Provide Russian Core Infrastructure Center. Management o Russian federation. Middleware deployment and resource induction. Resource Center from the end of 1st year of the project. |
| 49 | Central Lab. for Parallel Processing, Bulgarian Academy of Sciences, Sofia, Bulgaria | CLPP-BAS | 1 | 24 | Coordinator of Bulgarian Grid Consortium (BgGrid). Focus on local Operation and Support Centre for Bulgaria in cooperation with GRNET operating the Regional Operation and Support Centre. Local support for training and dissemination activities<br>**NA2**: Dissemination plan for the SEE federation. Provide dissemination and outreach activities in Bulgaria and Romania<br>**SA1**: Responsible for user support and resource induction in Bulgaria. Support to the local users and integration of BgGrid resources centers into the EGEE infrastructure. Responsible for interacting with GRNET and the other SEE partners for the smooth operation of the distributed ROC. Will provide all the necessary operational and statistical information for the deliverables. |
| 50 | University of Cyprus, Nicosia, Cyprus | UCY | 1 | 24 | Coordinator of Cyprus Grid (CyGrid). Focus on local Operation and Support Centre for Cyprus in cooperation with GRNET operating the Regional Operation and Support Centre. Local support for training and dissemination activities.<br>**NA2**: Identify target user communities and applications relevant to the region. Provide dissemination and outreach activities in Greece, Cyprus and Israel.<br>**SA1**: Responsible for national user support and resource induction in Cyprus. Support to the local users and integration of CyGRID resources centers into the EGEE infrastructure. Responsible for interacting with GRNET and the other SEE partners for the smooth operation of the distributed ROC. Will provide all the necessary operational and statistical information for the deliverables. |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|---|---|---|
| 51 | Greek Research and Technology Network, Athens, Greece | GRNET | 1 | 24 | Coordinator of HellasGrid Task Force, Operating the central cluster and storage area network in Athens, as well as the National Research and Education backbone network.<br>**SA1**: Overall coordinator of the distributed Regional Operation and Support Center of South East Europe federation. Responsible for overall middleware deployment in the region and resource induction in Greece. Cooperation with national user support and resource induction partners in the region ((Greece, Bulgaria, Cyprus, Israel, Romania) and with the CICs and the OMC centrally.<br>**SA2** : participation to SLA definitions.<br>**NA3**: Overall coordination of the training and induction activities in the region. Production and localization of the training material and courses from introductory to advanced user material. Interaction with the other SEE and central partners for feedback and improvements.<br>**NA5**: GRNET support project activity on international cooperation especially through the organization of the European eInfrastructure reflection group and the production of a series of eInfrastructure White Papers and roadmaps. |
| 52 | Tel Aviv University, Tel Aviv, Israel | TAU | 1 | 24 | TAU is a major university in Israel coordinating Israelian grid collaboration (Israel Academic Grid-IAG) together with the IUCC, Israel's NREN, that will be responsible for technical aspects and coordination of grid related activities.<br>**SA1**: Responsible for national user support and resource induction in Israel. Support to the local users and integration of IAG resources centers into the EGEE infrastructure. Responsible for interacting with GRNET and the other SEE partners for the smooth operation of the distributed ROC. Will provide all the necessary operational and statistical information for the deliverables<br>**NA3**: Provide a series of training sessions in Israel, first to the HEP users and then to other user groups in the IAG. Interaction with the other training teams for feedback. |
| 53 | National Institute for Research and Development in Informatics, Bucharest, Romania | ICI | 1 | 24 | Coordinator of Romanian Grid Consortium (RoGrid). Focus on local Operation and Support Centre for Romania in cooperation with GRNET operating the Regional Operation and Support Centre. Local support for training and dissemination activities.<br>**SA1**: Responsible for national user support and resource induction in Romania. Support to the local users and integration of RoGRID resources centers into the EGEE infrastructure. Responsible for interacting with GRNET and the other SEE partners for the smooth operation of the distributed ROC. Will provide all the necessary operational and statistical information for the deliverables<br>**NA3**: Provide training sessions in Romania and Bulgaria covering the RoGRID partners and BGConsoritum. Interaction with the other training teams for feedback. |
| 54 | Laboratório de Instrumentação e Física Experimental de Partículas, Lisboa, Portugal | LIP | 1 | 24 | LIP focuses on particle physics and instrumentation technologies, including embedded processors, data transmission equipment and data acquisition systems. It maintains a flexible portfolio of technology development, technology transfer and dissemination, which includes Positron Emission Mammography and Grid Computing.<br>**SA1**: Quality Assurance of operational techniques and run the backup Operations Team for Southwest Europe. |
| 55 | S.A.X. Centro de Supercomputación de Galicia, Santiago de Compostela, Spain | CESGA | 1 | 24 | CESGA provides horizontal services in High Performance computing, High Throughput computing and Regional Networking services to scientific, technological and industrial users. It will apply its wide experience in operational services, user support and adaptation of applications to EGEE.<br>**SA1** : Development, adaptation, deployment and operation of Monitoring and Accounting Components |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
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| 56 | Consejo Superior de Investigaciones Cientificas, Madrid, Spain | CSIC | 1 | 24 | Largest scientific research institute in Spain. Experience in grid projects (CrossGrid) and applications in several scientific areas. Promoter of the spanish grid initiative, IrisGrid.<br>**NA4**- The Centro Nacional de Biotecnologia will collaborate with CNRS on applications for genomics and proteomics.<br>**SA1**- The Instituto de Fisica de Cantabria and the Instituto de Fisica Corpuscular will provide a secure high availability CA service and VO management.<br>The two other activities come from the participation of the Spanish NREN, RedIRIS :<br>**NA5**- RedIRIS support project activity on international cooperation especially through the organization of the European eInfrastructure reflection group and the production of a series of eInfrastructure White Papers and roadmaps. |
| 57 | Institut de Física d'Altes Energies, Barcelona, Spain | IFAE | 1 | 24 | IFAE focuses on particle physics while maintaining a flexible portfolio of activities in technology innovation and transfer (e.g. pixel detectors for mammography, synchrotron light sources, cluster computing, DataGrid, CrossGrid). IFAE coordinates the Southwest region.<br>**SA1**: Its Port d'Informació Científica Division (PIC), with collaboration of the CIEMAT, will host the Southwest Operations Team and a Petabyte-level data facility. |
| 58 | Instituto Nacional de Técnica Aeroespacial, Madrid, Spain | INTA | 1 | 24 | INTA is a multi-disciplinary institute with core activities in aerospace and experience in High Performance Computional environments. Its Centro de Astrobiología (CAB, associated to the NASA Astrobiology Institute) focuses on research in fundamental biology related to search for life in extreme environments.<br>**SA1**: CAB's Advanced Computing Lab will host middleware deployment operations and assist in root-cause problem analysis in application interfacing. |
| 59 | Universidad Politécnica de Valencia, Valencia, Spain | UPV | 1 | 24 | UPV has large experience in the field of Parallel and Distributed Computing and its application to several fields (e-health, simulation in engineering, etc.) and technology transfer. This expertise has been applied in different European projects since the 3rd European Framework Programme (Hipercosme, HiperTTN, DISMEDI, VRSUR, EUTIST-M, TT@MED,etc.).<br>**NA4**: Support to the identification, interfacing and evaluation of Grid medical applications. |
| 60 | University of Chicago, Chicago IL-USA | University of Chicago | 1 | 24 | One of the two founding partners of the Globus project.<br>**JRA1:** Worldwide leading middleware development centre. EGEE Middleware re-engineering. |
| 61 | University of Southern California, Marina del Rey CA, USA | USC | 1 | 24 | One of the two founding partners of the Globus project.<br>**JRA1**: USC/Information Sciences institute is a leading institution in the development of Grid middleware and is one of the developers of the Globus Toolkit® (GT2) and the Virtual Data Toolkit (VDT).<br>Developer of core Grid technology used by EEGE. Experience in international collaborations including UK eScience, DataGrid, and GridLab.<br>EGEE roles:<br>• Develop, implement and operate a transatlantic VDT testing facility for the Virtual Data Toolkit.<br>• Support the deployment and trouble shooting of the VDT in EGEE.<br>• Bug fixing and functionality enhancement of EGEE software.<br>• Design of EGEE software system (2004).<br>• Participate in EGEE technical meetings, present seminars and tutorials, and visit EGEE sites to facilitate technology exchange. |
| 62 | The Board of Regents for the University of Wisconsin System - Madison USA | Wisconsin-Madison Univ. | 1 | 24 | Lead partner of the Condor project.<br>**JRA1**: Worldwide leading middleware development centre. EGEE Middleware re-engineering. |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
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| 63 | Royal Institute of Technology - Center for Parallel Computers (PDC) | KTH | 1 | 24 | PDC is a centre for high-performance computing and visualization for the Swedish academic community and the largest academic HPC site in the Swedish National Infrastructure for Computing. PDC has a proven record of excellence in large scale computing, grid computing and computer security. PDC is a contributing partner in the European DataGrid project<br>**JRA3**: Leading partner, managing and taking major responsibility for the security joint research activity. |
| 64 | Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, Roma, Italia | ENEA | 1 | 24 | Large Italian public institution aimed to research and technology transfer to industry. The organisation is distributed in Italy (12 sites). ENEA has several vector and parallel supercomputers (about 300 CPUs ) linked in ENEA-GRID architecture. This GRID is currently linked to DataGrid project using globus interface in collaboration with ESA at Frascati (Rome) site.<br>EGEE roles:<br>**SA1**: grid operations: specific user support for vector and parallel super-computers . |
| 65 | Università degli Studi della Calabria, Arcavacata di Rende (CS), Italia | UniCal | 1 | 24 | Active partner in the SPACI Project recently founded by the Italian Ministry for Education and Research. It hosts one of the infrastructure main site and is one of the test-bed sites of the Italian Grid.it project.<br>EGEE roles:<br>**SA1**: grid operations: specific user support for parallel, vector and non-linux systems. |
| 66 | Università degli Studi di Lecce, Lecce, Italia | UniLe | 1 | 24 | Active partner in the SPACI Project recently founded by the Italian Ministry for Education and Research. It hosts one of the infrastructure main sites. Involved in several Grid technology development and application projects (Dynamic Grid Environments for Earth Observation Systems, Bioinformatics, and Climatology). Experience in middleware development, advanced grid portals, scheduling algorithms. Through the ISUFI/CACT node, is main partner in the GridLab European Project, supporting middleware development.<br>EGEE roles:<br>**SA1**: grid operations: specific user support for parallel, vector and non-linux systems. |
| 67 | Università degli Studi di Napoli "Federico II", Napoli, Italia | UniNa | 1 | 24 | Active partner in the SPACI Project recently founded by the Italian Ministry for Education and Research. It hosts one of the infrastructure main site. Experience in middleware development, parallel scientific libraries. One of the test-bed sites of the Italian Grid.it project<br>EGEE roles:<br>**SA1**: grid operations: specific user support for parallel, vector and non-linux systems. |
| 68 | Delivery of Advanced Network Technology to Europe Limited, Cambridge, UK | DANTE | 1 | 24 | DANTE has been responsible for four consecutive generations of European research networks, and is active in the ongoing development of European research networking. It plans, builds and manages international networking services on their behalf. The pan-European research network enables European scientists to compete on an international stage by providing them with a world-class backbone that offers the bandwidth and the Quality of Service required for research and development activities at this level. It represents the basis for the introduction of 'virtual laboratories' and 'virtual institutes' in Europe.<br>**JRA4**: DANTE is involved in the design and deployment of interdomain monitoring infrastructure. DANTE will ensure that this meets the needs of EGEE. DANTE is also involved in the implementation of guaranteed IP and switched services |

| Participant number | Participant Name (Organization, city, country) | Participant Short name | Date enter project | Date exit project | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|---|---|---|
| 69 | Verein zur Foerderung eines Deutschen Forschungsnetzes e.V., Berlin, Germany | DFN | 1 | 24 | DFN is the NREN in Germany for Research networking, connecting all major universities and research labs and connecting them to the world wide research networks, specifically to Geant.<br>**JRA4** (special activity) network services development.<br>**NA5**- DFN support project activity on international cooperation especially through the organization of the European eInfrastructure reflection group and the production of a series of eInfrastructure White Papers and roadmaps. |
| 70 | Consortium GARR, Roma, Italy | GARR | 1 | 24 | The Consortium GARR operates Italian NREN. It supplies the Italian Academic and Research Community with connectivity to the GARR backbone. It provides a broadband Network service, lambda service and interconnection service to the GEANT Network and to the other worldwide Research Networks.<br>It is involved in many EU projects including GEANT, 6Net,EcSIRT and EumedConnect.<br>**NA5:** GARR will focus on international cooperation especially through the organization of the European eInfrastructure reflection group and the production of a series of eInfrastructure White Papers and roadmaps.<br>**JRA4** : participation to bandwidth allocation and reservation task and network performance monitoring and diagnostic tools task |
| 71 | Entidad Pública Empresarial | RED.ES | 4 | 24 | The "entidad pública empresarial RED.ES" ("RED.ES" – http://www.red.es) is a public entity which belongs to the Spanish Ministry for Industry, Tourism and Commerce ("Ministerio de Industria, Turismo y Comercio" – MIN – http://www.min.es), through its State Department for Telecommunications and Information Society ("Secretaría de Estado de Telecomunicaciones y para la Sociedad de la Información" - SETSI - see http://setsi.min.es).<br>The main duty of RED.ES is to promote the development of Information Society. For this purpose, RED.ES:<br>a) manages the Registry for domain names under ".es" (http://www.nic.es);<br>b) has put in place a "Telecom and Information Society Observatory" (http://www.observatorio.es) and advices the Government in matters related to these fields;<br>c) manages several programs related to the promotion of the Information Society, such as "Internet for Schools" (http://www.internetenlaescuela.es) or "Internet for rural areas" (http://www.internetrural.es);<br>d) promotes the digitalization of the Spanish cultural heritage (http://www.patrimonio.es);<br>e) provides several e-government services to public administrations; and<br>f) manages the Spanish NREN, RedIRIS<br>RED-ES joins EGEE due to the change in legal entity of redIRIS, formerly under CSIC.<br>**NA5:** The budget and responsibilities allocated to the NA5 activity for CSIC/redIRIS are re-assigned to RED.ES/redIRIS. |

**Table 1b: List of the entities which are contributing to the project but are not signatory of the contract**

| Organisation (name, city, country) | Short name | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|
| **Research Institutes involved in the programme of work** | | |
| Université Libre de Bruxelles, Brussels, Belgium | ULB | Expertise in grid deployment and grid applications. |
| Interuniversitair Micro-Elektronica Centrum vzw, Leuven, Belgium | IMEC | QoS in networks (strong involvement in previous IST projects). Network monitoring related to grid operations |
| Université Catholique de Louvain, Louvain-la-Neuve, Belgium | UCLb | Running Grid testbeds. Primarily in the context of CMS |
| Estonian Educational and Research Network, Tartu, Estonia | EENet | EENet is a governmental nonprofit organization established in 1993 with the task of managing, coordinating and developing the computer network of science, education and culture. Development projects are being carried out in cooperation with universities and institutes. EENet has acquired experience in most of the advanced technologies, for example ATM, fiber-optics, radio-links, GRID, etc. |
| Computer Science Department, Università di Milano Informatica, Milano, Italy | UMI | The Università di Milano Informatica (UMI) team is constituted of academic people deeply involved in research fields connected with the scope of EGEE: WEB services, dynamical data base management, data security, job descriptional languages, object oriented programming. They will collaborate with INFN in middleware re-engineering. Leader is Prof. Bruno Apolloni. |
| Istituto Nazionale Di Astrofisica, Rome, Italy | INAF | Large Italian public institution performing scientific and technological research in the fields of astronomy, radio-astronomy, space astrophysics and cosmo-physics. It will migrate, in conjuction with INFN, astro-science applications to the grid. |
| Politecnico Di Bari, Bari, Italy | POLIBA | The Politecnico Di Bari team consists of computer scientists who will work, in conjuction with INFN, on middleware –re-engineering. |
| Stichting Nationale Computerfaciliteiten, Den Haag, Netherlands | NCF | NCF provides the computer facilities for scientific computing in the Netherlands. It manages several super-computers, mass storage systems and PC clusters and supports the national grid infrastructure. It is the prime point of knowledge dissemination and facilitates and coordinates international collaboration. |
| Universitetet i Oslo, Norway | UiO | UiO runs national HPC resources since 1993. The center has also been involved in establishing the national HPC MetaCentre in Norway together with the three other universities. It currently manages Grid activities in the NOTUR consortium. The Department of Physics is actively participating the NorduGrid project with the goal of establishing a prototype grid for processing data from LHC |
| UNINETT, Trondheim, Norway | UNINETT | UNINETT is the responsible for the national educational and research data networks in Norway . It manages networks, domain name registration, CERT (Computer Emergency Response Team) and provides connectivity to NORDUnet. It has a programme in place to increase network capacity in the period 2003-2006, with possibility for dedicated connections, between Norway and the rest of Europe. |
| Linköping University -National Supercomputer Centre | LiU | NSC is one of the lead sites in the Swedish National Infrastructure for Computing. NSC has a proven track record of excellence in large scale production computing. NSC constructs and operates large scale PC-clusters for academic and commercial users. |
| Scientific and Technical Research Council of Turkey; Turkish Academic Network and Information Center, Ankara, Turkey | TUBITAK | Scientific and Technical Research Council of Turkey, Turkish Academic Network and Information Center |
| HealthGrid association | HEALTH GRID | Association to promote the usage of grid technology in health. Participation to the deployment of grid biomedical applications |
| High Performance Computing Center North, Umeå University, Sweden | HPC2N | HPC2N has long-term leading expertise in development of algorithms for parallel computing and provision of state of the art computational resources. HPC2N is a partner in the Swedish meta center, SNIC,. and will thus contribute towards the activities in the Swedish Regional Operations Center. |
| The Danish IT centre for educationa dn research | UNI*C | UNI*C (http://www.unic.dk/generelt/english/index.html) has a long experience in preparing and executing coursesaround IT and will work with KU-NATFAK on training and education within activity NA3 |

| Organisation (name, city, country) | Short name | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|
| Institute of Computer Science-Foundation for Research and Technology Hellas, Heraclion, Greece | ICS-FORTH | Major Research Institute with extensive participation and experience in Grid projects (fabric and middleware ) - Operation of the distributed GRNET ROC (Heraclion-Crete area) in cooperation with University of Crete. Operator of the Hellasgrid Resource Center in Heraclion-Crete, which will be added to the EGEE infrastructure in M16 as this is described in SA1 activity |
| IUniversity of Crete, Heraclion, Greece | UOC | Major Academic Institute and Hellasgrid partner with extensive experience in the parallel computing- Operation of the distributed GRNET ROC in Heraclion-Crete in cooperation with ICS-FORTH (Activity SA1). |
| University of the Aegean, Syros, Greece | AEGEAN | Major Academic Institute with extensive experience in directory services and security issues. Responsible for Hellasgrid infrastructure security aspects in cooperation with Aristotle University of Thessaloniki (SA1). |
| Aristotle University of Thessaloniki, Thessaloniki, Greece | AUTH | Major Academic institute with active participation in Crossgrid project operating the Hellasgrid Certification Authority (CA). Responsible for the operation of the Hellasgrid CA of the GRNET ROC (for Greece and potentially other South East countries). Cooperation with University of Macedonia for the operation of the distributed GRNET ROC (Thessaloniki area) (SA1). Operator of the Hellasgrid Resource Center in Thessaloniki, which will be added to the EGEE infrastructure in M16 as this is described in SA1 activity. |
| Reseach Academic Computer Technology Institute, Patras, Greece | CTI | Major Research Institute with extensive participation and experience in research projects - Operation of the distributed GRNET ROC (Patras area), in cooperation with University of Patras. Operator of the Hellasgrid Resource Center in Patras, which will be added to the EGEE infrastructure in M16 as this is described in SA1 activity |
| University of Patras, Patras, Greece | UPATRAS | Hellasgrid partner and major Academic institute with active participation in Grid FP5 projects. Cooperation with CTI in SA1 for the operation of GRNET distributed ROC (Patras area). |
| University of Ioannina, Ioannina, Greece | UOI | Hellasgrid partner and major Academic institute with active participation in Grid Bio-informatics. Contribution in NA3 (User Training and Induction), with emphasis on the Greek Bio-informatics community |
| Institute of Communication and Computer Systems, Athens, Greece | ICCS | ICCS is a major research institute associated with the Department of Electrical and Computer Engineering (ECE) of the National Technical University of Athens (NTUA). ICCS has extensive participation in FP5 Grid middleware and infrastructure projects. ICCS will assist the induction of the major GRNET cluster node in EGEE infrastructure in M6, as described in activity SA1, in cooperation with Demokritos and IRIS. |
| National Centre for Scientific Research “Demokritos”, Athens, Greece | DEMOKRITOS | Demokritos is a Hellasgrid partner and major research institute with active participation in the FP5 Crossgrid project. Demokritos will assist the induction of the major GRNET cluster node in EGEE infrastructure in M6, as described in activity SA1, in cooperation with ICCS and IRIS. |
| Center for Integrated Research for the Information Society, Athens, Greece | IRIS | IRIS is a new established institution and its main mission is the promotion of Information Society in Greece. IRIS will assist the induction of the major GRNET cluster node in EGEE infrastructure in M6, as described in activity SA1, in cooperation with ICCS and Demokritos. |
| Institute of Accelerating Systems and Applications, Athens, Greece | IASA | IASA is Hellasgrid partner and a research institute affiliated with six departments (Medicine, Physics, Electrical and Computer Engineering, Chemical Engineering and General Sciences) of the University of Athens and the National Technical University of Athens (NTUA). Its main role is the operation of the GRNET distributed ROC in the Athens area and the induction of the 2nd Hellasgrid node in Athens in M16, as this is described in the tables of SA1. |
| University of Athens, Athens, Greece | UoA | University of Athens is a major academic institute in Greece. Its main role is the operation of the GRNET distributed ROC in the Athens area in cooperation with IASA and the induction of the 2nd Hellasgrid node in Athens in M16, as this is described in the tables of SA1. |
| National Observatory of Athens, Athens, Greece | NOA | NOA is a major research institute in Greece with extensive experience (among others) in meteorology, astronomy and astrophysics. It will contribute in the project in the NA3 activity (User Training and Induction), with emphasis on the induction of new user communities. |
| University of Macedonia, Thessaloniki, Greece | UOM | Major Academic institute with active involvement in parallel computing and grid projects. UOM will cooperate with AUTH for the operation of the distributed GRNET ROC (Thessaloniki area) (SA1). Operator of the Hellasgrid Resource Center in Thessaloniki, which will be added to the EGEE infrastructure in M16 as this is described in SA1 activity. |

| Organisation (name, city, country) | Short name | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|
| Center for Research & Technology Hellas, Thessaloniki, Greece | CERTH | Major research institute with active involvement in Virtual Collaboration Environment Projects. It will contribute in the operation of GRNET distributed ROC in SA1 (Thessaloniki area), providing support to the area users. It will investigate the use of AccessGrid for the good coordination of the distributed ROC. |
| Hellenic National Meteorological Service | EMY | EMY is the Institute providing the National Meteorology Services and a Hellasgrid partner. In EGEE they will monitor the applications activities (NA4) from the user perspective. |
| Athens University of Economics and Business, Computer Science Division | AUEB | AUEB is a major academic institute in Greece and a Hellasgrid partner. They plan to monitor the applications activities (NA4). |
| University of Pireaeus | UNIPI | UNIPI is a major academic institute in Greece and a Hellasgrid partner. They plan to monitor the applications activities (NA4). |
| National Technical University of Athens, Athens, Greece | NTUA | NTUA is a major academic institute in Greece with extensive participation and experience in multiple research and Grid related projects (GRIA, GRIDLAB). NTUA will support the users of the 2nd Hellasgrid node in Athens area as part of SA1 and NA3 activities. |
| University of Manchester, Manchester, UK | UvMan | The University of Manchester is host to the UK's NorthWest e-Science centre. Manchester has particular specialisms, on the applications side in BioMedical e-Science and on the middleware side in Semantic Grid and Grid-enabled visualization. We play a leading role in GGF with 6 GGF co-chairs based at Manchester. The University hosts one of the four core nodes of the UK e-science grid and is actively engaged in the grid development programme for the LHC. We are developing integration of Globus and UNICORE with partners in the Framework 5 GRIP project.<br>**SA1**: coordination of the development and deployment of the UK's Northern Regional tier-2 centre for the LHC |
| Imperial College of Science Technology and Medicine, London, UK | ICUL | The London e-Science Centre at Imperial College is one of the eight Regional Centres in the EPSRC/DTI e-Science Core Technology programme. The Centre has the responsibility to develop and promote e-Science activities, particularly in London and the South East of Britain. The Centre provides machine and systems support for the UK Grid and is involved in a wide range of collaborative e-Science projects, for example support for high-throughput HEP applications. The Centre's research specialisation is the development of high-level service-oriented e-Science middleware.<br>**SA1:** coordinate the development and deployment of the UK's London Regional tier-2 centre for the LHC |
| University of Glasgow, Glasgow, UK | UvGlasgow | UK National e-Science Centre is a collaboration between the Universities of Glasgow and Edinburgh; it is the leading training and education centre for Grid researchers in the UK. Glasgow is also leading the UK grid development programme for the LHC<br>**SA1**: coordinate the development and deployment of the UK's Scottish Regional tier-2 centre for the LHC |
| University "Politehnica" of Bucharest, Romania (www.pub.ro) | UPB | UPB is the largest technical university in Romania. During last years the Computer Science and Engineering Department, which belongs to the Faculty of Automatics and Computers, has been developing researches in parallel and distributed systems and programming, networking , Grid computing. UPB will cooperate with ICI for the development and operation of the education and research networking infrastructure, along with RoEduNet as the national operator of the education network. UPB will support the users from academic area and will be active in training activities. |
| "Horia Hulubei" National Institute for Physics and Nuclear Engineering, Bucharest, Romania (www.nipne.ro) | NIPNE | NIPNE is the main component of the cluster of institutes for physics, located on the Magurele platform in Bucharest. Its research priorities include such fields as theoretical physics, nuclear and atomic physics, particle physics, life and environment physics. To support this research activity, NIPNE is active in developing the Grid infrastructure and providing specific services for the physics platform. NIPNE will cooperate in SA1 and NA3 activities (mainly focused on application development requirements), including support for RoGRID users belonging to the Magurele platform. |
| National Institute for Aerospace Research, Bucharest, Romania (www.incas.ro) | INCAS | INCAS has more than 40 years of experience in aerospace design, experimental aerodynamics and numerical methods for applied aerodynamics and fluid mechanics. Its research platform includes wind tunnels and HPSC computational platform, based on a 32 nodes Beowulf cluster and access to a Cray T3E-1200 supercomputer using GRID technology. INCAS will provide RC functionality and will support the NA3 activities with emphasis on the induction of new users communities. |

| Organisation (name, city, country) | Short name | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|
| University of Bucharest, Romania (www.unibuc.ro) | UB | UB is a major academic organization in Bucharest the field of theoretical physics, mathematics, theoretical and applied informatics. UB will contribute in supporting the user communities from academia and public administration areas through NA3 specific activities. |
| Telefonica I+D, http://www.tid.es/english/home2.html | TID | TID has been created by Telefonica S.A. to fulfil its research and development requirements and to contribute to telefonica Group's competitiveness through technological innovation. TID will contribute to the SA1 activity and contribute to the SA1 deliverables. |
| Swiss National Supercomputing Centre. www.cscs.ch | CSCS | Provides powerful computing, data storage and access facilities to research in Switzerland. Contributing resource to SA1 and working on biomed applications as part of NA4. |
| The Inter University Computational Center, http://www.iucc.ac.il/ | IUCC | The Inter University Computing Center (IUCC) is Israel's NREN, responsible for the national academic internet infrastructure and hosting super-computer facilities. It will serve as the grid Certificate Authority, will employ manpower in both SA1 and NA3 activities, and will host a site on the EGEE grid. |
| | | |
| **Research Institutes interested in the programme of work** | | |
| Institute for Nuclear Research and Nuclear Energy, Bulgaria | INRNE | Letter of Support |
| Princeton University, Department of Physics Joseph Henry Laboratories, USA | | Letter of Support |
| Max Planck Institut fuer Extraterrestrische Physics, Germany | GAVO | Letter of Support |
| Research Institute for Symbolic Computation Johannes Kepler University, Linz Austria | RISC | RISC-Linz has a long-standing expertise on computer mathematics (with focus and symbolic computation) and on the development of parallel and distributed software systems aimed at applications in this field. |
| Institut fuer Hochenergiephysik der Oesterreichischen Akademie der Wissenschaften, Vienna -Austria | HEPHY | Expertise in the analysis of high energy physics experiments (track and vertex fitting procedures, physics data analysis). |
| Turkish Academic Network and Information Center, Ankara Turkey | TANIC | Coordinator of the TR-Grid initiative and operating the National Research and Education backbone network |
| Molecular Imaging and Multimodality | IM3 | Project to promote and coordinate Spanish national research groups involved in the design, development and validation of new medical imaging acquisition techniques and the transfer of results to industry |
| Norwegian University of Science and Technology, Trondheim, Norway | NTNU | NTNU is one of the 4 Norwegian HPC centers providing HPC resources and user support for the national research infrastructure. Their experience includes in-depth knowledge of distributed credential based user administration, accounting and networked data storage. Long term experience with both standard and trusted operating systems on clustered as well as traditional systems. |
| University of Tromsoe, Norway | UiTOE | UiT is one of the 4 Norwegian HPC centres providing HPC resources and user support for the national research infrastructure. Research into distributed and parallel systems has been going on since 1987. Presently there are a wide range of ongoing projects on distributed systems, GRID and multi-clusters |
| BELNET, Belgium | BELNET | Networking (deployment, new networking developments). Grid deployment |
| University of Oxford, Oxford, UK | UvOxford | The University of Oxford e-Science centre hosts one of the four core nodes of the UK e-science grid and is actively engaged in the grid development programme for the LHC. OeSC is involved in a large number of collaborative e-science projects, with other Universities and industry partners. The projects are in many different scientific fields from biology to engineering. **SA1:** coordinate the development and deployment of the UK's Southern Regional tier-2 centre for the LHC |

| Organisation (name, city, country) | Short name | Short description (i.e. fields of excellence) and specific roles in the consortium |
|---|---|---|
| University of Leeds, Leeds, UK | UvLeeds | The University of Leeds represents The White Rose Consortium. This is a consortium of the Universities of Leeds, Sheffield and York. Building on the experience of the White Rose Grid – see http://www.whiterose.ac.uk/HPDGrid.cfm - and coordinating e-Science activities of the three Universities, the White Rose Consortium will add expertise in Real-time Distributed Design Support and Diagnostic Systems and Real-time Distributed Collaborative Visualisation Services. The University will also hosts one the four core nodes of the UK e-Science Grid.<br>**SA1:** Coordinate development and deployment of Grid infrastructure in the White Rose Universities |
| Lund Center for Computational Science, Lund University, Sweden | LUNARC | LUNARC has a proven strong track record in applications of computational science with an emphasis on computational chemistry. LUNARC is a partner in the Swedish meta center, SNIC, and will contribute towards the activities in the Swedish Regional Operations Center. |
| Universitaet Innsbruck, Institut fuer Experimentalphysik | UIBK-EXP | Statistical data analysis, exp. data acquisition systems of high energy physics experiments. |
| **Industrial participants (letters of support)** | | |
| IBM Montpellier, France | | Letter of Support |
| Microsoft European Innovation Centre, Paris, France | | Letter of Support |
| Enterprise Applications Integration, Torino, Italy | | Letter of Support |
| NICE, Camerano Casasco, Italy | | Letter of Support |
| HELIDE, Valencia, Spain | | Letter of Support |
| Biopôle Clermont-Limagne, France | | Consortium of SME's in the area of biotechnologies. Participation to the validation of biomedical applications |

**Table 2: List of activities of *I3***

| Activity Number | Descriptive Title | Short description and specific objectives of the activity |
|---|---|---|
| ***Networking activities*** | | |
| NA1 | Management of *I3* | Overall management of the project |
| NA2 | Dissemination and Outreach | Operate the dissemination Web site, support mail lists and web base collaborative tools, organize presentations, visits, 2 project conferences and showcases per year, publication of dissemination material |
| NA3 | User Training and Induction | Produce training and course material. Deliver on-site courses and support distributed courses in the project. |
| NA4 | Application Identification and Support | Support of HEP and Bio pilot applications. Identification of early users. Introduction of new user communities. Definition of common application interfaces and tools. Creation of an Industry Forum. |
| NA5 | Policy and International Cooperation | Cooperation with US NSF Cyberinfrastructure. Active collaboration with other EU projects and activities (FP5 GRIDSTART, Complex Problem Solving Middleware projects). Establish eInfrastructure reflection group in Europe. Participation to GGF activities. Collaboration with US and Russia. |
| ***Specific Service activities*** | | |
| SA1 | European Grid Support, Operation and Management | Core infrastructure services. Grid monitoring and control. Middleware deployment and resource induction. Resource and user support. Grid management. |
| SA2 | Network Resource Provision | Definition in collaboration with RN Geant and NRENs of SLRs, Modelling, SLSs, SLAs, Policies. |
| ***Research activities*** | | |
| JRA1 | Middleware Re-engineering and Integration | Implement production quality Core Grid services by re-engineering existing Middleware and by completing missing functionality. Integration of middleware components. Testing and validation. Establish and run an overall architecture team. |
| JRA2 | Quality Assurance | Project-wide quality assurance. Quality assurance in EGEE is the planned and systematic set of activities that ensure that processes, products and operation services conform to EGEE requirements, standards, procedures, and to the required level of services. |
| JRA3 | Security | Enable secure operation of a European Grid infrastructure. Develop security architectures frameworks and policies. Includes requirements cycle, definition of incident response methods and authentication policies. Consistent design of security mechanisms for all core Grid services. Production needs of resource providers with regard to identity integrity and protection |
| JRA4 | Network Services Development | Develop interfaces to the network control plane to allow Grid middleware to make immediate and advance reservations of network connectivity specified in terms of bandwidth, duration and quality of service. |

## Table 3: Summary table of expected budget and of the Community contribution requested - Full duration of project

**PLEASE NOTE:** table modified for better readability (the table is transposed and all figures are in €).

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | *Total expected* | *Max Community contribution* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | | |
| **1** | CERN | AC | exp, budget | 1 745 000 | 485 000 | | 800 000 | 200 000 | **3 230 000** | 1 800 000 | | **1 800 000** | 3 119 000 | | | | **3 119 000** | ***8 149 000*** | |
| | | | req, contrib | 1 745 000 | 485 000 | | 800 000 | 200 000 | **3 230 000** | 1 800 000 | | **1 800 000** | 3 119 000 | | | | **3 119 000** | | ***8 149 000*** |
| **2** | GUP | AC | exp, budget | | 10 000 | 20 000 | | | **30 000** | 95 000 | | **95 000** | | | | | | ***125 000*** | |
| | | | req, contrib | | 10 000 | 20 000 | | | **30 000** | 95 000 | | **95 000** | | | | | | | ***125 000*** |
| **3** | UNNINSBRUCK | AC | exp, budget | | | 10 000 | | | **10 000** | 78 000 | | **78 000** | | | | | | ***88 000*** | |
| | | | req, contrib | | | 10 000 | | | **10 000** | 78 000 | | **78 000** | | | | | | | ***88 000*** |
| **4** | CESNET | FCF | exp, budget | 6 000 | | 80 000 | 80 000 | | **166 000** | 332 000 | | **332 000** | 300 000 | | | | **300 000** | ***798 000*** | |
| | | | req, contrib | 6 000 | | 40 000 | 40 000 | | **86 000** | 166 000 | | **166 000** | 150 000 | | | | **150 000** | | ***402 000*** |
| **5** | BUTE | AC | exp, budget | | 18 000 | 17 500 | | | **35 500** | | | | | | | | | ***35 500*** | |
| | | | req, contrib | | 18 000 | 17 500 | | | **35 500** | | | | | | | | | | ***35 500*** |
| **6** | ELUB | AC | exp, budget | 6 000 | 12 000 | 17 500 | | | **35 500** | | | | | | | | | ***35 500*** | |
| | | | req, contrib | 6 000 | 12 000 | 17 500 | | | **35 500** | | | | | | | | | | ***35 500*** |
| **7** | KFKI-RMKI | FCF | exp, budget | 6 000 | | | | | **6 000** | 176 000 | | **176 000** | | | | | | ***182 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 88 000 | | **88 000** | | | | | | | ***94 000*** |
| **8** | MTA-SZTAKI | AC | exp, budget | 6 000 | 20 000 | 41 000 | 20 000 | | **87 000** | 18 000 | | **18 000** | | | | | | ***105 000*** | |
| | | | req, contrib | 6 000 | 20 000 | 41 000 | 20 000 | | **87 000** | 18 000 | | **18 000** | | | | | | | ***105 000*** |
| **9** | NIIF | FC | exp, budget | 6 000 | | | | | **6 000** | 113 000 | | **113 000** | | | | | | ***119 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 56 500 | | **56 500** | | | | | | | ***62 500*** |
| **10** | CYFRONET | AC | exp, budget | | | | | | | 168 500 | | **168 500** | | | | | | ***168 500*** | |
| | | | req, contrib | | | | | | | 168 500 | | **168 500** | | | | | | | ***168 500*** |
| **11** | ICM | AC | exp, budget | 6 000 | | 26 000 | | | **32 000** | 140 000 | | **140 000** | | | | | | ***172 000*** | |
| | | | req, contrib | 6 000 | | 26 000 | | | **32 000** | 140 000 | | **140 000** | | | | | | | ***172 000*** |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| **12** | PSNC | AC | exp, budget | | | 26 000 | | | **26 000** | 146 000 | | **146 000** | | | | | | ***172 000*** | |
| | | | req, contrib | | | 26 000 | | | **26 000** | 146 000 | | **146 000** | | | | | | | ***172 000*** |
| **13** | II-SAS | FCF | exp, budget | 2 000 | | 90 000 | | | **92 000** | 231 000 | | **231 000** | | | | | | ***323 000*** | |
| | | | req, contrib | 2 000 | | 45 000 | | | **47 000** | 115 500 | | **115 500** | | | | | | | ***162 500*** |
| **14** | JSI | FC | exp, budget | 6 000 | | | | | **6 000** | 162 000 | | **162 000** | | | | | | ***168 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 81 000 | | **81 000** | | | | | | | ***87 000*** |
| **15** | TCD | AC | exp, budget | 6 000 | | | | | **6 000** | 192 000 | | **192 000** | | | | | | ***198 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 192 000 | | **192 000** | | | | | | | ***198 000*** |
| **16** | CCLRC | FC | exp, budget | 6 000 | | | | | **6 000** | 3 720 000 | | **3 720 000** | 1 138 000 | | | | **1 138 000** | ***4 864 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 1 860 000 | | **1 860 000** | 569 000 | | | | **569 000** | | ***2 435 000*** |
| **17** | UEDIN | AC | exp, budget | 6 000 | 106 000 | 684 000 | 94 000 | | **890 000** | | | | | | | 253 213 | **253 213** | ***1,143,213*** | |
| | | | req, contrib | 6 000 | 106 000 | 684 000 | 94 000 | | **890 000** | | | | | | | 253 213 | 253 213 | | ***1,143,213*** |
| **18** | PPARC | FC | exp, budget | 6 000 | | | | 8 000 | **14 000** | | | | | | | | | ***14 000*** | |
| | | | req, contrib | 6 000 | | | | 4 000 | **10 000** | | | | | | | | | | ***10 000*** |
| **19** | UCL | AC | exp, budget | 6 000 | | | | | **6 000** | | | | | | | 37 787 | 37 787 | ***43 787*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | | 37 787 | 37 787 | | ***43 787*** |
| **20** | CEA | FC | exp, budget | 6 000 | | | | | **6 000** | 285 000 | | **285 000** | | | | | | ***291 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 142 500 | | **142 500** | | | | | | | ***148 500*** |
| **21** | CGG | FC | exp, budget | 6 000 | | | | | **6 000** | 315 000 | | **315 000** | | | | | | ***321 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 157 500 | | **157 500** | | | | | | | ***163 500*** |
| **22** | CNRS | FCF | exp, budget | | | | 2 000 000 | 40 000 | **2 040 000** | 2 710 000 | 400 000 | **3 110 000** | | 400 000 | | 400 000 | **800 000** | ***5 950 000*** | |
| | | | req, contrib | | | | 1 000 000 | | **1 000 000** | 1 355 000 | 200 000 | **1 555 000** | | 200 000 | | 200 000 | **400 000** | | ***2 955 000*** |
| **23** | CSSI | FC | exp, budget | 6 000 | | | 377 000 | | **383 000** | 300 000 | | **300 000** | | 400 000 | | | **400 000** | ***1 083 000*** | |
| | | | req, contrib | 6 000 | | | 188 500 | | **194 500** | 150 000 | | **150 000** | | 200 000 | | | **200 000** | | ***544 500*** |
| **24** | CRSA | FC | exp, budget | 6 000 | | | 384 000 | | **390 000** | | | | | | | | | ***390 000*** | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| | | | req, contrib | 6 000 | | | 192 000 | | **198 000** | | | | | | | | | | ***198 000*** |
| **25** | DESY | AC | exp, budget | 6 000 | | | | | **6 000** | 142 500 | | **142 500** | | | | | | ***148 500*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 142 500 | | **142 500** | | | | | | | ***148 500*** |
| **26** | DKRZ | FCF | exp, budget | 6 000 | | | 186 000 | | **192 000** | | | | | | | | | ***192 000*** | |
| | | | req, contrib | 6 000 | | | 93 000 | | **99 000** | | | | | | | | | | ***99 000*** |
| **27** | FhG | FC | exp, budget | 6 000 | | | 200 000 | | **206 000** | 680 000 | | **680 000** | | | | | | ***886 000*** | |
| | | | req, contrib | 6 000 | | | 100 000 | | **106 000** | 340 000 | | **340 000** | | | | | | | ***446 000*** |
| **28** | FZK | FC | exp, budget | 6 000 | 200 000 | 200 000 | | 100 000 | **506 000** | 1 074 000 | | **1 074 000** | | | | | | ***1 580 000*** | |
| | | | req, contrib | 6 000 | 100 000 | 100 000 | | | **206 000** | 537 000 | | **537 000** | | | | | | | ***743 000*** |
| **29** | GSI | FC | exp, budget | 6 000 | | | | | **6 000** | 285 000 | | **285 000** | | | | | | ***291 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 142 500 | | **142 500** | | | | | | | ***148 500*** |
| **30** | DATAMAT | FC | exp, budget | 6 000 | | | | | **6 000** | | | | 1 176 000 | | | | **1 176 000** | ***1 182 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | 588 000 | | | | **588 000** | | ***594 000*** |
| **31** | INFN | AC | exp, budget | | 100 000 | 100 000 | 400 000 | 100 000 | **700 000** | 1 563 000 | | **1 563 000** | 1 450 000 | | | | **1 450 000** | ***3 713 000*** | |
| | | | req, contrib | | 100 000 | 100 000 | 400 000 | 100 000 | **700 000** | 1 563 000 | | **1 563 000** | 1 450 000 | | | | **1 450 000** | | ***3 713 000*** |
| **32** | TERENA | FC | exp, budget | 6 000 | 833 500 | | | | **839 500** | | | | | | | | | ***839 500*** | |
| | | | req, contrib | 6 000 | 439 500 | | | | **445 500** | | | | | | | | | | ***445 500*** |
| **33** | VUB | AC | exp, budget | 6 000 | 93 000 | | | | **99 000** | | | | | | | | | ***99 000*** | |
| | | | req, contrib | 6 000 | 93 000 | | | | **99 000** | | | | | | | | | | ***99 000*** |
| **34** | KU-NATFAK | AC | exp, budget | 6 000 | | 93 000 | | | **99 000** | | | | | | | | | ***99 000*** | |
| | | | req, contrib | 6 000 | | 93 000 | | | **99 000** | | | | | | | | | | ***99 000*** |
| **35** | UH-HIP | AC | exp, budget | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | ***198 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | | ***198 000*** |
| **36** | FOM | FCF | exp, budget | | | | 388 000 | | **388 000** | 400 000 | | **400 000** | | | 400 000 | | **400 000** | ***1 188 000*** | |
| | | | req, contrib | | | | 194 000 | | **194 000** | 200 000 | | **200 000** | | | 200 000 | | **200 000** | | ***594 000*** |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| **37** | SARA | FC | exp, budget | 6 000 | | | | | **6 000** | 780 000 | | **780 000** | | | | | | ***786 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 390 000 | | **390 000** | | | | | | | ***396 000*** |
| **38** | UvA | AC | exp, budget | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | ***198 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | | ***198 000*** |
| **39** | UiB | AC | exp, budget | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | ***198 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | 192 000 | | **192 000** | | ***198 000*** |
| **40** | VR | AC | exp, budget | 6 000 | | | | | **6 000** | 588 000 | | **588 000** | | | | | | ***594 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 588 000 | | **588 000** | | | | | | | ***594 000*** |
| **41** | IHEP | FCF | exp, budget | | 20 000 | 53 200 | 34 000 | | **107 200** | 197 000 | | **197 000** | | | | | | ***304 200*** | |
| | | | req, contrib | | 10 000 | 26 600 | 17 000 | | **53 600** | 98 500 | | **98 500** | | | | | | | ***152 100*** |
| **42** | IMPB-RAS | AC | exp, budget | | 36 300 | 8 000 | 12 000 | | **56 300** | 20 000 | | **20 000** | | | | | | ***76 300*** | |
| | | | req, contrib | | 36 300 | 8 000 | 12 000 | | **56 300** | 20 000 | | **20 000** | | | | | | | ***76 300*** |
| **43** | ITEP | FCF | exp, budget | | 40 000 | 27 200 | 40 000 | | **107 200** | 197 000 | | **197 000** | | | | | | ***304 200*** | |
| | | | req, contrib | | 20 000 | 13 600 | 20 000 | | **53 600** | 98 500 | | **98 500** | | | | | | | ***152 100*** |
| **44** | JINR | FCF | exp, budget | | 53 200 | 24 000 | 30 000 | | **107 200** | 197 000 | | **197 000** | | | | | | ***304 200*** | |
| | | | req, contrib | | 26 600 | 12 000 | 15 000 | | **53 600** | 98 500 | | **98 500** | | | | | | | ***152 100*** |
| **45** | KIAM RAS | FCF | exp, budget | | 33 600 | | | | **33 600** | 118 000 | | **118 000** | | | | | | ***151 600*** | |
| | | | req, contrib | | 16 800 | | | | **16 800** | 59 000 | | **59 000** | | | | | | | ***75 800*** |
| **46** | PNPI | FCF | exp, budget | | 20 000 | 20 000 | 33 600 | | **73 600** | 78 000 | | **78 000** | | | | | | ***151 600*** | |
| | | | req, contrib | | 10 000 | 10 000 | 16 800 | | **36 800** | 39 000 | | **39 000** | | | | | | | ***75 800*** |
| **47** | RRC KI | FCF | exp, budget | | 54 400 | 20 000 | 40 000 | | **114 400** | 40 000 | 74 000 | **114 000** | | | | | | ***228 400*** | |
| | | | req, contrib | | 27 200 | 10 000 | 20 000 | | **57 200** | 20 000 | 37 000 | **57 000** | | | | | | | ***114 200*** |
| **48** | SINP MSU | FCF | exp, budget | | 107 200 | | 40 000 | | **147 200** | 236 000 | | **236 000** | | | | | | ***383 200*** | |
| | | | req, contrib | | 53 600 | | 20 000 | | **73 600** | 118 000 | | **118 000** | | | | | | | ***191 600*** |
| **49** | CLPP-BAS | AC | exp, budget | 6 000 | 70 000 | | | | **76 000** | 192 000 | | **192 000** | | | | | | ***268 000*** | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| | | | req, contrib | 6 000 | 70 000 | | | | **76 000** | 192 000 | | **192 000** | | | | | | | ***268 000*** |
| **50** | UCY | AC | exp, budget | 6 000 | 70 000 | | | | **76 000** | 192 000 | | **192 000** | | | | | | ***268 000*** | |
| | | | req, contrib | 6 000 | 70 000 | | | | **76 000** | 192 000 | | **192 000** | | | | | | | ***268 000*** |
| **51** | GRNET | FCF | exp, budget | 6 000 | | 240 000 | | 230 000 | **476 000** | 775 000 | 115 000 | **890 000** | | | | | | ***1 366 000*** | |
| | | | req, contrib | 6 000 | | 120 000 | | 115 000 | **241 000** | 387 500 | | **387 500** | | | | | | | ***628 500*** |
| **52** | TAU | AC | exp, budget | 6 000 | | 70 000 | | | **76 000** | 191 500 | | **191 500** | | | | | | ***267 500*** | |
| | | | req, contrib | 6 000 | | 70 000 | | | **76 000** | 191 500 | | **191 500** | | | | | | | ***267 500*** |
| **53** | ICI | FC | exp, budget | 6 000 | | 140 000 | | | **146 000** | 383 000 | | **383 000** | | | | | | ***529 000*** | |
| | | | req, contrib | 6 000 | | 70 000 | | | **76 000** | 191 500 | | **191 500** | | | | | | | ***267 500*** |
| **54** | LIP | FCF | exp, budget | 6 000 | | | | | **6 000** | 483 000 | | **483 000** | | | | | | ***489 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 241 500 | | **241 500** | | | | | | | ***247 500*** |
| **55** | CESGA | AC | exp, budget | 6 000 | | | | | **6 000** | 157 500 | | **157 500** | | | | | | ***163 500*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 157 500 | | **157 500** | | | | | | | ***163 500*** |
| **56** | CSIC | FC | exp, budget | 6 000 | | | 350 000 | | **356 000** | 635 000 | | **635 000** | | | | | | ***991 000*** | |
| | | | req, contrib | 6 000 | | | 175 000 | | **181 000** | 317 500 | | **317 500** | | | | | | | ***498 500*** |
| **57** | IFAE | AC | exp, budget | 6 000 | | | | | **6 000** | 281 000 | | **281 000** | | | | | | ***287 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 281 000 | | **281 000** | | | | | | | ***287 000*** |
| **58** | INTA | FC | exp, budget | 6 000 | | | | | **6 000** | 315 000 | | **315 000** | | | | | | ***321 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 157 500 | | **157 500** | | | | | | | ***163 500*** |
| **59** | UPV | FC | exp, budget | 6 000 | | | 334 000 | | **340 000** | | | | | | | | | ***340 000*** | |
| | | | req, contrib | 6 000 | | | 167 000 | | **173 000** | | | | | | | | | | ***173 000*** |
| **60** | University of Chicago | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |
| **61** | USC | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| **62** | Wisconsin-Madison Univ, | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |
| **63** | KTH | AC | exp, budget | 6 000 | | | | | **6 000** | | | | | | 390 000 | | **390 000** | ***396 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | 390 000 | | **390 000** | | ***396 000*** |
| **64** | ENEA | FCF | exp, budget | 6 000 | | | | | **6 000** | 186 000 | | **186 000** | | | | | | ***192 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | 93 000 | | **93 000** | | | | | | | ***99 000*** |
| **65** | UniCal | AC | exp, budget | | | | | | | 99 000 | | **99 000** | | | | | | ***99 000*** | |
| | | | req, contrib | | | | | | | 99 000 | | **99 000** | | | | | | | ***99 000*** |
| **66** | UniLe | AC | exp, budget | | | | | | | 99 000 | | **99 000** | | | | | | ***99 000*** | |
| | | | req, contrib | | | | | | | 99 000 | | **99 000** | | | | | | | ***99 000*** |
| **67** | UniNa | AC | exp, budget | | | | | | | 99 000 | | **99 000** | | | | | | ***99 000*** | |
| | | | req, contrib | | | | | | | 99 000 | | **99 000** | | | | | | | ***99 000*** |
| **68** | DANTE | FC | exp, budget | 6 000 | | | | | **6 000** | | | | | | | 186 000 | **186 000** | ***192 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | | 93 000 | **93 000** | | ***99 000*** |
| **69** | DFN | AC | exp, budget | 6 000 | | | | 107 500 | **113 500** | | | | | | | 100 000 | **100 000** | ***213 500*** | |
| | | | req, contrib | 6 000 | | | | 107 500 | **113 500** | | | | | | | | | | ***113 500*** |
| **70** | GARR | FC | exp, budget | 6 000 | | | | 100 000 | **106 000** | | | | | | | 215 000 | **215 000** | ***321 000*** | |
| | | | req, contrib | 6 000 | | | | | **6 000** | | | | | | | 107 500 | **107 500** | | ***113 500*** |
| **71** | RED.ES | FC | exp, budget | 6 000 | | | | 218 000 | **224 000** | | | | | | | | | ***224 000*** | |
| | | | req, contrib | 6 000 | | | | 109 000 | **115 000** | | | | | | | | | | ***115 000*** |
| **Totals** | | | | | | | | | | | | | | | | | | | |
| Total expected budget (€) | | | | 2 023 000 | 2 382 200 | 2 007 400 | 5 842 600 | 1 115 500 | **13 370 700** | 21 665 000 | 589 000 | **22 254 000** | 7 183 000 | 800 000 | 1 366 000 | 1 192 000 | **10 541 000** | ***46 165 700*** | |
| Max Community contrib, request (€) | | | | 2 023 000 | 1 724 000 | 1 560 200 | 3 584 300 | 641 500 | **9 533 000** | 13 963 500 | 237 000 | **14 200 500** | 5 876 000 | 400 000 | 1 166 000 | 691 500 | **8 133 500** | | ***31 867 000*** |

## Table 3bis: Summary table of expected budget and of the Community contribution requested - First reporting period plus 6 months

**PLEASE NOTE:** table modified for better readability (the table is transposed and all figures are in €).

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | *Total expected* | *Max Community contribution* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | | |
| **1** | CERN | AC | exp, budget | 1 090 625 | 303 125 | | 500 000 | 125 000 | **2 018 750** | 1 125 000 | | **1 125 000** | 1 949 375 | | | | **1 949 375** | ***5 093 125*** | |
| | | | req, contrib | 1 090 625 | 303 125 | | 500 000 | 125 000 | **2 018 750** | 1 125 000 | | **1 125 000** | 1 949 375 | | | | **1 949 375** | | ***5 093 125*** |
| **2** | GUP | AC | exp, budget | | 6 250 | 12 500 | | | **18 750** | 59 375 | | **59 375** | | | | | | ***78 125*** | |
| | | | req, contrib | | 6 250 | 12 500 | | | **18 750** | 59 375 | | **59 375** | | | | | | | ***78 125*** |
| **3** | UNNINSBRUCK | AC | exp, budget | | | 6 250 | | | **6 250** | 48 750 | | **48 750** | | | | | | ***55 000*** | |
| | | | req, contrib | | | 6 250 | | | **6 250** | 48 750 | | **48 750** | | | | | | | ***55 000*** |
| **4** | CESNET | FCF | exp, budget | 3 750 | | 50 000 | 50 000 | | **103 750** | 207 500 | | **207 500** | 187 500 | | | | **187 500** | ***498 750*** | |
| | | | req, contrib | 3 750 | | 25 000 | 25 000 | | **53 750** | 103 750 | | **103 750** | 93 750 | | | | **93 750** | | ***251 250*** |
| **5** | BUTE | AC | exp, budget | | 11 250 | 10 938 | | | **22 188** | | | | | | | | | ***22 188*** | |
| | | | req, contrib | | 11 250 | 10 938 | | | **22 188** | | | | | | | | | | ***22 188*** |
| **6** | ELUB | AC | exp, budget | 3 750 | 7 500 | 10 938 | | | **22 188** | | | | | | | | | ***22 188*** | |
| | | | req, contrib | 3 750 | 7 500 | 10 938 | | | **22 188** | | | | | | | | | | ***22 188*** |
| **7** | KFKI-RMKI | FCF | exp, budget | 3 750 | | | | | **3 750** | 110 000 | | **110 000** | | | | | | ***113 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 55 000 | | **55 000** | | | | | | | ***58 750*** |
| **8** | MTA-SZTAKI | AC | exp, budget | 3 750 | 12 500 | 25 625 | 12 500 | | **54 375** | 11 250 | | **11 250** | | | | | | ***65 625*** | |
| | | | req, contrib | 3 750 | 12 500 | 25 625 | 12 500 | | **54 375** | 11 250 | | **11 250** | | | | | | | ***65 625*** |
| **9** | NIIF | FC | exp, budget | 3 750 | | | | | **3 750** | 70 625 | | **70 625** | | | | | | ***74 375*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 35 313 | | **35 313** | | | | | | | ***39 063*** |
| **10** | CYFRONET | AC | exp, budget | | | | | | | 105 313 | | **105 313** | | | | | | ***105 313*** | |
| | | | req, contrib | | | | | | | 105 313 | | **105 313** | | | | | | | ***105 313*** |
| **11** | ICM | AC | exp, budget | 3 750 | | 16 250 | | | **20 000** | 87 500 | | **87 500** | | | | | | ***107 500*** | |
| | | | req, contrib | 3 750 | | 16 250 | | | **20 000** | 87 500 | | **87 500** | | | | | | | ***107 500*** |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | | |
| **12** | PSNC | AC | exp, budget | | | 16 250 | | | **16 250** | 91 250 | | **91 250** | | | | | | ***107 500*** | |
| | | | req, contrib | | | 16 250 | | | **16 250** | 91 250 | | **91 250** | | | | | | | ***107 500*** |
| **13** | II-SAS | FCF | exp, budget | 1 250 | | 56 250 | | | **57 500** | 144 375 | | **144 375** | | | | | | ***201 875*** | |
| | | | req, contrib | 1 250 | | 28 125 | | | **29 375** | 72 188 | | **72 188** | | | | | | | ***101 563*** |
| **14** | JSI | FC | exp, budget | 3 750 | | | | | **3 750** | 101 250 | | **101 250** | | | | | | ***105 000*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 50 625 | | **50 625** | | | | | | | ***54 375*** |
| **15** | TCD | AC | exp, budget | 3 750 | | | | | **3 750** | 120 000 | | **120 000** | | | | | | ***123 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 120 000 | | **120 000** | | | | | | | ***123 750*** |
| **16** | CCLRC | FC | exp, budget | 3 750 | | | | | **3 750** | 2 325 000 | | **2 325 000** | 711 250 | | | | **711 250** | ***3 040 000*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 1 162 500 | | **1 162 500** | 355 625 | | | | **355 625** | | ***1 521 875*** |
| **17** | UEDIN | AC | exp, budget | 3 750 | 66 250 | 427 500 | 58 750 | | **556 250** | | | | | | | 158 258 | **158 258** | ***714 508*** | |
| | | | req, contrib | 3 750 | 66 250 | 427 500 | 58 750 | | **556 250** | | | | | | | 158 258 | **158 258** | | ***714 508*** |
| **18** | PPARC | FC | exp, budget | 3 750 | | | | 5 000 | **8 750** | | | | | | | | | ***8 750*** | |
| | | | req, contrib | 3 750 | | | | 2 500 | **6 250** | | | | | | | | | | ***6 250*** |
| **19** | UCL | AC | exp, budget | 3 750 | | | | | **3 750** | | | | | | | 23 617 | **23 617** | ***27 367*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | | 23 617 | **23 617** | | ***27 367*** |
| **20** | CEA | FC | exp, budget | 3 750 | | | | | **3 750** | 178 125 | | **178 125** | | | | | | ***181 875*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 89 063 | | **89 063** | | | | | | | ***92 813*** |
| **21** | CGG | FC | exp, budget | 3 750 | | | | | **3 750** | 196 875 | | **196 875** | | | | | | ***200 625*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 98 438 | | **98 438** | | | | | | | ***102 188*** |
| **22** | CNRS | FCF | exp, budget | | | | 1 250 000 | 25 000 | **1 275 000** | 1 693 750 | 250 000 | **1 943 750** | | 250 000 | | 250 000 | **500 000** | ***3 718 750*** | |
| | | | req, contrib | | | | 625 000 | | **625 000** | 846 875 | 125 000 | **971 875** | | 125 000 | | 125 000 | **250 000** | | ***1 846 875*** |
| **23** | CSSI | FC | exp, budget | 3 750 | | | 235 625 | | **239 375** | 187 500 | | **187 500** | | 250 000 | | | **250 000** | ***676 875*** | |
| | | | req, contrib | 3 750 | | | 117 813 | | **121 563** | 93 750 | | **93 750** | | 125 000 | | | **125 000** | | ***340 313*** |
| **24** | CRSA | FC | exp, budget | 3 750 | | | 240 000 | | **243 750** | | | | | | | | | ***243 750*** | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | Total expected | Max Community contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | All NA | SA1 | SA2 | All SA | JRA1 | JRA2 | JRA3 | JRA4 | All JRA | | |
| | | | req, contrib | 3 750 | | | 120 000 | | **123 750** | | | | | | | | | | ***123 750*** |
| **25** | DESY | AC | exp, budget | 3 750 | | | | | **3 750** | 89 063 | | **89 063** | | | | | | ***92 813*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 89 063 | | **89 063** | | | | | | | ***92 813*** |
| **26** | DKRZ | FCF | exp, budget | 3 750 | | | 116 250 | | **120 000** | | | | | | | | | ***120 000*** | |
| | | | req, contrib | 3 750 | | | 58 125 | | **61 875** | | | | | | | | | | ***61 875*** |
| **27** | FhG | FC | exp, budget | 3 750 | | | 125 000 | | **128 750** | 425 000 | | **425 000** | | | | | | ***553 750*** | |
| | | | req, contrib | 3 750 | | | 62 500 | | **66 250** | 212 500 | | **212 500** | | | | | | | ***278 750*** |
| **28** | FZK | FC | exp, budget | 3 750 | 125 000 | 125 000 | | 62 500 | **316 250** | 671 250 | | **671 250** | | | | | | ***987 500*** | |
| | | | req, contrib | 3 750 | 62 500 | 62 500 | | | **128 750** | 335 625 | | **335 625** | | | | | | | ***464 375*** |
| **29** | GSI | FC | exp, budget | 3 750 | | | | | **3 750** | 178 125 | | **178 125** | | | | | | ***181 875*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 89 063 | | **89 063** | | | | | | | ***92 813*** |
| **30** | DATAMAT | FC | exp, budget | 3 750 | | | | | **3 750** | | | | 735 000 | | | | **735 000** | ***738 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | 367 500 | | | | **367 500** | | ***371 250*** |
| **31** | INFN | AC | exp, budget | | 62 500 | 62 500 | 250 000 | 62 500 | **437 500** | 976 875 | | **976 875** | 906 250 | | | | **906 250** | ***2 320 625*** | |
| | | | req, contrib | | 62 500 | 62 500 | 250 000 | 62 500 | **437 500** | 976 875 | | **976 875** | 906 250 | | | | **906 250** | | ***2 320 625*** |
| **32** | TERENA | FC | exp, budget | 3 750 | 520 938 | | | | **524 688** | | | | | | | | | ***524 688*** | |
| | | | req, contrib | 3 750 | 274 688 | | | | **278 438** | | | | | | | | | | ***278 438*** |
| **33** | VUB | AC | exp, budget | 3 750 | 58 125 | | | | **61 875** | | | | | | | | | ***61 875*** | |
| | | | req, contrib | 3 750 | 58 125 | | | | **61 875** | | | | | | | | | | ***61 875*** |
| **34** | KU-NATFAK | AC | exp, budget | 3 750 | | 58 125 | | | **61 875** | | | | | | | | | ***61 875*** | |
| | | | req, contrib | 3 750 | | 58 125 | | | **61 875** | | | | | | | | | | ***61 875*** |
| **35** | UH-HIP | AC | exp, budget | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | ***123 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | | ***123 750*** |
| **36** | FOM | FCF | exp, budget | | | | 242 500 | | **242 500** | 250 000 | | **250 000** | | | 250 000 | | **250 000** | ***742 500*** | |
| | | | req, contrib | | | | 121 250 | | **121 250** | 125 000 | | **125 000** | | | 125 000 | | **125 000** | | ***371 250*** |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | *Total expected* | *Max Community contribution* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | | |
| **37** | SARA | FC | exp, budget | 3 750 | | | | | **3 750** | 487 500 | | **487 500** | | | | | | ***491 250*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 243 750 | | **243 750** | | | | | | | ***247 500*** |
| **38** | UvA | AC | exp, budget | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | ***123 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | | ***123 750*** |
| **39** | UiB | AC | exp, budget | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | ***123 750*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | 120 000 | | **120 000** | | ***123 750*** |
| **40** | VR | AC | exp, budget | 3 750 | | | | | **3 750** | 367 500 | | **367 500** | | | | | | ***371 250*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 367 500 | | **367 500** | | | | | | | ***371 250*** |
| **41** | IHEP | FCF | exp, budget | | 12 500 | 33 250 | 21 250 | | **67 000** | 123 125 | | **123 125** | | | | | | ***190 125*** | |
| | | | req, contrib | | 6 250 | 16 625 | 10 625 | | **33 500** | 61 563 | | **61 563** | | | | | | | ***95 063*** |
| **42** | IMPB-RAS | AC | exp, budget | | 22 688 | 5 000 | 7 500 | | **35 188** | 12 500 | | **12 500** | | | | | | ***47 688*** | |
| | | | req, contrib | | 22 688 | 5 000 | 7 500 | | **35 188** | 12 500 | | **12 500** | | | | | | | ***47 688*** |
| **43** | ITEP | FCF | exp, budget | | 25 000 | 17 000 | 25 000 | | **67 000** | 123 125 | | **123 125** | | | | | | ***190 125*** | |
| | | | req, contrib | | 12 500 | 8 500 | 12 500 | | **33 500** | 61 563 | | **61 563** | | | | | | | ***95 063*** |
| **44** | JINR | FCF | exp, budget | | 33 250 | 15 000 | 18 750 | | **67 000** | 123 125 | | **123 125** | | | | | | ***190 125*** | |
| | | | req, contrib | | 16 625 | 7 500 | 9 375 | | **33 500** | 61 563 | | **61 563** | | | | | | | ***95 063*** |
| **45** | KIAM RAS | FCF | exp, budget | | 21 000 | | | | **21 000** | 73 750 | | **73 750** | | | | | | ***94 750*** | |
| | | | req, contrib | | 10 500 | | | | **10 500** | 36 875 | | **36 875** | | | | | | | ***47 375*** |
| **46** | PNPI | FCF | exp, budget | | 12 500 | 12 500 | 21 000 | | **46 000** | 48 750 | | **48 750** | | | | | | ***94 750*** | |
| | | | req, contrib | | 6 250 | 6 250 | 10 500 | | **23 000** | 24 375 | | **24 375** | | | | | | | ***47 375*** |
| **47** | RRC KI | FCF | exp, budget | | 34 000 | 12 500 | 25 000 | | **71 500** | 25 000 | 46 250 | **71 250** | | | | | | ***142 750*** | |
| | | | req, contrib | | 17 000 | 6 250 | 12 500 | | **35 750** | 12 500 | 23 125 | **35 625** | | | | | | | ***71 375*** |
| **48** | SINP MSU | FCF | exp, budget | | 67 000 | | 25 000 | | **92 000** | 147 500 | | **147 500** | | | | | | ***239 500*** | |
| | | | req, contrib | | 33 500 | | 12 500 | | **46 000** | 73 750 | | **73 750** | | | | | | | ***119 750*** |
| **49** | CLPP-BAS | AC | exp, budget | 3 750 | 43 750 | | | | **47 500** | 120 000 | | **120 000** | | | | | | ***167 500*** | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | *Total expected* | *Max Community contribution* |
| | | | req, contrib | 3 750 | 43 750 | | | | **47 500** | 120 000 | | **120 000** | | | | | | | ***167 500*** |
| **50** | UCY | AC | exp, budget | 3 750 | 43 750 | | | | **47 500** | 120 000 | | **120 000** | | | | | | ***167 500*** | |
| | | | req, contrib | 3 750 | 43 750 | | | | **47 500** | 120 000 | | **120 000** | | | | | | | ***167 500*** |
| **51** | GRNET | FCF | exp, budget | 3 750 | | 150 000 | | 143 750 | **297 500** | 484 375 | 71 875 | **556 250** | | | | | | ***853 750*** | |
| | | | req, contrib | 3 750 | | 75 000 | | 71 875 | **150 625** | 242 188 | | **242 188** | | | | | | | ***392 813*** |
| **52** | TAU | AC | exp, budget | 3 750 | | 43 750 | | | **47 500** | 119 688 | | **119 688** | | | | | | ***167 188*** | |
| | | | req, contrib | 3 750 | | 43 750 | | | **47 500** | 119 688 | | **119 688** | | | | | | | ***167 188*** |
| **53** | ICI | FC | exp, budget | 3 750 | | 87 500 | | | **91 250** | 239 375 | | **239 375** | | | | | | ***330 625*** | |
| | | | req, contrib | 3 750 | | 43 750 | | | **47 500** | 119 688 | | **119 688** | | | | | | | ***167 188*** |
| **54** | LIP | FCF | exp, budget | 3 750 | | | | | **3 750** | 301 875 | | **301 875** | | | | | | ***305 625*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 150 938 | | **150 938** | | | | | | | ***154 688*** |
| **55** | CESGA | AC | exp, budget | 3 750 | | | | | **3 750** | 98 438 | | **98 438** | | | | | | ***102 188*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 98 438 | | **98 438** | | | | | | | ***102 188*** |
| **56** | CSIC | FC | exp, budget | 3 750 | | | 218 750 | | **222 500** | 396 875 | | **396 875** | | | | | | ***619 375*** | |
| | | | req, contrib | 3 750 | | | 109 375 | | **113 125** | 198 438 | | **198 438** | | | | | | | ***311 563*** |
| **57** | IFAE | AC | exp, budget | 3 750 | | | | | **3 750** | 175 625 | | **175 625** | | | | | | ***179 375*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 175 625 | | **175 625** | | | | | | | ***179 375*** |
| **58** | INTA | FC | exp, budget | 3 750 | | | | | **3 750** | 196 875 | | **196 875** | | | | | | ***200 625*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 98 438 | | **98 438** | | | | | | | ***102 188*** |
| **59** | UPV | FC | exp, budget | 3 750 | | | 208 750 | | **212 500** | | | | | | | | | ***212 500*** | |
| | | | req, contrib | 3 750 | | | 104 375 | | **108 125** | | | | | | | | | | ***108 125*** |
| **60** | University of Chicago | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |
| **61** | USC | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |

| | | | | Networking activities (NA) | | | | | | Specific service activities (SA) | | | Research activities (JRA) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part, Number | Part, Short name | Cost Model | Amounts (€) | NA1 | NA2 | NA3 | NA4 | NA5 | **All NA** | SA1 | SA2 | **All SA** | JRA1 | JRA2 | JRA3 | JRA4 | **All JRA** | *Total expected* | *Max Community contribution* |
| **62** | Wisconsin-Madison Univ, | FC | exp, budget | | | | | | | | | | | | | | | | |
| | | | req, contrib | | | | | | | | | | | | | | | | |
| **63** | KTH | AC | exp, budget | 3 750 | | | | | **3 750** | | | | | | 243 750 | | **243 750** | ***247 500*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | 243 750 | | **243 750** | | ***247 500*** |
| **64** | ENEA | FC | exp, budget | 3 750 | | | | | **3 750** | 116 250 | | **116 250** | | | | | | ***120 000*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | 58 125 | | **58 125** | | | | | | | ***61 875*** |
| **65** | UniCal | AC | exp, budget | | | | | | | 61 875 | | **61 875** | | | | | | ***61 875*** | |
| | | | req, contrib | | | | | | | 61 875 | | **61 875** | | | | | | | ***61 875*** |
| **66** | UniLe | AC | exp, budget | | | | | | | 61 875 | | **61 875** | | | | | | ***61 875*** | |
| | | | req, contrib | | | | | | | 61 875 | | **61 875** | | | | | | | ***61 875*** |
| **67** | UniNa | AC | exp, budget | | | | | | | 61 875 | | **61 875** | | | | | | ***61 875*** | |
| | | | req, contrib | | | | | | | 61 875 | | **61 875** | | | | | | | ***61 875*** |
| **68** | DANTE | FC | exp, budget | 3 750 | | | | | **3 750** | | | | | | | 116 250 | **116 250** | ***120 000*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | | 58 125 | **58 125** | | ***61 875*** |
| **69** | DFN | AC | exp, budget | 3 750 | | | | 67 188 | **70 938** | | | | | | | 62 500 | **62 500** | ***133 438*** | |
| | | | req, contrib | 3 750 | | | | 67 188 | **70 938** | | | | | | | | | | ***70 938*** |
| **70** | GARR | FC | exp, budget | 3 750 | | | | 62 500 | **66 250** | | | | | | | 134 375 | **134 375** | ***200 625*** | |
| | | | req, contrib | 3 750 | | | | | **3 750** | | | | | | | 67 188 | **67 188** | | ***70 938*** |
| **71** | RED.ES | FC | exp, budget | 3 750 | | | | 136 250 | **140 000** | | | | | | | | | ***140 000*** | |
| | | | req, contrib | 3 750 | | | | 68 125 | **71 875** | | | | | | | | | | ***71 875*** |
| **Totals** | | | | | | | | | | | | | | | | | | | |
| Total expected budget (€) | | | | 1 264 375 | 1 488 875 | 1 254 625 | 3 651 625 | 697 188 | **8 356 688** | 13 540 625 | 368 125 | **13 908 750** | 4 489 375 | 500 000 | 853 750 | 745 000 | **6 588 125** | ***28 853 563*** | |
| Max Community contrib, request (€) | | | | 1 264 375 | 1 077 500 | 975 125 | 2 240 188 | 400 938 | **5 958 125** | 8 727 188 | 148 125 | **8 875 313** | 3 672 500 | 250 000 | 728 750 | 432 188 | **5 083 438** | | ***19 916 875*** |

**Table 4: Deliverables List**

| Deliverable No[1] | Activity No[2] | Deliverable title | Lead participant | Delivery date[3] | Estimated indicative resources | Nature[4] | Dissemination level[5] |
|---|---|---|---|---|---|---|---|
| DNA2.1 | NA2 | Production of Project Information Presentation | TERENA | M01 | 1K | R | PU |
| DNA2.2.1 | NA2 | External customer facing web site, mailing lists and web based tools | TERENA | M01 | 785K | P | PU |
| DNA2.3.1 | NA2 | Internal project facing web site, mailing lists and web based tools | CERN | M01 | 200K | P | PU |
| DJRA1.1 | JRA1 | Architecture and Planning (Release 1) | CERN | M03 | 398K | R | PU |
| DNA1.1.1 | NA1 | First Quarterly periodic report | CERN | M03 | 155.6K | R | CO |
| DNA1.2 | NA1 | Gender Action Plan | CERN | M03 | 155.6K | R | PU |
| DNA2.4.1 | NA2 | Dissemination Plan with revisions at M9, and M15 including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) | TERENA | M03 | 100K | R | PU |
| DNA3.1.1 | NA3 | Training Plan with revisions at M9 and M15 | UEDIN | M03 | 91K | R | PU |
| DNA4.1 | NA4 | Definition of Common Application Interface and Planning Document | CNRS | M03 | 200K | R | PU |
| DSA1.1 | SA1 | Detailed execution plan for first 15 months of infrastructure operation | CERN | M03 | 150K | R | PU |
| DJRA2.1 | JRA2 | Quality Plan for EGEE | CSSI | M04 | 133.34K | R | PU |
| DNA5.1.1 | NA5 | eInfrastructure reflection group White Papers in conjunction with the EGEE Project Conferences | CERN | M04 | 139.4K | R | PU |
| DJRA1.2 | JRA1 | Design of grid services (Release 1) | CERN | M05 | 217K | R | PU |
| DJRA3.1 | JRA3 | Global security architecture | KTH | M05 | 156.86K | R | PU |
| DJRA4.1 | JRA4 | Specification of interfaces for bandwidth reservation services | UCL | M06 | 80.31K | P+R | PU |
| DNA1.1.2 | NA1 | Quarterly periodic report | CERN | M06 | 155.6K | R | CO |
| DNA2.2.2 | NA2 | External web site and tools at full capacity. | TERENA | M06 | 785K | P | PU |
| DNA2.3.2 | NA2 | Internal web site and tools at full capacity. | CERN | M06 | 200K | P | PU |
| DNA2.5 | NA2 | Production of appropriate printed PR material | CERN | M06 | 637K | R | PU |
| DNA2.6.1 | NA2 | Dissemination Progress Reports with revisions at M12 and M18 | TERENA | M06 | 396.5K | R | PU |
| DNA3.2 | NA3 | Initial Training Course Material (continuously revised thereafter) | UEDIN | M06 | 625K | R | PU |
| DNA4.2 | NA4 | Target Application Sector Strategy document | CNRS | M06 | 250K | R | PU |
| DSA1.2 | SA1 | Release notes corresponding to the initial pilot Grid infrastructure operational | INFN | M06 | 35K | R | PU |
| DSA2.1 | SA2 | Survey of application requirements and identification of service classes. | CNRS | M06 | 118.5K | R | PU |
| DNA5.2 | NA5 | European Grid project synergy roadmap (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) | CERN | M09 | 139.4K | R | PU |

[1] Deliverable numbers in order of delivery dates: D1 – Dn

[2] Activity that will produce this Deliverable

[3] Month in which the deliverables will be available. Month 0 marking the start-date of the project, and all delivery dates being relative to this start date.

[4] Please indicate the nature of the deliverable using one of the following codes:
**R** = Report **P** = Prototype **D** = Demonstrator **O** = Other

[5] Please indicate the dissemination level using one of the following codes:
**PU** = Public
**PP** = Restricted to other programme participants (including the Commission Services).
**RE** = Restricted to a group specified by the consortium (including the Commission Services).
**CO** = Confidential, only for members of the consortium (including the Commission Services).

| Deliverable No[1] | Activity No[2] | Deliverable title | Lead participant | Delivery date[3] | Estimated indicative resources | Nature[4] | Dissemination level[5] |
|---|---|---|---|---|---|---|---|
| DJRA3.2 | JRA3 | Site access control architecture | FOM | M09 | 238.91K | R | PU |
| DJRA4.2 | JRA4 | Definition of standardised network measurement query/response interfaces | UEDIN | M09 | 40.15K | P+R | PU |
| DNA1.1.3 | NA1 | Quarterly periodic report | CERN | M09 | 155.6K | R | CO |
| DNA1.3.1 | NA1 | Periodic report | CERN | M09 | 155.6K | R | CO |
| DNA2.4.2 | NA2 | Dissemination Plan revision including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) | TERENA | M09 | 100K | R | PU |
| DNA3.1.2 | NA3 | Training Plan revision | UEDIN | M09 | 91K | R | PU |
| DNA3.3.1 | NA3 | Training Progress Report with updates at M15 and M24 | UEDIN | M09 | 1100K | R | PU |
| DNA4.3.1 | NA4 | EGEE Application Migration Progress report with revisions at M15 and M21 | CNRS | M09 | 1680K | R | PU |
| DSA1.3 | SA1 | Accounting and reporting web site publicly available | CCLRC | M09 | 30K | R | PU |
| DNA5.1.2 | NA5 | eInfrastructure reflection group White Papers in conjunction with the EGEE Project Conferences | CERN | M09 | 139.4K | R | PU |
| DJRA1.3 | JRA1 | Software and associated documentation (Release 1) | CERN | M12 | 2952K | P+R | PU |
| DJRA2.2 | JRA2 | Annual Report on EGEE Quality Status, including software and Grid operations and plan for second year | CSSI | M12 | 266.66K | R | PU |
| DNA1.1.4 | NA1 | Quarterly periodic report | CERN | M12 | 155.6K | R | CO |
| DNA2.6.2 | NA2 | Dissemination Progress Reports revision | TERENA | M12 | 396.5K | R | PU |
| DNA5.3 | NA5 | Progress report on International Cooperation Activities | CERN | M12 | 139.4K | R | PU |
| DSA1.4 | SA1 | Assessment of initial infrastructure operation and plan for next 12 months | IN2P3 | M12 | 8576K | R | PU |
| DSA2.2 | SA2 | Institution of SLAs and appropriate policies | CNRS | M12 | 118.5K | R | PU |
| DJRA1.4 | JRA1 | Architecture and Planning (Release 2) | CERN | M14 | 265K | R | PU |
| DSA1.5 | SA1 | First release of EGEE Infrastructure Planning Guide (“cook-book”), | CERN | M14 | 300K | R | PU |
| DSA1.6 | SA1 | Release notes corresponding to the full production Grid infrastructure operational | CCRLC | M14 | 35K | R | PU |
| DJRA1.5 | JRA1 | Design of grid services (Release 2) | CERN | M15 | 108K | R | PU |
| DNA1.1.5 | NA1 | Quarterly periodic report | CERN | M15 | 155.6K | R | CO |
| DNA2.4.3 | NA2 | Dissemination Plan revisions including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) | TERENA | M15 | 100K | R | PU |
| DNA3.1.3 | NA3 | Training Plan revision | UEDIN | M15 | 91K | R | PU |
| DNA3.3.2 | NA3 | Training Progress Report update | UEDIN | M15 | 1100K | R | PU |
| DNA4.3.2 | NA4 | EGEE Application Migration Progress report | CNRS | M15 | 1120K | R | PU |
| DNA5.1.3 | NA5 | eInfrastructure Forum White Papers in conjunction with the EGEE Project Conferences | CERN | M15 | 139.4K | R | PU |
| DJRA3.3 | JRA3 | Global security architecture (first revision) | KTH | M16 | 530.90K | R | PP |
| DJRA4.3 | JRA4 | Report on implications of IPv6 usage for the EGEE Grid | UEDIN | M18 | 80.31K | P+R | PU |
| DNA1.1.6 | NA1 | Quarterly periodic report | CERN | M18 | 155.6K | R | CO |
| DNA1.3.2 | NA1 | Periodic report | CERN | M18 | 155.6K | R | CO |
| DNA2.6.3 | NA2 | Dissemination Progress Reports revision | TERENA | M18 | 396.5K | R | PU |
| DNA5.4 | NA5 | European Grid project synergy report (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) | CERN | M18 | 139.4K | R | PU |
| DJRA1.6 | JRA1 | Software and associated documentation (Release 2) | CERN | M21 | 2531K | P+R | PU |

| Deliverable No[1] | Activity No[2] | Deliverable title | Lead participant | Delivery date[3] | Estimated indicative resources | Nature[4] | Dissemination level[5] |
|---|---|---|---|---|---|---|---|
| DJRA4.4 | JRA4 | Implementation of single-domain bandwidth reservation pilot service | UEDIN | M21 | 321.23K | P+R | PU |
| DJRA4.5 | JRA4 | Service to supply network performance information to resource brokering middleware | UEDIN | M21 | 160.62 | P+R | PU |
| DNA1.1.7 | NA1 | Quarterly periodic report | CERN | M21 | 155.6K | R | CO |
| DNA4.3.3 | NA4 | EGEE Application Migration Progress report | CNRS | M21 | 1120K | R | PU |
| DNA5.1.4 | NA5 | eInfrastructure reflection group White Papers in conjunction with the EGEE Project Conferences | CERN | M21 | 139.4K | R | PU |
| DSA1.7 | SA1 | Updated EGEE Infrastructure Planning Guide | CERN | M22 | 150K | R | PU |
| DJRA1.7 | JRA1 | Final report on middleware re-engineering | CERN | M24 | 723K | R | PU |
| DJRA2.3 | JRA2 | 2nd Annual report on EGEE Quality Status, including software and Grid operations | CSSI | M24 | 200K | R | PU |
| DJRA3.4 | JRA3 | Assessment of security infrastructure report | KTH | M24 | 463.33K | R | PU |
| DJRA4.6 | JRA4 | Report on bandwidth allocation and reservation | UEDIN | M24 | 200.77K | R | PU |
| DJRA4.7 | JRA4 | Report on network monitoring | UEDIN | M24 | 160.62K | R | PU |
| DNA1.1.8 | NA1 | Quarterly periodic report | CERN | M24 | 155.6K | R | CO |
| DNA1.3.3 | NA1 | Periodic report | CERN | M24 | 155.6K | R | CO |
| DNA1.4 | NA1 | Report on Gender Action Plan | CERN | M24 | 155.6K | R | PU |
| DNA2.7 | NA2 | Final Dissemination & usage Report addressing the issues of public participation and awareness | TERENA | M24 | 200K | R | PU |
| DNA3.3.3 | NA3 | Training Progress Report update | UEDIN | M24 | 1100K | R | PU |
| DNA4.4 | NA4 | Final Report of Application Identification and Support Activity | CNRS | M24 | 1320K | R | PU |
| DNA5.5 | NA5 | Final progress report on International Cooperation Activities | CERN | M24 | 139.4K | R | PU |
| DSA1.8 | SA1 | Assessment of production infrastructure operation and outline of how sustained operation of EGEE might be addressed. | IN2P3 | M24 | 12863.5K | R | PU |
| DSA1.9 | SA1 | Release notes corresponding to expanded production Grid infrastructure operational | INFN | M24 | 35K | R | PU |
| DSA2.3 | SA2 | Revised SLAs and policies | CNRS | M24 | 237K | R | PU |

# 2 Objectives of the I3

## 2.A Project Objectives

**The EGEE Vision**

EGEE aims to integrate current national, regional and thematic Grid efforts, in order to create a seamless European Grid infrastructure for the support of the European Research Area. This infrastructure will be built on the EU Research Network GEANT and exploit Grid expertise that has been generated by projects such as the EU DataGrid project, other EU supported Grid projects and the national Grid initiatives such as UK e-Science, INFN Grid, Nordugrid and US Trillium.
The EGEE vision is that this Grid infrastructure will provide European researchers in academia and industry with a common market of computing resources, enabling round-the-clock access to major computing resources, independent of geographic location. The infrastructure will support distributed research communities, including relevant Networks of Excellence, which share common Grid computing needs and are prepared to integrate their own distributed computing infrastructures and agree common access policies. The resulting infrastructure will surpass the capabilities of localised clusters and individual supercomputing centers in many respects, providing a unique tool for collaborative computer-intensive science ("e-Science") in the European Research Area. Finally, the infrastructure will provide interoperability with other Grids around the globe, including the US NSF Cyberinfrastructure, contributing to efforts to establish a worldwide Grid infrastructure. The scope of the project is illustrated in Fig. 1.

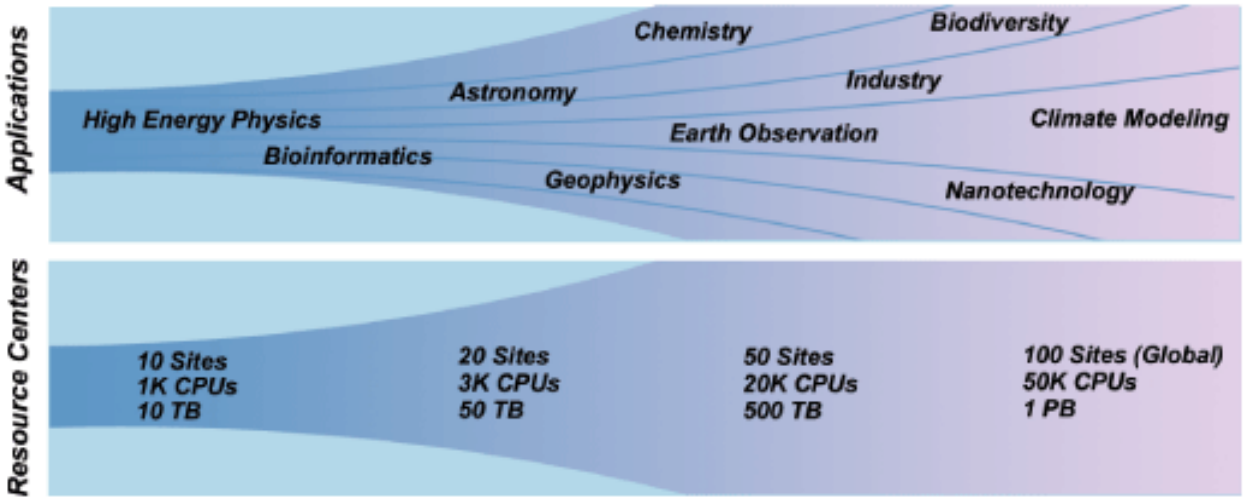



**Figure 1:** ***Schema of the evolution of the European Grid infrastructure from two pilot applications in high energy physics and biomedical Grids, to an infrastructure serving multiple scientific and technological communities, with enormous computer resources. The applications and resource figures are purely illustrative. The EGEE project covers Year 1 and 2 of a planned four year programme.***

EGEE is a two-year project conceived as part of a four-year programme. Major implementation milestones after two years will provide the basis for assessing subsequent objectives and funding needs. Given the service oriented nature of this project, two pilot applications areas have been selected to guide the implementation and certify the performance and functionality of the evolving European Grid infrastructure. One is the Large Hadron Collider Computing Grid (LCG: www.cern.ch/lcg ), which relies on a Grid infrastructure in order to store and analyse petabytes of real and simulated data from high-energy physics experiments at CERN. The other is Biomedical Grids, where several communities are facing equally daunting challenges to cope with the flood of bioinformatic and healthcare data – a prime example being the Health Grid association (http://www.healthgrid.org/).
Given the rapidly growing scientific needs for a Grid infrastructure, it is deemed essential for the EGEE project to "hit the ground running", by deploying basic services, and initiating joint research and networking activities before the formal start of the project. The LCG project will provide basic resources and

infrastructure already during 2003, and Biomedical Grid applications will be planned at this stage. The available resources and user groups will then rapidly expand during the course of the project, as illustrated in Figure 1. To ensure that the project ramps up rapidly, project partners have agreed to begin providing their unfunded contribution prior to the official start of the project.

**The EGEE Mission**

In order to achieve the vision outlined above, EGEE has a three-fold mission:

1. To deliver production level Grid services, the essential elements of which are manageability, robustness, resilience to failure, and a consistent security model, as well as the scalability needed to rapidly absorb new resources as these become available, while ensuring the long-term viability of the infrastructure.

2. To carry out a professional Grid middleware re-engineering activity in support of the production services. This will support and continuously upgrade a suite of software tools capable of providing production level Grid services to a base of users which is anticipated to rapidly grow and diversify.

3. To ensure an outreach and training effort which can proactively market Grid services to new research communities in academia and industry, capture new e-Science requirements for the middleware and service activities, and provide the necessary education to enable new users to benefit from the Grid infrastructure.

Reflecting this three-fold mission, the EGEE proposal is structured in three main areas of activity: **services, middleware** and **networking**. These are described in the sections SA, JRA and NA of the proposal, respectively, and key aspects for each of these areas are summarised below.

It is essential to the success of EGEE that the three areas of activity should form a tightly integrated "Virtuous Cycle", illustrated in Figure 2. In this way, the project as a whole can ensure rapid yet well-managed growth of the computing resources available to the Grid infrastructure as well as the number of scientific communities that use it. As a rule, new communities will contribute new resources to the Grid infrastructure. This feedback loop is supplemented by an underlying cyclical review process covering overall strategy, middleware architecture, quality assurance and security status, and ensuring a careful filtering of requirements, a coordinated prioritization of efforts and maintenance of production-quality standards.

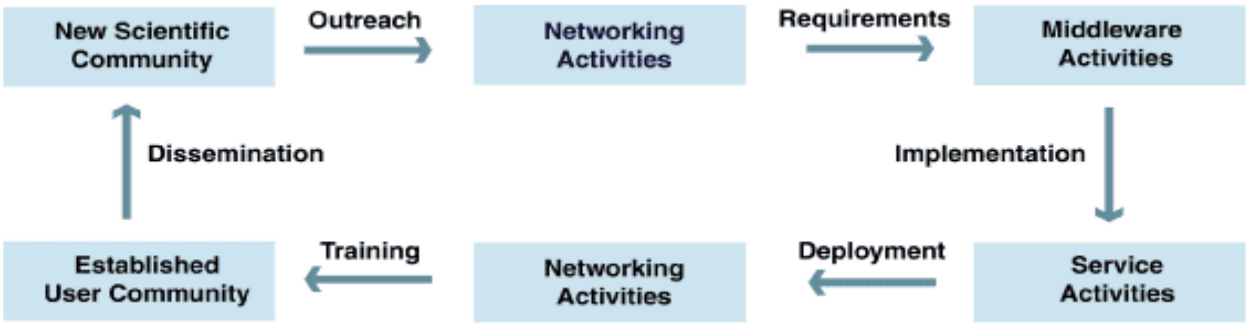



**Figure 2:** ***The "Virtuous Cycle" for EGEE development. A new scientific community makes first contacts to EGEE through outreach events organized by Networking Activities. Follow-up meetings by applications specialists may lead to definition of new requirements for the infrastructure. If approved, the requirements are implemented by the Middleware Activities. After integration and testing, the new middleware is deployed by the Service Activities. The Networking Activities then provide appropriate training to the community in question, so that it becomes an established user. Peer communication and dissemination events featuring established users then attract new communities.***

# 2.B Relevance to the objectives of the Communication Network Development – Grids Area

**Integration of Activities**

The various types of activities described in this proposal will be integrated principally through three mechanisms:

- the communication flow of the project
- key horizontal activities that will span the project
- the overall management structure of the project

These three types of integration are detailed below

Integration through communication flow

The Networking, Joint Research and Service activities are strongly integrated through the cyclical process that is required to introduce new scientific communities to Grid computing opportunities and inject new resources into the infrastructure. This “Virtuous Cycle” is summarised in the figure above.

As well as this cyclical flow of information, regular meetings and conferences are necessary to diffuse information effectively and rapidly throughout a large project. Based on the experience of successful efforts to integrate activities in the European DataGrid project, a hierarchy of meetings will be implemented to ensure strong and persistent integration efforts of the activities throughout the duration of the project. These meetings include:

- Weekly conference calls of the management of activities;
- Regular site visits of project management team members to activity sites, to review status of deliverables;
- Quarterly face-to-face meetings of the managers of all activities;
- Bi-annual all-hands progress reviews of all activities in the project;
- Active use at all levels of an internal website to register and evaluate progress of activities, and continuously update status of deliverables;
- Use of internal newsletter to ensure awareness of integration issues throughout the body of the project staff.

**Integration through key horizontal activities**

Four key horizontal activities are planned in the project, which ensure integration of the activities:

- architecture of grid services and their operation
- requirements capture for new applications and operations issues
- quality assurance to ensure a high-level of service
- security addressing the concerns of the user communities and resource centres

An Architecture Team will provide the project with architectural oversight and an architectural strategy that evolves flexibly with technological developments. In practice, the Architecture Team will involve key players from all other technical activities in the project, and will report to the Technical Director.

The requirements of different user communities will be captured by representatives of the Applications Interface activity. Similarly, the expectations of different resource centres, as service providers, will be dealt with by the Regional Operations Centres, with the EGEE Operations Management providing overall guidelines as well as legal and policy assistance. A cycle is envisioned by which the requirements captured by these activities in the first three months of the project are effectively incorporated in the deployment of the Grid infrastructure and associated Grid middleware reengineering over the first 15 months.

A quality assurance team, again involving persons in each technical activity, will provide uniform guidelines on tools to be used and methods to be implemented in developing and deploying the necessary Grid infrastructure. The Quality Assurance Head will report to the Project Director. It is anticipated that the quality assurance team will be particularly active during the first six months of the project, setting up the necessary framework for quality assurance that will be used throughout the project.

A security team will follow the different technical activities and provide input on security standards and develop minimum-security measures to be implemented in the initial deployment of the Grid infrastructure. As with quality assurance, it is expected that the security team will be particularly active during the first year of the project, and the Security Head will report directly to the Project Director.

**Integration through management structure**

The Project Executive Board will contain representatives of the three major categories of activity, as well as Security and Quality Assurance Heads, and will be supported by a common project office. This board will be led by the Project Director. This management team will follow on a daily basis the work of the partners to ensure that all activities are developed according to a well-defined overall strategy, and react rapidly and in a coordinated way to changes that could influence the direction of this strategy. The objective of the team will be to continuously optimize and rationalize use of resources across the different activities, to stimulate communication between all activities, and to intervene in case of perceived redundant or missing components amongst the activities.

**Integrated provision and increased performance of the infrastructure**

The fundamental premise of this project is that the European research community will benefit from integration of existing established national and regional Grid infrastructures together with existing European and international testbeds.
The most advanced national activities today, such as the e-Science programme in the UK or the national Grid programme in Italy, are at the forefront of global Grid developments and demonstrate the breadth and depth of Grid research at the national level in Europe. However, such national programs are not coordinated at present, and there is currently no provision for bringing other emerging national and regional Grid infrastructures into a commonly shared set of resources.
This project builds on the competence and proven ability of the European DataGrid project, the largest Grid software development project ever funded by the EU. Through this project, there is already experience of running Grid services on a European-wide testbed. These initial efforts have still to be developed into reliable round-the-clock Grid services.
To achieve true production level Grid services, a much higher level of integration of resources is necessary. The programme of activities in this project will ensure coordination of further advances in middleware technology. It will support reengineering and integration of existing middleware technologies to achieve and maintain production quality middleware. The programme will further – and in contrast to previous efforts – set as a primary goal the creation of a common operation infrastructure, operation centres and support centres. In addition, the programme will provide a coherent training and dissemination programme to ensure a managed and sustainable growth of the scientific community benefiting from the Grid.

**Raising the level of performance of the infrastructures**

Deployed in a coordinated way, the infrastructure aggregated in this project provides an unprecedented computer power that is easily accessible to scientists. By maintaining the focus of the project on deployment of core services, while in parallel developing advanced services, this project will provide the European Research Area with a unique competitive advantage, since no other region of the globe has plans to deploy a science Grid of this size on this timescale.
This competitive advantage will translate into benefits for smaller, less-well resourced sites in the European Research Area to access computing power that would otherwise be unaffordable. The competitive advantage will also ensure more efficiently managed computing resources and avoid unnecessary duplication of investment in the European Research Area. Finally, the dynamic allocation of unprecedented total computing power on a pan-European Grid will provide opportunities for the scientific community to tackle unprecedented challenges in computational science, which will in turn raise awareness of Grid computing and attract an even wider community of users.
A key feature for ensuring integrated provision of infrastructure is clear and user-friendly access policy, shielding users from the complexity of access to heterogeneous resources. This can be described as a “European common market of computing and data processing”, and will contribute strongly to increased performance of the infrastructure from the user perspective.

## 2.C Long-term sustainability and structuring effect

**Structuring effect**

The project has already, in its conception phase, led to significant anticipatory structuring of the European Research Area, creating regional federations: Northern Europe (Belgium, Denmark, Estonia, Finland, the Netherlands, Norway, Sweden), South West Europe (Portugal, Spain), South East Europe (Bulgaria, Cyprus, Greece, Israel, Romania), Central Europe (Austria, Czech Rep, Hungary, Poland, Slovakia, Slovenia), which aim to leverage national resources in a more effective way for broader European benefit. As the Grid infrastructure is deployed, the project will further align national programs where they are strongest, and identify and fill gaps in resources and technology yet avoid needless duplication.

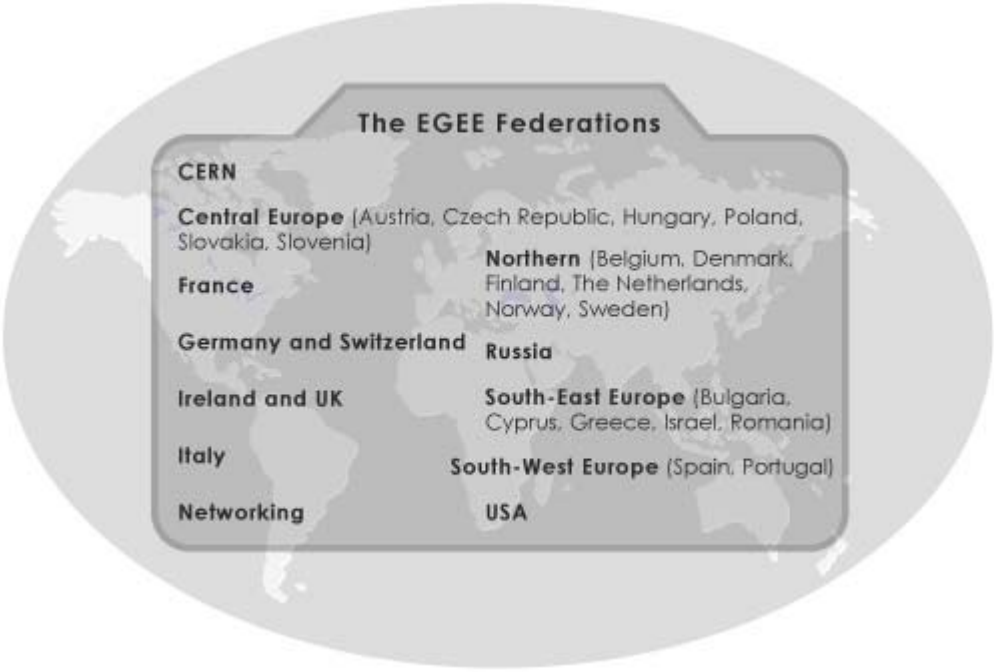



***Figure 3: Partner Federations of EGEE. Details of representation for each partner country and region can be found on www.cern.ch/egee***

The structuring effects of the project will extend beyond the original participants, as it will support and generate virtual organizations in specific disciplines. A case in point is a pilot application for the project from the high-energy physics community, where the project will contribute directly to structuring and supporting the virtual organization developing the Large Hadron Collider Computing Grid (LCG) in Europe. In turn, this virtual organization will provide requirements and resources of value to the project. A second pilot application will be directed at the needs of the biomedical Grid community, and will help to integrate emerging Grids being operated by hospitals and bioinformatics research centers. This community is targeted because of the relatively advanced state of Grid awareness and relevant applications software. Benefits of engaging this community will flow both ways, as it will provide both requirements and resources for the infrastructure. A third area of application development will target other virtual organizations in a range of scientific disciplines, from climate modelling and biodiversity to mechanical engineering and nanotechnology, which are anticipated to benefit greatly from a common Grid infrastructure. These will be integrated rapidly into the project, providing further users, new requirements and resources.

From the point of view of individual computer centres in Europe, the project effectively structures the exploitation of their resources by a range of virtual organizations, providing more efficient and wider-ranging use of their facilities for all types of scientific applications, and increasing the added value of these investments to science. Ultimately, the project will promote the development of a consistent and highly integrated fabric of research infrastructures of the highest quality and performance in Europe and beyond, and this will in turn help increase the mobility of individuals and ideas, both within the field of Grid computing, and in the disciplines that will benefit from the established infrastructure.

The project is designed to interface closely with GEANT, to ensure that the deployed Grid profits fully from the established high-capacity and high-speed communications networks already available for all researchers in Europe. The project will also generate network development in conjunction with thematic priority 2 Information Society Technologies. This will occur in the form of high performance Grids and testbeds being developed for specific scientific applications, for industrial uptake of the technology, and for extension of the infrastructure to specific computing infrastructures such as supercomputing facilities. This sort of activity is anticipated to be supported by accompanying Special Support Actions. These related SSAs will ensure that the deployed technology becomes deeply imbedded in the wider cyber-infrastructure of the European Research Area, and strongly linked to US cyber-infrastructure and similar developments in other regions.

**Sustainability effect**

High-level research is increasingly complex, interdisciplinary and costly and requires constantly increasing critical mass of resources. This project responds to these challenges and needs directly, in a way that few individual organizations or even nations can do. Providing a unified Grid infrastructure for Europe supports directly the eEurope Action Plan, as it provides improved IT services for researchers and students. Also, the project will help to coordinate policies on Grid computing at national, regional and European levels, which will ensure the long-term sustainability of the established infrastructure, and facilitate its extension to third countries. Russia is a case in point, where an emerging Grid infrastructure is anticipated to be integrated during the course of the project.
By deploying a European Grid infrastructure at this time, Europe ensures full benefits of its investment in Grid technology to date, and sustains the considerable expertise and human capital that has been generated in the European DataGrid project and related EU Grid projects. This sustained effort and relentless push towards production-level Grid services for Europe will further enhance Europe's lead position as an integrator of Grid technologies, and as a Grid infrastructure provider.
It is planned that significant parts of the infrastructure be transferred over a four-year period to the private sector. Uptake of the technology and its maintenance by will ensure an optimum long-term sustainable use of the infrastructure on a European scale, in a way that responds effectively to market forces. Sustainability in this later phase will be further enhanced through efficiency gains due to wide adoption of common standards by industry, making the infrastructure easier to support, and creating opportunities for the computing industry to provide generic solutions.
It is conceivable that after this period an established user community and resource providers will be able to continue to expand the Grid infrastructure without needs for further EU financial help.
The re-engineered EGEE middleware, the established resource access policies and the overall Grid management infrastructure will make the effort of maintaining and expanding the EGEE Grid sustainable at optimal cost/performance rates for the ERA and wider end-user communities.
Clearly if additional EU funding would be secured in future, the process could be accelerated and new communities would profit from and contribute to this infrastructure.

# 3 Potential Impact

## 3.A Contributions to standards

One of the functions of the Operations Management Centre of activity SA1 is to drive the collaboration with peer organisations in the U.S. and in Asia-Pacific to ensure the interoperability of grid infrastructures and services. This is necessary in order that the EGEE user communities, that are frequently international with wider membership than the EGEE partners, are able to seamlessly access resources both within and outside those provided through EGEE. This it will do through encouraging collaborative projects and agreements on tools, service definitions, standards and protocols, both directly with other grid projects and through international standards bodies such as the Global Grid Forum (GGF).
The developments associated with implementing IPv6 networks will be monitored together with middleware developments that are able to make use of IPv6-specific functionalities. A test-bed system based on IPv6 networking, and providing services that require that functionality (such as specific security provision for an application), can be foreseen for evaluation once such facilities become available.

JRA1 intends to select, maintain and support middleware components conforming to OGSA/OGSI standards being proposed by the GGF. These standards are just being defined, and will certainly need to be improved over the coming years. JRA1 intends to contribute to the evolution of such standards based both on lessons learned in the FP5 projects such as DataGrid, and experience to be gathered in EGEE by supporting the components in a true production environment.
Commonly accepted international business practice standards demand compliance with quality management and quality improvement specifications, such as the ISO 9001. The EGEE QA activity described in JRA2 is inspired by such international standards to provide a structured approach to quality management, and effective tools for describing and implementing reliable and well-managed Grid services.

Since EGEE will grow to cover a wide variety of applications both in the academic and economic domains (see activity NA4), the common application interface tool-kit, that EGEE will progressively develop and integrate in its middleware, will form a potential basis for a standard for the easy and powerful interfacing of users with a grid infrastructure.
The Network Services Development Research Activity (JRA4) will work on the definition of standardised network measurement query/response interfaces operating over currently existing heterogeneous measurement infrastructures, with adequate authorization. The usage of IPv6 in a Grid context will also be studied through this activity, focusing in particular on the advantages which might be offered to EGEE through its use.

## 3.B Contributions to policy developments

The SA1 activity will address policy developments in several areas. These will include:

- *Organisation of Certificate Authorities*. The project will develop policies for negotiating project-wide agreed sets of accepted CAs.
- *Organisation of the Virtual Organisations*. During the project policies for membership of Virtual Organisations will be developed, including mechanisms for vouching for new members that requires a chain of trust between the VO management down to the institution for which the VO member works. These policies are closely associated to those of the Certificate Authorities. Organisation of CAs and VOs will require policies to be developed in order that international agreements enabling inter-grid operations required by many VOs will be possible.
- *Policies for resource access and usage, and development of resource scheduling policies*. Access to resources is potentially subject to many constraints, and it will be essential to clarify under what conditions VOs and their members may access resources provided by resource centres. Issues to be addressed include scheduling and priorities.
- *Grid security policies*. An essential aspect of operating the infrastructure is the development of appropriate security policies. These must be designed such that the needs and requirements of the partner sites (resource centres, infrastructure centres) are satisfied, balancing the needs of privacy of information of individuals, accountability, and traceability. These issues have been addressed

somewhat in previous grid projects (EU DataGrid, LCG), but must be developed over the EGEE project term.

One of the most important criteria to be measured when integrating a new application with EGEE will be the potential added value brought by the Grid concept and EGEE powerful infrastructure. We will carefully measure what has been achieved in each case, both quantitatively (i.e. resources made available) and qualitatively (work that could not be have done otherwise). It is expected that these detailed reports will have a major impact on policy-making by identifying areas of highest benefit.

## 3.C Risk assessment and related communication strategy

The risk management procedure for EGEE project is part of the EGGE Quality Plan defined under activity JRA2. The risk management procedure defines rules to identify, estimate, treat and monitor risks.

The building of such a large scale virtual computing facility poses several potential risks. An obvious example is that unauthorised people gain access to the facilities and make use of them to cause disruption/denial of service to EGEE itself, use the facilities to launch attacks on other organisations or individuals, or use the facilities to attempt to gain access to other computing facilities. The strategy to minimise these types of risk is several-fold. Firstly the project will maintain active security activities in each project area, with a coherence brought by the general security activity (JRA3). In SA1, a security group will be an inherent part of the operational activities. The CICs and ROCs have security as one of their essential roles, with oversight and policy development in the OMC. Secondly, as part of the SA1 security work, the project will use a documented risk assessment to focus efforts on the most serious risks in order to mitigate them where possible. This risk assessment will be regularly updated, and will also guide the development of the security and resource access policies.

As part of the dissemination activities it will be important that the actions undertaken by the security groups are communicated to the partners, the applications groups and the general public. The operations security groups will work with the dissemination activity to provide this information without disclosing information that may be used to gain access to the facilities.

# 4 Outline Implementation Plan for the full duration of the project

## 4.A Activities

The EGEE project consists of 11 activities including 5 networking, 2 specific services and 4 joint research activities. Each activity is described below.

### 4.A.1 Networking activities

The EGEE networking activities consist of five activities:

1. NA1: Management of the I3
2. NA2: Dissemination and Outreach
3. NA3: Training and Induction
4. NA4: Application Identification and Support
5. NA5: Policy and International Cooperation

Each of these is now summarised in turn:

**Management of the I3**

High quality management will be a key to the success of the EGEE Integrated Infrastructure Initiative. While the lead partners of the project each have considerable experience of managing large projects, an I3 is a considerably larger and more complex undertaking than previously attempted. Therefore, a management structure is defined which seeks to build upon the partners' established best practice and also to be of a sufficient scale to manage such a complex project.

The structure (described in detail in activity NA1) has been designed to deal with the typical project management challenges and problems associated with a diverse collection of scientific and industrial partners. The major focus is the need to ensure that the management of EGEE provides the environment to deliver dependable quality production services. This will be essential for the effective exploitation of the results throughout the different scientific and industrial user communities interested in this project and its overall success.

**Dissemination and Outreach**

The Dissemination and Outreach Activity will use several approaches to ensure that information regarding the development and services of EGEE are actively communicated to the widest possible audience. The objective being to encourage adoption of the EGEE technology and services across European academia and industry.

The major approaches used will be:

- A lively up-to-date central web sites providing a one-stop-shop for all major project information, with links to the regional web sites where localised information will be found.
- A series of focused email distribution lists that will be of interest to users and potential users of EGEE services.
- Four major events of one-week duration, that will promote liaison between the EGEE project in an open and cooperative way, to the potential users and decision makers.

TERENA will undertake the hosting and maintenance of the central web site and will be supported by the other participants who will supply the technical content. TERENA will work with CERN, UEDIN and CNRS to ensure that this material is put to best use in the production of PR material.

**Training and Induction**

Creating a large, varied user community across Europe and beyond is one of the central objectives of the EGEE. User Training and Induction activity – NA3 – which focuses on meeting the following objectives:

- To produce a portfolio of training material and courses from introductory to advanced user material.
- To use this material to train a wide variety of users both internal to the EGEE consortium and from the external user groups from across Europe who will make use of the infrastructure.
- To ensure an EGEE Team Spirit is engendered early in the project's lifetime.

The outcome of this activity will be twofold: firstly the creation of a well trained group of EGEE users across the European Union and from a wide variety of disciplines, secondly the creation of a set of high quality training material, in a variety of European languages**.** The activity will be lead by the UK National e-Science Centre, building on its existing expertise in this area within the UK e-Science Programme. Supporting the lead partner are 21 organisations from across Europe. These organisations will provide a focus for training in their local region, assist with and run training courses and, where appropriate, translate training material into their own language.

**Application Identification and Support**

The Application Identification and Support activity will support the induction of new users, new communities and new virtual organisations into EGEE community. It will develop and disseminate appropriate information to these groups proactively addressing them and their needs.
The objectives are to identify, through a well-defined integration procedure which starts with the dissemination actions (NA2), a portfolio of early user applications from a broad range of application sectors from academia, industry and commerce. A significant and well trained workforce will then be devoted to each new selected community to support development and production use of all of its applications on the EGEE infrastructure and thereby establish a strong user base on which to build a broad EGEE user community.
A special role will be given to two pilot application areas – Particle Physics and Biomedical sciences. These two communities are already grid-aware and ready to deploy challenging real applications at the very beginning of EGEE. They will provide invaluable feedback to the whole infrastructure.
A strong management and coordination structure will oversee the work in each application area, monitor the integration process and optimize cross-application fertilization to define common application interfaces and tools. This activity will deal primarily with expert representatives of communities. The goal is to ensure that all EGEE users are well supported. The activity will assimilate and evaluate records of the work and provide information to the requirements and planning activities.

**Policy and International Cooperation**

The Policy and International Cooperation activity will contribute to dissemination of EGEE results beyond Europe, and help to set international standards that ensure the Grid is widely adopted.
The activity will focus on the delivery of:

- A series of cooperation agreements with regions from around the world.
- Through the establishment of a European eInfrastructure reflection group produce a series of eInfrastructure White Papers and roadmaps.
- Management of co-operation with other European grid projects.

## 4.A.2 Specific service activities

The EGEE specific services activities consist of two activities:

1. SA1: Grid Operations, Support and Management
2. SA2: Network resource provision

Each of these is now summarised in turn:

**Grid Operations, Support and Management**

The Grid Operations, Support and Management activity (SA1) will create, operate, support and manage a production quality European Grid infrastructure which will make computing, storage, instrumentation and informational resources at many Resource Centres across Europe accessible to User communities and virtual organisations in a consistent way according to agreed access management policies and service level agreements. It will build on current National and International Grid initiatives which are already deploying Grid infrastructures. The key aim in assembling this infrastructure is to incorporate and exploit existing expertise and experience within the European Union in deploying, supporting and operating prototype Grids. The LCG project will play a central role in providing an operational infrastructure from the earliest stage of the EGEE Grid.

The key objectives of this activity are to provide the following functions:

- Core Infrastructure services;
- Grid monitoring and control;
- Middleware deployment and resource induction;
- Resource and user support;
- Grid management;
- International collaboration.

The originality of this activity lies very much in its strong production focus and the scale and breadth of its pan-European and world-wide multi-disciplinary target user constituency. No Grid project in the world has to date attempted to construct a production infrastructure on such a large scale. The Grid-empowered infrastructure will be open to the entire European Research Area, with strong links to infrastructures also outside the EU. The excellence derives from the quality of the partners of EGEE, especially the depth of their experience in Grid technologies and operations gained from participation in successful Grid test-bed projects, and the level of computing and storage resources provided.

The main purpose of the EGEE Grid Operations, Support and Management activity is to make the resources at the Resource Centres accessible to user communities structured as virtual organisations across Europe in a professionally managed, persistent, reliable and secure way.

The objectives are implemented through a layered structure of operations and management activities:

- **Layer I: Regional Operations Centres** (ROC) which deploy Grid middleware at Resource Centres to connect resources to the EGEE Grid and provide geographically local front line support to both users and Resources Centres, eventually on a 24x7 basis.
- **Layer II: Core Infrastructure Centres** (CIC) which provide the basic service infrastructure of the Grid, operating the key services which connect users with resources. The CICs will also support the Regional Operations Centres. The CICs will guarantee eventual 24x7 operations.
- **Layer III: Operations Management Centre** (OMC) which manages the operation of the entire EGEE Grid from a single centralised location.

In addition there are the Resource Centres that provide and manage the computing, storage, and network resources.

**Network Resource Provision**

The Network Resource Provision activity (SA2) will capture requirements from EGEE users in terms of network capacity and service class. It will perform aggregate modeling, derive Service Level Specifications for network provision, create Service Level Agreements with the network providers, and monitor SLA adherence against aggregate traffic (demand) and network performance (supply). It will manage the relationship between EGEE and the network providers, through a formal liaison body. The SA2 activity will be managed by CNRS/UREC and realised in cooperation with RRC KI and unfunded effort from DANTE and the NRENs.

## 4.A.3 Joint research activities

The EGEE joint research activities consist of four activities:

1. JRA1: Middleware Engineering and Integration Research
2. JRA2: Quality Assurance
3. JRA3: Security
4. JRA4: Network Services Development

Each of these is now summarised in turn:

**Middleware Engineering and Integration**

The objective of the Middleware Engineering and Integration Research Activity (JRA1) is to provide robust middleware components, deployable on several platforms and operating systems, corresponding to the core Grid services identified and developed in earlier projects. This activity aims to do the minimum original implementation of middleware necessary to achieve this goal; instead, the originality of the activity lies in selecting, potentially re-engineering and integrating a set of reliable production-quality services that together form a dependable and scalable infrastructure that meets the needs of a large, diverse e-Science user community. The evolution of such a set of middleware components towards a Service Oriented Architecture (SOA) adopting emerging standards such as OGSI is an important goal of this activity. The JRA1 activity is lead by CERN and includes CESNET, DataMAT, INFN and CCLRC.

**Quality Assurance**

Quality assurance activity (JRA2) is the planned and systematic set of activities that ensure that processes, products and operation services conform to EGEE requirements, standards, procedures, and to the required level of services. Quality assurance will be integrated in each project activity, in order to enable the production-quality operations of an international Grid infrastructure. The JRA2 Quality Assurance Management team (QAM) is in charge of the overall project quality and coordinates the Quality Group composed of QA representatives from each activity. The main role of QA representatives is to ensure that quality measures as agreed are applied inside their activity group. The execution of the verification and testing activities is the responsibility of the individual activities. The JRA2 activity is managed and realised by CSSI and CNRS.

**Security**

The goal of the Security activity (JRA3) is to enable the deployment of a production-quality Grid that includes services, resources and applications that are security-conscious and handle sensitive information. More specifically, the work will help enable a grid infrastructure with: an increased level of security of sites involved; a rapid response to intrusions; sound authentication procedures, accepted by both sites and users; and a solid authorization and accounting system.

**Network Services Development**

The Network Services Development activity (JRA4) is composed of two tasks: resource allocation/reservation and network performance monitoring, both of which have a network-specific dimension. These tasks are aimed at the evolution of research-level techniques into production-level Grid services, requiring development of what is currently available and implementation of appropriate interfaces, followed by deployment across the network domains of the GEANT/NREN networks. The JRA4 activity will be managed by UCL with DANTE contributing to the resource reservation task, and DFN and CNRS/UREC contributing to network monitoring.

# 4.B Plans

## 4.B.1 Plan for using and disseminating knowledge

The knowledge and information accumulated by the EGEE partners will be used to feed technical content to the Dissemination and Outreach activity. A major vehicle for the dissemination activity will be a lively and up-to-date EGEE central web site hosted at TERENA. This will be supplemented by focused email distribution lists and web based collaborative tools hosted at TERENA. The material will also be used as the source for the production of printed material that can be used to support conferences, workshops and training sessions. CERN will use the material in support of their contacts with the media.

In order to give some exposure to the types of services that can be expected from EGEE, CERN and TERENA will develop a portal on the external web site giving demonstration access to a limited range of Grid applications. The full plans for using the knowledge and information acquired in the EGEE project will be defined in the "Project Information Dissemination Plan", scheduled for delivery in month 3 and updated in month 9 of the project.

## 4.B.2 Gender Action Plan

Most of the partners in EGEE are scientific organizations with an established policy of equal gender opportunities. CERN, the leading partner, has an excellent record history with an equal opportunity programme established long time ago.

Gender includes two deliverables related to gender action: a gender action plan early in the project (DNA1.2) and a report on the effect of the plan at the end of the project (DNA1.4)

## 4.B.3 Raising public participation and awareness

The level of awareness of the possibility of using the EGEE services and technology will be raised through a number of measures. The central web server will be a major vehicle for mass exposure of the project to the online community. Email lists, bulletins and online collaborative tools will all be used to draw potential users into the EGEE community. The four EGEE conferences will be used to target a wider audience in the academic and commercial sectors and CERN will use their contacts in the media to provide as high a level of exposure on radio, TV and the press.

## 4.C Milestones

**Major Milestones over full project duration (for a complete list, please see: http://egee-jra2.web.cern.ch/EGEE-JRA2/EUDocuments/Deliverables/Deliverables.htm)**

| | | |
|---|---|---|
| M01 | MNA2.1.1 | External customer facing web site, mailing lists and web based tools |
| M01 | MNA2.2.1 | Internal project facing web site, mailing lists and web based tools |
| M01 | MNA4.1 | Definition of requirements from applications and first version of associated testsuite |
| M03 | MSA2.1 | First meeting of EGEE-Geant/NRENs Liaison Board |
| M03 | MNA2.3.1 | Dissemination Plan including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| M03 | MNA3.1 | Training and induction planning phase complete |
| M03 | MJRA4.1 | Definition of initial network performance metrics and composite measurements required. |
| M05 | MJRA2.1 | QA website deployed including Quality Plan, procedures and standards |
| M06 | MSA1.1 | The initial pilot production grid will be operational. The infrastructure will include 4 Core Infrastructure Centres, 9 Regional Operations Centres, and at least 10 Resource Centres. The system will be based on the best existing middleware. An associated deliverable (DSA1.2) is a set of release notes relevant to this service and describing it |
| M06 | MNA4.2 | First applications migrated to the EGEE infrastructure |
| M06 | MNA3.2 | First user training material and induction course available |
| M09 | MNA1.1 | Successful completion of first review |
| M09 | MNA5.1 | European Grid project synergy roadmap. First draft eInfrastructure White Papers issued |
| M09 | MSA2.2 | Initial requirements aggregation model, specification of services as SLSs on the networks |
| M12 | MSA2.3 | Operational interface between EGEE and GEANT/NRENs. |
| M12 | MJRA4.3 | Prototype tool to access network performance metrics from a limited set of measurement points |
| M12 | MNA3.3 | First external review of User Training and Induction with feedback |
| M14 | MSA1.3 | The first full production grid based on EGEE middleware. An additional Core Infrastructure Centre in Russia will be on-line in addition to the existing 4 CICs and 9 ROCs, and the service will provide access to at least 20 Resource Centres. Associated deliverables (DSA1.5) will be the corresponding release notes, and the first release of the EGEE Infrastructure Planning Guide (“cook-book”) |
| M15 | MJRA4.4 | Prototype bandwidth reservation within static network configuration |
| M15 | MNA2.3.3 | Final Version of the Dissemination plan available (including exploitation details provided by project partners) |
| M15 | MJRA4.7 | Specification of end-to-end bandwidth reservation system |
| M18 | MNA1.2 | Successful completion of second review |
| M20 | MJRA1.8 | Release candidate 2 enters testing and validation period (Release 2) |
| M24 | MSA1.5 | A second generation production service using second major release of EGEE middleware. At least 50 resource centres will be accessible through the service. Associated deliverables (DSA1.6) include updated release notes and Infrastructure Planning Guides |
| M24 | MNA3.4 | Second external review of User Training and Induction with feedback |
| M24 | MNA1.3 | Successful completion of third and final review |

# 5 Detailed implementation plan

## 5.A Networking Activities

Just as the EGEE services will build on and integrate national facilities, so too, EGEE's plan for disseminating knowledge will benefit from existing national and European efforts by organisations with a track record in dissemination. The organisations responsible for the wide dissemination of information about the project will address research and industrial organisations that may benefit from EGEE. The goal is to ensure that potential users in all relevant disciplines are attracted to use EGEE. We are committed to engaging with both the research and industrial/commercial communities and we propose a number of focussed methods to reach out to them. We intend to grow both our existing user base and new sectors from academia, industry and commerce. We expect to be judged on our ability to attract new applications and new users to the Grid.

The project's dissemination plan includes support for the induction of new users, new communities and new virtual organisations into the EGEE community as shown in Figure 4. It will develop and disseminate appropriate information to these groups proactively, taking into account their specific needs. The dissemination plan includes the operation of help desks and consultancy services dealing primarily but not exclusively with expert representatives of communities. The goal is to ensure that all EGEE users are well supported. The dissemination plan includes assimilation and evaluation of records of this work and provides input to the requirements and planning activities of the project.

The dissemination plan provides for four activities: Dissemination and Outreach, User Training and Induction, Application Identification and Support and International Cooperation. The continuous progression of EGEE users that is supported by the dissemination plan is illustrated in the following diagram. We emphasize that there is no sharp boundary between attracting new users and their development to experts and leaders. We will have a strong focus on the encouraging new applications and new user domains to make use of the EGEE Grid infrastructure, thereby increasing the need and take-up of the Grid across Europe.


**Figure 4:** ***The "Virtuous Cycle" for EGEE development, emphasizing the role of the Networking activities. The step between "Tentative New Users" and "Committed Users" involves in practice: capture of requirements and reengineering and deployment of middleware adapted to the user needs (if necessary).***

The dissemination plan must be managed in close correlation with the deployment of the EGEE infrastructure because: (1) the rate of attracting and developing users must match EGEE's capacity and requirements, (2) information from development and operations provides the content, (3) information gathered from users must inform EGEE's operations and development, and (4) staff interaction and carefully managed staff involvement in other activities will accelerate knowledge pool development. This management may include scheduling the approach to particular potential user groups, particular research disciplines and particular geographic regions.

| Target | End Year 2 | End Year 4 |
|---|---|---|
| Number of Users | ≥ 3000 | ≥ 5000 |
| Respectability | ≥ 15% peer reviewed | ≥ 50% peer reviewed |
| Breadth | ≥ 5 disciplines | ≥ 5 disciplines |
| Multinational | ≥ 15 countries | ≥ 15 countries |
| Multilingual | ≥ 4 languages | ≥ 8 languages |

**Table A: General EGEE targets for uptake, to be facilitated by activities in the dissemination field.**

## 5.A.1 Activity NA1 - Management of the I3

### 5.A.1.1 Quality of the Management of the I3

High quality management will be a key to the success of the EGEE Integrated Infrastructure Initiative. While the lead partners of the project each have considerable experience of managing large projects, an I3 is a considerably larger and more complex undertaking than previously attempted. Therefore, a management structure is described below, which seeks to build upon the partners' established best practise and also to be of a sufficient scale to manage such a complex project.

The structure has been designed to deal with the typical project management challenges and problems associated with a diverse collection of scientific and industrial partners. Our major focus is the need to ensure that the management of EGEE provides the environment to deliver dependable quality production services. This will be essential for the effective exploitation of the results throughout the different scientific and industrial user communities interested in this project and its overall success.

As indicated above, the project will be managed using an overall management structure built on the basis of the experience gained by some of the proponents and by the proposed lead and coordinating partner in similar large EU projects and in particular in the EU DataGrid project. The managerial structure of other successful projects of a scale comparable to EGEE shows a very similar internal organisation.

#### *5.A.1.1.1 Detailed structure*

Because EGEE aims to integrate various national and international Grid infrastructures it will require an overall central management organisation flexible enough to smoothly integrate with the pre-existing management infrastructures, while on the other hand it will require enough authority to lead and control the overall development of the joint research activities and the provision of the planned services.

The lead partner will appoint a dedicated overall Project Director. Dr. Fabrizio Gagliardi, the designated project director, has repeatedly demonstrated his considerable experience and skills in organizing and running large international projects. His most recent notable success has been the management of the EU DataGrid project (www.edg.org).

He will be assisted by a project office, modelled on the basis and the experience of the EU DataGrid project, but expanded and strengthened to meet the requirements of the EGEE I3. In particular the senior CERN management have recognised the need to provide dedicated financial and legal support to the project in order to ensure that the financial and legal responsibilities, passed from the European Commission to the coordinating partner in the context of the new Framework 6 instruments, are properly resourced.

A senior financial administrator, two administrative assistants and a project secretary will form the administrative part of the office. The EGEE project office will receive assistance from the CERN legal services during the project negotiation and execution; if necessary a dedicated budget line will be allocated for specific legal consulting.

The management staff funded via activity NA1 is summarised in Table B below.

| **Partner** | Role | Effort in FTE (EU funded) |
|---|---|---|
| CERN | Project Director | 1.0 |
| CERN | Technical Director | 1.0 |
| CERN | Financial Administrator | 1.0 |
| CERN | Administrative Assistant | 2.0 |
| CERN | Project Secretary | 1.0 |
| **total** | | **6.0** |

**Table B NA1 effort (funded) in FTEs**

A public relations (PR) and dissemination officer and a documentation/WEB publishing assistant will complete the Project Office staff but are included in the funding of activity NA2.

In parallel with the financial and administrative management, the technical and scientific management structure will be composed as follows:

- A Technical Director will be in charge of the overall coordination of the various technical activities (each of these activities will deploy their own internal technical management structure) and will act as Deputy Project Director. Dr. Robert Jones has been designated for this position.
- An Operations manager will be in charge of the overall operation of the EGEE Grid infrastructure. In the first phase of the project this role will be performed by the LCG Operations manager. Dr. Ian Bird has been designated for this position.
- A Middleware manager supervising the Middleware re-engineering and coordinating the middleware activities in the middleware clusters. Mr. Frederic Hemmer has been designated for this position.
- A Quality Engineer Head responsible for overall quality assurance across all activities of the project. Mr. Gabriel Zaquine has been designated for this position.
- A Security Head responsible for overall grid security aspects across the middleware re-engineering and grid operations activities of the project. Mr. Ake Edlund has been designated for this position.
- The Manager of the dissemination, outreach, training activities. Prof. Malcolm Atkinson has been designated for this position.
- An Application manager responsible for representing all the application domains that make use of the grid infrastructure. Dr. Vincent Breton has been designated for this position.
- A Network Head responsible for network provision and developments for the grid infrastructure. Mr Jean Paul Gautier has been nominated for the position.

All these managers will form the Project Executive Board (PEB). With the exception of the project and technical directors, the PEB members are funded via the appropriate activity. This board will meet weekly (in person or by telephone conference calls) and ensure the daily management of the project. The Project Director will chair and manage this board.

The heads of the transversal activities (Quality Assurance, Security) are present in the Project Executive Board to ensure appropriate managerial awareness on these very critical issues and prompt reaction in case of problems from the senior project management.

Given the strong interdependency between EGEE and one of the two main pilot applications (Particle Physics) at least in the launch phase, the head of the Operation is provided by the correspondent position in the LCG PEB (www.cern.ch/lcg).

Conversely the Technical Director and the Middleware manager will participate in the LCG PEB. The EGEE Project Director will liaise directly with the LCG Project Leader and exchange participation in the relevant senior boards.

Since CERN is leading partner of both projects and both the above positions will be covered by CERN senior staff, any potential conflict will be resolved in a conciliation procedure sponsored by the CERN Director General.

#### *5.A.1.1.2 Detailed technical management structure*

The scientific strategic direction of the project will be set by the Project Director with the advice of the External Advisory committee and in agreement with the PEB. These plans will be presented and discussed twice a year at the General Project Conferences.

The General Project Conferences will also host meetings of the External Advisory Committee. This committee will be composed of internationally recognized experts in the Grid field. They will advise the Project Director on the validity and relevance of the project plans in an international and worldwide Grid context.

The Project Executive Board will hold on a quarterly basis (or more regularly if urgent issues arise) expanded meetings including other key technical project members and representatives of the major user communities. At these meetings the project deliverables and quarterly reports will be reviewed and approved before submission to the EU. The meetings will be assisted by a professional independent reviewer to be contracted by the Project Lead partner. The EU DataGrid, among other projects, has successfully used this approach, which has also been highly valued by the EU and the EU independent reviewers.

Successful internal review of the project deliverables on a quarterly basis will be an indispensable condition for continued financial support of the participating partners.

The consortium agreement will specify clear conditions by which responsibility and correspondent EU funding will be re-assigned to other partners in case of persistent failure to pass the internal review process.

The Quality Assurance Head will be responsible for assuring that the agreed project quality criteria are applied to all aspects of the project. This person will lead a Quality Board composed of quality engineers from all of the project's activities. This Board will meet monthly and interact on a daily basis by e-mail.

Security is a major priority for the infrastructure. An overall Security Head will therefore be appointed from the partner responsible for this activity to propose, implement and monitor the project's security architecture, and this person will be part of the Project Executive Board.

The head of the dissemination, outreach and training activities will ensure that the activity of the partners responsible for, dissemination, education, training, consulting and outreach are progressing properly and are on track and in line with the overall project plans and progress.

The head of the applications support will be responsible for guiding the application domains in their migration to the grid infrastructure and ensure their requirements are met via the work of the grid operations and middleware re-engineering activities.

The head of networks will be responsible for ensuring the provision of network facilities for the grid infrastructure and the relations with the NRENs and Geant.

All the key technical activity managers and heads will be nominated by the Project Director and approved by the Project Management Board. They will be fully charged to the various activity lines budget and fully funded by the EU. They will be 100% dedicated to the project.

#### *5.A.1.1.3 Reporting lines*

The Project Director will be supported by the Project Office, lead the Project Executive Board and report to the Project Management Board (PMB). The Project Director will act as a single point of contact to the EU authorities and will be responsible for constant, appropriate communication between the EU and the PMB. The Technical Director will be the Project Director's deputy. He will be responsible for the overall technical coordination of the project with the advise of the members of the PEB cross-activity groups.

The Project Director will be the scientific secretary of the PMB and be responsible for maintaining the PMB action list and ensuring it is acted upon. An administrative secretary will be responsible for taking notes, publishing and distributing meeting agendas and all relevant documents, in addition to taking care of any PMB logistics.

The Project Director will agree and prepare the agenda for the PMB meetings with the PMB chair. The PMB chair will be elected at a simple majority vote by the PMB members. He or she will be in charge for a 6-month term. The Project Director will act as PMB deputy chair when required.

PMB members will be nominated by the principal partners of the project according to the procedure defined in the Consortium Agreement. The PMB will be responsible for ensuring that the EU contract is properly executed and that the terms of the agreed EGEE Consortium Agreement are properly implemented. The project consortium agreement will cover all aspects of the relations between partners, their responsibilities, liabilities, ownership of IPR, licensing, and exploitation issues. Furthermore, the consortium agreement will also address conflict resolution methods. It will be signed once the project has been negotiated with the EU contract coming into force.

The PMB members will also be responsible for ensuring direct administrative and managerial links to their respective regions and stakeholders. This will allow for the smooth integration of the overall EGEE project management with the respective regional and national authorities.

It is foreseen that a meeting with all the project partners (Collaboration Board) will be held during the project conferences (every 6 months). The EGEE management structure and reporting lines are illustrated in **Figure 5**.

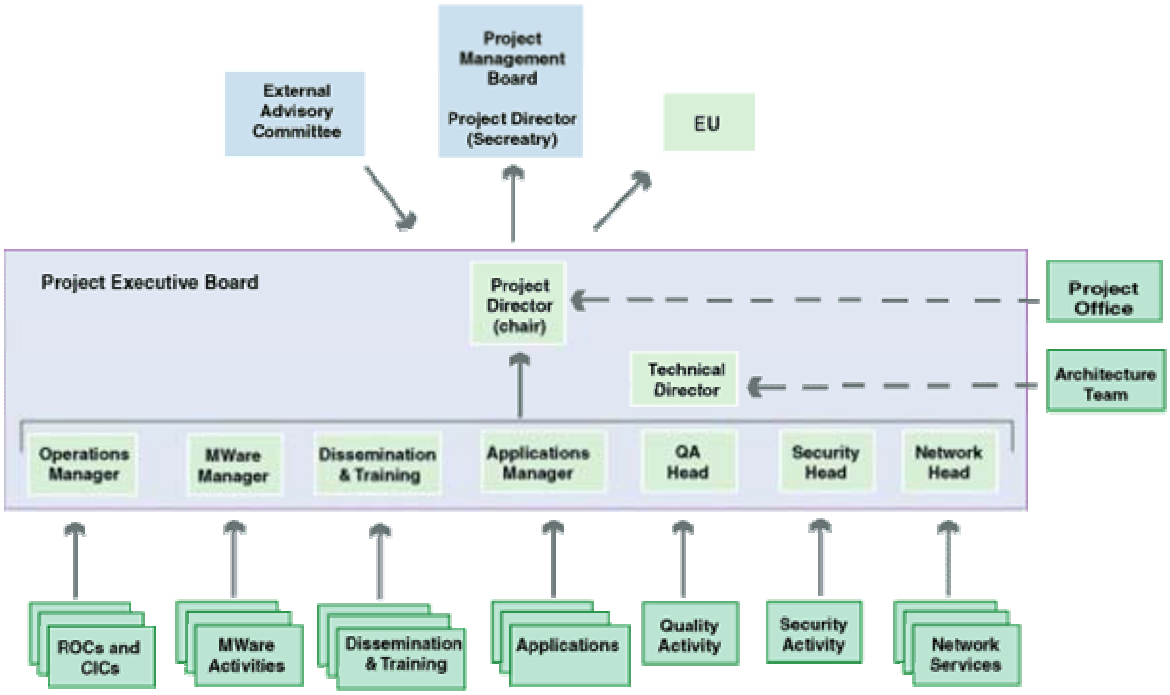



**Figure 5 *EGEE management structure***

#### *5.A.1.1.4 Information flow*

The project will make full use of a comprehensive project management website to ensure a constant, high quality information flow to all partners. This website will act as a repository for all relevant documents, distribution lists, electronic bulletin boards and meeting information. It will be operated by the Project Office and be linked to the overall project Web site. The main dissemination, support and training website will be open to a much wider community. The individual project activities will maintain their own working Web sites, which will also be linked as appropriate to the main dissemination website.

Quarterly newsletters, distributed via dedicated mailing lists and the twice yearly Project Conference will ensure a wide information flow and dissemination activity. At these project conferences, representatives from other relevant projects will be invited to talk and ensure synergies and opportunities for cooperation – both with other European projects and other international projects – are identified and acted upon.

The Project Conferences, organised via activity NA2, will be held in several locations around Europe, rotating amongst the various main project partner sites. For these meetings, the local Grid infrastructure management will be responsible for the logistics and also encouraged to co-locate their major local Grid events with this meeting. Other specific outreach and training events will be held in conjunction with these project conferences. The end-user communities will be invited to these project conferences to provide feedback on the use of the project infrastructure and to discuss future project plans.

Project user groups and representatives from industry (members of the EGEE Industry Forum) will hold their meetings at these conferences and provide input and feedback to the project.

### 5.A.1.2 Quality of the plan for using and disseminating knowledge

EGEE will be a provider of computing and data access services as pervasive in nature as the research networking services provided by the GÉANT and NREN networks. Other EGEE activities focus on the development and operational aspects of the service. The Networking activities described in the next sections focus on the creation and support of a community of EGEE users across Europe that is as inclusive as possible.

Just as the EGEE services will build on and integrate national facilities, so too will EGEE's Training & Induction and Dissemination & Outreach activities. These activities will be responsible for the wide dissemination of information about the project to research and industrial organisations that may benefit from EGEE. The goal is to ensure that potential users in all disciplines are attracted to use EGEE.

The Application Identification and Support activity will support the induction of new users, new communities and new virtual organisations into EGEE community. It will develop and disseminate appropriate information to these groups proactively addressing them and their needs.

This activity will deal primarily with expert representatives of communities. The goal is to ensure that all EGEE users are well supported. The activity will assimilate and evaluate records of the work and provide information to the requirements and planning activities.

The Policy and International Cooperation activity will contribute to dissemination of EGEE results beyond Europe, and help to set international standards that ensure the Grid is widely adopted.

To achieve a sufficient rate of induction of new users and to support existing users and developers, an extensive organisation is necessary. Two sites, the UK National e-Science Centre and TERENA, will lead this organisation, recruiting, assisting and overseeing other sites, which will provide services more locally using materials developed at the lead site. Each partner site is expected to have an existing track record in training and outreach and to offer facilities for hosting networking events.

### 5.A.1.3 Summary

| **Activity number :** | NA1 | **Start date or starting event:** start of project | | | | | | | Project start | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Participant:** | 1 CERN | 4. CESNET | 6. ELUB | 7 KFK-RMKI | 8. MTA-SZTAKI | 9. NIIF | 11. ICM | 13 II-SAS | 14 JSI | 15 TCD |
| **Expected Budget per Participant:** | 1745 | 6 | 6 | 6 | 6 | 6 | 6 | 2 | 6 | 6 |
| **Requested Contribution per Participant:** | 1745 | 6 | 6 | 6 | 6 | 6 | 6 | 2 | 6 | 6 |
| **Participant:** | 16 CCLRC | 17 UEDIN | 18 PPARC | 19 UCL | 20 CEA/DSM | 21 CGG | 23 CSSI | 24 CRSA | 25 DESY | 26 DKRZ |
| **Expected Budget per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Requested Contribution per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Participant:** | 27 FhG | 28 FZK | 29 GSI | 30 DATAMAT | 32 TERENA | 33 VUB | 34 KU-NATFAK | 35 UH-HIP | 37 SARA | 38 UvA |
| **Expected Budget per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Requested Contribution per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Participant:** | 39 UiB | 40 VR | 49 CLPP-BAS | 50 UCY | 51 GRNET | 52 TAU | 53 ICI | 54 LIP | 55 CESGA | 56 CSIC |
| **Expected Budget per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Requested Contribution per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Participant:** | 57 IFAE | 58 INTA | 59 UPV | 63 KTH | 64 ENEA | 68 DANTE | 69 DFN | 70 GARR | | |
| **Expected Budget per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | | |
| **Requested Contribution per Participant:** | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | | |

**Objectives**

- Overall project management and reporting to the EU
- Daily management of the project activities, resource allocation and monitoring
- Conflict resolutions and corrective actions

**Description of work**

1. Set up the overall management structure according to the management plan
2. Nominate and hire the necessary key technical positions
3. Run the necessary management boards and bodies

4. Ensure timely delivery of project deliverables to the EU
5. Implement and oversee the appropriate quality control on the project deliverables including a formal internal review process
6. Document and disseminate project results in coordination with the project dissemination line of activity and responsible partners.

**Deliverables**

| | | | |
|---|---|---|---|
| DNA1.1.1-8 | M3 | (CERN) | Quarterly periodic reports |
| DNA1.2 | M3 | (CERN) | Gender Action Plan |
| DNA1.3.1 | M9 | (CERN) | Periodic report |
| DNA1.3.2 | M18 | (CERN) | Periodic report |
| DNA1.3.3 | M24 | (CERN) | Periodic report |
| DNA1.4 | M24 | (CERN) | Report on Gender Action Plan |

**Milestones[6] and expected result**

| | | |
|---|---|---|
| MNA1.1 | M9 | Successful completion of first review |
| MNA1.2 | M18 | Successful completion of second review |
| MNA1.3 | M24 | Successful completion of third and final review |

The successful completion of the second review should entail submission of a second two year project

**Justification of financing requested**

A project of this size will require at least 7% of the total requested EU funding for the overall project management. This will be complemented by the support of the administrative and legal services of the coordinating partner and the other participating partners and the EU unfunded management of the regional Grid infrastructures. The requested funding include personnel costs for the Project Office, travel, office equipment and consultancy costs (legal and project external reviewers).

**Please note: The other partners are present in NA1 to cover the cost of producing the audit certificates for each reporting period.**

[6] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

## 5.A.2 Activity NA2 - Dissemination and Outreach

### 5.A.2.1 Objectives and expected outcome of the activity

The objectives of the dissemination activity are to:

- Disseminate the benefits of the EGEE infrastructure to new user communities ensuring an appropriate message is delivered to each of them.
- Provide a clear path to the new user induction mechanism in order that new contacts may be converted to real users.
- Ensure the information tools needed by each audience are available to support the growth of many, varied, individual user communities.
- Identify EGEE's target new user community audiences and applications.
- Plan how and when to approach these user communities.

The expected outcome of the activity will be the establishment, in conjunction with Networking Activities, NA3 to NA5, of a large, well informed EGEE user community spanning many scientific and industrial disciplines that bring many different applications to be used on the EGEE Grid infrastructure.
The central purpose of this activity is to ensure that as many potential users of EGEE as possible are aware of the services available and that they know how to become an EGEE user. The challenge is to reach new communities, such as new research disciplines, new industrial and commercial groups and branches of government. Extension and support of existing communities is also required.
The following mechanisms will be used:

1. The operation of a lively, up-to-date and technically informative one-stop web site, which will be progressively extended to address further potential groups of users and languages.
2. The support of mail lists and web based collaborative tools to enable notification, communication and to encourage specialist group formation.
3. The organisation of presentation of talks in collaboration with the other project partners at a large number of relevant meetings of researchers, engineers, biomedical, businesses and governmental meetings, N.B. these are meetings specific to disciplines and potential user communities, e.g. an EGEE representative would talk at a pharmacology meeting.
4. Visits to industrial and research centres, using the EGEE community's combined set of contacts.
5. Organisation of project conferences. Each year there will be one event aimed at bringing the EGEE partners, users and potential users together at a project wide conference. Additionally each year there will be an open event aimed at the wider community of users and potential users of Grid technology and service. These meetings will provide showcases targeted at attracting and informing decision makers from industry, government and research organisations. It is possible that such events would benefit from being co-located with a major and influential event. The TERENA conference such as TNC, is being explored along with other suitable events.
6. The production and dissemination of publications, such as press releases, introductory brochures and papers. The project will work with DG INFSO providing input to their publications as appropriate.
7. The project will use the Commission concertation activity to maximise cooperation with other related projects that are expected to start in the area of Research Infrastructure, this will be undertaken as part of EGEE activities in NA5.
8. Co-operate with related EU funded projects to organize joint grid events.
9. An internal website and web based collaborative tools will be provided by CERN to facilitate good internal communications between the partners.

During the first month of the project, a brief project presentation including sections on project overview, participants, costs, funding, technical approach and expected achievements and impacts will be produced.

An important aspect of this work is proper integration. For example, brochures, papers, web site material and papers must provide follow-up material for mechanisms 3, 4 and 5. The proper follow-up of leads and interested people, through to induction and training is essential. This follows the path shown in the diagram below. Figure 6 illustrates the components of the EGEE dissemination and outreach processes.

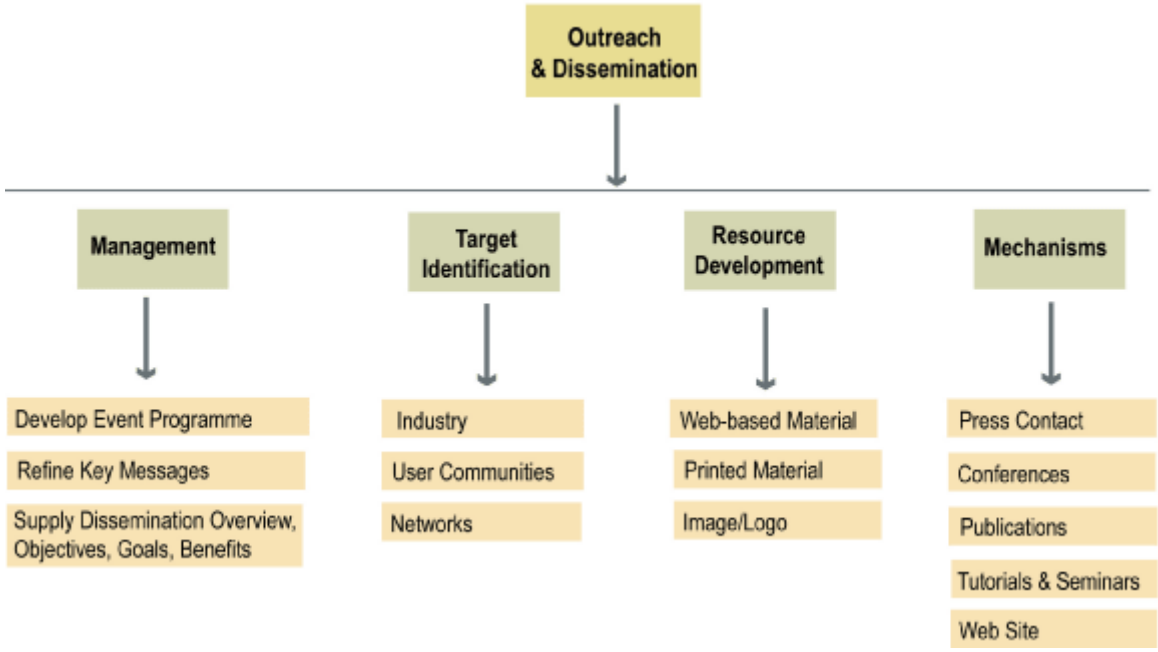



**Figure 6:** ***Overview of Outreach and Dissemination task breakdown***

Resources are required for each of the above mechanisms. This will be coordinated predominantly by TERENA, and augmented by CERN & UEDIN and the other partners involved in Networking Activities.
A crucial deliverable is the induction and support of users as described above. A complete description, including user documentation and tutorial material will be on the web site, in at least one language by Project Month 6 (PM6). This will be achieved by collecting existing material, making it available on the Web, and by coordinating conference presentations. The collection of material from the partners, preparing for dissemination and hosting of the central web site will be undertaken by TERENA.
There will be at least 10 presentations coordinated by CERN and delivered by speakers, chosen among the key project members, per year with appropriate supporting publications. This depends on collating existing material at the start of EGEE, e.g. from DataGrid, GRIDSTART, UEDIN and Globus, and on input from other EGEE teams. This will be organised jointly by UEDIN and TERENA.
There will be twice yearly Project Conferences showcasing EGEE achievements and potential applications. Each year one of these events will be oriented towards the needs of current and potential new users within the academic community already familiar with the Grid concept. The first four days will focus on EGEE and its then current user and developer community from academia and industry. The latter two days be directed at new users, particularly industry and business, and the combined contact databases of the EGEE consortium, as well as other publicity, will be used to attract participants.
A second larger event will be held each year with the objective of attracting a much wider audience, providing a showcase to informing decision makers from industry, government and research organisations.
It is anticipated that other events could be co-located with the project conference to increase synergy and optimize cost. The events will in principle have the duration of a full week, normally starting on Sunday to allow for cheap airfares. Collocating of EGEE conferences with a major TERENA event such as TNC and other influential events is being explored to ascertain what synergies and benefits could be achieved
The success of these events will be measured by the number of participants who are induced to progress towards a closer relationship with EGEE, as shown in Table A. The percentages represent the proportion of new participants from industry, business and government.

| Measure of success | End Year 2 | End Year 4 |
|---|---|---|
| New Contacts via Web Site and Publications | ≥ 500 per year (10%) | ≥ 500 per year (20%) |
| New Contacts via Presentations at Meetings | ≥ 500 per year (10%) | ≥ 500 per year (20%) |

**Table C** ***Measures of success in the dissemination field***

### 5.A.2.2 Participants

This section presents an outline of each of the partners involved in these activities. To avoid repetition the following list is referenced in the texts of NA3 and NA4. Specific details of the finances requested per participant and for 3rd party support vary and are therefore given per Networking Activity. Each of the partners' roles is described in turn (see Figure 7), starting with the partner tasked with coordinating these activities.

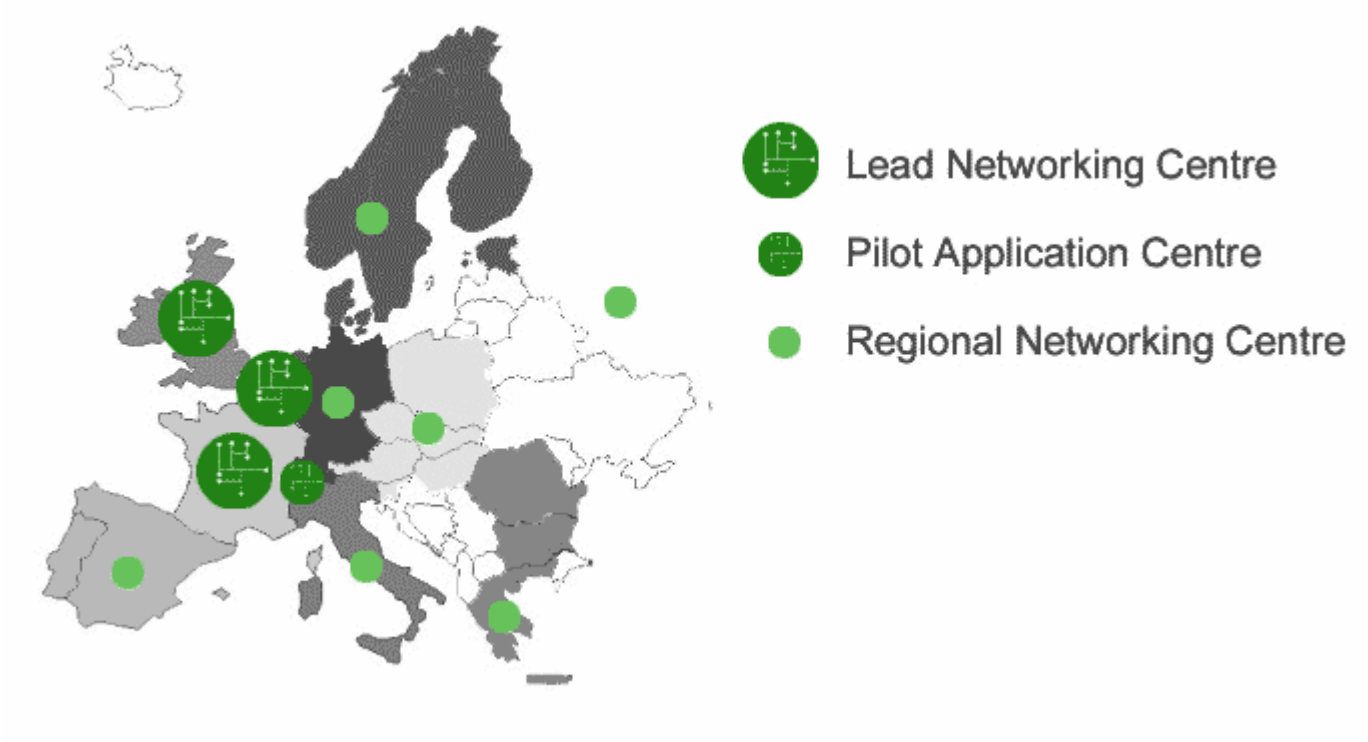



**Figure 7:** ***Distribution of Networking activities NA2-NA4 over Europe. The symbols illustrate regional distribution and do not reflect precise geographic location of activities. Lead partners are UEDIN (UK) for overall leadership and also Training and TERENA (Netherlands) for Dissemination and CNRS in France for the Applications Interface coordination. The different application domains are coordinated by CNRS for the biomedical area with support from the South West Europe Federation, CERN for high energy physics and INFN in Italy for general applications with support from the Central Europe Federation.***

**TERENA:** The Trans-European Research and Education Networking Association (TERENA), the association of European National Research and Education Networks will be the lead partner for the EGEE dissemination activities (NA.2) working closely with UEDIN, CERN and the regional dissemination partners. TERENA has developed extensive expertise and skills over many years in coordinating complex technical projects and disseminating information both for its NREN oriented activities and within the context of the European Commissions IST Framework Programme.
TERENA will allocate 2 FTE's of technical staff (Project Development Officers) to work on the technical aspects associated with project. In addition TERENA will allocate 1 FTE's of support staff in the functions, IT Support for mailing lists and web based collaborative tools, a webmaster, and Conference Organiser. With this mix we will be able to support:

- a professionally designed and maintained external (customer facing) one-stop-shop, comprehensive and lively web site, providing full coverage of the EGEE project and its technological context
- Web based collaborative tools for the support of external (customer facing) interactions
- Liaison and coordination between the central dissemination activities hosted by TERENA in Amsterdam and the activities of the regional dissemination partners (CERN, UEDIN, CNRS, INFN, and those in Germany, Switzerland and Russia). It will be particularly necessary to build effective information links into the new applications communities through CNRS to ensure good information flow to new discipline areas.

- Organisational support for two conference events each year – One project oriented event, and one larger open event.
- TERENA will provide a dissemination planning document by month 3, with revisions at month 9 and month 15, detailing the dissemination opportunities and mechanisms that will be used to address them.
- At the end of the activities foreseen in this proposal (month 24) TERENA will provide a report on the dissemination activities addressing the issues of public participation and awareness that have been achieved.
- TERENA will also participate in dissemination, training, outreach and applications area management meetings with the other main partners in the activities NA3 (UEDIN) & NA4 (CNRS) as well as occasionally attending PEB meetings.

Since 1996 TERENA has successfully been involved in many EU-funded projects including: Scampi (lead partner), SERENATE, 6NET, COMREN, SCIMITAR, SCIMITAR2 and TEQUILA.

**UK:** The University of Edinburgh, represented in the project by the UK National e-Science Centre (UEDIN) and drawing on the activities and experience of EPCC will be the lead centre for activity NA3. The UEDIN will work closely with TERENA on matters of information dissemination.

- UEDIN will be the lead partner for all training activities that are fully described in NA3
- UEDIN will undertake all publicity and dissemination activities related to their training activities.

**CERN:** CERN, who are described in detail elsewhere in this proposal, will host a complementary outreach activity within the Project Office. Past experience with EU projects has shown the importance of a small dissemination unit (a PR and dissemination officer and a documentation/WEB publishing assistant) fully integrated with the PO. The close contact with the project management is crucial to the effective propagation and extensive use of dissemination material and to the handling of unforeseen outreach and PR events (VIP, journalists and TV visits, last minute participation to conferences and events, publication of news, press releases, etc.).

CERN dissemination activity will include:

- Coordination of EGEE attendance at EC concertation meetings (with resources coming from the NA5 partners)
- Contribution of material for major technical publications and shorter information/data sheets. In addition, the publicity activity will include providing assistance to the European Commission in producing their publications related to EGEE activities
- Development and maintenance of the internal project web sites and related collaborative tools (in close collaboration with the lead NA2 partner to assure the same “look and feel”
- Contribution to the production of dissemination material (with support of the NA2 lead partner)
- Documentation (filming, photos, etc.) of major events involving the management of the project
- Organization and handling of specific PR events
- Management of the relations with the CERN HEP community

**France:** CNRS as the overall application manager will work in very close coordination with NA2. The integration process for new applications to be deployed in EGEE, described in the NA4 section, will be in phase with the dissemination process lead by NA2. CNRS will also extract the most significant achievements from the applications already deployed to provide NA2 with good dissemination material, as well as the complete statistics of applications usage of the EGEE infrastructure.
CNRS, as the largest research organisation in France and in Europe, covering all fields of science, and leader of the French EGEE effort, will of course play a very important role for national dissemination activities in France. Its permanent staff in charge of outreach and communication will make sure that EGEE activities are well known at all levels in France, from the general public, the economic and political world. The effort to deploy GRID nodes in public schools to associate the young pupils to exciting scientific endeavours will be pursued vigorously.
Ecole Centrale de Paris, one of the best engineering schools in France, will be in charge of the Industry Forum and will be therefore work in very close association with NA2 management. They will form a solid industrial “users club” with an active role in developing economic models for the GRID development in the economic world. The Ecole Centrale team has been attached to NA4, so they can be as close as possible to

the applications to extract the best success stories. They are part of the NA4 steering committee and will work in very close contact with CNRS.

**Germany/Switzerland:** The Swiss and German organisations involved in the NA2-NA4 activities will build on their existing expertise in this area. They will focus on meeting the needs of their user base through targeted dissemination and training activities. They will work with the partners of NA4 to identify and bring new applications from their countries into EGEE.
The Hermann von Helmholtz Association of National Research Centres is the union of 15 major research institutions such as DESY, GSI in Darmstadt and the Forschungszentrum Karlsruhe (FZK). The participating centres perform research and development in the fields of natural sciences and engineering (including biomedicine). They contribute significantly to research of the structure of matter, Earth and environment, traffic and aerospace, health, energy, and the further development of multidisciplinary key technologies, such as materials research, information technology and nanoelectronics, reaction engineering and separation technology, nanotechnology, Microsystems engineering, superconductivity, and information and communication.

Regarding dissemination of EGEE results, the centres have an impressive infrastructure at their disposal for close cooperation with universities and institutions of higher education. By working together in collaborative research centres and with graduate schools, the association has contacts with nearly all German institutions of higher education. Furthermore, FZK operates a division specialized on technology transfer.

The dissemination and outreach activities will be supported by

- Production of high-quality printed matter and marketing brochures.
- Organization of project related courses and conferences.
- Regular visits to scientific and industrial partners.
- Consultation of potential customers.
- Deployment of a Web portal to serve as a point of contact for the German Grid community and all other interested parties.

**Italy:** INFN has a long tradition of dissemination and training, dedicated both to the scientific community and to the general public. For several years INFN has had a Technology Transfer Committee (http://www.infn.it/ctt) which is responsible for demonstrating and communicating to society (especially including schools and industry), the scientific results achieved by the INFN activities and the possible spin-off activities. Along with the Technology Transfer Committee, INFN has managed a Committee for the Transition to the New Computing Technologies (see http://www.infn.it/cntc), which has periodically organized training courses and demonstration events. This activity has now been taken over by the INFN Grid project. Finally the INFN press and dissemination office organize press releases and participation to major exhibitions.
INFN intend to build upon their existing successful Grid dissemination activities at both national and international level which have concerned the organization of several tutorials and training sessions, the development of the World Grid demo for DataTAG at the IST and Supercomputing 2002 conferences and the creation of the GENIUS web portal (see https://genius.ct.infn.it), a high level interface to the DataGrid middleware (and DataTAG GLUE's) developed in conjunction with the NICE company.

**Northern Europe:** The networking activity for the Northern European Grid (NEG) Federation is a challenge because of the variety (seven) of very different languages and cultures. As the NEG Federation started prior to, and independent of, the EGEE initiative some measures have been taken already to improve communication and dissemination among the NEG partners. Web sites and mailing lists have been established and NEG partner meetings have been organised. These measures have come on top of similar activities going on within the countries in the context of national grid activities; DutchGrid, EstGrid, NorduGrid and SweGrid have organised meetings, conferences, tutorials etc. and website and mailing lists exit also at a national level.
The EGEE dissemination and outreach action (NA2) in the NEG Federation will coordinate and augment all these individual activities. Instruments like websites (in all seven languages) and mailing lists will be extensively used. The NEG partner meetings will be enlarged to workshops and will be held regularly and rotate over the participating countries. Such workshops will be used then to attract other possibly interested user communities from science, industry and government. Moreover scientific and industrial exhibits and

conferences will be used to present talks and papers to display the EGEE project and raise interest among the visitors of such events.

**South-East Europe**: The South East European Federation consists of 5 countries including Bulgaria, Cyprus, Israel, Greece and Romania. EGEE SEE area countries have considerable needs for dissemination, training and outreach, which will enable their smooth integration with the rest of Europe. The agreed cooperation model in the region is the geographically distributed one, i.e. the partners in the different countries have agreed to share the different activities and responsibilities, while Greek Research and Technology Network (GRNET) will be coordinating the overall effort. The proposed work will be covered by EGEE-funded complemented by partner's unfunded efforts from their national projects i.e. Bulgarian Grid consortium, Cyprus Grid (CyGrid), Greek National effort (Hellasgrid Task Force), Isreali Academic Grid (IAG) and Romanian Grid (RoGrid),
GRNET has a key role in Greece and being both the Hellenic National Research and Education Network (NREN) and the coordinating partner of the Hellasgrid Task Force, which is a national consortium with main objective to coordinate and promote the adoption of Grid technologies in Greece. Hellasgrid Task Force partners have active role in the FP5 IST CrossGrid project. GRNET has also played a catalyst role for the development of the region and has significant experience and established mechanisms for dissemination, outreach and training through pioneering efforts and projects such as SEEREN and Eumedconnect. SEEREN www.seeren.org stands for South-East European Research Networking and is 5th framework IST accompanying measures project working on the establishment of a research networking basis, which is vital for the further deployment of the Grid middleware.
SEEREN has already established a human network holding various workshops and promoting awareness of Grid technologies in the region. As a consequence the South East Grid eInfrastructure Development proposal (SEE-GRID) www.see-grid.org, was submitted in the 6th FP and is expected to cooperate closely with EGEE. Note that SEE-GRID beneficiaries are the non-EGEE funded countries, while the common EGEE-SEEGRID participating countries of the region (Romania, Bulgaria, Hungary and Greece) will provide their experience (also acquired by EGEE) to these countries. Finally, GEANT and Eumedconnect have developed a well-structured human network among the NRENs of both European and Mediterranean countries including participation from Cyprus and Israel.
University of Cyprus has also significant expertise in the dissemination and training activities such as organising conferences, workshops and information days. As a result UCY will be co-organising the "2nd European Across Grid Conference" in Nicosia in cooperation with the GridStart project. Such conferences, workshops and other events will be organised by all SE partners aiming at promoting an integrated research networking and Grid middleware environment forming the so-called "eInfrastructure". In this direction and in cooperation with the European Commission, the first EU eInfrastructure workshop was held in Athens in June 2003 during the EU Greek Presidency (www.eInfrastructures.org) and significant steps have been made towards the formation of a policy group for the adoption of the eInfrastructure in Europe and beyond. This work could be continued inside activity NA5 in cooperation with the next presidencies partly funded by EGEE. GRNET will also assist the organizing committee of the 14th World Congress on Information Technology (WCIT 2004- www.worldcongress2004.org) to organise a Scientific Forum that will run in parallel to the main WCIT event in Athens and bring together the industrial and research partners in Grid technology. The subject selected is related to Grid Services- along with their challenges and perspectives - which is a very hot issue for the research (eScience), the industry (eBusiness-eIndustry) and potentially for the governments (eGovernment). EGEE partners can play a significant role in this conference bringing their eScience views and experience in the tables, and SEE partners will prepare a plan for their better participation and dissemination of results of the conference. GRNET will also host the TERENA Networking Conference 2004 in Rhodos and this will be a significant event that could be combined with EGEE efforts, shifting the gravity to the integrated research networking and Grid environment.
Similarly to dissemination, the EGEE SEE area countries have considerable needs for training sessions and tutorials. Keeping in mind the diverse languages in the area and the difficulties this entails, local support will be needed. We foresee considerable needs inside NA3 for different levels of tutorials on EGEE specifics and also on the necessary background, such as the Globus Toolkit version 2 and 3, OGSI, Condor-G etc. GRNET will be coordinating the regional applications support helpdesk for EGEE SEE and interface to the local helpdesks of the countries. Support will be provided at different levels and feedback will be given to the operations and requirements teams.

In summary, SE partners plan to:

- Plan, organise and actively participate in conferences, workshops and other events promoting awareness of the integrated research networking and Grid middleware environment, as well as bringing closer the research communities with industry
- Closely cooperate with the SEE-GRID project
- Prepare local training sessions and tutorials for the essential grid middleware components
- Participate in the preparation of a European policy committee for the adoption of the eInfrastructure concept
- Prepare web sites in the local languages that will assist the promotion of the EGEE efforts
- Use the established infrastructures and project's human networks such as SEEREN, Eumedconnect and GEANT for the promotion of EGEE

**Central Europe:** The Central European EGEE Federation consists of a number of academic and research centres, out of which several already possess noticeable experience in Grid technology, owing to participation in the Framework 5 CrossGrid, DataGrid, Eurogrid, GridLab, GRIP and GRIDSTART projects. In the past years several members of the Federation have been organizing events oriented on dissemination of Grid technologies, such as the DataGrid conference in Budapest, the Euro PVM/MPI conference in Linz, the Cracow Grid Workshop, the IST 2002 event in Copenhagen, etc. These events often included "Grid tutorials" and/or "Grid open days". Many partners have also organized regular seminars on Grid technology at their institutions (e.g. Cyfronet), and several promoted Grid topics in lecturing and in student theses.
Our dissemination activities in EGEE will be based on this experience and include:

- prepare dissemination brochures on applications which are native to the Federation (e.g. "Grids for flood crisis support");
- during the first two years of the project (2004 and 2005) – organize "Grid open days", oriented towards potential users (including demonstrations) in every country of the Federation;
- develop and support dedicated Web pages.

To support the presented programme of work, 1 FTE will be required; the institutions involved will provide resources which will match EGEE allocations.

**Russia**: The Russian Data Intensive GRID (RDIG) Consortium will undertake the following dissemination activities:

- IHEP - Russian versions of EGEE documents and material; Lead partner for dissemination in scientific institutions of Russian Ministry for Atomic Energy; Support of the corresponding Web site;
- IMPB RAS - Operate the dissemination Web site, based on the existing Joint Centre for Computational Biology and Bioinformatics. Support of computational and information databases in biology and metabases on Internet bio resources. Involve other biological institutions in the RDIG EGEE infrastructure;
- ITEP - Support mail lists. Partner for dissemination in scientific institutions of Russian Ministry for Atomic Energy; operate the corresponding Web site, organization of showcases and presentations in this area;
- JINR - Lead partner for CIS research centres involvement in the EGEE activities. Operate the corresponding dissemination Web site; organize presentations and showcases for JINR Member states. Organize RDIG-EGEE meetings and conferences on distributed computing in science and education in Russia and CIS countries;
- KIAM RAS - Lead partner for dissemination in the area of Computer Science and Applied Mathematics, in particular, in Russian Academy of Sciences. Production of introductory and advanced papers on architecture, common services and other basic GRID services, and its dissemination by means of the Russian public computer press. Translation of basic Grid technologies papers into Russian and making them widely available through Internet. Education of young specialists from Moscow State University for work in the field of Grid technologies. GRID services training courses organization;
- PNPI - Support Web site and Web-based tools for dissemination in institutions in St-Petersburg region, organize presentations and showcases for St-Petersburg region;
- RRC KI - Operate the dissemination Web site in the nuclear physics and energy area in Russia, support mail lists, organize presentations and show cases in this area;
- SINP MSU - Organize presentations and showcases for Higher Education area; Organize RDIG-EGEE management meetings and conferences, Publication of dissemination material and support of corresponding Web site. Organization and support of distributed education courses on GRID.

### 5.A.2.3 Justification of financing requested

The following table outlines effort requested for the first 2 years of the project for NA2 – Dissemination and Outreach. Unfunded effort is matching effort contributed from the partners' existing Grid and related activities. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| Federation | Regional Summary Funded | Regional Summary Unfunded | Partner | Effort Funded per year | Effort Unfunded per year |
|---|---|---|---|---|---|
| | **3.0** | | 32. TERENA | 3.0 | |
| | **2.0** | | 1. CERN | 2.0 | |
| **UK & IRELAND** | **0.5** | **0.5** | 17. UEDIN | 0.5 | 0.5 |
| **France** | | | | | |
| **Italy** | **1** | **0.5** | 31. INFN | 1 | 0.5 |
| **Germany/Switzerland** | **0.5** | **0.5** | 28. FZK | 0.5 | 0.5 |
| **Northern Europe** | **0.5** | **0.5** | 33. VUB | 0.5 | 0.5 |
| **South-East Europe** | **1.4** | **1.4** | 49. CLPP BAS | 0.7 | 0.7 |
| | | | 50. UCY | 0.7 | 0.7 |
| **Central Europe** | **0.33** | **0.33** | 2.GUP | 0.05 | 0.05 |
| | | | 5. BUTE | 0.09 | 0.09 |
| | | | 6. ELUB | 0.09 | 0.09 |
| | | | 8. MTA-SZTAKI | 0.1 | 0.1 |
| **Russia** | **9.08** | **0.82** | 41. IHEP | 0.53 | |
| | | | 42. IMPB-RAS | 0.83 | 0.82 |
| | | | 43. ITEP | 1.05 | |
| | | | 44. JINR | 1.33 | |
| | | | 45. KIAM RAS | 0.8 | |
| | | | 46. PNPI | 0.53 | |
| | | | 47. RRC KI | 1.33 | |
| | | | 48. SINP MSU | 2.68 | |
| **Total** | **18.31** | **4.55** | | | |

**Table D** ***Summary of Effort and Funding Sought***

We believe that this level of effort will be required to ensure the successful management and delivery of this activity. While the effort is highly distributed we believe that EGEE dissemination will require this to ensure we cover as much of the European Union as possible. Although this will clearly present a more complex management challenge, we believe the benefits – in terms of access to widely distributed user communities and languages – will outweigh any difficulties caused. The funding shown in the above table is in general indicative.

In addition to travel and overhead costs, which are included, there will clearly be other costs associated with the dissemination activities and these are summarised in the table below.

| Item | Cost (K€) |
|---|---|
| Publications and other specific costs (TERENA) | 50 |
| Publications and other specific costs (UEDIN) | 20 |
| Publications and other specific costs (CERN) | 85 |
| 4 x EGEE Project Conferences (TERENA) | Met by attendance fee |
| **Total** | **155** |

**Table E** ***Dissemination costs***

The overall costs for the four EGEE Project Conferences will be met by charging a small attendance fee for each five-day event as has been common practice in the DataGrid project.

### 5.A.2.4 Summary

| **Activity number :** | NA2 | **Start date or starting event:** | | | | Project start | | |
|---|---|---|---|---|---|---|---|---|
| **Participant:** | 1 CERN | 2 GUP | 5 BUTE | 6 ELUB | 8 SZTAKI | 17 UEDIN | 28 FZK | 31 INFN |
| **Expected Budget per Participant (K€):** | 485 | 10 | 18 | 12 | 20 | 106 | 200 | 100 |
| **Requested Contribution per Participant (K€):** | 485 | 10 | 18 | 12 | 20 | 106 | 100 | 100 |
| **Participant:** | 32 TERENA | 33 VUB | 41 IHEP | 42 IMPB RAS | 43 ITEP | 44 JINR | 45 KIAM RAS | 46 PNPI |
| **Expected Budget per Participant (K€):** | 833.5 | 93 | 20 | 36.3 | 40 | 53.2 | 33.6 | 20 |
| **Requested Contribution per Participant (K€):** | 439.5 | 93 | 10 | 36.3 | 20 | 26.6 | 16.8 | 10 |
| **Participant:** | 47 RRC KI | 48 SINP MSU | 49 CLPP BAS | 50 UCY | | | | |
| **Expected Budget per Participant (K€):** | 54.4 | 107.2 | 70 | 70 | | | | |
| **Requested Contribution per Participant (K€):** | 27.2 | 53.6 | 70 | 70 | | | | |

**Objectives**

- Disseminate the benefits of the EGEE infrastructure to new user communities ensuring an appropriate message is delivered to each of them.
- Provide a clear path to the new user induction mechanism in order that new contacts may be converted to real users
- Ensure the information tools needed by each audience are available to support the growth of many, varied, individual user communities.
- Identify EGEE's target new user community audiences and applications.
- Plan how and when to approach these user communities.

**Description of work**

The following tasks will be undertaken to meet the above objectives:

1. The operation of a lively, up-to-date and technically informative one-stop web site, which will be progressively extended to address further potential groups of users and languages.
2. The support of mail lists and web based collaborative tools to enable notification, communication and to encourage specialist group formation.
3. The organisation of presentation of talks in collaboration with the other project partners at a large number of relevant meetings of researchers, engineers, biomedical, businesses and governmental meetings, N.B. these are meetings specific to disciplines and potential user communities, e.g. an EGEE representative would talk at a pharmacology meeting.
4. Visits to industrial and research centres, using the EGEE community's combined set of contacts.
5. Organisation of project conferences. Each year there will be one event aimed at bringing the EGEE partners, users and potential users together at a project wide conference. Additionally each year there will be an open event aimed at the wider European community of users and potential users of Grid technology and service. These meetings will provide showcases targeted at attracting and informing decision makers from industry, government and research organisations.
6. The production and dissemination of publications, such as press releases, introductory brochures

and papers. The project will work with DG INFSO providing input to their publications as appropriate.
7. The project will use the Commission concertation activity to maximise cooperation with other related projects that are expected to start in the area of Research Infrastructure, this will be undertaken as part of EGEE activities in NA5
8. An internal website and web based collaborative tools will be provided by CERN to facilitate good internal communications between the partners
9. TERENA will put regular bulletins, using text provided by the partners on the public EGEE web site hosted by TERENA

**Deliverables**

| | | |
|---|---|---|
| DNA2.1 | M1 | (TERENA) Production of Project Information Presentation |
| DNA2.2.1-2 | M1 | (TERENA) External customer facing web site, mailing lists and web based tools |
| DNA2.3.1-2 | M1 | (CERN) Internal project facing web site, mailing lists and web based tools |
| DNA2.4.1-3 | M3 | (TERENA) Dissemination Plan with revisions at M9, and M15 including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| DNA2.5 | M6 | (CERN and TERENA) Production of appropriate printed PR material |
| DNA2.6.1-3 | M6 | (TERENA) Dissemination Progress Reports with revisions at M12 and M18 |
| DNA2.7 | M24 | (TERENA) Final Dissemination & usage Report addressing the issues of public participation and awareness |

**Milestones[7] and expected result**

The major milestones associated with this activity:

| | | |
|---|---|---|
| MNA2.1.1 | M1 | (TERENA) Release of Basic External website, mailing lists and tools |
| MNA2.2.1 | M1 | (CERN) Release of basic internal website, mailing lists and tools |
| MNA2.3.1 | M3 | (TERENA) First version of the project information dissemination plan |
| MNA2.1.2 | M6 | (TERENA) External web site and tools at full capability |
| MNA2.2.2 | M6 | CERN) Internal web site and tools at full capability |
| MNA2.4 | M6 | (CERN) Publicity material production |
| MNA2.5.1 | M6 | (TERENA) First Dissemination Progress Report |
| MNA2.3.2 | M9 | (TERENA) Revision of the Dissemination plan available |
| MNA2.5.2 | M12 | (TERENA) Second Dissemination Progress Report |
| MNA2.3.3 | M15 | (TERENA) Final Version of the Dissemination plan available (including exploitation details provided by project partners) |
| MNA2.6 | M24 | (TERENA) Final Dissemination Report addressing the issues of public participation and awareness |

The expected result of this activity will be the establishment, in conjunction with Networking Activities, NA3 to NA5, of a large, well informed EGEE user community spanning many scientific and industrial disciplines.

[7] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

**Justification of financing requested**

In total approximately 10 EU funded FTEs will be deployed on this activity across Europe per year with commensurate matching unfunded effort being made available by the partners. The costs for events, the website and publicity material are based on the considerable prior experience of the partners when undertaking such activities.

## 5.A.3 Activity NA3 - User Training and Induction

### 5.A.3.1 Objectives and expected outcome of the activity

Creating a large, varied user community across Europe is one of the central objectives of the EGEE I3. Networking Activity 3 – User Training and Induction focuses on meeting the following objectives:

- To produce a portfolio of training material and courses from introductory to advanced user material.
- To use this material to train a wide variety of users both internal to the EGEE consortium and from the external user groups from across Europe who will make use of the infrastructure.
- To ensure an EGEE Team Spirit is engendered early in the project's lifetime.

The outcome of this activity will be twofold: firstly the creation of a well trained group of EGEE users across the European Union and from a wide variety of disciplines, secondly the creation of a set of high quality training material, in a variety of European Languages**.** An overview of the tasks involved is shown in Figure 8**.**

#### *5.A.3.1.1 EGEE User Training*

There will be need for training at a variety of levels:

- There is a need for introductory tutorials on EGEE specifics and on the necessary background, e.g. OGSI and GT3.
- Existing and new users will then need a series of courses to raise their skill level in application development to whatever is required for their research.
- In conjunction with the introductory courses, it is appropriate to help researchers through the stages of becoming users and their first use of EGEE services. This will require properly equipped training rooms and tutoring. We hope to take full advantage of existing local facilities to meet this need.

Tutorials have greatest practical value if users are taught about the steps needed to submit jobs to the Grid. For this purpose, dedicated "dummy" Certification Authorities and restricted dissemination test beds (running the same middleware as the EGEE production system) must be available from the beginning of EGEE. Moreover, since participants at some tutorials will not be experts in Grid computing, high-level user interfaces such as dedicated web portals should be deployed for hands-on sessions. This will exploit experience gained from the INFN Grid and DataGrid with the GENIUS grid portal (https://genius.ct.infn.it).
The initial training material, including tutorials and practical classes will be developed and managed by NeSC (**UEDIN**) with input from other EGEE teams. During each year, courses will be presented at multiple sites and in multiple languages to make them easily accessible. This has been done very successfully by CERN during the DataGrid project.

We will seek to capture at least one run of each training course on video and audio and make them available over the web so that they can be replayed and used by project members at any time.

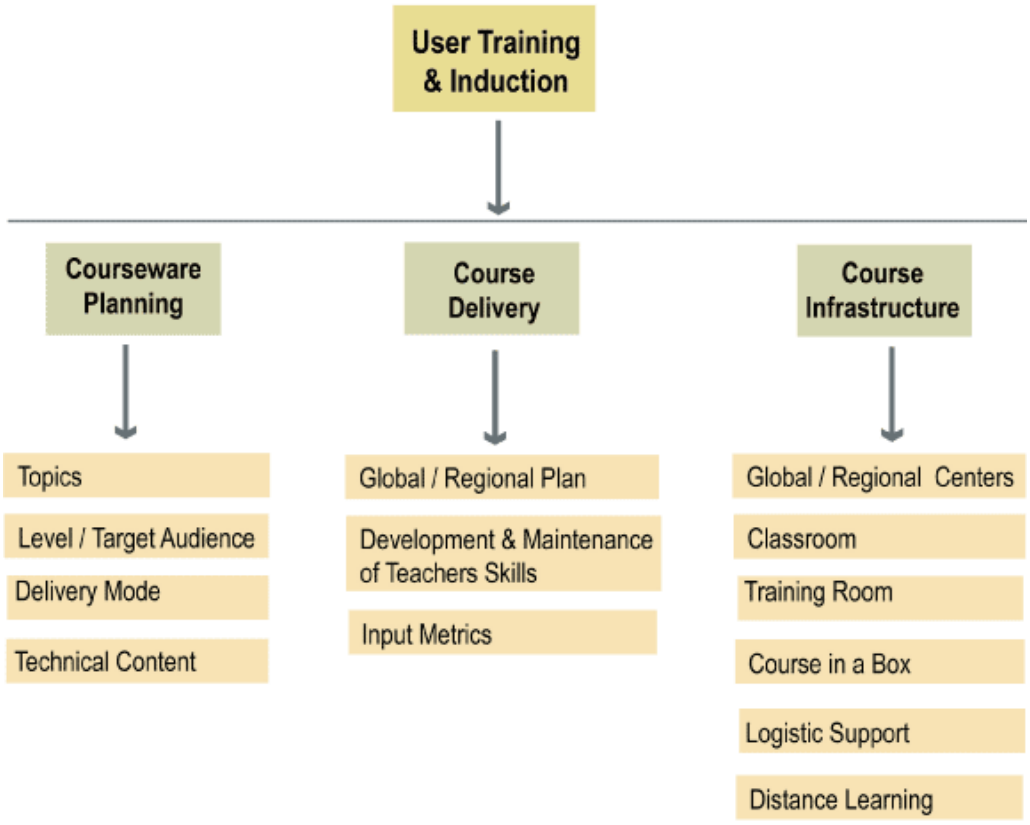



**Figure 8** ***Overview of User Training and Induction task breakdown***

#### *5.A.3.1.2 EGEE Consortium Training*

In addition to user training, this activity must include training for members of EGEE – in other words inward-aimed training. Frequently similar material with a different presentation style will be used for inward and outward training. Normally, course material and practical exercises will be tested with selected audiences mostly drawn from the EGEE team before external use. Details of the planned scale of this activity are given in the user-training section above. This activity should support the following:

1. Helping new recruits to gain necessary skills and knowledge and to extend the skills of the established team.
2. Helping develop an EGEE team spirit and providing an opportunity for focussed discussions on the next steps and progress to date at the Technical Activity specific Retreats.

| Course Type | Average Attendance | Course Requirements | Number per Year |
|---|---|---|---|
| Induction | 50 | 2 Day, Web Access | ≥ 10 |
| Application Developer Training | 25 | 4 Day, Workstations | ≥ 8 |
| Advanced Courses | 25 | 5 Day, Workstations | ≥ 2 |
| Technical Activity specific Retreats | 30 | 2 Day | ≥ 6 |

**Table F** ***Training course types for Activity NA3***

### 5.A.3.2 Participants

There are 22 partners in total involved in NA3. The activity will be led by the UK National e-Science Centre (NeSC) who will represent the UK & Ireland region. The following regions will also be represented in this activity: Central Europe, Germany & Switzerland, Italy, Northern Europe, Russia, and South East Europe. A short description of each participant and their role in the project is given below organised into regions:

**UK & Ireland**

The University of Edinburgh (**UEDIN**), represented in the project by the UK National e-Science Centre (NeSC) and drawing on the activities and experience of EPCC will be the lead centre for Activity NA3. NeSC (**UEDIN**) will employ a full-time manager responsible to lead the activity. An event coordinator at NeSC will be responsible for coordinating all of the events, and for planning, commissioning and managing those events. Some aspects of this may be delegated to other sites for events in their region or discipline constituency. A core unit of the training team will be at the lead site. There will be trainers and user-support teams at other sites, to gain languages, to improve accessibility, and to have a breadth of representatives on which all of these activities are built.
NeSC (**UEDIN**) will take responsibility for managing the formation and operation of the full training team, drawing on capabilities in various user communities and on existing national and regional training and outreach centres. This will include negotiating agreements with other sites to provide training, and oversight of that training to ensure the quality of training services. NeSC will manage the schedule of EGEE training and outreach and liaise closely with the lead partners of NA2 and NA4.
For each training event it will arrange planning, development, staffing, registration and programmes. It will also liaise with the Operations, Support and Management team to ensure users are correctly directed to the appropriate support mechanisms.
The NeSC (**UEDIN**) team already runs approximately 50 training, dissemination and outreach events per year. The EPCC team have extensive and leading roles in FP5 Projects, e.g. GRIDSTART, and in training, access and industrial outreach, e.g. TRACS2000. EPCC and NeSC have taken a leading role in developing Grid middleware for data access and integration via the Grid, e.g. the OGSA-DAI software released in conjunction with GT3. They will draw on these experiences to lead the training, event scheduling, event management and industrial dissemination. This will include organising training material and overseeing the training and outreach events.
NeSC's (**UEDIN**) main technical role will be to develop the courses and supporting material. To do this, they will expect specialist help from other EGEE teams, who will be expected to provide technical information and documentation, and some presentations. Edinburgh will take regional responsibility for outreach and dissemination for the UK and Eire.

**Central Europe**

The Central Europe region will be represented by nine organisations in NA3 (**GUP**, **UNIINNSBRUCK**, **CESNET**, **BUTE**, **ELUB**, **MTA SZTAKI**, **ICM**, **PSNC** and **II-SAS**) that consist of a number of academic and research centres, out of which several already possess noticeable experience in Grid technology, owing to participation in the Framework 5 CrossGrid, DataGrid, Eurogrid, GridLab, GRIP and GRIDSTART projects. In the past years several members of the Federation have been organizing events oriented on dissemination of Grid technologies, such as the DataGrid conference in Budapest, the Euro PVM/MPI conference in Linz, the Cracow Grid Workshop, the IST 2002 event in Copenhagen, etc. These events often included "Grid tutorials" and/or "Grid open days". Many partners have also organized regular seminars on Grid technology at their institutions (e.g. Cyfronet), and several promoted Grid topics in lecturing and in student theses.
Our NA3 activities in EGEE will be based on this experience.
We plan to:

- include Grid technology in academic lectures and M.Sc./Ph.D. theses at the technical universities of Cracow, Brno, Budapest, Innsbruck, Linz, Poznan and others, organize dedicated Grid seminars for researchers at every institution participating in the Federation;
- prepare tutorials on layered software oriented towards interactive applications and organize dedicated training workshops (several per year) for students and potential users;
- during the first year of the project (2004) - develop dedicated training center(s) in one or two partner countries, serving the whole community;

- prepare dissemination brochures on applications which are native to the Federation (e.g. "Grids for flood crisis support");
- during the first two years of the project (2004 and 2005) – organize "Grid open days", oriented towards potential users (including demonstrations) in every country of the Federation;
- develop and support dedicated Web pages.

**Germany & Switzerland**

**FZK** is the largest non-commercial science and engineering institution in Germany and will represent Germany & Switzerland in NA3. Regarding user training and induction, the centre has an impressive infrastructure at disposal for close cooperation with industry, universities and institutions of higher education. For this purpose FZK operates a training centre and it is envisaged to offer EGEE related courses and tutorials on a regular basis in order to promote the use of the EGEE infrastructure in Germany. The funded EGEE activity will take care of the training and induction of German users by:

- Localization of EGEE related didactic material;
- Presentation of EGEE training and course material.

All activities will be performed in close collaboration with the German Grid User Support Centre and NeSC. A Web portal will be installed and supported to serve as a single point of contact for the German Grid community and all other interested parties.

**Italy**

**INFN**, who will represent Italy in NA3, has a long tradition of dissemination and training, dedicated both to the scientific community and to the general public. For several years INFN has had a Technology Transfer Committee (http://www.infn.it/ctt) which is responsible for demonstrating and communicating to society (especially schools and industry), the scientific results achieved by the INFN activities and the possible spin-off activities. Along with the Technology Transfer Committee, INFN has managed a Committee for the Transition to the New Computing Technologies (see http://www.infn.it/cntc), which has periodically organized training courses and demonstration events. This activity has now been taken over by the INFN Grid project. Finally the INFN press and dissemination office organize press releases and participation in major exhibitions.
INFN intend to build upon their existing successful Grid dissemination activities at both national and international level which have concerned the organization of several tutorials and training sessions, the development of the World Grid demo for DataTAG at the IST and Supercomputing 2002 conferences and the creation of the GENIUS web portal (see https://genius.ct.infn.it), a high level interface to the DataGrid middleware (and DataTAG GLUE's) developed in conjunction with NICE.
The activities foreseen in the context of NA3 will concentrate on:

1. The organization of dedicated tutorials and training sessions all over Italy in order to publicize the benefits of the EGEE grid infrastructure to industry, government and other sciences taking part in the IG-BIGEST initiative; this will include the production of documentation and all needed dissemination material; subject to EGEE funding, INFN Grid can contribute to support also the EGEE participation to general European or international events.
2. The set up of an EGEE separate test bed in Italy for demos, still running the official middle-ware released within the project, fully dedicated to dissemination activities to be used during the tutorials and training events and by application users. This will be normally supported during working hours and extensions can be negotiated. It is assumed that other EGEE partners will take the responsibility of providing resources and support for this test bed outside Italy to gain a European dimension.
3. The development, installation and maintenance of the GENIUS grid portal on the dedicated EGEE demo test bed in order to help new users to get started. INFN Grid will provide unfunded efforts with Nice to keep the evolution of this portal in line with the evolution of the EGEE middleware and LHC experiments grid application layer. In addition, subject to contributions from partners of other sciences, INFN grid will provide expertise to allow them to easily start designing high level front-ends for their scientific applications.

**Northern Europe**

The networking activity for the Northern European Grid (NEG) Federation is a challenge because of the variety (seven) of very different languages and cultures. As the NEG Federation started prior to, and independent of, the EGEE initiative some measures have been taken already to improve communication and dissemination among the NEG partners. Web sites and mailing lists have been established and NEG partner meetings have been organised. These measures are in addition to similar activities going on within the countries in the context of national grid activities; DutchGrid, EstGrid, NorduGrid and SweGrid have organised meetings, conferences, tutorials etc. and website and mailing lists exist also at a national level.
Within the NEG Federation, who will be represented within NA3 by **KU-NATFAK** there will be an increasing need of training at various levels. Use will be made of the tutorials which will be prepared by NeSC (**UEDIN**) for the introductory training courses but those courses will have to be translated into the various languages and be maintained. More specialised courses will be developed within the NEG Federation itself depending on the requests from the users and developers.
As many of the active participants from the NEG Federation are also university professors we have the plan to develop some academic classes at introductory and more advanced level. This material will then be disseminated among the other partners in EGEE for further use.
To achieve coordination among the various NEG efforts, which are spread over seven countries, appropriate experts from all NEG partners will be delegated into a NEG networking group. This group will coordinate dissemination and outreach (NA2), training and induction (NA3) and application identification and support (NA4) within NEG and towards the whole of EGEE.

**Russia**

Russia will be represented in NA3 by six organizations – **IHEP**, **IMPB RAS**, **ITEP**, **JINR**, **PNPI**, and **RRCKI**. Each of the organizations will take a specific role as outlined below:

- IHEP - Training and Induction of users from Moscow region; Prepare user training and course material, support and distribute it;
- IMPB RAS - Produce training and course materials on GRID in biology. Training and induction of users in biology;
- ITEP - Produce training and course material, training of users from Russian nuclear centers;
- JINR - Organize the Grid tutorials, training and education for EGEE user community in CIS countries. Support of distributed courses on the project;
- PNPI - Provide user training and GRID tutorials for St-Petersburg region;
- RRC KI - Training of the users for CA and Security, prepare training and course material, support distributed course on these topics.

**South East Europe**

**GRNET** is the partner coordinating the South East European regional efforts and will lead the South East Europe (SEE) effort within NA3. Two further SEE partners are represented in NA3 – **TAU** and **ICI**.
GRNET is coordinator of the HellasGrid Task Force and operate the central cluster and storage area network in Athens as well as the National Research and Education backbone network. In NA3, GRNET will undertake the overall coordination of the training and induction activities in the region. This will involve production and localisation of training material and courses from introductory to advanced user material and interaction with the other SEE and EGEE partners for feedback and improvements. GRNET will be responsible for training in Greece and Cyprus and will provide the appropriate hardware infrastructure and facilities (course infrastructure), where the courses will be delivered.
TAU is a major Israeli University and is coordinating the Israeli grid collaboration (Israel Academic Grid – IAG) together with the IUCC, Israel's NREN. The IAG will be responsible for technical aspects and coordination of Grid related activities in Israel. In NA3, TAU will develop the necessary skills in order to provide a series of training sessions in Israel, first to the HEP users and then to other user groups in the IAG. Feedback and interaction between other training teams will be a priority.
ICI, the National Institute for Research and Developments in Informatics based in Bucharest, is the coordinator of the Romanian Grid Consortium (RoGrid). In NA3 they will provide the corresponding course infrastructure and material in order to accommodate training sessions in Romania and Bulgaria covering the

RoGrid partners and BGConsortium. Again, feedback and interaction between other training teams will be a priority.
In summary, the EGEE SEE area countries have considerable needs for training sessions and tutorials. Keeping in mind the diverse languages in the area and the difficulties this entails, local support will be needed. We foresee considerable needs for different levels of tutorials on EGEE specifics and also on the necessary background, such as OGSI, and GT3.

### 5.A.3.3 Justification of financing required

The following table outlines effort for the first 2 years of the project for NA3 – User Training and Induction. Effort shown as "Unfunded" is matching effort contributed from the partners' existing Grid and related activities. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%. Both funded and unfunded effort committed to the project will be subject to reporting to the European Commission. This table differs from those showing effort elsewhere in the project as, in the context of training, it is possible to use bursts of effort in a location, and to achieve presentation of courses with a few person weeks of effort. For example, the typical arrangement will be that NeSC (**UEDIN**) will produce (revise) a course, or set of courses. Then a team in a particular country will translate (revise) that material in the local language, schedule and arrange local presentations, and conduct the courses with support from the NeSC team when it is required. This means that, in contrast with software engineering and operations, sustained engagement is not necessary. Consequently, it is an advantage to plan to use small units of labour resource in a large number of locations, as this will reach a large user community. We also take into account the different employment costs in these different countries.

| No. | Partner | Funded Effort (Person Months) | Unfunded Effort (Person Months) | Funding (K€) |
|---|---|---|---|---|
| | **UK & Ireland** | | | |
| **17** | UEDIN (NeSC) | 72 | 72 | 699 |
| | **Central Europe** | | | |
| **2** | GUP | 2.4 | 2.4 | 20 |
| **3** | UNIINNSBRUCK | 2.4 | 2.4 | 10 |
| **4** | CESNET | 20.6 | | 40 |
| **5** | BUTE | 3.8 | 3.8 | 18 |
| **6** | ELUB | 4 | 4 | 18 |
| **8** | MTA SZTAKI | 12 | 12 | 48 |
| **11** | ICM | 6.4 | 6.4 | 26 |
| **12** | PSNC | 6.4 | 6.4 | 26 |
| **13** | II-SAS | 23 | | 45 |
| | **Germany & Switzerland** | | | |
| **28** | FZK | 24 | | 100 |
| | **Italy** | | | |
| **31** | INFN | 12 | 12 | 100 |
| | **Northern Europe** | | | |
| **34** | KU-NATFAK | 16 | 16 | 100 |
| | **Russia** | | | |
| **41** | IHEP | 32.4 | 0 | 26.6 |
| **42** | IMPB RAS | 4.8 | 4.8 | 8 |

| No. | Partner | Funded Effort (Person Months) | Unfunded Effort (Person Months) | Funding (K€) |
|---|---|---|---|---|
| **43** | ITEP | 16.1 | | 13.6 |
| **44** | JINR | 15.6 | | 12 |
| **46** | PNPI | 12.7 | | 10 |
| **47** | RRC KI | 12.7 | | 10 |
| | **South East Europe** | | | |
| **51** | GRNET | 30 | | 120 |
| **52** | TAU | 8.75 | 8.75 | 70 |
| **53** | ICI | 35 | | 70 |
| | | | | |
| | **Total** | **373.05** | **150.95** | **1,590.2** |

**Table G *Summary of Effort and Funding Sought*[8]**

| | Course Type | | | |
|---|---|---|---|---|
| | **Induction** | **Application Developer Training** | **Advanced Courses** | **Technical Activity Retreats** |
| Number per Year | 10 | 8 | 2 | 6 |
| Average Attendance | 50 | 25 | 25 | 30 |
| Course Length (days) | 2 | 4 | 5 | 2 |
| Course Equipment | Web Access | Workstations | Workstations | |
| Num. of EGEE Staff | 2 | 2 | 2 | 2 |
| Num. of non-EGEE Experts | 0 | 1 | 3 | 0 |
| Course materials and other specific costs | €64,000 | €41,600 | €12,400 | €14,400 |

**Table H *Costs for EGEE Tutorials and Training Courses***

The above table shows the costs which are included in NeSC's (**UEDIN's**) costs for undertaking the large number of training events described below. We have sought to capitalise on existing facilities operated by EGEE partners around Europe – the facilities rental cost is therefore zero. Considerable travel costs will be incurred, estimated at €90,000. These are included in NeSC's costs. The overall total in addition to effort for the training activity is therefore estimated to be €99,000.

[8] The cost of employing personnel varies for each partner

### 5.A.3.4 Summary

| **Activity number :** | NA3 | **Start date or starting event:** | | | Project start | | | |
|---|---|---|---|---|---|---|---|---|
| **Participant:** | | **2 GUP** | **3 UINNSBRUCK** | **4 CESNET** | **5 BUTE** | **6 ELUB** | **8 MTA SZTAKI** | **11 ICM** | **12 PSNC** |
| **Expected Budget per Participant K€** | | 20 | 10 | 80 | 17.5 | 17.5 | 41 | 26 | 26 |
| **Requested Contribution per Participant K€:** | | 20 | 10 | 40 | 17.5 | 17.5 | 41 | 26 | 26 |
| **Participant:** | | **13 II-SAS** | **17 UEDIN** | **28 FZK** | **31 INFN** | **34 KU-NATFAK** | **41 IHEP** | **42 IMPB RAS** | **43 ITEP** |
| **Expected Budget per Participant K€:** | | 90 | 684 | 200 | 100 | 93 | 53.2 | 8 | 27.2 |
| **Requested Contribution per Participant K€:** | | 45 | 684 | 100 | 100 | 93 | 26.6 | 8 | 13.6 |
| **Participant:** | | **44 JINR** | **46 PNPI** | **47 RRC KI** | **51 GRNET** | **52 TAU** | **53 ICI** | | |
| **Expected Budget per Participant K€:** | | 24 | 20 | 20 | 240 | 70 | 140 | | |
| **Requested Contribution per Participant K€:** | | 12 | 10 | 10 | 120 | 70 | 70 | | |

**Objectives**

- To produce a portfolio of training material and courses from introductory to advanced user material.
- To use this material to train a wide variety of users both internal to the EGEE consortium and from the external user groups from across Europe who will make use of the infrastructure.
- To ensure an EGEE Team Spirit is engendered early in the project's lifetime.

**Description of work**

The tasks associated with this Networking Activity will focus around three main areas:

- Production of training material from introductory to advanced.
- Teaching of this material to the EGEE user community.
- Teaching of this material internally within the EGEE consortium.

In the first two years of the project we expect to run over forty training courses for over 1500 people from across the EGEE consortium and user communities. We will have a particular focus on hands-on training to ensure early usage of the EGEE infrastructure.

Each course will be followed up by recording participant and provider evaluations. These will be analysed and used to direct course improvements. Summary statistics will be published as Key Performance Indicators every 3 months.

| **Deliverables** | | |
|---|---|---|
| DNA3.1.1-3 | M3 | Training Plan with revisions at M9 and M15 |
| DNA3.2 | M6 | Initial Training Course Material (continuously revised thereafter) |
| DNA3.3.1-3 | M9 | Training Progress Report with updates at M15 and M24 |

| **Milestones[9] and expected result** | | |
|---|---|---|
| MNA3.1 | M3 | Planning phase complete – DNA3.1.1 delivered |
| MNA3.2 | M6 | First user training material and induction course available |
| MNA3.3 | M12 | First external review of User Training and Induction with feedback |
| MNA3.4 | M24 | Second external review of User Training and Induction with feedback |

The outcome of this activity will be twofold: firstly the creation of a well trained group of EGEE users across the European Union and from a wide variety of disciplines, secondly the creation of a set of high quality training material, in a variety of European Languages**.**

**Justification of financing requested**

In total funding for 196 person months of effort is requested along with some additional budget to run training events across Europe. Having run over 50 training events over the past year, NeSC (**UEDIN**) has considerable experience in running such events and managing their costs to ensure best value for money. While we have tried to focus the production of much of the training material in one place, we have also taken the approach of involving partners from across the consortium in this activity. We believe this will greatly improve the opportunity for training material to be translated and taught throughout Europe.

[9] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

## 5.A.4 Activity NA4 - Application Identification and Support

### 5.A.4.1 Objectives and expected outcome of the activity

Activity NA4 focuses on the identification and support of early-user and established applications for use on the EGEE infrastructure. It has the following objectives:

- To identify through the dissemination partners and a well defined integration process a portfolio of early user applications from a broad range of application sectors from academia, industry and commerce.
- To support development and production use of all of these applications on the EGEE infrastructure and thereby establish a strong user base on which to build a broad EGEE user community.
- To initially focus on two well-defined application areas – Particle Physics and Life sciences.

The expected outcome of the activity will be the establishment of a broad portfolio of applications across a wide range of sectors suited to execution on the EGEE infrastructure meeting the needs of a broad collection of user groups from many sectors across Europe as illustrated in Figure 9 (note the timeline for the introduction of each application domain is purely illustrative).

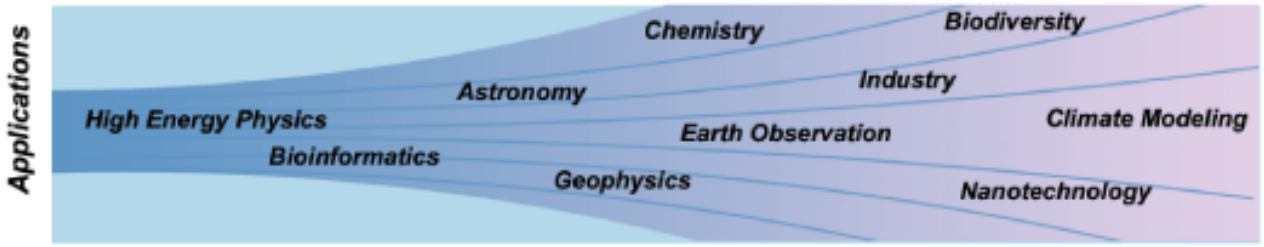



**Figure 9** ***Schematic illustration of the broadening portfolio of scientific communities using the European Grid infrastructure over the four year programme of which EGEE represents the first two years. The applications names are purely illustrative.***

#### *5.A.4.1.1 Identification of existing and new application sectors*

Building upon considerable existing experience of the state of the Grid applications sector in Europe, the partners in this activity will work closely with the dissemination and training teams to identify and qualify suitable existing and new applications domains from across Europe, using a well defined integration process. The selection process will focus on:

- Identification of suitable user sectors and their applications who have a demonstrated need to make use of the EGEE infrastructure in cooperation with the dissemination and training teams.
- Establishing contact with suitable users within these sectors who are keen to commit time and effort to understanding the benefits of the infrastructure to their particular application(s).
- Undertaking feasibility studies to understand the complexity of application migration to be useful on the Grid infrastructure.
- Training, with the direct help of Activity NA3, and support, with the direct help of Activity SA1 to these new domains.

Where new application domains are identified we will focus on the production of one of more pilot applications from these domains to encourage the active participation of users who can be convinced, through these early success stories, of the benefits that the EGEE infrastructure will bring to their particular field.

We are keen to ensure the widest possible spread of application sectors and will in particular focus on the outreach required to bring new applications from the industrial and commercial sectors into the Grid domain. We see this as key to establishing the widespread uptake of Grid technologies across Europe. For industrial applications we will seek applications from:

- European consortia of SMEs;
- Large companies involved in projects using collaborative work intensively;

- Companies willing to test the coupling of their own computing facilities with the EGEE production facility.

For the industrial and services companies, the objective is to demonstrate the economic advantages of the GRID notably in terms of time to market and return on investment. This will be the object of a detailed study of the different uses of the GRID infrastructures (data-computing, applications on demand etc.) in order to propose associated business models and services. The result of this work will depend also on the availability of administration tools, especially for accounting, billing and monitoring.

#### *5.A.4.1.2 Pilot applications*

In order to establish an application portfolio for EGEE in the early stages of the I3 we will focus on the application needs of two committed groups of users: the Particle Physics community, in particular the 4 LHC experiments, and the Biomedical community.
The need for a reliable, robust, production quality Grid infrastructure for these early-user communities has already been established in the pioneering work of the EU DataGrid Project and other national initiatives across Europe over the past 3 years. Considerable work has already taken place to encourage the creation of Grid-enabled applications in these two sectors and we intend to build on this.

##### 5.A.4.1.2.1 HEP Physics

With the onset of data production from the LHC project at CERN likely to take place within the lifetime of the EGEE I3, Particle Physics has a clear need to take advantage of the EGEE infrastructure as quickly as possible. We have already shown the applicability of the Grid to meet the user requirements of this area of science – however, to date a robust infrastructure, suited to real data production has been lacking. EGEE will provide this environment, and we will build on the existing applications work undertaken by DataGrid and other Grid projects to ensure applications are available for this community in the early stages of the EGEE infrastructure roll-out. This work will be led by a team at CERN who are already deeply committed to the use of the Grid for LHC experiment applications. Very large benefits will derive from the complementarity of EGEE and of LCG, the mission-oriented LHC Computing Grid project (LCG), coordinated by CERN and involving the worldwide HEP community participating in the LHC experiments.

##### 5.A.4.1.2.2 Biology/Health Applications

The Biomedical community has rapidly established itself as a key user of Grid technology throughout Europe. Many suitable applications exist in this sector, which covers a broad applications domain from genomics through to medical imaging and healthcare applications. In the same way as with the Particle Physics community we will build on the work undertaken to date to ensure applications are available for life science researchers across Europe in the early stages of EGEE. This work will take as a focal point a centre of excellence in France but will seek to establish a broad community of bioinformatics application users from across Europe. In particular we will seek to make early links to the healthcare community through the HealthGrid association.
NA4 will undertake the following specific activities with these two communities:

- Identification of current applications portfolios;
- Selection of a base applications portfolio for early use on the EGEE infrastructure;
- The definition of a common application interface via generic use cases and requirements;
- Support to the development community to migrate applications to the EGEE infrastructure;
- Early feedback to the EGEE development activities to ensure EGEE developments meet the immediate needs of established user communities;
- Evaluation of grid impact on application performances.

It is our intention that suitable applications are identified and migrated to the EGEE infrastructure in time for its first release and so that these applications, and their associated success stories, can be used directly in the dissemination and training activities outlined in the preceding Networking Activities.
The European DataGrid project has focussed on three initial applications areas: Particle Physics, Bioinformatics and Earth Observation. Each of these areas has successfully demonstrated the applicability of the Grid approach to their research needs. The project is currently looking at common requirements for high-level Grid services with a view to future common high-level grid middleware. Each application area is mapping a number of high-level use cases to the initial use cases defined by DataGrid. The aim is to produce a first document that will constitute a solid foundation for this activity by identifying common areas and points of divergence.

The experience of DataGrid and other FP5 projects have shown the relevance of the grid paradigm for Biomedical sciences at a prototype level. The next logical task is to harvest biologically and medically relevant results in a grid environment.

#### 5.A.4.1.2.3 Objectives and expected outcome of the pilot activities

The main objectives of the HEP activity are to encourage and help the HEP community to migrate their applications to the LCG/EGEE infrastructure, and to provide ongoing feedback to the development activities to ensure that the needs of the HEP community are met. This latter activity will include the processes of requirements gathering and design of the grid services. In addition there will be work on the definition of a common generic application interface for application-independent grid functions, this being accomplished together with the other application groups. Conversely it is expected that the Architecture and middleware teams of EGEE will take advantage of the substantial experience accumulated by the HEP community in the initial definition of the EGEE architecture. The LHC Grid blueprint architecture (ARDA), for instance, will be used by the architecture team as an important input for their work.
The objectives of the BioMed activity are to identify a portfolio of applications in the area of Biomedical sciences, to select a subset for an early deployment on the EGEE infrastructure, to contribute to the definition of a common application interface with the other research fields, to encourage and help the Biomedical community to migrate applications to the EGEE infrastructure and to provide early feedback to the EGEE development activities to ensure EGEE progress meets the needs of the Biomedical community.
To identify a portfolio of applications, the activity will build on existing projects and consortia focussed on the application of grid technology to Life sciences. Within DataGrid already, about 12 genomics and medical imaging applications are being prototyped on the DataGrid testbed, half of them originating from CNRS laboratories. Another portfolio of more than 30 Biomedical grid applications was identified by the HEAVEN consortium. Through the HealthGrid association (http://www.healthgrid.org) gathering potential actors of a grid for health, members of the Biomedical community will be encouraged to propose the deployment of applications on EGEE infrastructure. The application selection process will take into account their technical requirements in terms of grid services, the scientific interest and the support committed by the institutes involved in terms of infrastructure and manpower.
Care will be taken to include in EGEE grid facility sites having adequate support for middleware installation and maintenance.
Care will also be taken to select a panel of applications relevant to the different usages of the grid from grid computing to data management. The scientific focus of the different applications should also be complementary. As much as possible, applications will address the five levels (molecule, cell, tissue, individual, population) relevant to biomedical science.
To reach the first milestone MNA4.2 (first applications migrated to EGEE infrastructure) at Project Month 6, early deployment of 2 or 3 initial applications will start at the beginning of the project.
After the applications have been deployed, their results will also be evaluated. This evaluation is of extreme importance to provide convincing showcases for the promotion of grid technology in the Biomedical community.
This first task will be led by Universidad Politecnica de Valencia for Medical and Centro Nacional de Biotecnologia for Bioinformatics applications and will be shared by the three institutions (UPV, CNB/CSIC, CNRS).
The identification of new applications, their selection and the evaluation of their gridification is a process that will keep going on during the project and require the equivalent of 1 FTE.

### *5.A.4.1.3 Generic Applications*

Although High Energy Physics and Biomedical Applications, discussed above, are the two most important “customers” of the EGEE infrastructure, and their feed-back is essential for the re-engineering and fine tuning of the middle-ware services, the success of the Project strongly relies on the use of the continental infrastructure also by other different applications, belonging both to science and industry realms, which we address here as generic applications.
On this purpose, we will also seek to cooperate with existing Framework 5 funded projects to deploy their applications on the EGEE infrastructure. For example, the CrossGrid project has deployed and extended the EU DataGrid software for interactive compute and data intensive applications such as simulation and visualisation for surgical procedures, flooding crisis, team decision support systems, and air pollution combined with weather forecasting. These application areas and user communities are obvious candidates for extending the scope of applications that will be early exploiters of the EGEE Grid infrastructure.
We will then undertake the following specific activities:

- organization of dissemination and tutoring events to spread the grid paradigm and attract people from science and industry. These activities are under the responsibility of the NA2/NA3 teams, with which a close liaison will be established;
- selection of applications to be ported onto the EGEE infrastructure, in a gradual and orderly manner;
- support the development community to migrate their generic applications to the EGEE infrastructure using high level user interfaces such as grid portals;
- evaluation of grid impact on generic application performances.

#### 5.A.4.1.3.1 Objectives and expected outcome of the generic applications activity

The objectives of this activity are to identify a portfolio of generic applications in the area of science and industry to be deployed on the EGEE infrastructure, to use and contribute to the definition of a common application interface with other research fields, to encourage and help scientific and industrial communities to easily migrate their applications to the EGEE infrastructure using high level user interfaces such as grid portals, and to provide feedback to the EGEE development activities to ensure EGEE progress meets the needs of a community as vast and diverse as possible.

#### 5.A.4.1.3.2 Identification of a portfolio of applications and selection of a subset

The integration process of the generic applications onto the EGEE infrastructure will follow a multi-step well-defined procedure, in order to guarantee efficiency, transparency and accountability. The first contacts that a scientific domain, not yet grid-aware, will experience with EGEE will occur through our dissemination and training activities, described in the sections 5.2A and 5.3A of this Technical Annex. The next steps are described below:

- Selection: The selection process will use the following criteria: scientific interest of the proposed work, with particular emphasis on the grid added-value, coordination of the corresponding community, grid-awareness of this community (with a minimum requirement that a small team followed the EGEE training), dedication of the community to this application, agreement to the various EGEE policies and especially the security and resources allocation policies.
  This selection process will be placed under the responsibility of a scientific and technical panel, with a large diversity. The EGEE applications managers, operation manager, security manager will be ex-officio members of this panel.

- Technical involvement: When a new application will be selected, significant human EGEE resources will be allocated to the integration of this application onto the infrastructure, for a given time period. This team, placed under the responsibility of the Generic application manager will work in very close coordination with the dedicated team coming from the selected application. After this initial period, the support to this community should proceed through the normal user-support group described in section 5.3A.

- Allocation policy: When a new application will be selected, the corresponding VO will be created. The pool of resources, if any, brought by this community will be allocated with full priority at the beginning, to the proposed application, in addition with a fraction of the available resources from other VOs, according to the general EGEE principles set out in section 5.A1. After some time, a fraction of the initial proprietary resources will also be opened to the usage of other communities. This general rule will of course entail some exceptions, mainly in case of industrial/highly confidential applications.

- Measuring/reporting: Significant effort will be devoted to the quantitative assessment of the whole process, as well as of the usage of the human and computing resources in the deployment and production phase. Automatic tools will be used to generate standard monthly reporting of the various activities.

This applications integration will be pursued in a gradual and orderly manner, in order to take the best advantage of the available manpower for the new community's integration and to avoid the risk of generating bad user experiences that could result from lack of proper attention if too many new applications are treated simultaneously.

#### *5.A.4.1.4 Support of the migration of applications to the LCG/EGEE infrastructure*

##### 5.A.4.1.4.1 HEP Applications

The 4 LHC experiments (Atlas, ALICE, CMS, LHCb) each have developed functioning distributed computing systems over the past few years. In the past 2 years they have made good progress in integrating Grid technology into these systems, notably in Europe with DataGrid, DataTAG and Nordugrid software, and in the US with software from the various US projects. The experiments have also produced significant grid software, for example the Alien system of ALICE and the DIRAC system of LHCb. They will continue this work in the context of the LCG project which aims at providing a production service to the experiments. The main experiment applications are currently the generation of vast quantities of simulated data necessary for the preparation of the experiments and LHC start-up in 2007, and their reconstruction and analysis. In addition to this highly organised data production work there is the computing associated with thousands of physicists and engineers all over the world accessing the data for individual analyses. The load characteristics associated with the analysis work are highly variable and will place very special demands on the grid for resource allocation and quality of service.

The principal function of the team of 8 people (see 'funded/non-contracting participants' for group organisation), employed by and based at CERN, will be to work with the 4 LHC experiments, to ensure their requirements are taken into account, to give practical help in interfacing the experiment application to grid services, and to evaluate the performance of the software deployed within the LCG service environment, as well as in pre-production testbeds.

It is foreseen that non-LHC experiments, as they have done in DataGrid, will participate in EGEE. Current examples are US based experiments, BaBar and D0, which are currently taking production data and are basing their medium-term computing strategy on distributed computing resources served by a powerful Grid. These will be supported on a best-efforts basis.

##### 5.A.4.1.4.2 BioMed Applications

Once the applications are selected, the proposing institutes will be invited to carry on with their deployment on the EGEE infrastructure. A significant fraction of the resources allocated to this activity will be devoted to supporting the migration of these new applications. In particular, a team of CNRS engineers will be in charge of providing this support, which involves the organization and the administration of the biomedical virtual organization(s), the interface between application developers and middleware groups, application oriented training and user support. For this task, the CNRS team is expected to work in close relationship with the engineers at Universidad Politecnica de Valencia and CNB/CSIC to share expertise and provide extended user support. Regular meetings by tele- and videoconference are foreseen.
All institutes involved with the applications will be encouraged to dedicate part of their resources to become an EGEE node. Care will be taken to include in EGEE grid facility sites having adequate support for middleware installation and maintenance. Training sessions will be organized in connection with Networking Activity 3.

This task being central to the success of the activity, the equivalent of 4FTE will be dedicated to it, including a CNRS team of 3 engineers and the equivalent of 1FTE from Spanish institutes.

#### 5.A.4.1.4.3 Generic Applications

Leveraging on the experience gained within the DataGrid project, experts of the selected applications will be put in contact with the developers of the GENIUS grid portal in Italy, with stages of a few days (maximum 1 week), in order to learn how to build the graphic user interface between the given generic application and the available grid services. The tools used for this work will evolve according to the developments in the common application software.
As above, the institutes involved with the selected generic applications will be encouraged to dedicate part of their resources to become an EGEE node. Care will be taken to include in EGEE those grid facility sites having adequate support for middleware installation and maintenance. Training sessions will be organized in connection with Networking Activity 3.

### *5.A.4.1.5 Ongoing feedback to the EGEE development activity*

#### 5.A.4.1.5.1 HEP applications

At the beginning of the project, and throughout its lifetime, there will be a continuing dialogue between HEP applications and middleware developers for the processes of requirements gathering , grid service design and the practical evaluation of software for its functionality and performance. Applications will also be part of the testing and acceptance processes for the middleware. We have learned from DataGrid that all of these processes need to be ongoing to avoid 'big bang' effects due to infrequent overall system status reviews.
This ongoing dialogue will be accomplished by HEP applications participation in the architecture, design and system testing groups. To facilitate this dialogue the HEP applications staff will have to work as a coherent team, whilst still maintaining experiment specific support, but looking for commonality in the support and associated tools.

#### 5.A.4.1.5.2 BioMed applications

A clear lesson from DataGrid is the necessity to establish strong and lasting relationships between the end users and the groups developing middleware. This connection requires expertise in middleware technology as well as in biomedical science to be able to correctly transmit the needs of end users in a language and a format understandable by technology developers. Maintaining a lively connection is also time consuming as it requires following the middleware evolution as well as the evolution of the application deployment. Moreover, it is not sufficient to inform middleware developers of user needs. When new services are made available by developers to meet specific requirements, it is important to inform the user community on the availability of these new services and the necessity to test them.
As a result, one FTE from CNRS shared with the other application areas will be dedicated to this task.

#### 5.A.4.1.5.3 Generic applications

During the migration of generic applications to the EGEE infrastructure, a continuous feed-back will be given to the middle-ware developers, especially pointing out missing features. Important developments are expected in the common applications interface which aims at hiding the details of interfacing to grid services from the user. It is expected that important advances will be made as this software is adapted to the needs of the end user in various areas, these resulting from the feedback to the developers of both the common applications interface and the underlying middleware. In addition an aim is to aid the applications to develop application specific interfaces using common tools.

#### 5.A.4.1.6 Common Application Layer Specification

The applications aim to have to have a high level view of services for the basic functions of job management, data management and VO organisation. This is aimed at developing high level API specifications of these services, and also application-independent portals which could be used by applications to interface to these services. HEP applications have participated to such development work both in DataGrid and LCG, and it is foreseen to continue participation in EGEE for the specification and evaluation of such software and tools.
Because of its highly pluridisciplinary vocation and culture, CNRS will actively pursue and enlarge its effort started within DataGrid to define and develop a common application layer by dedicating the equivalent of one FTE shared with the other applications area during the project lifetime. A major issue will be the evolution of this layer to adapt to the needs of industry. Specific requirements for SME's in the area of biotechnology will be collected through the Biopôle Clermont-Limagne

In order to help the interfacing between generic application and EGEE middle-ware and not to re-invent similar solution many times, we will make use, wherever and whenever possible, of the common application layer discussed in the previous sub-sections.

The HEP contribution to this work will build on previous and current work accomplished within DataGrid and LCG. The initial requirements work for applications dates back to May 2002 with the production of the HEPCAL 1, HEPCAL prime and HEPCAL 2 documents specifying basic use cases for HEP data processing. The DataGrid/AWG (Application Working Group) is defining requirements for a high level common application layer based on the needs of HEP, Bio-medicine and Earth Sciences, and is using the HEPCAL document to provide templates for requirements analysis. The DataGrid work also includes an appraisal of the work achieved by the EU funded project Gridlab in defining high level APIs for Grid Services. A requirement summary using all these inputs will be made available at M1.
Within LCG a working group, with representatives from all experiments is working on a blueprint architecture for grid services (ARDA). This will serve as a first input to the EGEE Architecture team. The HEPCAL work is continuing in the framework of the LCG/GAG (Grid Applications Group), developing use cases and requirements for the analysis of physics data. This will also give important input to architecture and design work.

The Biomedical applications contribution will include an analysis from the biomedical perspective of the work done in DataGrid concerning a common application interface.
The Generic applications contribution will include an general analysis of the work done in DataGrid concerning grid portals with special respect to GENIUS.
The formal approval of a requirements document will constitute an internal milestone after Month 1, for usage by the JRA1 group.

#### 5.A.4.1.7 Application Migration

Each LHC experiment will be using software deployed by EGEE on the LCG/EGEE infrastructure for large-scale production and user analysis. This will be of increasing scale throughout the lifetime of the EGEE project.
Evaluations will be made by LCG/EGEE of the performance and efficiency of the EGEE software as used for this work in the areas of job management, data management and VO organisation. Evaluations will also be made of the deployed infrastructure and its stability and performance.
The migration progress report will include a description of the Biomedical and generic applications and an evaluation of the performances achieved.

#### 5.A.4.1.8 Target Application Sector Strategy

The contribution will focus on the strategy of the biomedical sector regarding the selection of applications and their evaluation, the inclusion of biomedical sites in EGEE grid facility, the structure of biomedical virtual organization(s) and the connection to other European projects or national initiatives.
The Generic contribution will focus on the strategy of the generic application sector regarding the selection of applications and their evaluation, the inclusion of generic application sites in EGEE grid facility, the structure of generic virtual organization(s) and the connection to other European projects or national initiatives.

## 5.A.4.2 Participants

### *5.A.4.2.1 HEP Applications*

*CERN (funded and unfunded)*
The 4 posts funded by EGEE will be placed with the CERN EP/SFT group. This group has representatives from all the LHC experiments, including the software architects, and also includes coordinators for several key LCG activities, including the applications area.
CERN will provide 4 FTEs in addition to the 4 FTEs funded by EGEE, giving a team of 8. There are several people already within the LCG project, funded by CERN, working in this area. F. Harris, the DataGrid HEP Applications WP Manager, will form part of this effort for the start-up phase of the EGEE project.
Strong working links with the 4 LHC experiments will be established, and two people will be assigned to each experiment. The team will be managed as a coherent whole allowing some flexibility in support of the experiments and the establishment and execution of common goals. Members of the team will work with the experiments to help define and execute the work programmes associated with integrating the experiment systems with EGEE middleware. They will evaluate the performances obtained on the LCG infrastructure and provide material for the evaluation reports.

Members of the team will contribute to the work on the common application layer specification, liaising closely with the LCG ARDA and GAG activities
It is planned that 80% of the effort of team members will go towards experiment specific activities, and 20% for common activities such as architecture, design, and the production of the EGEE deliverables.

*Russian Institutes*
The planned activities of the participating Russian institutes are as follows:

- IHEP - Management of ATLAS VOs in Russia; Support of ALICE, CMS and LHCb pilot applications; Identification of early users;
- ITEP - Management of LHCb and ALICE VOs in Russia, Support of ATLAS and CMS pilot applications; Identify early users; Introduction of new user communities;
- JINR - Support ATLAS, ALICE, CMS and LHCb pilot applications; Identify early users; Introduction of new user communities;
- PNPI - Support HEP pilot applications (ATLAS, CMS, ALICE, LHCb) for St-Petersburg region, identification of early users;
- RRC KI - Support of ALICE pilot applications. Lead partner for Nuclear Fusion GRID applications in Russia. Identification of early users. Introduction of new user communities;
- SINP-MSU - Management of CMS VO in Russia; Support of ATLAS, ALICE and LHCb pilot applications; Introduction of new user communities;

### *5.A.4.2.2 Bio Applications*

**Funded participants:**

Universidad Politecnica de Valencia,
The UPV will participate with one engineer in the identification of Grid-based medical applications, the validation of the performance of these applications and the support for the migration of applications to the EGEE infrastructure. UPV has a wide experience in the development of advanced healthcare applications (IST-1999-20226, IST-1999-20783, IST-2001-34614, …) and technology transfer (TT@MED, HiperTTN, etc.) involving an important number of hospitals from the Valencian network of healthcare centres. The Valencian region is provided with one of the most important network communication infrastructure between public hospitals (the Arterias Network) and the UPV is in contacts with the Directorate General for Modernization and Research of the Valencian Government to encourage the deployment of Grid-based applications in the public healthcare system. Moreover, the UPV is a nationwide reference in biomedicine with the Network Centre of Biomedical Engineering which involves several research centres and institutes.

CNB/CSIC
CNB/CSIC will contribute 1 EU funded engineer/scientist plus a matching 1FTE that will work closely with the teams at CNRS and the UPV in the activity tasks. CNB will be leading the identification of Bioinformatics applications for Grid migration, cooperating in the support and migration tasks to EGEE infrastructure and finally, the validation of their usefulness and performance. The CNB will collate through the EMBnet/CNB service the participation of the Biocomputing Unit (BCU) and the Protein Design Group (PDG) of CNB. These teams have a broad experience working in International Projects, having coordinated complex EU projects, participating as partners in dozens of them and forming part of large International Consortia such as the European Molecular Biology network (EMBnet) and the US Partnership for Advanced Computer Infrastructure. CNB teams also have close experience encouraging SMEs research activities having promoted already two Bioinformatics spin-offs (Integromics and Alma). The key contribution of CNB participation will be our expertise, which expands a broad blend of biological and computational skills as a result of a sustained record of interdisciplinary activities and collaboration with other organisations.

CNRS
CNRS will create a team of three application developers/users based in geographically close laboratories located in the Rhône-Alpes/Auvergne region. These laboratories have played a major role in the DataGrid biomedical work package and have developed an efficient working relationship. The three engineers will contribute to all the different activity objectives and are expected to be highly mobile. They will act as an application oriented support team for the different groups developing biomedical applications together with the engineers at UPV and CNB. Beside this team, 1 engineer will be dedicated to the identification of applications, the definition of a common application layer and the feedback to EGEE development activity.

Russia :
IMPB RAS - Support of pilot applications in the fields of biomolecular structure reconstruction, molecular dynamics and E-cell project;

**Non-contracting participants:**

HealthGrid association
The HealthGrid association aims at promoting the use of grid technology for healthcare. It gathers representatives of the most active institutes in the area of grids for health in Europe. Its web site is already a reference point for the groups involved or willing to deploy biomedical applications in a grid environment. It will be a very helpful tool to identify applications and to promote the results of application deployment.

Biopôle Clermont-Limagne
Biopôle Clermont-Limagne is one of the largest gathering of SME's in the area of biotechnology in France. Biopôle Clermont-Limagne is already involved in the Rugbi project to develop Bio-informatics services in a grid environment.

University of Tokyo
Research Center for Advanced Science and Technology of the University of Tokyo (Japan) addresses research topics in the area of computer architecture, logic design methodology, asynchronous computing and dependable Computing. Recent developments include bio-informatics in a distributed environment.

#### *5.A.4.2.3 Collaborating projects:*

IM3 project

IM3 is a three-year project (2003-2005) which focuses on the integration of the research in Molecular Imaging and Multimodality in Spain. It comprises 41 partners, each one involving several research groups and several hundreds of researchers. IM3 will contribute as application providers and end-users of the applications. Half of the partners of the network are hospitals, clinics and medical research centres that deal daily with patients and are interested in advanced information technology applications.

#### *5.A.4.2.4 Generic Applications*

A team of two applications developers/users will be based in Italy and also supported by the other partners, in particular the Central Europe Federation, with the specific remit of working to identify general and particularly new applications on the EGEE infrastructure. These two partners are in close contact with many research communities, eager to deploy their applications on the Grid.
In Germany, Fraunhofer-Gesellschaft, the leading organization of institutes of applied research and development in Europe will work together with the partners of NA4 to identify and migrate general and new industrial relevant applications for use on the EGEE Infrastructure. DKRZ provides state-of-the-art supercomputing, data service and other associated services to the national and international scientific community to conduct top of the line earth system and climate modeling. In NA4 the role of DKRZ is identification and adaptation of early user applications from earth system research.
In the Netherlands, FOM will apply to EGEE all the expertise gained within the DataGrid project to support applications coming from earth observations and astronomy.
These participants will be complemented by participants from across the remainder of Europe with a broad remit to identify encourage the use of applications from a number of their local academic and industry sectors.
These funded participants will be complemented by commensurate unfunded effort from each of the above partners and from the collection of national initiatives from across Europe represented by the EGEE I3.

Funded participants:

INFN will lead this effort with a funded allocation of 4 FTE. Central Europe, Germany, Northern Europe with 1 funded FTE each will complement the effort as described above.

Non-contracting participants:
Each funded partner will contribute the same unfunded manpower to the task. In addition, for each selected application, a dedicated team will be identified within that community to start deploying this application on EGEE infrastructure.

#### *5.A.4.2.5 Benefits to the participants and the relevant scientific and industrial community*

The institutes participating to the applications deployed on EGEE grid facility will benefit of the resources made available to them in terms of computing and storage resources. As well, the institutes dedicating resources to EGEE will benefit from the project operational support. While the average utilization of their resources is likely to increase, they will be able to find additional resources on the grid in periods of overload.
The definition of a common application interface will ease the expansion of grid technology in the various communities
As well, the support for migration of applications will help spread the knowledge of grid technology. Indeed, the team of engineers partially funded by EC will propagate its knowledge within a first circle of institutes participating to the project and later on to the larger community of developers deploying the portfolio of selected applications.
Finally, the feedback to EGEE development community will allow the development of services addressing specific needs of each community and as such prepares their future.

#### *5.A.4.2.6 Overall coordination activities*

The EGEE infrastructure opens the perspective of deploying high level bio-informatics and medical informatics services in a stable grid environment. The goal of the activity is to create a core group of institutes pioneering a life science grid and attracting the biomedical community to the grid technology by convincing results. This community being still reluctant to invest in this technology on infrastructures at the European level, EC funding allows the deployment of convincing showcases.
NA4 will create grid awareness inside new communities belonging to science and industry in order to trigger/help/support them to migrate their application onto the EGEE infrastructure making use of high level user interfaces such as grid portals. The identification and deployment of significant use cases belonging to the area of generic applications will be key to large-scale adoption of the grid technology.

**Management**

The role of the NA4 overall coordination is to make sure that:

- The overarching goal of smooth integration into EGEE infrastructure of a wide variety of applications from many scientific fields is successfully reached
- The necessary feedback is timely provided to the Operations and Middleware groups using the Pilot Applications
- Optimum cross-fertilization takes place between the three application domains, including the development of the common application interface.
- Proper reporting of NA4 activities and finances to the EGEE management.

The interaction between NA4 and other related EGEE activities will be facilitated by the presence of the NA4 general coordinator in the EGEE PEB.
Within NA4, the day-to-day operational responsibilities rely on the 3 application managers: HEP, Bio and Generic. All other issues will be dealt with by the NA4 steering committee described below:

**The Steering committee**

The management structure of the NA4 activity is based on a steering committee.
Its composition is formed by the NA4 coordinator, his deputy, the managers of the 3 applications domain (HEP, Bio and Generic) and the EGEE Industry Forum chair. If needed, managers of related activities, (Dissemination/training, Middleware, Operations, Security, Architecture ) will be asked to join some Steering committee sessions.
The role of the steering committee is to discuss and agree on all NA4 strategic issues, receive regular reports from the three application managers, prepare documentation required by EGEE, receive regular report of PEB activities.
The steering committee will normally hold a phone conference every two weeks.
To ensure the whole application process is on track and the various users communities are satisfied, the steering committee meetings will join with the Project Executive Board (described in NA1) on a monthly basis (the frequency of these meetings will be reviewed and adjusted accordingly during the lifetime of the project) and designated members of each community will be invited. The designated members for the pilot applications will consist of the official representatives of the 4 LHC experiments and of two senior members of the biomedical community. For the generic applications, a senior member will be chosen during the integration process.
These enlarged meetings will address overall application strategy issues while the restricted NA4 steering committee will deal with day-to-day management of the activity.

**The Industry Forum**

The Industry Forum will be the contact point between EGEE and the industrial world. Established and managed in the framework of the Application Identification and Support activity NA4, the forum groups together the potential users of the projects results and creates new opportunities of collaboration among people acting in different disciplines and with different roles in the business world.
The Industry Forum members gain the know-how that will put them in a favourable position for the development of new solutions and, in the long run, the commercialisation of value-adding services for a wide set of users (in industry, institutions, commerce etc).
The Industry Forum organises meetings, coordinates on-line discussions, presents live demonstrations where industrial representatives are able to acquire specific knowledge in terms of Grid technology and applications.

| Name | Institute | Role and expertise |
|---|---|---|
| Guy Wormser | CNRS-France | Organiser of the NA4 Industry Forum and EGAAP. |
| Vincent Breton | CNRS-France | NA4 Activity manager. Founder of Healthgrid association. |
| Johan Montagnat | CNRS-France | Responsible of Bio applications in DataGrid. |
| Frank Harris | CERN/Oxford | NA4 HEP Application manager. Responsible of HEP applications in DataGrid. |
| Roberto Barbera | INFN-Italy | NA4 Generic Application manager. Author of the GENIUS grid portal, a widely used user interface to various GRID middlewares |
| Christian Saguez | Ecole Centrale Paris-France | Member of the NA4 Steering committee. Chair of the EGEE Industry Forum. Has developed direct contacts with over 50 large and small companies interested in EGEE |
| Francois Etienne | CNRS-France | NA4 deputy manager. Responsible of DataGrid test bed. |

**Table I Composition of the NA4 steering committee**

**Interfaces with all EGEE activities**

The application sector must interface with basically all areas of EGEE since it represents the end of this complex chain, from middleware to operations, including quality insurance and security. This explains why a special attention has been given to that aspect. To that effect, dedicated personnel has been allocated within NA4 to liaise with its closest neighbours: dissemination and training on one side, middleware and quality insurance on the other.
A full-time person will make sure that the EGEE virtuous cycle dissemination/training/user induction/application deployment proceeds smoothly and will report both to NA2/NA3 and NA4 management.
A strong Verification and Validation team will be charged to produce test cases , starting from the various use cases developed by the two pilot application domains and the other applications, in close contact with middleware and quality assurance teams. They will then run these test cases on the infrastructure and report any problems. This team will be led by CSSI (2 funded FTE) with the help of CNRS (1 funded FTE). Testing suites for the HEP and biomed pilot applications based on presently existing ones developed in the context of DATAGRID will be formally approved at month 1 as an internal milestone and maintained throughout the project.

| Application domain | Partner | FTE per Task(funded) |
|---|---|---|
| Bio | CNRS (22) | 2 |
| | CSIC (56) | 1 |
| | UPV (59) | 0,9 |
| | IMPB RAS (42) | 0,3 |
| HEP | CERN (1) | 4 |
| | IHEP (41) | 0.8 |
| | ITEP (43) | 1.0 |
| | JINR (44) | 0.8 |
| | PNPI (46) | 0.8 |
| | RRC KI (47) | 1.0 |
| | SINP-MSU(48) | 1.0 |
| Generic | INFN (31) | 4 |
| | CESNET(4) | 0,8 |
| | MTA(8) | 0,2 |
| | DKRZ(26) | 0,5 |
| | FhG(27) | 0,5 |
| | FOM(36) | 1 |
| NA3 Liaison | UEDIN(17) | 0,5 |
| Overall Coordination | CNRS(22) | 2 |
| Testing team | CNRS(22) | 1 |
| | CSSI(23) | 2 |

**Table J Effort per task for each NA4 partner**

### 5.A.4.3 Justification of financing requested

The following table outlines effort and funding requested for that effort for the first 2 years of the project for NA4 – Applications Identification and Support. Effort shown in brackets is matching effort contributed from the partners' existing Grid and related activities. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| Partner | Effort funded (and unfunded), in FTEs per year |
|---|---|
| 1-CERN | 4(4) |
| 4-CESNET | 1.6 |
| 8-MTA | 0.2 (0.2) |
| 17-UEDIN | 0.5 (0.5) |
| 22-CNRS | 10 |
| 23-CSSI | 2 |
| 24-CRSA | 2 |
| 26-DKRZ | 1 |
| 27-FhG | 1 |
| 31-INFN | 4 (2) |
| 36-FOM | 2 |
| 41-IHEP | 0.8 |
| 42-IMPB RAS | 0.3 (0.3) |
| 43-ITEP | 1 |
| 44-JINR | 0.8 |
| 46-PNPI | 0.8 |
| 47-RRC KI | 1 |
| 48-SINP-MSU | 1 |
| 56-CSIC | 2 |
| 59-UPV | 2 |
| Totals | 38 (7) FTEs per year |

**Table K Summary of Effort and Funding Sought per partner**

Full details of funding requested for these FTEs is given in the NA4 Summary Table.

### 5.A.4.4 Summary

| Activity number : | NA4 | Start date or starting event: | | | Project start | | |
|---|---|---|---|---|---|---|---|
| Participant: | 1 CERN | 4 CESNET | 8 MTA | 17 UEDIN | 22 CNRS | 23 CSSI | 24 CRSA |
| Expected Budget per Participant (K€): | 800 | 80 | 20 | 94 | 2000 | 377 | 384 |
| Requested Contribution per Participant (K€): | 800 | 40 | 20 | 94 | 1000 | 188.5 | 192 |
| Participant: | 26 DKRZ | 27 FhG | 31 INFN | 36 FOM | 41 IHEP | 42 IMPB RAS | 43 ITEP |
| Expected Budget per Participant (K€): | 186 | 200 | 400 | 388 | 34 | 12 | 40 |
| Requested Contribution per Participant (K€): | 93 | 100 | 400 | 194 | 17 | 12 | 20 |
| Participant: | 44 JINR | 46 PNPI | 47 RRC | 48 SINP | 56 CSIC | 59 UPV | |
| Expected Budget per Participant (K€): | 30 | 33.6 | 40 | 40 | 350 | 334 | |
| Requested Contribution per Participant (K€): | 15 | 16.8 | 20 | 20 | 175 | 167 | |

**Objectives**

To identify through the dissemination partners a portfolio of early user applications from a broad range of application sectors from academia, industry and commerce.
To support development and production use of all of these applications on the EGEE infrastructure and thereby establish a strong user base on which to build a broad EGEE user community.
To initially focus on two well-defined application areas – Particle Physics and Biomedical sciences.
To define common application interfaces and tools

**Description of work**

Building upon our existing experience of the Grid applications domain in Europe we will focus on:

- Identification of suitable user sectors and their applications with a demonstrated need of the EGEE infrastructure in cooperation with the dissemination and training teams;
- Establishing contact with suitable users within these sectors who are keen to commit time and effort to understanding the benefits of the infrastructure to their particular application(s);
- Undertaking feasibility studies to understand the complexity of application migration to be useful on the Grid infrastructure;
- The creation of an Industry Forum;
- Training, with the direct help of Activity NA3, and support, with the direct help of Activity SA1 to these new domains;
- Initially, focus on the application needs of two committed groups of users: the Particle Physics community and the Biomedical community and we will undertake the following specific activities:
    - Identification of current applications portfolios.
    - Selection of a base applications portfolio for early use on the EGEE infrastructure.
    - The definition of a common application interface via generic use cases and requirements;
    - Support to the development community to migrate applications to the EGEE infrastructure;
    - Early feedback to the EGEE development activities to ensure EGEE developments meet the immediate needs of established user communities.
    - Evaluation of grid impact on application performances.

**Deliverables**

| | | | |
|---|---|---|---|
| DNA4.1 | M3 | (CNRS) | Definition of Common Application Interface and Planning Document |
| DNA4.2 | M6 | (CNRS) | Target Application Sector Strategy document |
| DNA4.3.1-3 | M9 | (CNRS) | EGEE Application Migration Progress report with revisions at M15 and M21 |
| DNA4.4 | M24 | (CNRS) | Final Report of Application Identification and Support Activity |

**Milestones[10] and expected result**

| | | | |
|---|---|---|---|
| MNA4.1 | M1 | (CNRS) | Definition of requirements from applications and first version of associated testsuite |
| MNA4.2 | M6 | (CNRS) | First applications migrated to the EGEE infrastructure |
| MNA4.3 | M12 | (CNRS) | First external review of Applications Identification and Support with feedback |
| MNA4.4 | M24 | (CNRS) | Second external review of Applications Identification and Support with feedback |

The expected outcome of the activity will be the establishment of a broad portfolio of applications across a wide range of sectors suited to execution on the EGEE infrastructure meeting the needs of a broad collection of user groups from many sectors across Europe.

**Justification of financing requested**

In total approximately €3.6 Million are requested for this activity. The effort paid for by this funding will be matched with unfunded effort by the partners thereby doubling the available effort. This activity builds closely on the experience of the user communities in the EU DataGrid project where the activities of experiment independent application scientists, the so called “loose cannons” proved very successful in stimulating application demand for the early testbeds. We have designed this activity around that experience and the levels of funding requested reflect our knowledge of what is required.

[10] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

## 5.A.5 Activity NA5 - Policy and International Cooperation

### 5.A.5.1 Objectives and expected outcome of the activity

The development of the Grid is a global activity. With its decision to make early funding available to the European Grid community, the European Commission has enabled Europe to take its rightful place at this table.
The principal objective of this coordination activity is to allow EGEE to operate in this global development environment and to ensure Europe can work constructively with the major Grid players from around the world.

In EGEE we will seek to cooperate with all of the global regions currently involved in Grid research and development including (but not limited to): the Asia Pacific region, North America, Russia and South America. In particular we will use the funding granted from the European Commission to support our in-depth cooperation with the Russia Federation and continue to help the partners from the United States of America to obtain US funding for their share of EGEE work. The specific objectives of this work are to:

- Foster cooperation between EGEE and the global regions listed above and in particular with the US future NSF Cyberinfrastructure initiative. This will be implemented via the establishment of EGEE Russian and US Grid federations. The corresponding work plan is documented in the other relevant EGEE activity lines.
- Establish a eInfrastructure reflection group in Europe with active participation by a selected number of European NRENs (GRnet, RED.ES, DFN and GARR), national Grid bodies and governmental authorities with guidance from the EU.
- Through the various EGEE NA activities establish active collaboration with other EU Grid projects and initiatives: contacts and preliminary discussions already started with the DEISA project in view of developing a detailed roadmap about the establishment of the European Research Infrastructure to be documented in a public deliverable first due at PM9 and revised at PM18. With the launching of other EU Grid projects following the conclusion of the present open calls, this collaboration will be extended to other projects and the above roadmap update accordingly.
- Close collaboration is under way with the SEE-GRID project coordinators and other related initiatives such as Diligent, Gridlab II, Garden, Grande and Invited. Other proposals will be contacted as they become known, in particular after the conclusion of the IST call on Grid for complex problem solving. An activity of coordination like GRIDSTART in the FP5 will be promoted within EGEE in view of submitting a future SSA if appropriate.
- Play a leading role in standards setting through attendance by the various EGEE activity members at global standards bodies such as the Global Grid Forum (with active support and resources provided by NA2).

Specific deliverables of this work will include:

- A series of cooperation agreements with other relevant projects (already drafted with RN GN2 and being considered for DEISA and will be proposed to other relevant initiatives).
- Through the establishment of a European eInfrastructure reflection group produce a series of eInfrastructure White Papers and roadmaps.
- Establishment of pairing agreements between US projects and European Centres of Excellence (i.e. EPCC/UK, PDC/S, CNAF/I, CERN/INT). This will be reported on under activity JRA1.
- Specific middleware components developed in both the United States of America to meet the particular needs of the EGEE user and applications communities (through the activity of JRA1).
- Extension of grid infrastructure to Russian centres taking advantage of the extension of the GEANT network to this region.

#### *5.A.5.1.1 International Cooperation*

We expect the benefits from the cooperation activity to be numerous – some tangible (e.g. specific software components, interoperability tests, common access policies etc) and some intangible (e.g. greater dialogue between global regions, greater understanding of the global user needs, greater understanding of specific regional requirements in security for instance etc). While no specific funding is requested from the European

Union in this task, we expect all partners to take a role in order to foster good international relations between scientists and researchers around the world.

#### *5.A.5.1.2 European eInfrastructure Reflection group*

EGEE represents the first European production-quality Grid infrastructure at this scale. Built upon national resources from across the EU and beyond, the need for policy setting in many areas is becoming more and more important. As the flagship Grid infrastructure project in Europe it is important that EGEE takes a leading role in the establishment of Grid policies across the European Research Area. The primary objective of this work will be to facilitate and stimulate a EU eInfrastructure reflection group. The output from this group's deliberations will be a series of eInfrastructure White Papers and recommendations to the regulatory authorities in the EU member states and in the EU Commission. The eInfrastructure reflection group will be operated as follows:

- The eInfrastructure reflection group will be facilitated by EGEE who will coordinate the appointment of an authoritative Chairman elected within the group.
- Membership of the eInfrastructure reflection group will be by invitation from the appointed Chairman in consultation with EU member states authorities and under EU guidance.
- Members will be selected from senior relevant personnel from National Governmental funding bodies and International Organizations, senior relevant personnel from European Infrastructure providers, key international players and senior relevant personnel from the major European and national Grid initiatives.
- We accept that all of these members are extremely busy and difficult to obtain. To achieve our aims we will therefore appoint dedicated staff to the task of stimulating discussions, running the group (including minute taking and information dissemination) and the production of draft eInfrastructure White Papers for subsequent consideration by the group and provide inputs for DG INFSO publications.

In order to expose the EGEE I3 to the chosen wide spectrum of senior policy makers from across Europe, we will organise the one-day eInfrastructure reflection group meetings in conjunction with the major EGEE Project Conferences. These will be held rotating among the current EU presidencies. As the eInfrastructure reflection group gains momentum we expect to extend it to include International policy setting; with an agreed European policy framework in place, this will give Europe a key strength in the global context.
Initial eInfrastructure Working Groups are expected to focus on: Common Access Policies, Resource Sharing, Accounting, Cost Models, Networking, and Security including proper schemas for Certification Authorities.

Should it be the case that another eInfrastructure reflection group is formed in the near future with the support of the European Commission we will not compete with it but will seek to connect to it and support it.

#### *5.A.5.1.3 Participants*

The above described work will be supported by 3 EU funded FTEs and 3.9 FTEs which will be provided by the interested NRENs, CERN, CNRS, INFN, PPARC and in coordination with the overall project management and project office at CERN.

**European NRENs**

The National Research and Education Networks provide networking services to the research and education communities. NRENs aim to deploy the most advanced national networking infrastructures for research, requiring that they gather requirements and determine specifications for, finance, procure and manage the network infrastructure and services. They also collaborate to deploy the pan-European research backbone, GEANT. The selected NRENs have extensive knowledge of the structure and operational procedures of the corresponding NREN Policy Committee and have been contributing towards the establishment of the integrated research networking and Grid infrastructure for eScience, called "eInfrastructure" (http://www.einfrastructures.org). The Greek Presidency - Ministry of Development-GSRT, the European Commission and the Greek Research and Technology Network (GRNET) in collaboration with the Greek National Documentation Centre (EKT) organized the first eInfrastructure event in Athens, where one of the basic output-recommendations was the establishment of the eInfrastructure reflection group. The effort paid for by the European Commission will be fully matched by the NRENs and deployed to facilitate and stimulate the eInfrastructure reflection group and the other above mentioned related activities. The NRENs and network related organizations will organize themselves, for administration purposes, into a federation including TERENA, DANTE, DFN and GARR with representatives from GEANT and RN2(Geant2).

**United States of America**

EGEE will interact with the Grid R&D community in the US via the Globus and Condor projects. This is a natural choice as the two projects are involved in most of the Grid projects in the US and are likely to play a key role in providing Grid technology and middleware to EGEE. Of particular importance in this context is the support of the Virtual Data Toolkit. Each of the projects will "pair" with an EGEE centre of excellence (for instance Globus with NeSC/EPCC (UEDIN) in the UK and CERN and Condor with INFN in Italy and PIC in Spain). Close ties between the US projects and suitable EGEE partners will guarantee effective exchange of technology and requirements and facilitate mutual trust and timely flow of information. The Principal Investigators of the US projects will coordinate the US interaction with EGEE. They will leverage existing funding (NMI-1, GriPhyN, iVDGL, PPDG) to support this collaboration. An initial sum of 250K$ from the American funding agencies for 2004 has been agreed to support this activity and it is expected that this will be increased as the detailed planning of the activities on both sides of the Atlantic progress.

**Relationship of EGEE to US Cyberinfrastructure activities**

Once the EGEE Grid empowered infrastructure in operation, we will negotiate with the US Department of Energy (DOE) and the US National Science Foundation (NSF) to establish links to key portions of the US Cyberinfrastructure Grid activities. We have already had informal discussions with those agencies and both have expressed great interest in pursuing such collaborations.
The value of Grids grows exponentially as the number and type of resources accessible through grids increases. This is an extension of Metcalfe's Law, which states that the usefulness, or utility, of a network equals the square of the number of users. Furthermore, many Grid applications, both scientific research projects and commercial activities, involve people, institutions, and resources that are located in the United States.
Consequently, EGEE plans to connect US Grid activities of the US DOE and the US NSF. The DOE connection is largely related to the LCG CERN project. The NSF connection will be broader and associated with the Cyberinfrastructure activities. The NSF has funded the Teragrid, which is in the final stages of implementation as a production Grid for scientific Grid computing. In addition, NSF has announced plans to increase substantially over the next year the number of institutions connected by the Teragrid. The EGEE Director has close working relationships with the leaders of Teragrid, which will facilitate the planned collaborations and connections.
The Grid middleware in use by Teragrid is compatible with that which will be deployed by EGEE. As noted elsewhere in this proposal, the EGEE partners have extensive experience working with the key developers of the Globus, Condor, and OGSA/OGSI middleware. Multi-gigabit/s network links to the US research networks are in place and there are plans for additional ones. In addition, the Cyberinfrastructure plans include a considerable emphasis on data-intensive Grid applications and on providing access to large collections of scientific data, much of which would be highly valuable to European Grid projects.

**Russia**

The main goal of the cooperation with Russia is the integration of the Russian GRID segments, created over the past two years, into the EGEE infrastructure.
Since several Russian HEP institutes have participated unfunded in the European GRID project DataGrid, and this has included the successful deployment of the DataGrid middleware and participation in DataGrid testbeds. A Russian Certification Authority centre (http://lhc.sinp.msu.ru/CA) has been created, providing this service to users from across Russia. A prototype GRID Operations Centre has been created in the framework of this activity (including such basic services as resource brokering and Grid monitoring).
Over the past two years the basic application area for the Russian Grid activity has been High Energy Physics, although biology is becoming an increasingly important field. Russian HEP institutes from 1999 have participated actively in LHC computing, and since 2002 have started their participation in LCG project. A Russian Regional Centre had joined the LCG infrastructure in July 2003.
Considerable important Grid research and development activities are ongoing in Russia. In particular, at the Keldysh Institute of Applied Mathematics RAS (KIAM RAS) the *Metadispatcher* is being developed with a focus on the implementation of advanced mathematical algorithms for resource allocation and job scheduling. RRC KI (partner 47) is the coordinating institute for the proposed Russian Fusion grid project to start in 2004.

Up to now the Grid activity in Russia has been based on the deployment of Grid middleware, developed in Europe (DataGrid) and USA (GLOBUS, Condor) with a basic emphasis on intensive operations with huge data globally distributed over the computing centres around the world. This task is recognized by Russian scientific community as the primary priority for successful participation in international scientific projects. To attain this target, six HEP and nuclear institutes (SINP MSU, ITEP, RRC KI, JINR, IHEP, PNPI), the mathematics and computer science institute (KIAM RAS) and the biology institute (IMPB RAS) have organized a consortium - Russian Data Intensive GRID (RDIG).

Using the funding allocated by the EU and fully matched by the Russian funding agencies, RDIG will undertake the following tasks:

- Integrate RDIG as an operational and functional part of EGEE infrastructure by
  - Establishing a Russian Core Infrastructure Centre (CIC) from month 12
  - Establishing distributed Regional Operations Centre
  - Integrating the RDIG infrastructure with EGEE
- Participation in Application Identification and Support tasks.

### 5.A.5.2 Justification of financing requested

The following table gives the distribution of funded and unfunded resources per year for this activity. The separation between “Funded” and “Unfunded” depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| **Partner** | Effort in FTE (EU funded + unfunded)[11],[12] |
|---|---|
| CERN | 1.0 + 1.0 |
| GRNET | 1 |
| INFN | 1 + 0.5 |
| CSIC | 1 |
| DFN | 0.5 + 0 |
| GARR | 0.0 + 0.5 |
| PPARC | 0.2 |
| CNRS | 0.0 + 0.2 |
| FZK | 0.0 + 0.5 |

**Table L NA5 effort (funded and unfunded) in FTEs**

This combination of funded and unfunded resources will allow the establishment of a core support centre distributed through the major funded partners and a network of distributed activities in the various federations to make sure the proposed policy are widely recognized and take into account the maximum spectrum of resources and needs.

**PPARC**

Management and coordination of individual consortium contributions to the EGEE project is understood to be accounted within each work area of the project (funded or unfunded). Within the UK + Ireland, coordination is through the UK Particle Physics and Astronomy Research Council (PPARC) on behalf of the UK e-Science Programme. PPARC will provide the direct link to the UK e-Science programme and coordination with other UK Research Councils. This coordination effort is unfunded EU effort accounted to the appropriate work packages. However, a small fraction of the total funded effort, relating specifically to travel in support of

[11] The numbers shown have been rounded for simplicity. See the NA5 activity summary table for exact figures.

[12] The matching unfunded effort for partner DFN is described and accounted for in activity JRA4

coordination of the UK+Ireland consortium, representation on EGEE executive and related committees, and conferences, workshops, and other events forming a part of the NA5 activities, is accounted here.

**United States of America**

Discussions are on-going with the US groups to clarify the level of their commitment to the EGEE project and the mechanism by which it will be enacted. Clarifications will be made before the project start-date.

**Russia**

The funding requested from the European Commission will be matched by the financial support of RDIG activity by Russian financing agencies in the framework of Joint Programme "Creation of National Computer Network of New Generation" (Ministry of Industry, Science and Technologies - MoIST; Ministry of Atomic Energy - MoAE; Russian Academy of Sciences - RAS; and others), and by the local sources of the participating institutes. Then, additional budgets from these and other Russian sources will be allocated to cover EGEE relevant costs on equipment, networking (regional and international links, in particular link to GEANT), overheads etc. The total budget requested from the European Commission of 1 MEuro for two years will be sufficient to fund an additional total of at least 13 FTEs in Russian institutes.

### 5.A.5.3 Summary

| **Activity number :** | NA5 | Start date or starting event: Project start | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Participant:** | 1 CERN | 18 PPARC | 22 CNRS | 28 FZK | 31 INFN | 51 GRNET | 56 CSIC/ 71 RED.ES | 69 DFN | 70 GARR |
| **Expected Budget per Participant:** | 200 | 8 | 40 | 100 | 100 | 230 | 230 | 107.5 | 100 |
| **Requested Contribution per Participant:** | 200 | 4 | 0 | 0 | 100 | 115 | 115 | 107.5 | 0 |

**Objectives**

The objectives of this coordination work are to:

- Foster cooperation between EGEE and the rest of the world Grid activities.
- Establish a eInfrastructure Reflection Group in Europe.
- Establish in-depth cooperation between two specific countries – the United States of America and Russia for mutual benefit.
- Be the European counterpart of the being launched US Cyberinfrastructure Initiative.
- Play a leading role in standards setting through our attendance at global standards bodies such as the Global Grid Forum.

**Description of work**

The proposed work will focus on the support of the project delivery of:

- A series of cooperation agreements with regions from around the world.
- Through the establishment of a European eInfrastructure reflection group produce a series of eInfrastructure White Papers and roadmaps.
- Establishment of pairing agreements between US projects and European Centres of Excellence.
- Specific middleware and application components developed in both the United States of America and Russia to meet the particular needs of the EGEE user and applications communities. The work with the US will have a specific focus on Globus, Condor and in particular the Virtual Data Toolkit (VDT) which are fundamental components of the grid middleware.

**Deliverables**

| | | | |
|---|---|---|---|
| DNA5.1.1-4 | M4 | (CERN) | eInfrastructure Reflection Group White Papers in conjunction with the EGEE Project Conferences |
| DNA5.2 | M9 | (CERN) | European Grid project synergy roadmap (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) |
| DNA5.3 | M12 | (CERN) | Progress report on International Cooperation Activities |
| DNA5.4 | M18 | (CERN) | European Grid project synergy report (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) |
| DNA5.5 | M24 | (CERN) | Final progress report on International Cooperation Activities |

**Milestones[13] and expected result**

| | | |
|---|---|---|
| MNA5.1 | M9 | European Grid project synergy roadmap. First draft eInfrastructure White Papers issued |

The expected outcome of the activity will be the establishment of an EU eInfrastructure reflection group, contribution to EU DG INFSO publications and concertation events and a broad portfolio of mutually beneficial cooperation with other projects and initiatives from around the world who are currently involved in Grid research and development.

**Justification of financing requested**

The requested funding from the European Commission will support approximately 3 FTEs plus their travel costs and overheads. They will part of a team of approximately 7 FTEs.

The funding proposed from the European Commission for Russia, which will be matched by Russian funding, will be sufficient to fund an additional total of at least 13 FTEs in Russian institutes (€1million).

[13] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

# 5.A.6 Overall Implementation and Co-ordination of the Networking Activities

## 5.A.6.1 Relevance to the Objectives of the Networking Activities

### *5.A.6.1.1 Execution plan for first 24 months*

Figure 11, on the following page, shows a Gantt chart and Activity Interdependencies diagram for NA1 to NA5. Although funding in this proposal is only sought for the first 24 months of the EGEE I3 we expect its final duration to extend to 48 months. Our detailed planning at this stage only extends to the first 24 months. At project month 18 we intend to submit a second proposal addressing the latter 24 months of the project with detailed planning based on our experiences in the first 24 months. The first 24 months of the project from the standpoint of the Networking Activities will progress as follows:

- **Project start:** The detailed planning of the management structures and functions described in NA1 will allow the project to become quickly established. We intend to have all management functions and staffing in place by the start of the project to ensure a quick start-up phase. Each of the five networking activities begins at the start of the project. We are committed to ensuring our initial plans are at an advanced stage by the time the project starts. The Project Consortium Agreement will have been signed by all partners.
- **PM3:** The first milestones for NA2 and NA3 occur at the end of PM3. Both of these activities will have completed their planning phases and delivered the initial dissemination plan, target audience strategy and training plan documents. Initial dissemination will have started and the production of training courses will have begun. NA4 will have completed its planning and defined its Common Application Interface.
- **PM6:** This milestone is shared by activities NA2 to NA5 and represents a key transition in the project from start-up phase to the main phase. The NA1 management activities will be running smoothly, the first Project Conference will have taken place with many additional meetings such as the EU eInfrastructure reflection group having taken place around it. The dissemination activities of NA2 will be well underway and initial progress will be reported. The first user training material and induction course will be available from NA3 and initial progress in this area will be reported. With regard to applications the first of these will have been ported to the EGEE infrastructure.
- **PM9:** The main focus at this point will be the first review by the European Commission. We will use this process to address any shortcomings which are identified in the project and to take refocus any work, including reassignment of effort and responsibilities, where failing partners are identified.
- **PM12:** This point represents the middle of the project (assuming initial funding for 24 months). Many deliverables are due between PM6 and PM12 including: the first Annual Report; revised dissemination and training plans, based on experience to date; the first application migration and target application sector strategy reports; and the first report on international cooperation.
- **PM18:** The project will be mature by this point. Each of the activities will have developed to a stable position. The main focus at this point will be the second review by the European Commission. We will use this process to address any shortcomings which are identified in the project and to take refocus any work, including reassignment of effort and responsibilities, where failing partners are identified. The initial group of planning and reporting deliverables will have been updated more than once. At this point we will seek to propose a 24 month extension to EGEE and refocus the work accordingly.
- **PM24:** If, for whatever reason, no further funding is forthcoming, this point will mark the end of the project. The final project review will occur at this point

The proposed management structure which will oversee and coordinate activities NA2 to NA3 is shown below:

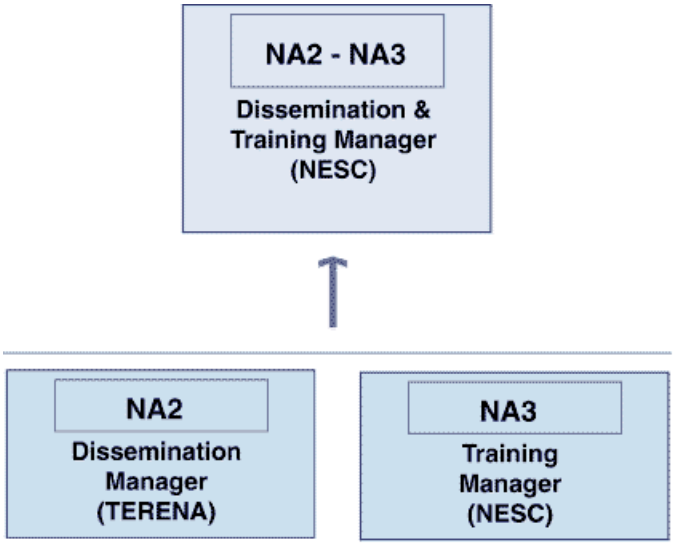



***Figure 10 NA2-NA3 Management Structure – the diagram shows the overall management by NeSC of these activities with specific organisations identified to lead each individual activity.***

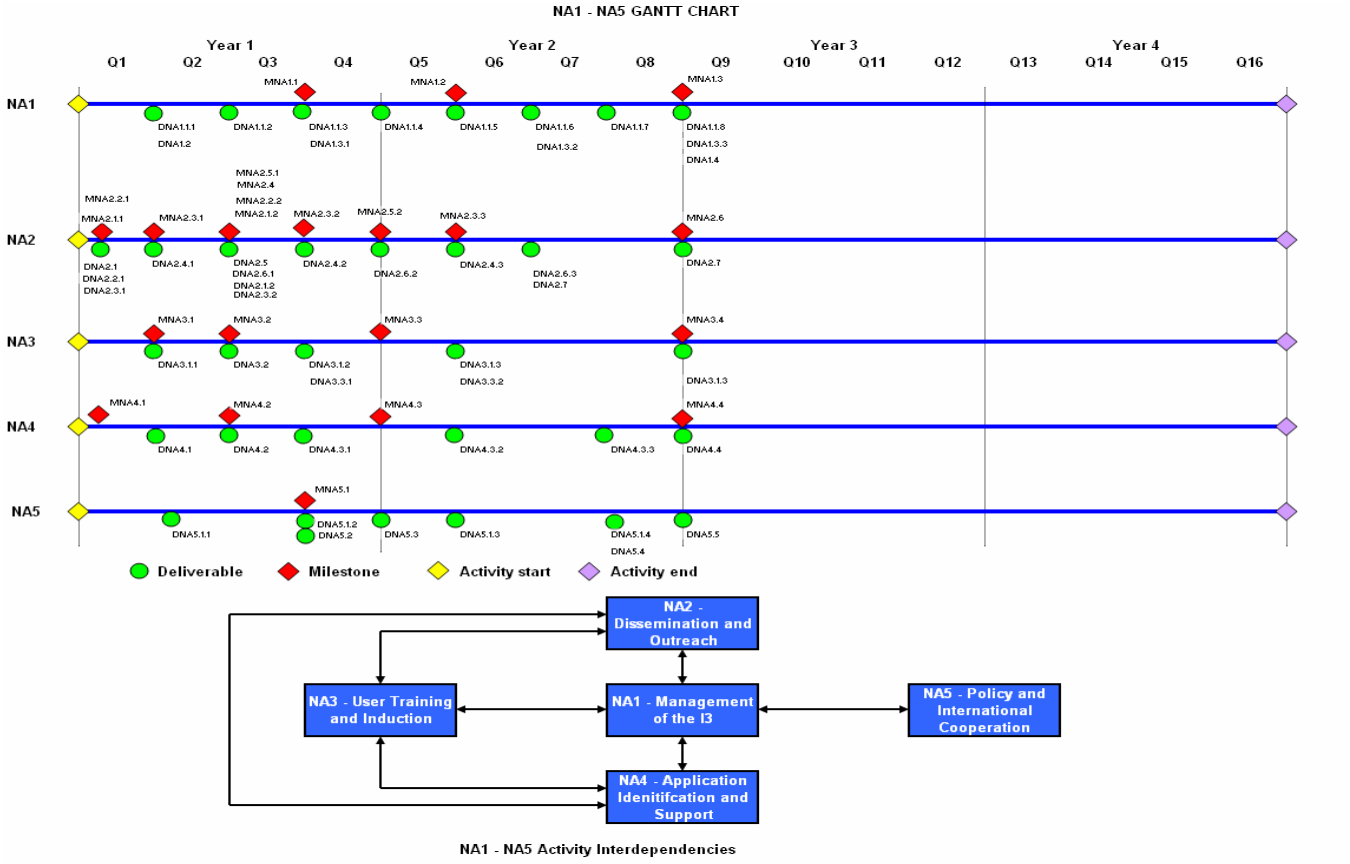



**Figure 11 NA1-NA5 Gantt chart and activity interdependency diagram**

| | | |
|---|---|---|
| MNA1.1 | M9 | Successful completion of first review |
| MNA1.2 | M18 | Successful completion of second review |
| MNA1.3 | M24 | Successful completion of third and final review |
| MNA2.1.1 | M1 | Release of Basic External website, mailing lists and tools |
| MNA2.2.1 | M1 | Release of basic internal website, mailing lists and tools |
| MNA2.3.1 | M3 | First version of the project information dissemination plan |
| MNA2.1.2 | M6 | External web site and tools reach full capability |
| MNA2.2.2 | M6 | Internal web site and tools reach fully capability |
| MNA2.4 | M6 | Publicity material production |
| MNA2.5.1 | M6 | First Dissemination Progress Report |
| MNA2.3.2 | M9 | Revision of the Dissemination plan available |
| MNA2.5.2 | M12 | Second Dissemination Progress Report |
| MNA2.3.3 | M15 | Final Version of the Dissemination plan available (including exploitation details provided by project partners) |
| MNA2.6 | M24 | Final Dissemination Report addressing the issues of public participation and awareness |
| MNA3.1 | M3 | Planning phase complete – DNA3.1.1 delivered |
| MNA3.2 | M6 | First user training material and induction course available |
| MNA3.3 | M12 | First external review of User Training and Induction with feedback |
| MNA3.4 | M24 | Second external review of User Training and Induction with feedback |
| MNA4.1 | M1 | Definition of requirements from applications and first version of associated testsuite |
| MNA4.2 | M6 | First applications migrated to the EGEE infrastructure |
| MNA4.3 | M12 | First external review of Applications Identification and Support with feedback |
| MNA4.4 | M24 | Second external review of Applications Identification and Support with feedback |
| MNA5.1 | M9 | European Grid project synergy roadmap. First draft eInfrastructure White Papers issued |

***Table M – Summary of NA1-NA5 milestones***

| | | |
|---|---|---|
| DNA1.1.1-8 | M3 | Quarterly periodic reports |
| DNA1.2 | M3 | Gender Action Plan |
| DNA1.3.1 | M9 | Periodic report |
| DNA1.3.2 | M18 | Periodic report |
| DNA1.3.3 | M24 | Periodic report |
| DNA1.4 | M24 | Report on Gender Action Plan |
| DNA2.1 | M1 | Production of Project Information Presentation |
| DNA2.2.1-2 | M1 | External customer facing web site, mailing lists and web based tools |
| DNA2.3.1-2 | M1 | Internal project facing web site, mailing lists and web based tools |
| DNA2.4.1-3 | M3 | Dissemination Plan with revisions at M9, and M15 including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| DNA2.5 | M6 | Production of appropriate printed PR material |
| DNA2.6.1-3 | M6 | Dissemination Progress Reports with revisions at M12 and M18 |
| DNA2.7 | M24 | Final Dissemination & usage Report addressing the issues of public participation and awareness |
| DNA3.1.1-3 | M3 | Training Plan with revisions and M9 and M15 |
| DNA3.2 | M6 | Initial Training Course Material (continuously revised thereafter) |
| DNA3.3.1-3 | M9 | Training Progress Report with updates at M15 and M24 |
| DNA4.1 | M3 | Definition of Common Application Interface and Planning Document |
| DNA4.2 | M6 | Target Application Sector Strategy document |
| DNA4.3.1-3 | M9 | EGEE Application Migration Progress report with revisions at M15 and M21 |
| DNA4.4 | M24 | Final Report of Application Identification and Support Activity |
| DNA5.1.1-4 | M4 | eInfrastructure reflection group White Papers in conjunction with the EGEE Project Conferences |
| DNA5.2 | M9 | European Grid project synergy roadmap (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) |
| DNA5.3 | M12 | Progress report on International Cooperation Activities |
| DNA5.4 | M18 | European Grid project synergy roadmap (in collaboration with DEISA, SEE-GRID and other relevant initiatives and EU projects) |
| DNA5.5 | M24 | Final progress report on International Cooperation Activities |

***Table N – Summary of NA1-NA5 deliverables***

| | | |
|---|---|---|
| M01 | DNA2.1 | Production of Project Information Presentation |
| M01 | DNA2.2.1 | External customer facing web site, mailing lists and web based tools |
| M01 | DNA2.3.1 | Internal project facing web site, mailing lists and web based tools |
| M03 | DNA2.4.1 | Dissemination Plan with revisions at M9, and M15 including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| M03 | DNA3.1.1 | Training Plan with revisions and M9 and M15 |
| M03 | DNA4.1 | Definition of Common Application Interface and Planning Document |
| M04 | DNA5.1.1-4 | eInfrastructure reflection group and associated White Papers with further meetings and draft White Papers in conjunction with the EGEE Project Conferences |
| M06 | DNA2.2.2 | External web site and tools at full capacity. |
| M06 | DNA2.3.2 | Internal web site and tools at full capacity. |
| M06 | DNA2.5 | Production of appropriate printed PR material |
| M06 | DNA2.6.1 | Dissemination Progress Reports with revisions at M12 and M18 |
| M06 | DNA3.2 | Initial Training Course Material (continuously revised thereafter) |
| M06 | DNA4.2 | Target Application Sector Strategy document |
| M09 | DNA1.3.1 | Periodic report |
| M09 | DNA2.4.2 | Dissemination Plan revision including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| M09 | DNA3.1.2 | Training Plan revision |
| M09 | DNA3.3.1 | Training Progress Report with updates at M15 and M24 |
| M09 | DNA4.3.1 | EGEE Application Migration Progress report with revisions at M15 and M21 |
| M09 | DNA5.2 | European Grid Project synergy roadmap (in collaboration with DEISA and other relevant initiatives) |
| M12 | DNA2.6.2 | Dissemination Progress Reports revision |
| M12 | DNA5.3 | Progress report on International Cooperation Activities |
| M15 | DNA2.4.3 | Dissemination Plan revisions including a formal planning for using and disseminating knowledge throughout the project (including target audiences and measures for success) |
| M15 | DNA3.1.3 | Training Plan revision |
| M15 | DNA3.3.2 | Training Progress Report update |
| M15 | DNA4.3.2 | EGEE Application Migration Progress report |
| M18 | DNA1.3.2 | Periodic report |
| M18 | DNA2.6.3 | Dissemination Progress Reports revision |
| M21 | DNA4.3.3 | EGEE Application Migration Progress report |
| M21 | DNA5.4 | Revised European CI roadmap (in collaboration with DEISA and other relevant initiatives) |
| M24 | DNA1.3.3 | Periodic report |
| M24 | DNA1.4 | Report on Gender Action Plan |
| M24 | DNA2.7 | Final Dissemination & usage Report addressing the issues of public participation and awareness |
| M24 | DNA3.3.3 | Training Progress Report update |

| | | |
|---|---|---|
| M24 | DNA4.4 | Final Report of Application Identification and Support Activity |
| M24 | DNA5.5 | Final progress report on International Cooperation Activities |

**Table O: Summary of NA1-NA5 deliverables in Chronological Order**

### 5.A.6.2 Networking Activities final summary

Overall, the ensemble of the networking activities which has been presented in this section has been designed with four clear goals in mind:

1. To ensure the proper and effective management of the EGEE I3;
2. To provide appropriate dissemination of the opportunities afforded by the EGEE infrastructure to as wide a constituency of potential users from industry, academia and commerce as possible.
3. To enable the creation of new users, to train them to make their first use of the infrastructure and to guide them to become experienced users.
4. To promote international collaboration with similar projects in and outside the EU.

Each of the activities presented has key links into other activities integrated by EGEE. These links include:

- NA1: The overall management activity is designed to link to all of the integrated activities in order to ensure the smooth management of the project;
- NA2: Will work closely with the service activities to ensure the benefits of EGEE usage are widely disseminated. At the same time this activity will seek to feed information into the joint research activities gathered from user feedback on the website for instance.
- NA3: The development of the training work packages will be very closely linked to the specific support activities. This will ensure the training activities train the user community based on the latest information available from the service providers.
- NA4: We expect the applications identification process to find many instances of missing functionality in the EGEE infrastructure. This activity will work closely with the joint research activities to ensure these needs are passed on and the various application communities are kept well informed of progress to meet their needs.
- NA5: The EU eInfrastructure reflection group activity will attempt to formulate policies for the Grid based on the experience of the specific service activities. Close links with these activities, and the joint research activities in the context of international cooperation are therefore vital and will be pursued vigorously. Close collaboration with similar international Grid activities will be promoted through this activity in connection with the Specific Services and Joint Research activities.

The partners believe that the success of these networking activities will be key to the growth of the user base, and therefore to the success of the infrastructure.

# 5.B Specific Service Activities

## 5.B.1 Scientific and Technological Excellence

### 5.B.1.1 Quality of the Grid-empowered infrastructure

This principal aim of EGEE is to integrate existing national, regional and thematic Grid efforts in order to create a production-quality European Grid infrastructure operating 24 hours per day which will enable access to computing, storage, instrumentation and informational resources across the European Research Area, for a diverse range of e-Science user communities. Existing scientific and computing infrastructures and information sources will thus be made available to a wider range of researchers than ever before, vastly increasing the interconnectivity of European research and ensuring the fullest exploitation of those resources. New collaborations, new services and new modes of interaction will arise, with the European Grid infrastructure acting as the medium. This infrastructure will be unique in the world, as no other country or region is currently planning an integration of resources on this scale.

The computing resources that EGEE integrates will be provided by a large, and growing, number of Resource Centres. These will operate over a wide scale of capabilities, ranging from a simple informational resource to large-scale computing and storage centres. These Resource Centres are not supported directly by the EGEE project, but represent one of the main contributions of the project partners. Table P below gives an overall summary of the resources located at some of the leading computer centres in Europe, which are partners to the EGEE project.

**Table P** ***Overall summary of computer resources of EGEE partners***

| Region | Country | Vector (Gflops) | Parallel (Gflops) | Cluster (num. nodes) | Disk (Tbytes) | Automated Tape (Tbytes) | Avg. LAN (Mbps) | Avg. WAN (Mbps) |
|---|---|---|---|---|---|---|---|---|
| | **(CERN)** | **N/A** | **N/A** | **900** | **140.0** | **800.0** | **1250.0** | **10000.0** |
| | **France** | **N/A** | **N/A** | **915** | **22.6** | **300.0** | **2333.3** | **2333.3** |
| | **Germany** | **N/A** | **N/A** | **489** | **43.3** | **114.5** | **413.8** | **102.7** |
| | **Italy** | **100.0** | **100.0** | **725** | **60.0** | **100.0** | **1000.0** | **1000.0** |
| | **UK and Ireland** | **N/A** | **N/A** | **900** | **200.0** | **150.0** | **1000.0** | **10000.0** |
| | Austria | N/A | 1.2 | 3 | 0.1 | N/A | 25.0 | 25.0 |
| | Czech Rep | N/A | 5.5 | 64 | 12.5 | 7.2 | 1000.0 | 625.0 |
| | Hungary | N/A | 54.0 | 545 | 1.6 | 0.6 | 61.7 | 1166.7 |
| | Poland | 36.9 | 45.1 | 205 | 4.6 | 9.7 | 28.3 | 114.0 |
| | Slovakia | N/A | N/A | 24 | 0.2 | N/A | 100.0 | N/A |
| | Slovenia | N/A | N/A | 30 | 2.5 | N/A | 300.0 | 250.0 |
| **Central-East Total** | | **36.9** | **105.8** | **871** | **21.5** | **17.5** | **136.1** | **590.5** |
| | Belgium | N/A | N/A | 50 | 2.0 | N/A | N/A | N/A |
| | Denmark | N/A | N/A | 60 | 1.0 | N/A | N/A | N/A |
| | Norway | N/A | 99.6 | 94 | 1.2 | 6.0 | 1000.0 | 2500.0 |
| | Sweden | N/A | N/A | 800 | 120.0 | 120.0 | 1000.0 | 10000.0 |
| | Netherlands | N/A | 1000.0 | 1000 | 50.0 | 500.0 | 500.0 | 200.0 |
| | Finland | N/A | N/A | 32 | N/A | N/A | 1000.0 | 1000.0 |
| **Northern Total** | | **N/A** | **1099.6** | **2036** | **174.2** | **626.0** | **642.9** | **2314.3** |
| | Bulgaria | N/A | N/A | 12 | 0.2 | N/A | 10.0 | 3.4 |
| | Cyprus | N/A | 4 | 18 | 0.1 | N/A | 100.0 | 15.0 |
| | Greece | N/A | N/A | 192 | 10.0 | 5.0 | 1000.0 | 2500.0 |
| | Israel | N/A | N/A | 50 | 2.2 | N/A | 100.0 | 15.5 |
| | Romania | N/A | 4.5 | 50 | 1.5 | N/A | 250.0 | 77.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Southeast Total** | | **N/A** | **8.5** | **322** | **14** | **5.0** | **292** | **522.28** |
| | Portugal | N/A | N/A | 50 | 1.0 | N/A | 100.0 | 160.0 |
| | Spain | N/A | N/A | 208 | 9.5 | 115.7 | 587.5 | 144.4 |
| **Southwest Total** | | **N/A** | **N/A** | **258** | **10.5** | **115.7** | **533.3** | **146.2** |
| | Russia | N/A | 2.8 | 152 | 36.1 | 59.6 | 296.7 | 71.8 |
| **Other Total** | | **N/A** | **2.8** | **152** | **36.1** | **59.6** | **296.7** | **71.8** |
| **Grand Total** | | **137** | **1313** | **7691** | **757** | **2388** | **657** | **1095** |

The computing resources that the partners bring to the project are detailed in Table 6 below. This table details both the computing resources and human resources contributed by the regional partners to the EGEE project. To represent the scale of the computing resources, the number of cluster nodes has been used.

**Table 6** ***General description of the constituent parts of the Grid-empowered infrastructure.***

***Note:*** *In this table the personnel total is shown to indicate the scale of the institution or resource centre. The "% dedication" column indicates the fraction of those staff that will be involved in operating and making those resources available to EGEE. The number of cluster nodes shows the size of the compute resource at that centre, while the "% nodes" column indicates the fraction that will be available to EGEE.*

| Region | Country | Contributor | Web site Address | Personnel Total | % dedication | Number of cluster nodes | % nodes |
|---|---|---|---|---|---|---|---|
| | | **CERN** | **www.cern.ch** | **280** | **43** | **1800** | **50** |
| | France | CGG | www.cgg.com | 4 | 25 | 250 | 40 |
| | | CNRS | www.cnrs.fr | 15 | 63 | 150 | 20 |
| | | CRSA | www.ecp.fr | 6 | 67 | 20 | 100 |
| | | Ecole Centrale Paris | www.ecp.fr | 1 | 100 | 50 | 50 |
| | | IN2P3 | www.in2p3.fr | 30 | 35 | 1200 | 60 |
| | | Saclay | www-dapnia.cea.fr | 2 | 50 | 100 | 20 |
| **France Total** | | | | **79** | **62** | **1770** | **32** |
| | Germany | DESY | www.desy.de | 11 | 8 | 4 | 50 |
| | | GSI | www.gsi.de | 7 | 23 | 100 | 15 |
| | | FZK | www.fzk.de | 22 | 40 | 700 | 50 |
| | | FhG | www.fhg.de | 29 | 21 | 157 | 24 |
| **Germany Total** | | | | **69** | **25** | **961** | **42** |
| | Italy | INFN | www.infn.it | 40 | 67 | 750 | 73 |
| | | Uni-Napoli | www.unina.it | 5 | 40 | 100 | 50 |
| | | Uni-Lecce | www.unile.it | 5 | 40 | 100 | 50 |
| | | Uni-Cosenza | www.unical.it | 5 | 40 | 100 | 50 |
| | | ENEA | www.enea.it | 14 | 14 | 110 | 22 |
| **Italy Total** | | | | **69** | **50** | **1160** | **62** |
| | **UK and Ireland** | **PPARC, University of Edinburgh, CLRC, UCL, Dublin** | www.research-councils.ac.uk/escience | **235** | **15** | **6400** | **34** |
| Central-Europe | Austria | Austrian Grid Consortium | www.gup.uni-linz.ac.at/austriangrid | 3 | 50 | 9 | 30 |
| | Czech Rep | CESNET | Meta.cesnet.cz | 20 | 34 | 160 | 40 |
| | Hungary | Budapest Techn. Univ. and Economics | www.iit.bme.hu | 8 | 20 | 22 | 30 |
| | | KFKI Research Institute for Particle and Nuclear Physics | www.rmki.kfki.hu | 4 | 63 | 50 | 100 |
| | | MTA SZTAKI | www.lpds.sztaki.hu | 4 | 60 | 58 | 50 |
| | | Office for National Infrastructure and Information Development | www.iif.hu | 10 | 30 | 1500 | 30 |
| | Poland | Academic C.C. CYFRONET Cracow Univ of Science and Tech | www.cyf-kr.edu.pl | 9 | 50 | 46 | 50 |
| | | ICM | www.icm.edu.pl | 10 | 60 | 128 | 60 |
| | | Poznan Supercomputing and Networking Center | www.man.poznan.pl | 28 | 6 | 132 | 10 |
| | Slovakia | Institute of Informatics | agents.ui.sav.sk | 9 | 32 | 24 | 100 |

| Region | Country | Contributor | Web site Address | Personnel Total | % dedication | Number of cluster nodes | % nodes |
|---|---|---|---|---|---|---|---|
| | Slovenia | Jozef Stefan Institute | www-f9.ijs.si | 4 | 40 | 60 | 50 |
| **Central-Europe Total** | | | | **109** | **40** | **2189** | **48** |
| Northern | Belgium | None | | 7 | 50 | 100 | 50 |
| | Denmark | Niels Bohr Institute | www.nbi.dk | 7 | 29 | 1200 | 5 |
| | Norway | Bergen Center for Computational Science | www.ii.uib.no | 14 | 27 | 144 | 65 |
| | Sweden | SNIC/SweGrid | www.snic.vr.se | 49 | 14 | 1600 | 50 |
| | Netherlands | DutchGrid | www.dutchgrid.nl | 0 | 0 | 1000 | 100 |
| | Finland | None | | 2 | 50 | 74 | 43 |
| **Northern Total** | | | | **79** | **28** | **4118** | **54** |
| SouthEast | Bulgaria | CLPP, INRNE | www.bas.bg | 14 | 37 | 36 | 33 |
| | Cyprus | UCY | http://grid.ucy.ac.cy | 10 | 20 | 36 | 50 |
| | Greece | GRNET | www.hellasgrid.gr | 24 | 16 | 640 | 30 |
| | Israel | IUCC | www.iucc.ac.il | 34 | 10 | 500 | 10 |
| | Romania | ICI-National Inst. for R&D in Informatics | www.ici.ro | 24 | 60 | 100 | 50 |
| **Southeast Total** | | | | **106** | **29** | **1312** | **25** |
| SouthWest | Portugal | LIP | www.lip.pt | 4 | 50 | 124 | 40 |
| | Spain | INTA CAB Madrid | www.cab.inta.es | 11 | 9 | 50 | 64 |
| | | CESGA Santiago | www.cesga.es | 6 | 17 | 80 | 30 |
| | | CSIC CNB Madrid | www.cnb.uam.es | 4 | 25 | 28 | 10 |
| | | IFAE PIC | www.ifae.es | 10 | 30 | 50 | 50 |
| | | ITACA Valencia | www.itaca.upv.es | 4 | 25 | 100 | 20 |
| | | CSIC IFIC Valencia | ific.uv.es/ | 4 | 25 | 192 | 25 |
| | | CSIC IFCA Santander | www.ifca.unican.es | 4 | 25 | 170 | 33 |
| **Southwest Total** | | | | **52** | **23** | **794** | **30** |
| Other | Russia | IHEP (Institute of High Energy Physics) | www.ihep.ru | 12 | 50 | 40 | 60 |
| | | IMPB RAS (Institute of Mathematical Problems of Biology) | www.impb.ru | 12 | 50 | 32 | 25 |
| | | ITEP (Institute For Theoretical and Experimental Physics) | www.itep.ru | 17 | 50 | 100 | 40 |
| | | RRC KI (Russian Research Centre "Kurchatov Institute") | www.kiae.ru | 11 | 68 | 32 | 25 |
| | | JINR (Joint Institute for Nuclear Reserch) | www.jinr.ru | 10 | 50 | 80 | 30 |
| | | PNPI (Petersburg Nuclear Physics Institute) | www.pnpi.spb.ru | 6 | 50 | 20 | 50 |
| | | SINP Moscow State University | gris.sinp.msu.ru | 14 | 61 | 40 | 30 |
| **Other Total** | | | | **72** | **61** | **344** | **37** |
| **Grand Total** | | | | **1228** | **37** | **17654** | **43** |

The scale of the infrastructure for which EGEE is aiming is substantial. Some indicative figures in terms of computing resources and utilisation are:

- End 2005 (year 2): In excess of 50 Resource Centres connected providing 25,000 processors with >5 petabyte storage, and delivering a sustained throughput of at least 2000 jobs per hour.
- End 2007 (year 4): In excess of 200 Resource Centres connected providing 100,000 processors with >15 petabyte storage, and delivering a sustained throughput of at least 5000 jobs per hour.

The role of EGEE is to make the resources at the Resource Centres accessible to user communities and virtual organisations across Europe in a professionally managed, persistent and secure way. The Grid-empowered infrastructure that EGEE brings together will therefore offer a range of services to these

communities and organisations. These services are fundamentally generic in nature and belong to four broad categories:

- Access to the resources of the Grid,
- Operation of the Grid as a reliable service,
- Deployment of New Resources and Middleware on the Grid,
- Support for Grid operations at the regional and global level.

The services are listed in Table 7 and their integration is more fully described in the activity SA1 and SA2.

***Table 7 General description of the services provided by the Grid-empowered infrastructure***

| Service | Objectives | User Community Served |
|---|---|---|
| Resource access | Allow users access to a large collection of computing resources, mediated by resource brokering | Applications communities |
| Data/Application Repository | Provide data and applications at the resources where they are to be used | Applications communities |
| Information services | Publish information on Grid services and locations, resource capabilities and state | Applications and resource communities |
| User organisations | Provide framework for authentication and authorization | Applications communities |
| Monitoring and control | Monitor the operational state of the infrastructure, exercising control to maintain performance | Application and resource communities |
| Middleware deployment | Assist Resource Centres in deployment of middleware | Resource Centres |
| Resource validation | Validate a Resource Centre's deployment before connecting to infrastructure | Resource Centres |
| Resource centre support | Receive, respond and resolve to operational problems. | Resource Centres |
| User support | Resolve user problems with infrastructure. | Users in application communities |
| Networking | Provision of managed network resources | All user communities |

Specific user services including specific user support are developed as part of NA4.

### 5.B.1.2 Quality of the management

Built on top of a network of Resource Centres are the three layers of Operations, Support and Management as illustrated in Figure 19.

a) Layer I Regional Operations Centres (ROC) which deploy Grid middleware at Resource Centres to connect resources to the EGEE Grid and provide geographically local front line support to both users and Resources Centres on a 24x7 basis. There will be an ROC in each of the eight partner regions participating in EGEE, plus CERN. The ROC mandate includes the support to new Resource centres joining EGEE, the test and certification of those as EGEE nodes, as well as the detailed troubleshooting and middleware upgrades.
b) Layer II Core Infrastructure Centres (CIC) which provide the basic service infrastructure of the Grid, operating the key services which connect users with resources. The CICs will also support the Regional Operations Centres. The CICs will guarantee 24x7 operations of the grid infrastructure.
c) Layer III Operations Management Centre (OMC) which manages the operation of the entire EGEE Grid from a single centralised location.

The three support layers described above are all part of activity SA1 European Grid Operations Support and Management, and are staffed by people working for EGEE (funded jointly by EGEE and the national programmes), whereas the Resource Centres are staffed by the organisations that control the resources.

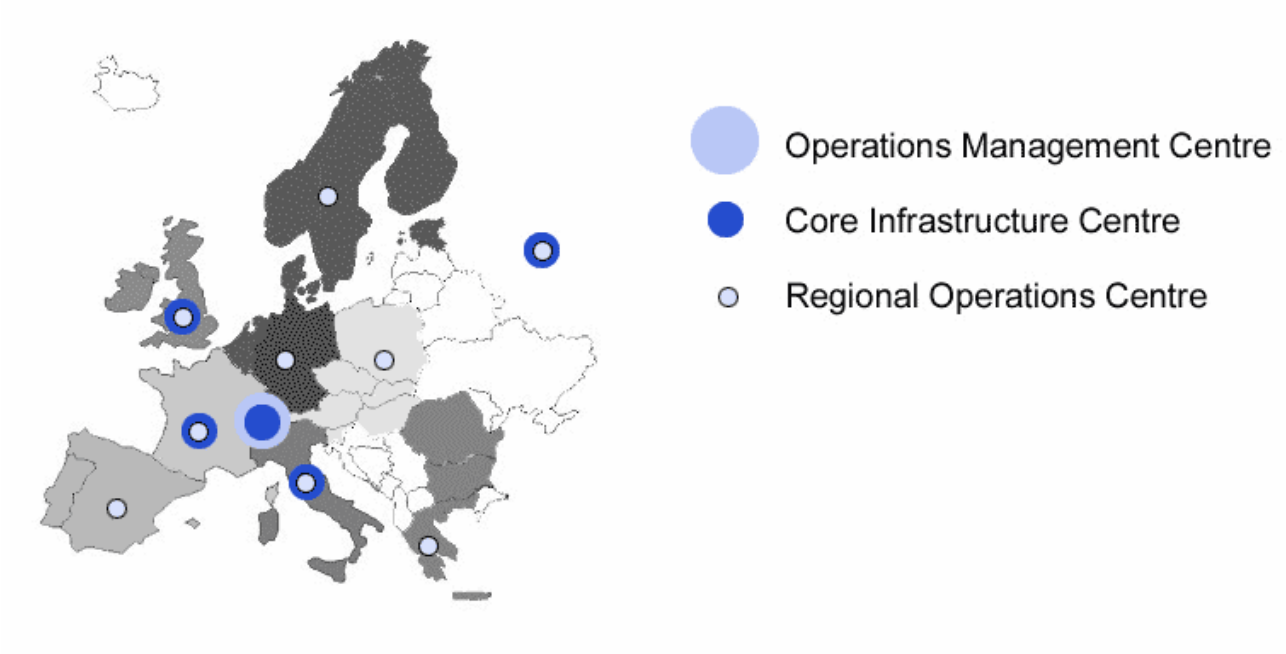



***Figure 12: Distribution of Service Activities over Europe. The symbols illustrate regional distribution and do not reflect precise geographical location of activities. The structure of the Grid services will comprise: EGEE Operations Management at CERN; EGEE Core Infrastructure Centres in the UK, France, Italy, Russia (PM12) and at CERN, responsible for managing the overall Grid infrastructure; Regional Operations Centres, responsible for coordinating regional resources, regional deployment and support of services. Specifics of the roles and responsibilities of these centres are included in the SA1 description***.

The deployment, operation and support of the Grid-empowered infrastructure is the objective of the dominant service activity, SA1, which clearly describes the roles and responsibilities of the centres in the above layers. The management structure that binds these centres together with the Network Resource Provision activity SA2 is illustrated in Figure 13. By ensuring that a single manager in the Project Executive Board has overview and responsibility for all Service activities, a high degree of coordination and consistent decision making can be ensured.

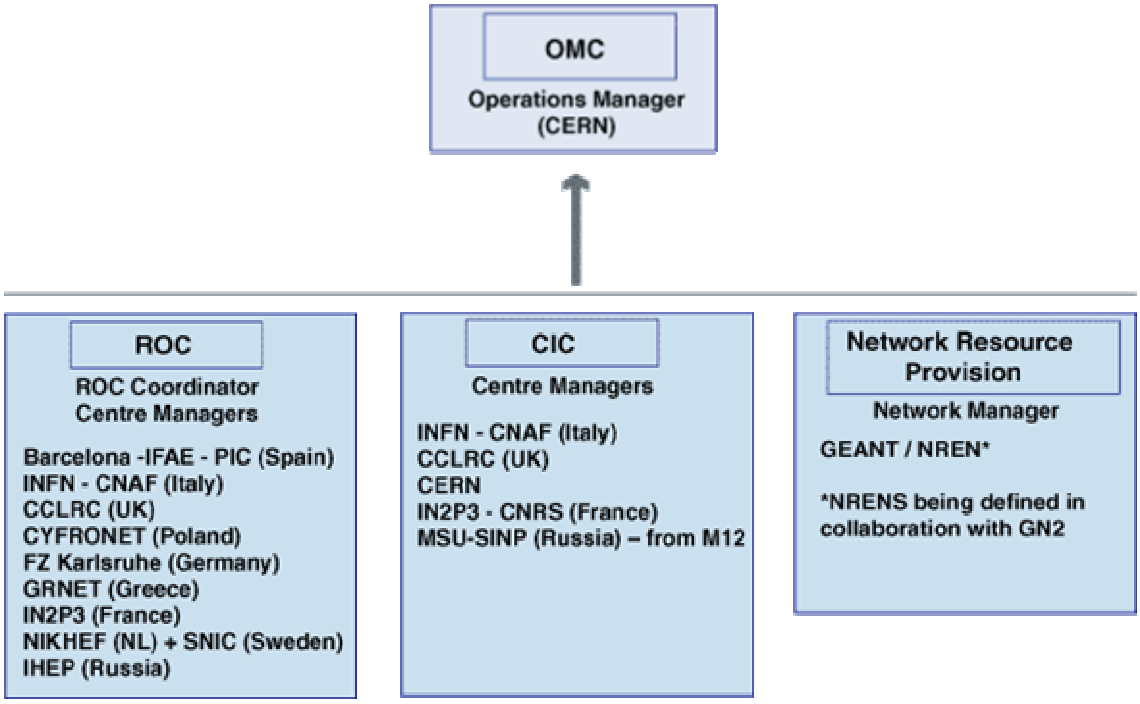



***Figure 13 Management Structure for Specific Service Activities SA1, SA2.***

### 5.B.1.3 Quality of the scientific environment

Much of the core middleware functionality required for initial operation of the Resource Centres will be available as a result of previous Grid projects such as DataGrid, CrossGrid, LCG, UK e-Science, INFN Grid, NorduGrid, etc. This will need to be reworked by the EGEE middleware engineering and integration activity (JRA1) to improve its robustness, portability, interoperability and documentation. This will be a gradual process and rather than wait until this has been done, it is proposed to operate the initial Grid Centres with the middleware available at the start of the project and upgrade as improved versions and suites are released by the middleware activity. The evolution of middleware releases will be a planned process with an agreed timetable and an established process for testing, integration, verification and validation, moving upgraded middleware components from development to operation.
A key aim in assembling the Grid infrastructure will be to incorporate and exploit existing expertise and experience within the European community in deploying, supporting and operating prototype Grids. The LCG project will play the central role in providing an operational infrastructure from the earliest stage of the EGEE Grid, allowing the project to “hit the ground running”. LCG will introduce an operational production Grid on an advanced timescale that will precede the start of the EGEE project. Its technical aims and objectives are closely aligned with those of EGEE and it is formed from a substantial part of one of the initial EGEE user communities, namely High Energy Physics, giving it a strong stake in EGEE from the outset.

The EGEE and LCG projects will therefore pool resources to provide the core infrastructure of the EGEE Grid, based on the LCG infrastructure that will be available at the very start of EGEE. The advantages for EGEE in having the core infrastructure strongly coupled to the LCG project are:

- Experience and resources – LCG will have a global infrastructure in operation at project start;
- focus – LCG has a clear commitment and a precise timescale to demonstrate that a Grid can indeed be used in production for large scale data-intensive scientific research;
- global reach – LCG will have significant capacity in North America and Asia, as well as large-scale resources at a number of sites in Europe.

Through this close relationship, the EGEE Grid will be based on the very firm foundation of a core infrastructure that will be operational from the earliest days of the project and will adapt and evolve to connect a growing range of user communities with an expanding resource base.

### 5.B.1.4 European added value and impact

Thanks to preliminary successes of EU-funded projects (DataGrid, DataTAG, CrossGrid), several scientific communities have gained experience with Grid technologies. One of these, the HEP community, has decided to base the future computing infrastructure of its largest scientific enterprise, the LHC programme, exclusively on Grid technologies. The impact of the successful first intensive production use of the Grid infrastructure by the LHC experiments will help pave the way for adoption of this infrastructure by other major scientific disciplines and eventually industry and commerce, with potentially very large benefits for European science and technology. As illustrated in the Figure below, EGEE will benefit initially from LCG, and once the European Grid infrastructure is established, it will in turn support a wide variety of user communities.

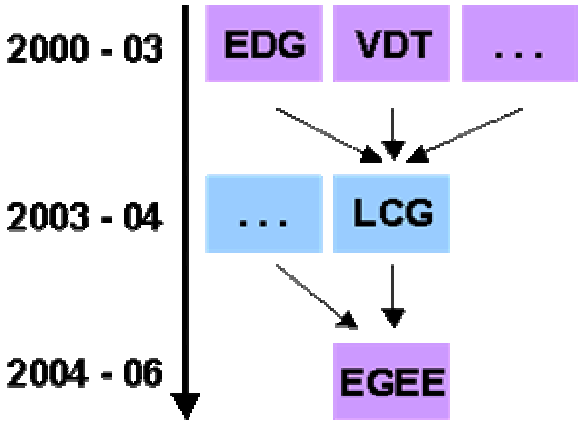



***Figure 14 Timeline showing the evolving relationship between DataGrid, LCG and EGEE. DataGrid is supplying middleware to LCG in 2003. In 2004, LCG will provide operations and resources to EGEE. Over the four-year programme envisaged in this proposal, EGEE will shift to be operations and resource provider to a number of virtual organisation, of which LCG will represent a subset***.

## 5.B.2 Activity SA1 - European grid Operations, Support and Management

### 5.B.2.1 Objectives and originality of the activity

This Grid Operations, Support and Management activity will create, operate, support and manage a production quality European Grid infrastructure which will make computing, storage, instrumentation and informational resources at many Resource Centres across Europe accessible to User communities and virtual organisations in a consistent way according to agreed access management policies and service level agreements. The terms of engagement by resource providers and users with the Grid-empowered infrastructure will be driven by policies determined by the European eInfrastructure reflection group described in NA5.
It will build on current National and International Grid initiatives such as LCG, the UK e-Science Grid, the Italian Grid, NorduGrid, etc, which are already deploying Grid infrastructures. The key aim in assembling this infrastructure is to incorporate and exploit existing expertise and experience within the European Union in deploying, supporting and operating prototype Grids. The LCG project will play a central role in providing an operational infrastructure from the earliest stage of the EGEE Grid.
The key objectives of this activity are

1. **Core Infrastructure services:** to operate a set of essential services, such as the information services, resource brokers, data management services, and administration of the virtual organisations, that bind distributed resources into a coherent infrastructure.
2. **Grid monitoring and control:** to proactively monitor the operational state of the Grid and its performance, initiating corrective action to remedy problems arising with either Core Infrastructure or Grid resources.
3. **Middleware deployment and resource induction:** to validate middleware releases and then to deploy them on Resource Centres throughout the Grid. Strict criteria will be placed on validating new middleware before production deployment. This will involve close interaction and feedback with the middleware engineering activity (JRA1) and the applications (NA4). Where new Resource Centres are to be incorporated into the Grid, assistance must be provided both in middleware installation and introduction of operational procedures at Resource Centres. Extra effort will be required to Resource Centres offering resources such as parallel and vector supercomputers that play strategic roles in a number of scientific fields.
4. **Resource and user support:** to receive, respond to and coordinate the resolution of problems with Grid operations from both Resource Centres and users; this role will filter and aggregate problems, providing solutions where known, and engaging Core Infrastructure or Middleware Engineering or other appropriate experts to resolve new problems.
5. **Grid management:** to co-ordinate the fulfilment of the above objectives by Regional Operations Centres (ROC) and Core Infrastructure Centres (CIC), together with managing the relationships with resource providers, through negotiation of service-level agreements, and the wider Grid community, through participation in liaison and standards bodies.
6. **International collaboration:** to drive collaboration with peer organisations in the U.S. and in Asia-Pacific to ensure the interoperability of grid infrastructures and services in order that the EGEE user communities that are frequently international with wider membership than the EGEE partners are able to seamlessly access resources both within and outside those provided through EGEE.

Broadly, the first two of these objectives are the responsibility of Core Infrastructure Centres, which operate the Grid infrastructure as a whole, while the second two objectives are to be carried out by Regional Operations Centres, which do what is necessary to bring new resources into the Grid and keep them operating These two layers will be overseen by an Operations Management Centre which will be responsible for their coordination across a number of centres, plus the maintenance of a perspective on the operational infrastructure as a whole. This centre will be responsible for the last two objectives.
The originality of this activity lies very much in its strong production focus and the scale and breadth of its pan-European and world-wide multi-disciplinary target user constituency. No Grid project in the world has to date attempted to construct a production infrastructure on such a large scale. The Grid-empowered infrastructure will be open to the entire European Research Area, with strong links to infrastructures also outside the EU. The excellence derives from the quality of the partners of EGEE, especially the depth of their

experience in Grid technologies and operations gained from participation in successful Grid test-bed projects, and the level of computing and storage resources provided.

### 5.B.2.2 Structure and Function of Operations, Support and Management

This section presents a structural and functional description of the proposed EGEE Grid Operations, Support and Management infrastructure and identifies its main components and their operational responsibilities.
The main purpose of the EGEE Grid Operations, Support and Management activity is to make the resources at the Resource Centres accessible to user communities structured as virtual organisations across Europe in a professionally managed, persistent, reliable and secure way. To do this, this activity must provide:

- Access to the resources of the Grid.
- Operation of the Grid as a reliable service.
- Deployment of new middleware and services on the Grid.
- Support of resource providers and users.
- Introduction of new Virtual Organisations and Resource Centres.

The objectives of this activity are implemented through a layered structure of operations and management activities:

- **Layer I: Regional Operations Centres** (ROC) which deploy Grid middleware at Resource Centres to connect resources to the EGEE Grid and provide geographically local front line support to both users and Resources Centres, eventually on a 24x7 basis. There will be an ROC in each of the nine regional federations participating in EGEE. The ROC mandate includes the support to new Resource centres joining EGEE, the test and certification of those as EGEE nodes, as well as the detailed troubleshooting and middleware upgrades. ROC's will develop architectures and implement solutions to incorporate into EGEE resources vector and parallel supercomputers and other non linux resources which may play a central role in particular science fields.
- **Layer II: Core Infrastructure Centres** (CIC) which provide the basic service infrastructure of the Grid, operating the key services which connect users with resources. The CICs will also support the Regional Operations Centres. The CICs will guarantee eventual 24x7 operations.
- **Layer III: Operations Management Centre** (OMC) which manages the operation of the entire EGEE Grid from a single centralised location.

In addition there are the Resource Centres that provide and manage the computing, storage, and network resources.

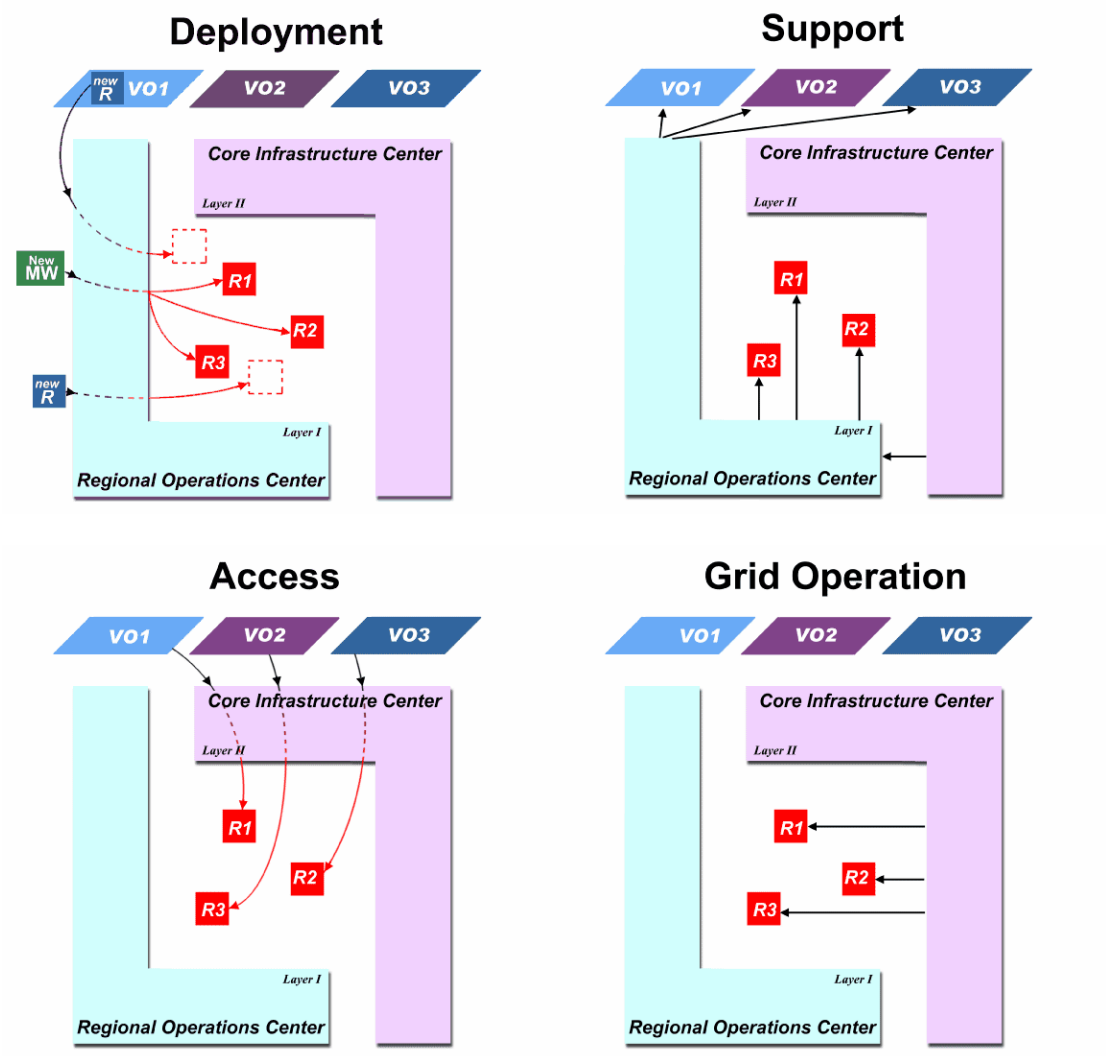



**Figure 15:** ***Schematic structure of the Operations, Support and Management activity, indicating the three Layers of this activity, and their relation to Virtual Organisations (VO) and Resource Centres (R). The figures illustrate conceptually the four classes of service provided: ACCESS – the VOs access the resources in the EGEE Grid infrastructure through the CICs; DEPLOYMENT – new resources and new middleware are deployed in the infrastructure, through the ROCs; SUPPORT – the ROCs support VOs and their individual users, as well as regional resources that are part of the infrastructure (the CICs support the Regional Operations Centres by monitoring overall Grid operations); OPERATION – the CICs are continuously monitoring and optimising overall efficiency of the resources on the Grid infrastructure, and supporting the ROCs.***

Figure 15 illustrates the structure of this activity and its relationship to user Virtual Organisations and Resource Centres. Layer I ROCs deploy middleware at Resource Centres to enable their induction into the Grid; once in the Grid, deployment at Resource Centres is repeated as Grid middleware evolves. The ROCs also provide support to both User VOs and Resource Centres, in which they interact with the Layer II CICs, and both Layer I and II are coordinated by the Layer III Operations Management Centre. Finally, users access resources through core services provided by the Layer II CICs, which monitor interactions between users and resources and the performance of the Grid.

This structure takes into account that the international infrastructure will be built on top of existing national, regional and/or specialized Grids. It is recognised that this infrastructure must be flexible so it can adapt as requirements change and our knowledge of how to operate a large Grid grows. In practice, more than one of these roles can be fulfilled at the same location.

The three layers described above are staffed by people working for EGEE (funded jointly by EGEE and the national programmes), whereas the Resource Centres are staffed by the organisations that operate the resources.

The functions, responsibilities and resource requirements associated with these components, plus the Resource Centres, are now described in detail.

#### *5.B.2.2.1 Resource Centres (RC)*

Resource Centres can range from small organisations with modest, perhaps specialised, resources to large well-established national and regional infrastructures. They can also be collections of resources belonging to and operated on behalf of user communities or virtual organisations. They will range in expertise from those with little or no prior knowledge of Grid technologies to those who already have considerable experience of operating resources in a Grid environment. Resource Centres are run by the organisations that operate the resources for the user communities and VOs, and staffed by competent technical personnel capable of operating the resource and committed to integrating them into the EGEE Grid infrastructure.

The main responsibility of Resource Centres within EGEE is to make their resources available to the Grid user community according to access management policies and service level agreements (SLAs) made with the EGEE via the Regional Operations Centre. These agreements will include such issues as operational availability, middleware updating policy, security procedures and other relevant service-related issues such as support policies.
In doing this, the Resource Centres will carry out the following tasks:

- Install approved EGEE Grid middleware on their resources including operational monitoring and authorisation and accounting tools;
- Provide necessary access and information to their Regional Operation Centre to be able to become certified and used within EGEE;
- Coordinate with ROC to solve operational problems as they arise;
- Resolve any local resource access problems.

EGEE must integrate a diverse range of resources into the Grid-empowered infrastructure. This is a major undertaking and requires a large, distributed activity to introduce these resources to the Grid and support their operation. This role is performed by the Regional Operations Centres described below.

#### *5.B.2.2.2 Regional Operations Centres (ROC)*

The EGEE Grid-empowered infrastructure must integrate a diverse range of resources to provide a range of high-availability services to the users of the Grid. This is a massive undertaking and requires a considerable activity to introduce these resources into the integrated infrastructure and support their operation as part of it. This will be accomplished by the Regional Operations Centres, which have a key role as sources of expert advice and technical support in the process of building and operating the Grid-empowered infrastructure. The ROCs will have the expertise to assist the growing number of Resource Centres in the transition to participation in the integrated infrastructure, through the deployment of EGEE middleware and the development of procedures and capabilities to operate those resources as part of the Grid-empowered infrastructure, including training for system managers at the Resource Centres. The development of deployment procedures and documentation will require some effort, and each initial deployment at a new Resource Centre will require close support, including on-site assistance where required. Effort will also be required to integrate into the EGGE infrastructure resources such supercomputers and other non-linux resources. ROC's will take care of the middle ware porting and deployment on non-linux resources and guarantee an adequate level of support for the users requiring such resources.

The middleware engineering activity will periodically deliver new releases for deployment across the Grid infrastructure at both Resource Centres and in the CICs. These releases will be delivered through the ROCs, which will have the responsibility for acceptance testing of the new middleware on a variety of platforms before deployment. Once validated against test suites produced in collaboration with the CICs and the applications groups, the Resource Centres and Core Infrastructure services will be upgraded in a coordinated way to produce minimal disruption to operational Grid services.
Once a Resource Centre is up and running, the relevant Regional Operations Centre will provide first-line support in resolving any operational problems originating at the Resource Centres. The ROCs will have sufficient expertise and information on the Grid operational state to diagnose problems as originating with operation of a resource, of an infrastructure service, or with the Grid middleware itself. In many cases, the problem will either be one already encountered, and for which a known solution is available, or soluble by the ROCs themselves. If problems cannot be easily solved, ROCs will refer problems onwards to the Core Infrastructure Centres. Once a problem is referred to a ROC, ownership rests with the ROC to ensure that it is resolved, where possible, and that the originator of the problem is kept informed of its status.

The Regional Operations Centres will also provide first-line support to Grid users to resolve infrastructure problems i.e. those arising from operations and middleware. The same problem ownership and referral to CICs applies as with resource-oriented problems. User problems originating with applications *per se* must be identified and referred to the relevant user community and/or applications development; larger and more sophisticated user organizations are likely to have their own support structures which can make the initial problem triage. On a less immediate level, applications issues may be pursued with the assistance of the application development support described in NA4.
Under the coordination of the Operations Management Centre the ROC is responsible for negotiating service level agreements (SLAs) with the Resource Centres in the region, and will include monitoring the Resource Centres to ensure delivery of the agreed services.
Each ROC will have a Centre Manager reporting to the OMC, a small deployment team and a larger team that provides 24-hour support on a shift basis. Support activities will be coordinated through a problem-tracking system operating across all centres.
There will be a coordinator of all the nine ROCs who will report directly to the Operations Manager, and who is responsible for organizing and coordinating the activities and operations of the ROCs. This ROC coordination activity will be undertaken by INFN (Italy). As required, the team will also take care of the development of architectures and the implementation of solutions necessary to integrate into the EGEE infrastructure non linux resources and to support the users interested in their use.
The collective and individual responsibilities of the Regional Operations Centres will include the following tasks:

- Establish agreed handover procedures and test suites with the users, middleware integration team and the Core Infrastructure Centres;
- Together with the applications validate new middleware releases and documentation provided by the integration team. This will include the performance of acceptance testing by the ROCs on a variety of platforms;
- Develop expertise in the use of Grid middleware to facilitate the diagnosis of problems experienced by users or Resource Centres;
- Distribute approved middleware releases to Resource Centres and Core Infrastructure Centres;
- Assist Resource Centres to deploy Grid middleware and to develop the technical and operational procedures to become part of the Grid;
- Distribute operational monitoring and authorisation and accounting tools to Resource Centres;
- Operate call centres to deal with technical queries from local users and Resource Centres, filtering out and resolving purely local problems not associated with the Grid infrastructure;
- Refer operational problems to the layer II Core Infrastructure Centres;
- Refer middleware problems to the middleware activity;
- Participate in operating a distributed query and problem tracking database system to keep a single EGEE Grid-wide log of all reported problems and solutions;
- Provide Grid Operations training for staff at Resource Centres;
- Work with CICs and Operations Management to make recommendations for improvement of the Grid infrastructure.

The separation of deployment and support as performed by the ROCs from the Core Infrastructure operated by the CICs allows the latter to focus on Grid-wide operation, while the deployment and support function can focus on resolving problems affecting specific resources.
In terms of funding and manpower, the ROCs represent the single biggest item in the EGEE proposal. This is justified from a management point of view, given the scope of the ROC activities. The ROCs must have expertise to assist resources in the transition to Grid participation, through the deployment of Grid middleware and the development of procedures and capabilities to operate those resources as part of the Grid. Once connected to the Grid, the organisations operating resources will need further support from the ROCs to resolve operational problems as they arise. This deployment and support function, provided by the ROCs, will be essential in building and maintaining the resource base of the Grid.
There will be nine ROCs, located in each of the national or regional federations of EGEE. This allows users and resources to be supported by Grid personnel on a regional basis, which should alleviate such pragmatic issues as language barriers in providing real-time support to a pan-European user community because of language and local contextual awareness issues. The ROCs will typically provide support line services to both users and Resource Centres in support of deployed Grid middleware. They will each be responsible for supporting specific Resource Centres in their regions and will cooperate with other Regional Operations Centres to back up each other's front-line user support teams and resolve problems crossing regional boundaries. The heads of the ROCs will report to the ROC coordinator.

#### *5.B.2.2.3 Core Infrastructure Centres (CIC)*

There will be a small number of EGEE Core Infrastructure Centres which will operate the core services on which the Grid infrastructure depends. They will function as a single distributed entity by sharing operational information on a frequent and regular basis. They will be in continuous contact and collectively they will manage day-to-day operation of the EGEE Grid infrastructure according to the operational policy defined by the EGEE Operations Management Centre. By maintaining transparency of the Grid operational state between them, any one of these EGEE Core Infrastructure Centres will be able to take over the operational responsibilities of another in the event of a serious operational problem. It is essential this function eventually be operated on a 24x7 basis.

Initially, the core infrastructure function will use middleware components and tools coming from different suppliers in existing Grid activities to establish the early operational Grid. Core infrastructure will have to undertake testing and a certain amount of integration work to assemble these services. However, the middleware engineering and integration activity will deliver an integrated middleware release at the end of year 1 that will be deployed by core infrastructure and implement the core Grid services in a more coherent and effective way. The development-deployment cycle will thereafter provide the core infrastructure with successively enhanced middleware releases to develop the operational capabilities of the Grid.

Core infrastructure manages the day-to-day operation of the Grid, including the active monitoring of the infrastructure and the Resource Centres, and takes appropriate action to protect the grid from the effects of failing components and to recover from operational problems. For example: a Resource Centre that is causing problems by generating invalid information may be removed from the grid until the problem has been fixed; the operations support line of a Resource Centre which has become inaccessible may be contacted to initiate recovery; a network operations centre may be informed of suspected failures. It is intended that tools will be developed to automate much of this work.

The primary responsibility of EGEE Core Infrastructure Centres is to operate essential Grid services, such as databases used for replica metadata catalogues and virtual organisation administration, resource brokers, information services, resource and usage monitoring. These services must be implemented before there can be an operational Grid at any level and their introduction is therefore amongst the highest priorities of EGEE.

In execution of their responsibility the EGEE Core Infrastructure Centres will carry out the following tasks:

- Implement and operate essential core Grid services, such as information directories, resource discovery, brokering and scheduling, replica catalogues and virtual organisation management.
- Ensure there are tested recovery procedures for all mission-critical operational services and fail-over arrangements between CICs.
- Regularly monitor the accessibility of operational services and resources at Resource Centres and take remedial action as necessary.
- Employ suitable operations management and performance tuning tools, commissioning development of new tools if required.
- Operate middleware configuration management and change control procedures.
- Collect, store and make available as appropriate operational monitoring and authorisation and accounting data from Resource Centres.
- Analyse and resolve operational problems referred by the Regional Operations Centres.
- Work with Operations Management to make recommendations for improvement of the Grid infrastructure.

There will be four CICs located at CERN and in Italy, France and the UK, and after month 12 a fifth in Russia. The sharing of responsibilities for core infrastructure services will evolve over time; some services will operate in a distributed fashion over multiple centres, while some of the centres might have specialist functions, operating certain services at a single location. All of the centres will have responsibilities for monitoring Resource Centres and Grid performance. There will be a tight coupling of the CICs, through the use of common tools and procedures, shared operational responsibility and close communication between operations teams, with each CIC Manager reporting to the CIC Coordinator in the Operations Management Centre.

#### *5.B.2.2.4 Operations Management Centre (OMC)*

The EGEE Grid Operations Management Centre will be located at CERN and consist of a small team of people selected for their substantial experience in managing existing Grid infrastructures. It will have overall management and coordination responsibility for day-to-day operation and service delivery of the EGEE Grid infrastructure and will define the operational policy, which is implemented by the EGEE Core Infrastructure Centres and Regional Operations Centres. In particular, the Operations Management team and the managers of the Core Infrastructure Centres will work very closely together.

The OMC team will be led by the EGEE Grid Operations Manager and will also include a deputy manager and staff with technical, contracts and administrative expertise. The OMC team will include two co-coordinators, one each for the ROCs and the CICs, to which the leaders of the operational centres report. There will also be a small team to maintain an operational overview of the Grid, ensuring that problems are being resolved within reasonable time frames and that performance and service delivery targets are being met. The Operational Managements Centre will also have a middleware and documentation archivist who maintains a central repository of middleware deployed on the infrastructure.
The Operations Manager and his/her team will consult with the EGEE Grid Operations Advisory Group (OAG) to receive advice on major operational policy issues and with the EGEE project management to whom it is ultimately responsible.
An essential aspect of the role of the OMC is to interface to international grid efforts to ensure interoperability of grid infrastructures. This it will do through encouraging collaborative projects and agreements on tools, service definitions, standards and protocols both directly with other grid projects and through international standards bodies such as the Global Grid Forum.
The EGEE Grid Operations Management Centre will:

- Be responsible for resource management for the EGEE Grid Operations, Support and Management infrastructure;
- Be responsible for delivery of the EGEE Grid operational service and for its improvement and development;
- Report on the status of the above to the EGEE project management as required;
- Co-ordinate the activities of the EGEE Regional Operations Centres and the Core Infrastructure Centres;
- Define and monitor operational performance and quality standards for the EGEE Grid;
- Coordinate the definition of the middleware certification and test criteria
- Inform decisions on the set of reference platforms on which middleware will be deployed and supported;
- Approve and initiate deployment of successfully tested middleware releases;
- Archive reference copies of all deployed middleware and associated documentation in a software management system;
- Enable cooperation and access agreements with user communities, virtual organisations and existing national and regional Grid infrastructures;
- Approve the service level agreements negotiated between the Resource Centres and the ROCs.
- Approve connection of new Resource Centres once they have correctly installed the necessary middleware and operational tools;
- Promote the development of cross-trust agreements between the various existing Certification Authorities (CAs) operating within the EGEE Grid community and encourage the establishment of new CAs where necessary;
- Liaise with user communities and virtual organisations to monitor their developing requirements;
- Hold regular review meetings with representatives of the federations managing the contributed resources;
- Maintain a collective overview of network performance and raise any significant issues through the appropriate channels;
- Participate in international bodies establishing standards for the protocols and interfaces involved in Grid operations;
- Negotiate operational relationships between EGEE and other Grid projects.

#### *5.B.2.2.5 Operations Advisory Group (OAG)*

This group is made up of representatives of the applications groups and representatives of the Resource Centres together with the managers of the ROCs and CICs. Its role is to advise the operations management on operational policy issues. It will also negotiate the agreements between the Resource Centres that are necessary to operate the Grid, such as agreement on security policies, access policies, and acceptance of certificate authorities and so on.

#### *5.B.2.2.6 The Model of User Support*

The model of User Support that EGEE will use is based on the assumption that the initial problem analysis will be provided by VO support experts, who then report grid related issues to the ROC, who in turn may

escalate the issue to the CICs. The CIC coordinates all reporting to middleware developers, and external resources (e.g. other grid operators, network operators, etc).
To provide appropriate user support the distributed structure of EGEE and the VOs has to be taken into account. Due to the interconnected structure of the systems and their complexity it is not possible to integrate the needed expertise in one set of people. Therefore the focus has to be on proper classification and assignment of the problems in a process that follows the layers of the software deployed on the grids. As existing experience in operating distributed environments has shown, a clear route to escalate problems and conflicts through the hierarchy has to be defined.
The OMC, together with representatives from the CICs, ROCs and VOs will develop detailed procedures and policies for user support including time limits for reacting to problems.
The user community of the EGEE project is very diverse and the applications built on top of the middleware will be highly complex. As a result for most users it will not be practical to decide with a sufficient level of certainty whether a problem originates from the middleware or application domain. On the other hand the different VOs might use the grid in very different ways which will require deep understanding of the VO-specific aspects to classify problems. For some user communities an additional dimension of complexity might exist based on regional differences. Thus it is essential that the VOs determine the origin of the problem. Later on they can decide if local user support structures are needed and are supportable by them. Problems that are application specific will then be subject to the communities' own procedures.
However, EGEE will need to collect quantitative information about the efforts needed to use the middleware and adapt to grid computing. Summary reports from the VOs on frequency of problems and time needed to resolve them are essential for this. The VO-based user support is expected to send in regular intervals VO specific reports to the OMC.
A problem being classified by the VO's user support as a grid problem will then be reported to the next level of user support. Since many problems are rooted in the operation and configuration of the grid resources the natural next level to deal with problems experienced by the users are the ROCs.
The ROCs will provide adequate support to do further classification of the problems and resolve them if possible. Each ROC will name a user support contact that manages the support inside the ROC and coordinates with the other ROCs support.
The classification at this level will distinguish between operational, configuration problems, violations of service agreements, problems that originate from the Resource Centres and problems that originate from the global services or from some internal problems of the software. Problems that are positively linked to an RC are then transferred to the responsibility of the ROC with which the RC is associated.
In case a problem can't be resolved by the ROCs user support or the nature of the problem is grid-wide the problem is referred to the CICs support structure. The CICs are expected to gather sufficient expertise to track grid problems to their source.
Each CIC will identify a user support contact person who is expected to assign problems to experts inside their CIC. Out of this group of people a support coordinator is selected by the OMC. The coordinator has the task of coordinating the tracking of problems and monitoring progress. The coordinator will, together with the CIC contacts, assign problems to CICs to match the local expertise and to balance the work. In addition the support coordinator will coordinate the reporting to the developers and external resources. The CIC support coordinator is responsible for preparing reports of the user support activities to the OMC.
The VO, CIC and ROC support coordinators are expected to provide input in the form of requirements to the team that develops the operational tools such as problem tracking systems.

#### *5.B.2.2.7 Production services and test-beds*

It is essential that from the very start of the project that EGEE deploys and operates a production-level grid service. This provides a baseline against which all developments will be compared. This must be a service that is useable and used by the user communities to do real work as this is the only way in which the real operational issues will be understood and addressed. The initial service to be deployed at the project start will be based on the LCG service and middleware.
Experience has shown that this however is not sufficient. In parallel with the production service EGEE must operate a development service where new functionality is validated, changes to middleware and services are certified not to break the service and user communities verify the new implementations and functionalities with their production applications. No middleware would be deployed to the production system without having been through this process. The production service must provide a continuous stable robust environment. The development system provides the test-bed upon which to address those issues.
Ideally the development system would run at all the resource centres in parallel with the production service. In practice a significant subset of at least 10-15 resource centres would be sufficient. The compute and storage resources associated to the development system need not be large.

The middleware is developed and integrated by the JRA1 activity and provided to the operations activity after having passed an agreed set of tests, together with the tests themselves in order that the SA1 testing group may verify the tests. The ROCs would assist the resource centres to deploy the new middleware on the development system under the coordination of the CICs. A standard matrix of tests, which gradually evolves with time, is used to validate the new middleware before the applications groups are given access to the new developments for application integration, testing, and verification. Problems discovered during this process are fed back to the developers for resolution. Once the applications groups, the resource centres, and the operations groups (ROCs and CICs) are satisfied then the new middleware will be scheduled for deployment on the production system at a mutually convenient time. Middleware and service implementations that do not pass these validation processes *will not be accepted* for deployment.
It is expected that this process is a continuous, gradual one of incremental small changes and improvements avoiding large "big-bang" integrations and changes which experience shows are extremely disruptive. However, there will be occasions when a major change is needed to introduce significant improvements (an example would be a move from a Globus 2 framework to an OGSA compliant service). In these cases where the expected benefits would outweigh the disruption the implementation would be done in agreement with all parties.
Finally, it may also be necessary to envisage a test bed that runs the current production services and middleware in parallel with the full production service. This is used to analyse and debug problems found with the production service itself and permits problem resolution without disruption of the production service.
This scale of services and test beds are what is necessary to build and maintain a reliable production quality infrastructure. It requires significant resources (machines and people) to implement. Those resources must be dedicated to this task.

#### *5.B.2.2.8 Development of operational tools*

As part of the activities of SA1 it will be essential that tools are acquired, developed or commissioned that will be used to manage and to eventually automate the operational activities in the ROCs and CICs. Certain general tools for the Resource Centres may also be required. These include tools for:

- Accounting and reporting on resource usage
- Monitoring of services and grid infrastructure systems
- Problem tracking and ticket exchange
- Support portals

The effort for such projects will come from collaborative teams drawn from the ROCs and CICs, preferably in collaboration with other grid deployment projects. These tools will be focused on evolving levels of automation which will be essential to build a long-term and manageable infrastructure.

#### *5.B.2.2.9 Introduction of new VOs and resources*

The project networking activity will actively attract new application communities to join the EGEE infrastructure. Once the community is identified the EGEE operations activity will work with the community to set up the corresponding virtual organisation, including advice on such things as setting up certificate authorities etc if necessary. The ROC serving the region(s) will work with the community's resource centres to install the middleware and bring them into the grid. A representative of the application community will participate in the Operations Advisory Group (OAG). The OAG together with the OMC will negotiate between the partners an agreement on the level of resources that will be made available to the new applications community.
Once it is agreed that a new applications community (VO) will join EGEE, the full services of the infrastructure, including the operational and user support provided by the CICs and ROCs will be available to the VO.
However, new virtual organisations must demonstrate a commitment to the project in order to justify the investment on behalf of EGEE to bring a new VO online. This commitment will include:

- An agreed minimum level of computational and storage resources consistent with the level of expected activity of the VO,
- Minimal level of network connectivity to the resource centres to be provided by the resource centre,
- Sufficient staff in the resource centres to provide the necessary level of operational support,
- Staff to provide the first level of user support to the VO,
- Organise training for the VO users in conjunction with the ROCs. It is expected that initial training to the VO be provided by EGEE, then the VO together with EGEE provide user level training tailored to the specific needs of the VO.

#### 5.B.2.2.10 Resource Allocation Mechanism

The EGEE infrastructure is intended to support and provide resources to many virtual organisations. In the initial stages of the project the four LHC experiments in High Energy Physics and a set of Bio-medical applications identified by NA4 will be supported. Each Resource Centre will support many VOs covering several application domains. This is already the case for many of these centres that currently participate in existing grid projects such as European DataGrid, CrossGrid and LCG.
In the initial stages of the project there must be a balance between the resources contributed by the application domains and those that they consume. This is important since many of those resources have been funded specifically for those application user communities. During the first six months of the project there are sufficient resources committed by the partners to ensure sufficient capacity for the needs of the initial set of virtual organisations.
Resource allocation across multiple sites will be made at the VO level. EGEE will establish inter-VO allocation guidelines; as an example High Energy Physics experiments have agreed to make no restrictions on resource usage by physicists from different institutions. Resource centres may have specific allocation policies that must be taken into account, for example due to funding agency attribution by science or by project. It is expected that there will be a level of peer review within application domains to inform the allocation process.
New resource centres that join the EGEE grid will be required to satisfy the minimum requirements described above. In particular, as new Virtual Organisations join, they should commit to bring a level of additional resources consistent with their requirements. The project must demonstrate that on balance this level of commitment is less than that required for the user community to perform the same work outside the grid. The difference will come from the access to idle resources of other VOs and resource centres. This is the essence of a grid infrastructure.
All compute resources made available to EGEE will be connected to the grid infrastructure. A site may have additional resources not initially available that may be included later once EGEE is show to be stable. This potential is significant. A small number of nodes at each site will be dedicated to operating the grid infrastructure services.
One of the requirements on the middleware activity (JRA1) and other potential sources of middleware is that mechanisms must be provided for implementing and enforcing resource quotas, allocations and limits.
The selection of new VOs and resources that join EGEE will be negotiated and administered by the networking activity NA4. This will be done in accordance with the policies designed and proposed by the eInfrastructure reflection group (NA5).

#### 5.B.2.2.11 IPv6 Developments

The developments associated with implementing IPv6 networks will be monitored together with middleware developments that are able to make use of IPv6-specific functionalities. A test-bed system based on IPv6 networking and providing services that require that functionality (such as specific security provision for an application) can be foreseen for evaluation once such facilities become available. The deployment of such a test- will depend on which sites have IPv6 capability at the time.

### 5.B.2.3 Execution-plan of the service activity

This section outlines how the EGEE Grid Operations, Support and Management infrastructure described above will be implemented and the major milestones involved. It discusses the potential communities likely to be involved as users of the infrastructure and provides two examples of interactions with the EGEE Grid organisation. Finally, it summarises how many centres of each type are envisaged and the resources which will be required.
Key objectives in implementation will be dependability, performance and functionality in descending order of priority.
The aspects of the implementation of this activity that must be addressed are described in the following.

#### 5.B.2.3.1 Service Ramp-up

From the beginning of the project all three of the services described above must be deployed and operated:

- **Production service:** This must be deployed at all the resource centres participating in the initial service, and will be based on the middleware and services deployed and operated by the LCG project at that time. The LCG service would move to the EGEE infrastructure in those centres at that point. The majority of the resources would be associated with this service. This is the service that will be supported until the OGSA-based service produced by this project is available.

- **Development service:** This should be deployed to at least 10 of the resource centres, and it is proposed that this service be based immediately on an OGSA framework, with the expectation that pre-project activities have progressed sufficiently to enable this. The point at which this implementation supersedes the initial (LCG-based) service will be determined operationally using the validation test matrix described above, but in any case this point must be reached before the end of the first year of the project.

The following table shows which centres will run the services initially at project start up, including the resource centres that will be part of the pilot service at Month 6, and those in the production service at Month 14.

| Region | OMC | CIC | ROC | RC @ M6 | RC @ M14 |
|---|---|---|---|---|---|
| CERN | Y | Y | | CERN | CERN |
| UK+Ireland | | Y | Y | CCLRC-RAL | CCLRC-RAL, ScotGrid, LondonGrid, NorthernGrid, SouthernGrid, Grid-Ireland |
| France | | Y | Y | CC-IN2P3-Lyon | CC-IN2P3-Lyon, CGG |
| Italy | | Y | Y | INFN-GRID distributed infrastructure (initial sites : INFN-Tier1 CNAF, INFN-LNL, INFN-Milano, INFN-Torino, INFN-Roma1), UniCal, UniLe, UniNa | INFN-GRID distributed infrastructure (main sites: INFN-Tier1 CNAF, INFN-LNL, INFN-Milano, INFN-Torino, INFN-Roma1), UniCal, UniLe, UniNa, ENEA |
| North | | | Y | FOM, SweGrid (6 centres) | FOM, SweGrid (6 centres) |
| SouthWest | | | Y | IFAE, LIP, CSIC | IFAE, LIP, CSIC, CESGA, INTA |
| Germany+Switzerland | | | Y | FZK, GSI | FZK, GSI, DESY, FhG |
| South East | | | Y | GRNET Central Node, Israel Academic Grid Central Node, UCY Node | Hellasgrid Nodes in Athens (2), Thessaloniki, Patra and Heraklion-Crete, CLPP-BAS node, ICI Node |
| Central Europe | | | Y | CYFRONET | CYFRONET, CESNET |
| Russia | | Y (M12) | Y | JINR, IHEP | JINR, IHEP, SINP-MSU, ITEP |

***Table Q: Services and Resource Centres Participating in 1st Pilot Grid***

The following table illustrates the resources that will be available to EGEE at the project start and by month 15.

| Region | CPU nodes Month 1 | Disk (TB) Month 1 | CPU Nodes Month 15 | Disk (TB) Month 15 |
|---|---|---|---|---|
| CERN | 900 | 140 | 1800 | 310 |
| UK + Ireland | 100 | 25 | 2200 | 300 |
| France | 400 | 15 | 895 | 50 |
| Italy | 553 | 60.6 | 679 | 67.2 |
| North | 200 | 20 | 2000 | 50 |
| South West | 250 | 10 | 250 | 10 |
| Germany + Switzerland | 100 | 2 | 400 | 67 |
| South East | 146 | 7 | 322 | 14 |
| Central Europe | 385 | 15 | 730 | 32 |
| Russia | 50 | 7 | 152 | 36 |
| **Totals** | 3084 | 302 | 8768 | 936 |

***Table R: Resources Available in EGEE at Project Start and by Month 15***

The centres that will deploy and operate the development service will be determined during the drafting of the detailed implementation plan due at month 3 (DSA1.1). It is likely that the sites that currently run the DataGrid application test-bed will form the core of the sites running this service, re-using those resources and offering a level of continuity from the FP5 projects.

#### *5.B.2.3.2 Resource Usage, Accounting and Reporting*

On a grid resources are shared between local users and the users from the various VOs using the resources provided. Many Resource Centres in EGEE will support multiple VOs. The project has to provide tools to allow grid-wide accounting of the usage of resources and to provide audit trails of the usage. Problems that have to be solved originate from the fact that the Resource Centres will do their local accounting and auditing in different ways depending on the local resource management tools that are in use.

The approach that EGEE will use is based on the concept of introducing a common, extensible reporting format for resource usage reporting. As part of the development of the operational tools this reporting format will be defined and tools developed to create reports from data collected. The level of details to be reported will be defined by the ROCs, the VOs and the OMC.

The Resource Centres will upload their accounting information in the EGEE format to a central repository daily. The central accounting repository will be maintained by the OMC. The audit trails, for reasons of privacy, will remain at the Resource Centres. Instead tools will be developed to be used by the security group to use these distributed files to trace incidents. The sites have to archive the data for at least 6 months.

The resource accounting information contains information of the individual users. This information is needed by VOs to do individual accounting and monitoring of the usage of resources by their members.

From the collected site accounting files the central accounting will create summary reports for the VOs and the sites. These reports will be published by a web server in a format defined by the OMC that will allow the Resource Centres and VOs to automatically process this information for internal usage, like setting quotas, notification of users. The setting up of this website will be a deliverable in project month 9. The website and the information published therein will be fully publicly available.

In addition monthly or quarterly global summary reports will be published and publicly available.

#### *5.B.2.3.3 Release Notes*

Each prototype service will be accompanied by release notes describing its operation, limitations and significant changes from the previous versions. These notes will appear formally as deliverables corresponding to the milestones of the pilot production grid at 6 months and to the full production grid at 14 months. In addition as a matter of course release notes will be produced for all service changes whether part of a milestone release or not as they are indispensable for the operation and maintenance of the grid infrastructure.

#### 5.B.2.3.4 EGEE Infrastructure Planning Guides ("Cook-books")

As part of building an infrastructure with the aim of providing a foundation for it to become long-lived it will be absolutely essential to provide a set of planning guides that can be used to assist new participants join or build components of the infrastructure. This applies equally to the resource centres and their administrators, the ROC's, the CIC's and the VO's themselves. These guides might use templates and checklists to assist administrators in such activities as designing a facility, determining what set of resources to acquire and how to configure them and so on. These will be detailed enough to allow administrators to understand what the limitations of the system are and how to address them. An example might be that of understanding which services can be run together on a single physical system, what the advantages are, what the disadvantages are, what configurations are required, and what (if any) consequences may arise.
The initial cook-book will be produced at the time of the fully operational production grid milestone at Month 14, and should be updated at the end of the project. This work will use the expertise and experiences of the CICs, ROCs, and staff in the Resource Centres and will be written with the assistance of the professional technical writers in NA3.

#### 5.B.2.3.5 Training

An important aspect of developing and expanding an operational Grid infrastructure is the need to train staff in how to operate this efficiently and productively and to disseminate this expertise widely within Europe (and beyond). To this end, the project will allocate resources to provide training positions at the established Centres where people will be able to work alongside experienced staff before going back to their local regions to start up a new Resource Centre or Regional Operations Centre.

#### 5.B.2.3.6 Milestones

During the first 6 months of the project EGEE will use the existing infrastructure components to rapidly establish the Core Infrastructure Centres and thus set up a pilot version of the production EGEE Grid services using co-located Resource Centres. The Regional Operations Centres will be brought on-line and begin to engage a limited number of Resource Centres at other sites, although a lot of effort in this early period will be spent on setting up support infrastructure, developing procedures and training materials and preparing test nodes for acceptance testing.
During the following 6 months improved middleware components will be introduced as available, and the Grid services moved towards full production operation and expanded. Additional Resource Centre installations will be made to broaden the resource base of the Grid in a continuous programme of Resource Centre induction. The procedures within the Regional Operations Centres and Core Infrastructure Centres will continue to be refined to achieve higher levels of service and efficiency.
The middleware engineering and integration activity will deliver its first fully integrated release at the end of the first year of operation and this will be deployed across the EGEE Grid Resource Centres and Core Infrastructure Centres. The deployment of integrated middleware will facilitate the transition to full production status early in year 2.
During the second year of operation, the process aspects of the Grid operations will be further improved and the network of Resource Centres expanded. The second major release of Grid middleware is planned for delivery at month 21 and deployment by month 24 to allow two cycles of the development-deployment process to be completed in the first two years of EGEE.
In the third and fourth years of EGEE operation, the scale of the Grid will continue to be expanded by the addition of Resource Centres and user communities. The middleware development-deployment cycle will continue to enhance and upgrade the middleware used at the Resource Centres and in the Core Infrastructure Centres. Preparatory work for this expansion will be made during the second year of the project based on the experience gained at that point.

The milestones for the first 24 months are summarised below.

| | |
|---|---|
| MSA1.1<br>6 months | Initial pilot production Grid operational<br>Based on best existing middleware |
| | 4 Core Infrastructure Centres |
| | 9 Regional Operations Centres |
| | 10 Resource Centres |
| MSA1.2<br>9 months | First review |
| MSA1.3<br>14 months | Full production Grid operational<br>Using integrated middleware release 1 |
| | 5 Core Infrastructure Centres |
| | 9 Regional Operations Centres |
| | 20 Resource Centres |
| MSA1.4<br>18 months | Second review |
| MSA1.5<br>24 months | Third review and Expanded production Grid operational<br>Using integrated middleware release 2 |
| | 5 Core Infrastructure Centres |
| | 9 Regional Operations Centres |
| | 50 Resource Centres |

**Table S** ***Milestones for first 24 months***

#### 5.B.2.3.7 Deliverables

The deliverables that this activity will produce during the first 24 months are described in the following table.

| Deliverable Number | Description | PM |
|---|---|---|
| DSA1.1 | Document describing the detailed plan for the first 15 months of activity with a list of Regional Operations Centres and Grid Operations Centres and dates of programmed activation. | 3 |
| DSA1.2 | Release notes corresponding to Milestone MSA1.1 | 6 |
| DSA1.3 | Accounting and reporting web site will be publicly available | 9 |
| DSA1.4 | Document assessing the achievement of the first year and the effectiveness of the organization and the functionality, availability and dependability of the deployed infrastructure. Also includes a detailed plan for the second 12 months of deployment of Centres. | 12 |
| DSA1.5 | First release of the EGEE infrastructure planning guide ("cook-book"), corresponding to MSA1.3 | 14 |
| DSA1.6 | Release notes corresponding to MSA1.3 | 14 |
| DSA1.7 | Updated EGEE Infrastructure planning guide | 22 |
| DSA1.8 | Document assessing the achievement of the second year and the effectiveness of the organization and the functionality, availability and dependability of the deployed infrastructure. | 24 |
| DSA1.9 | Release notes corresponding to MSA1.5 | 24 |

**Table T *Deliverables for the Grid Operations, Support and Management Activity***

We believe this is a realistic and detailed plan up to and beyond month 15 of the project. It will be reviewed at project month 9 following this review a new more detailed plan will be generated.

### 5.B.2.4 Quality of the management

#### 5.B.2.4.1 Management and competence of the Participants

Most of the participants are already involved in Grid activities either at the national or international level. Many of them are already involved in successful National or European projects like DataGrid or DataTAG. All the management experience gained in these projects is reflected in the present proposal.
The key facilities of this activity are located with partners who have demonstrated substantial achievements and experience in operating and managing Grid infrastructures. A list of these centres is given below, with the role of each centre and corresponding manpower, resources and services summarised. CERN will host the Operations Management Centre, and a Core Infrastructure Centre. There will be a further Core Infrastructure Centre at each of CNAF-Bologna, IN2P3-Lyon and CLRC-RAL, and after month 12 in Russia. The nine regional/national federations will all host a Regional Operations Centre, in some cases hosted at more than one location. The coordination and management of the Regional Operations Centres will be undertaken by Italy.
In particular, LCG has an approved programme to deploy a Grid infrastructure which will be expected to comprise about 20 sites worldwide early 2004 and a major milestone in 2007 to be able to cope with the first LHC experimental data collection, reduction and worldwide analysis.
The EGEE Grid Operations Management Centre described above will ensure a high level of coordination between layer I and II centres with the help of monitoring tools and audio and video presence techniques such as Access Grid (http://www.accessgrid.org/). Further details of the management structure, decision and information flow are given in the management activity NA1.
Details of the structure and function of operations, support and management are given in the previous sections.

#### *5.B.2.4.2 Management Structure and Responsibilities*

The management of the Operations activity has several layers described in earlier sections. The Operations Management Centre organises and coordinates the Core Infrastructure Centres and the Regional Operations Centres. On the OMC team are coordinators for the CICs and for the ROCs. The ROC coordination function will be in Italy – a manager and his deputy will have responsibility for organising and coordinating the activities and operations of the 9 ROCs. This manager will report to the Operations Manager and will formally be part of the OMC.
Each region (ROC) has a manager who is responsible for the grid operations in his region and who reports to the ROC coordinator. The ROC is responsible for negotiating SLAs with resource centres in the region and they are responsible for delivering an aggregated service or resource capacity. The ROC manager is the single point of responsibility to the OMC no matter how devolved or distributed the activity is within the region. The OMC cannot hope to manage that complexity. This is only solution that scales as more regions and resource centres are integrated.
Thus the ROCs are responsible to ensure the Resource Centres deliver the agreed level of service, and the ROCs report to the OMC (and each of the 9 ROC managers are represented at the OAG).
The Core Infrastructure Centres each have a manager who report to the CIC coordinator in the OMC who coordinates and organises the operations of the CICs.

**Table U** ***List of key facilities involved in the Grid Operations, Support and Management Activity[14]. A more detailed description, including key participant CVs and publications, can be found in Appendix 2.***

| Participant | Centre Role | Professional FTE (EU funded +unfunded) | Resources | Services |
|---|---|---|---|---|
| **CERN** | | | | |
| CERN | Operations Management Centre<br>Central Infrastructure Centre | 9 + 9 | CERN Computer Centre | Overall coordination and HEP coordination |
| **UK and Ireland** | | | | |
| CCLRC | Regional Operations Centre<br>Core Infrastructure Centre | 19 | National grid infrastructure<br><br>1 Gbps access to Network | Support Centre<br>Technology Group<br>National Grid Services<br>VO-specific Grid services<br>Large-scale CPU and Storage provision |
| TCD | Regional Operations Centre | 1 + 1 | Dedicated national grid infrastructure<br><br>1 Gbps access to Network | Resource Centre<br>National Grid Services<br>VO-specific Grid services |
| **France** | | | | |
| CNRS+CEA | Regional Operations Centre<br>Core Infrastructure Centre | 17 | National grid infrastructure and Large computing centre in Lyon | Support Centre<br>Technology Group<br>National Grid Services<br>VO-specific Grid services<br>Large-scale CPU and Storage provision<br>Large scale CPU and Storage provision |
| CGG | Regional Operation Centre | 1.8 | 1 Gbps access to Network<br>Monitoring tools | |
| CSSI | Regional Call Centre | 1.75 | | Local User support |
| **Germany and Switzerland** | | | | |
| DESY | Resource Centre, Support Centre | 3.75 | National grid infrastructure | User and Administrator support<br>CPU and Storage provision |
| FhG | Resource Centre, Support Centre | 5.75 | National grid infrastructure | User and Administrator support<br>Grid Monitoring and management<br>Middleware and service deployment |

[14] The separation between “Funded” and “Unfunded” depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| Participant | Centre Role | Professional FTE (EU funded +unfunded) | Resources | Services |
|---|---|---|---|---|
| | | | | CPU and Storage provision |
| FZK | Resource Centre, Regional Operations Centre, Grid User Support Centre | 3.75 | National grid infrastructure | User and Administrator support<br>Middleware and service deployment<br>Call centre<br>German CA<br>Large-scale CPU and Storage provision |
| GSI | Resource Centre, Support Centre | 1.75 | National grid infrastructure | User and Administrator support<br>CPU and Storage provision |
| **Italy** | | | | |
| INFN | Regional Operations Centre<br>ROC Coordination<br>Core Infrastructure Centre | 20 + 8.5 | National grid infrastructure<br><br>1 Gbps access to Network | Support Centre<br>Technology Group with expertise on Globus, Condor and EDG middleware services<br>National Grid Services<br>VO-specific Grid services<br>Large-scale CPU and Storage provision |
| ENEA | Resource Centre | 1 | Distributed clusters | Support Centre<br>CPU and Storage provision |
| Universita' della Calabria | Resource Centre | 0.5 + 0.5 | Computing Centre | Support Centre<br>CPU and Storage provision |
| Universita' di Lecce | Resource Centre | 0.5 + 0.5 | Computing Centre | Support Centre<br>CPU and Storage provision |
| Universita' di Napoli | Resource Centre | 0.5 + 0.5 | Computing Centre | Support Centre<br>CPU and Storage provision |
| **Northern Europe** | | | | |
| SARA & NIKHEF (FOM) | Level-2 Support Centre | 6 | National VL and grid infrastructure<br>One of the world largest internet exchange points<br>Several thousands of CPUs<br>Mass Storage | Support Centre<br>Technology Group<br>National VL and Grid Services<br>VO-specific Grid services<br>CA service |
| SNIC/SweGrid<br>HPC2N/Umea University<br>LUNARC/Lund University<br>NSC/Linkoping University<br>PDC/Royal Institute of Technology<br>UNICC/Chalmers University of Technology<br>UPPMAX/Uppsala University | Level-2 Support Centre | 3 + 3 | National Grid with six primary sites<br>2.5 Gbps local loops, 10 Gbps national backbone, Geant PoP, Baltic state direct connection<br>800 cpu's<br>Terascale Storage facilities | Operations, User, and Applications Support Centre<br>Technology Expertise: Security, File systems/Storage management, Performance tools and engineering, scientific software engineering.<br>National and International Grid Services<br>VO-specific Grid services |
| **South East Europe** | | | | |
| GRNET | Regional Operations Centre, Resource Centre, Local Support Centre | 4 | National grid infrastructure<br><br>1 Gbps access to Network | Large-scale CPU and Storage provision<br>Regional Support Centre<br>Technology Group<br>National Grid Services |
| CLPP-BAS | Regional Operations Centre Interface- Resource Centre, Local Support Centre | 1 + 1 | National grid infrastructure<br><br>34 Mbps access to Network | CPU provision<br>National Support Centre<br>Technology Group<br>National Grid Services |
| ICI | Regional Operations Centre Interface, Resource Centre, Local Support Centre | 2 | National grid infrastructure<br><br>2x 155 Mbps access to Network | Large-scale CPU and Storage provision<br>National Support Centre<br>Technology Group<br>National Grid Services |
| TAU | Regional Operations Centre | 1 + 1 | National grid | Large-scale CPU and Storage |

| Participant | Centre Role | Professional FTE (EU funded +unfunded) | Resources | Services |
|---|---|---|---|---|
| | Interface, Resource Centre, Local Support Centre | | infrastructure<br><br>2x 155 Mbps access to Network | provision<br>National Support Centre<br>Technology Group<br>National Grid Services |
| UCY | Regional Operations Centre Interface, Resource Centre, Local Support Centre | 1 + 1 | National grid infrastructure<br><br>34 Mbps access to Network | Large-scale CPU and Storage provision<br>National Support Centre<br>Technology Group<br>National Grid Services |
| **SOUTH-WEST EUROPE** | | | | |
| IFAE (PIC Division) | Regional Operations Centre | 2.3 + 2.3 | Data center with Petabyte-level Storage with Disk Caching<br><br>1 Gbps access to Network | Southwest Region Coordination<br><br>Primary Operations Management Team<br><br>Support Centre<br><br>National Grid Services<br><br>Data handling |
| LIP | Regional Operations Centre | 4 | Quality Assurance expertise<br><br>Hosting of clusters with direct access to GEANT backbone | Auxiliary Operations Management Team<br><br>Quality Assurance of Operational Procedures<br><br>Support Centre<br><br>National Grid Services |
| CESGA | Regional Operations Centre | 1.25 + 1.25 | Supercomputer and cluster computer center | Adaptation, deployment and operation of Monitoring and Accounting Components<br><br>Support Centre<br><br>National Grid Services<br><br>Large-scale CPU provision |
| CSIC (IFCA and IFIC Centers) | Regional Operations Centre | 4.4 | Computer cluster<br><br>Experience with Certification and Authentication | Interoperability and Operations of Certificate Authentication<br><br>Virtual Organization Management<br><br>Support Centre<br><br>National Grid Services<br><br>Large-scale CPU provision |
| INTA (CAB Center) | Regional Operations Centre | 2.2 | Computer cluster<br><br>Experience in middleware development<br><br>Molecular Biology data | Deployment and root-cause problem analysis of middleware<br><br>Support Centre<br><br>National Grid Services<br><br>Large-scale CPU provision |
| **CENTRAL EUROPE** | | | | |
| UNIINNSBRUCK | Local support centre | 0.4 + 0.4 | HPC centre<br>Network connectivity | National Grid services<br>User Support |
| GUP | Local support centre | 0.85 + 0.85 | HPC centre<br>Network connectivity | National Grid Services<br>User Support |
| CESNET | Support centre | 1.76 | HPC centre (Linux cluster, parallel machines)<br>622 Mbps access to network | National Grid Services<br>CPU and Storage provision<br>User Support |

| Participant | Centre Role | Professional FTE (EU funded +unfunded) | Resources | Services |
|---|---|---|---|---|
| KFKI-RMKI | Local Support Centre | 0.96 | HPC centre | National Grid Services<br>CPU and Storage provision<br>User Support |
| MTA SZTAKI | Local Support Centre | 0.09 + 0.09 | HPC centre | National Grid Services<br>User Support |
| NIIF | Local Support Centre | 0.64 | HPC centre<br>GEANT network access | National Grid services<br>User Support |
| CYFRONET | Regional Operations Centre | 0.85 + 0.85 | HPC centre (Linux cluster, parallel machines)<br>622 Mbps access to network | National Grid Services<br>Regional coordination<br>CPU and Storage provision and User Support |
| ICM | Regional Operations Centre | 0.74 + 0.74 | HPC centre (Linux cluster, parallel machines)<br>622 Mbps access to network | National Grid Services<br>Regional coordination<br>CPU and Storage provision<br>Support Centre |
| PSNC | Regional Operations Centre | 0.74 + 0.74 | HPC centre (Linux cluster, parallel machines)<br>622 Mbps access to network<br>GEANT network access | National Grid Services<br>Regional coordination<br>Network connectivity<br>CPU and Storage provision<br>User Support |
| JSI | Local support centre | 0.88 | HPC centre<br>622 Mbit network links<br>GEANT network connectivity | National Grid services<br>User Support |
| II SAS | Local support centre | 2.4 | HPC centre<br>Network connectivity | National Grid services<br>User Support |
| **Russia** | | | | |
| IHEP | Regional Operations Centre | 5.25 | National Atomic Energy GRID infrastructure,<br>PC clusters, Mass Storage,<br>100 Mbps access | Moscow Regional Operations and Co-ordination;<br>User Support and Training; grid deployment;<br>VO management;<br>CPU and storage provision |
| IMPB RAS | Application Operations Centre | 0.5 + 0.75 | National Computational Biology and Bioinformatics network,<br>PC cluster, 32 Mbps access | Operations and Support Center for Biology;<br>VO management;<br>CPU provision |
| ITEP | Local Support Centre, functions of CIC and ROC | 5.25 | National Atomic Energy GRID infrastructure,<br>PC clusters, Mass Storage,<br>155 Mbps access | Remote backup for Russia CIC and ROC;<br>ROC technology and integration functions;<br>VO management;<br>CPU and storage provision |
| JINR | Local Support Center, functions of CIC and ROC | 5.25 | HPC center (PC clusters, Mass Storage),<br>155 Mbps access | CIC and ROC monitoring functions;<br>ROC technology group; Grid deployment;<br>RC staff training;<br>CPU and mass storage provision |
| KIAM RAS | Local Support centre | 3 | PC cluster,<br>network access | MW validation, adaptation and documentation,<br>GRID consultations;<br>CPU and storage provision |
| PNPI | Local Support centre | 2 | PC cluster,<br>100 Mbps access | ROC functions in St-Petersburg region,<br>CPU and storage provision |
| RRC KI | Local Support Centre, Russian NREN Operation Center | 0.9 | Russian backbone network operation infrastructure; National Atomic Energy GRID infrastructure; | Russia CA and Security services ; Operational monitoring; RC staff training; Regional and international (GEANT) connectivity provision,<br>VO management; |

| Participant | Centre Role | Professional FTE (EU funded +unfunded) | Resources | Services |
|---|---|---|---|---|
| | | | PC cluster,<br>155 Mbps access | CPU and storage provision |
| SINP-MSU | Core Infrastructure Centre,<br>Local Support centre | 6 | PC cluster and Mass Storage,<br>155 Mbps access | National core Grid services;<br>RDIG administration support;<br>VO-specific Grid services and management;<br>CIC technology group;<br>RC staff training;<br>CPU and mass storage provision |

### 5.B.2.5 Justification of financing requested

Estimates of the levels of resource required for the various components of the EGEE Grid infrastructure described above are summarised in the table below. This represents the total resources required to operate and support the EGEE Grid infrastructure. The separation between "requested" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| Federation | Services provided | FTE Funded | FTE Unfunded | Financing Requested |
|---|---|---|---|---|
| CERN | OMC, CIC, Resource Centre | 9 | 9 | 1800 |
| UK+Ireland | CIC, 2 ROCs, 5 Resource Centres | 20 | 1 | 2052 |
| France | CIC, ROC, 3 Resource Centres | 20.55 | | 1805 |
| Italy | CIC, ROC, ROC Coordinator, 4 Resource Centres | 22.5 | 10 | 1953 |
| Northern Europe | 2 ROCs, 7 Resource Centres | 9 | 3 | 1178 |
| Germany + Switzerland | ROC, Support centres, 4 Resource Centres | 15 | 0 | 1162 |
| South East Europe | distributed ROC, 5 Resource Centres | 9 | 3 | 1154.5 |
| Central Europe | distributed ROC, 5 Resource Centres | 10.31 | 3.67 | 1152.5 |
| South West Europe | distributed ROC, 5 Resource Centres | 14.15 | 3.55 | 1155 |
| Russia | CIC, distributed ROC, 8 Resource Centres | 28.15 | 0.75 | 551.5 |
| **Totals** | | **157.66** | **33.97** | **13963.5 k€** |

**Table V** ***Total personnel resources required for EGEE Grid infrastructure[15].***

EGEE proposes that, because this infrastructure is based on extending the support and operations centres in existing National and Regional Grid programmes, approximately half of the total effort will be funded by the EU. The resource requested by the partners from the EU is given in detail in the table 5.B2.4. The remainder of the effort required to staff the operations centres on all three layers will be provided by the EGEE partners funded from existing programmes.

[15] The effort estimations have been rounded for simplicity. See the activity summary table for exact figures.

These resource requirements are what EGEE expects the EU to fund and are in addition to similar or greater levels of effort already provided by current Grid initiatives within Europe. They therefore represent the additional marginal effort required to operate a European Grid infrastructure in addition to current activities.
Resource Centres will not be funded directly. It is assumed that they will be supported through national or user community programmes.
The estimate of effort required at the Regional Operations Centres and Core Infrastructure Centres is based on current experience in running national and discipline-specific support centres.
The hardware resources for the centres in this activity are funded by the participants and are included in the overall computing resource table.
Resources will be allocated for training positions where people will be able to work at an established centre to gain experience before going back to their Resource Centres.

### 5.B.2.6 Exploitation of the results

The result of this activity will be to create an integrated pan-European production Grid built upon European national and regional Grid infrastructures and expertise, bound into a coherent system by a structured operational management and support organisation. This will offer to European research communities an unprecedented facility for eScience, accessible through sophisticated middleware enabling Grid services to connect diverse and dynamic user organisations with a large and growing pool of computing, instrumental and informational resources. Existing scientific and computing infrastructures and information sources will be available to a wider range of researchers than ever before, vastly increasing the interconnectivity of European research and ensuring the fullest exploitation of those resources.

This activity deploys and operates technology from external sources, including other activities within the project, in order to offer a high availability, high reliability service to a broad user community. New services are likely to arise with the EGEE Grid acting as the medium for the interaction between service providers and service consumers. This may gain a further dimension through potential industrial/commercial exploitation by the industrial partners engaged through the ***Industry Forum.***
Exploitation of the Grid needs to be considered on several levels. At the highest level, usage and provisioning of the Grid is a zero-sum game; what is taken from the Grid can only match what is put in and resources must be provided to match the needs of users. Where the EGEE Grid can and will deliver is in improving the accessibility of resources and therefore the degree of utilisation. Computing power is to some extent a perishable commodity, and what is not used now is lost for ever. By bringing together users and resources on a large scale and with efficient means for mediating between the two, the effectiveness of European eScience infrastructures will be enhanced, and at the same time the greater accessibility of resources to the entire European eScience community will enhance the capabilities of this community.
Access to use the EGEE Grid will therefore need to be balanced by securing matching sources of resource, and this project includes activities for the recruitment of both user organisations and resource providers. But beyond the macroscopic scale of balancing supply and demand, there must be a basis on which access rights are assigned in return for a contribution to the Grid. The initial user communities from the will certainly be supplying their resources to the Grid and thus acting also as resource providers, and this is clearly the simplest model for ensuring that both sides of the equation are addressed. To some extent, all user organisations must answer not only the question of what the Grid can do for them, but also what they can do for the Grid. This will be addressed by the eInfrastructure reflection group described in activity NA5.
Finally, at a smaller scale still, any resource provider will have parameters for the usage of resources under their ownership by other parties. The terms and conditions under which resources are connected to the Grid must be formalised and matched by terms and conditions agreed with users, and both sides of the interaction must be monitored and regulated by the core infrastructure of the Grid to ensure that rights and responsibilities are met.
Many user and resource provider organisations will collaborate in forming and using the EGEE Grid and Service Level Agreements will define the expected levels of service provided by and to each of them. It will be a substantial and difficult task to harmonize all the requests from different sets of users with the policies of many Resource Centres. Reducing the complexity of these many-to-many relations will be one of the major challenges of the EGEE Grid.

### 5.B.2.7 Risk Analysis

An improvement of existing deployed Grid infrastructures to create a Grid of true production quality Grid is a new challenge, and to do so on the scale proposed by EGEE is a vast undertaking. The step forward from

working test beds and separate national and regional infrastructures to a pan-European Grid suitable for real production has several possible risks. Some of them are clear:

- The Grid is a new technology and as such it is far from being perfect. Some architectural challenges are still unsolved and eventually many new services could be necessary to make a wide European Grid infrastructure sufficiently robust. New approaches are foreseen during the life of the project and new middleware will be available providing new necessary features. The transition to new releases and new services is a delicate process, which can in the end draw more resources than foreseen.
- Although all the participants have consolidated experience in Grid Technology, this is generally quite rare outside this community (or in the marketplace). Recruitment of new personnel will also require substantial training and this could slow down the initial momentum. Delays in the execution of the activity could frustrate the user communities and resource provider communities and have a bad impact on the effectiveness of the deployed infrastructure. However, the initially deployed resources will largely come from disciplines that already have a high level of Grid experience, and will be closely linked (some co-located) with Regional Operations and/or Core Infrastructure Centres. This will facilitate the interaction between Resource Centres and Grid support and operations.
- Unrealistic expectations of what the Grid will deliver must be avoided to prevent the perception of failure even when the technical and operational goals of the project have been achieved.

### 5.B.2.8 Summary

| **Activity number :** | SA1 | **Start date or starting event:** start of project | | | | | | | Project start | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Participant:** | 1 CERN | 2 GUP | 3 UNIINNSBRUCK | 4 CESNET | 7 KFKI-RMKI | 8 MTA-SZTAKI | 9 NIIF | 10 CYFRONET | 11 ICM | |
| **Expected Budget per Participant:** | 1800 | 95 | 78 | 332 | 176 | 18 | 113 | 168.5 | 140 | |
| **Requested Contribution per Participant:** | 1800 | 95 | 78 | 166 | 88 | 18 | 56.5 | 168.5 | 140 | |
| **Participant:** | 12 PSNC | 13 II-SAS | 14 JSI | 15 TCD | 16 CCLRC | 20 CEA/DSM | 21 CGG | 22 CNRS | 23 CSSI | 25 DESY |
| **Expected Budget per Participant:** | 146 | 231 | 162 | 192 | 3720 | 285 | 315 | 2710 | 300 | 142.5 |
| **Requested Contribution per Participant:** | 146 | 115.5 | 81 | 192 | 1860 | 142.5 | 157.5 | 1355 | 150 | 142.5 |
| **Participant:** | 27 FhG | 28 FZK | 29 GSI | 31 INFN | 36 FOM | 37 SARA | 40 VR | 41 IHEP | 42 IMPB RAS | 43 ITEP |
| **Expected Budget per Participant:** | 680 | 1074 | 285 | 1563 | 400 | 780 | 588 | 197 | 20 | 197 |
| **Requested Contribution per Participant:** | 340 | 537 | 142.5 | 1563 | 200 | 390 | 588 | 98.5 | 20 | 98.5 |
| **Participant:** | 44 JINR | 45 KIAM RAS | 46 PNPI | 47 RRCKI | 48 SINP-MSU | 49 CLPP-BAS | 50 UCY | 51 GRNET | 52 TAU | 53 ICI |
| **Expected Budget per Participant:** | 197 | 118 | 78 | 40 | 236 | 192 | 192 | 775 | 191.5 | 383 |
| **Requested Contribution per Participant:** | 98.5 | 59 | 39 | 20 | 118 | 192 | 192 | 387.5 | 191.5 | 191.5 |
| **Participant:** | 54 LIP | 55 CESGA | 56 CSIC | 57 IFAE | 58 INTA | 64 ENEA | 65 UniCal | 66 UniLe | 67 UniNa | |
| **Expected Budget per Participant:** | 483 | 157.5 | 635 | 281 | 315 | 186 | 99 | 99 | 99 | |
| **Requested Contribution per Participant:** | 241.5 | 157.5 | 317.5 | 281 | 157.5 | 93 | 99 | 99 | 99 | |

**Objectives**

This activity will create, operate, support and manage a production quality European Grid infrastructure which will make computing resources at Resource Centres across the ERA accessible to e-Science communities in a range of applications fields.

**Description of work**

- Operation of Core Infrastructure services to connect user communities with resources.
- Infrastructure monitoring and control to achieve required performance levels.
- Deployment of middleware and Resource Centres to expand and upgrade the infrastructure.

- Support of Resource Centres and User communities.
- Management of the Grid infrastructure.

**Deliverables**

| | | |
|---|---|---|
| DSA1.1 | M3 | Detailed execution plan for first 15 months of infrastructure operation. |
| DSA1.2 | M6 | Release notes corresponding to MSA1.1 |
| DSA1.3 | M9 | Accounting and reporting web site publicly available |
| DSA1.4 | M12 | Assessment of initial infrastructure operation and plan for next 12 months |
| DSA1.5 | M14 | First release of EGEE Infrastructure Planning Guide ("cook-book"). |
| DSA1.6 | M14 | Release notes corresponding to MSA1.3. |
| DSA1.7 | M22 | Updated EGEE Infrastructure Planning Guide. |
| DSA1.8 | M24 | Assessment of production infrastructure operation and outline of how sustained operation of EGEE might be addressed. |
| DSA1.9 | M24 | Release notes corresponding to MSA1.5 |

**Milestones and expected result**

| | | |
|---|---|---|
| MSA1.1 | M6 | Initial pilot Grid infrastructure operational. |
| MSA1.2 | M9 | First review |
| MSA1.3 | M14 | Full production Grid infrastructure (20 Resource Centres) operational. |
| MSA1.4 | M18 | Second review |
| MSA1.5 | M24 | Third review and expanded production Grid infrastructure (50 Resource Centres) operational. |

**Justification of financing requested**

This activity will operate 9 Regional Operations Centres eventually providing 24x7 support and 5 Core Infrastructure Centres providing 24x7 operational monitoring and control of the Grid infrastructure. Both of these categories of centre need a substantial staff in order to provide round-the-clock services. There is also a central Operational Management Centre co-coordinating the distributed centres. Throughout this multi-layer organisation spanning the ERA funding is requested to fund half of its personnel, a total of €14.61 Million funding for some 80 FTE over two years, with the remainder of personnel provided and funded by the project partners, and complemented by the actual infrastructure (machines, SW resources) etc used in the centres of this activity.

## 5.B.3 Activity SA2 - Network Resource Provision

### 5.B.3.1 Scientific and technological excellence

EGEE is proposing a large-scale Grid for eScience applications covering the European Research Area. This Grid will be a distributed infrastructure and will therefore be dependent on a communications network that links its resources. The European Research Area is currently served by a set of National Research and Education Networks (NRENs) linked via a high-speed pan-European backbone, the GEANT network, which is created and managed by a not-for-profit company, DANTE. The EGEE Grid will use the European research networks to connect the providers of computing, storage, instrumentation and applications resources with user virtual organizations.
Distinct from the resources supplied to the Grid, EGEE will construct an integrated and scalable system to manage:

- Access to the resources of the Grid
- Relationships between parties interacting via the Grid
- Operation of the Grid as a reliable service.

All of these dimensions must have a network perspective for successful provision of Grid services. The way in which these activities are realised will be determined by the requirements-defining activities of EGEE and shaped by the service-driven ethos that is vital to the success of the project.
It should be stressed that this activity is entirely about the management of the relationship between EGEE and DANTE and the NRENs, and their associated access networks and the provision of new services to EGEE over existing or planned network connectivity. It is outside the scope of EGEE to provide connections for any user or resource site, and there are no plans to do so; connectivity is the responsibility of the site connected and is provided by the research and access networks. Of course, it is important that sites connected to a Grid infrastructure have adequate bandwidth, performance etc., and EGEE should incorporate these aspects into the criteria for evaluation and validation of a site as appropriate to participate in the Grid. Where appropriate, EGEE can help to promote the need for a particular site to improve its connectivity in order to enhance its ability to participate in the Grid.
Network provision can itself be viewed as another class of Grid resource, in addition to computing, storage, applications etc., albeit a very large distributed resource partitioned into a number of domains with separate administrative authorities, which must collaborate to offer a coherent service. Grid applications are demanding in their requirements for capacity and quality-of-service (QoS), and yet must co-exist on the production network with the rest of the research community; provision of service to either community must not compromise the provision of service to the other, despite their differing requirements.
New levels of end-to-end service across multiple administrative domains will require significant enhancement of the network control plane infrastructure. EGEE will act in collaboration with the network administrative authorities to develop, with appropriate interfaces between Grid middleware and the network, a control plane infrastructure to allow the NRENs to meet the needs of the EGEE Grid.
The network resource requirements of EGEE will be met by bringing together what are currently research-only elements to make a reliable production-level Grid network service. Network-oriented joint research is necessary because end-to-end services in either network reservation or network monitoring cannot be provided today. The required joint research activities are described in activity JRA4.

### 5.B.3.2 Objectives and originality of the service activity

The objective of the network resource provision service activity is to ensure that EGEE has access to appropriate networking services provided by the GEANT and the NRENs that will link the users, resources and operational management of the EGEE Grid. This incorporates the definition of requirements, the specification of services technically and operationally, and the monitoring of service-level provision. The policies defining Grid access to the network will be defined by this activity.
Typically, an end-point in NREN-A will need to make a connection to an end-point in NREN-B, via the GEANT backbone, using a service with specific characteristics. Requests for a particular service are made to the next domain along the connection path, but in order to provide guaranteed end-to-end Quality-of-Service with resource reservation service requests must be co-coordinated across domains. At a minimum the following policies need to be defined:

- Individual: policies are required specifying which end-points of NREN-A and NREN-B can request network services, and the types and volumes of the services they may request.

- Membership: users may belong to virtual organizations (VOs) defined within the Grid context and not known as individuals to the NREN itself. A VO may as such be considered as user of the NREN, and the policies governing individual user rights may be delegated to the VO, with access rights associated to the individual or their role.
- Reservation: Grid users may need to allocate a chain of network resources in advance prior to scheduling and executing a job. GEANT and the NRENs must allow pre-allocation of resources and issue an authorization based on this reservation.
- Prioritisation: services may be created with a range of priority levels and policies are required to determine the distribution of capacity amongst these priority levels for the purposes of load-balancing and the allocation of services to particular organizations and roles.
- Aggregation: there must be a policy in GEANT that specifies the aggregate resources that may be provided to an NREN, with admission control performed within the NRENs. Note that the resource requests themselves may originate with Grid middleware, but capacity is constrained at the GEANT-NREN interface. Similar policies are required within an NREN to define the aggregate resources that may be requested by a Virtual Organization.
- Operations: there must be policies authorising parties to obtain operational information about the performance of the networks in order to trace, diagnose and resolve problems. Users and Grid operations centres will require different views of the network to monitor its performance.

Once the policies are defined and implemented in each network domain, users authenticated by identity and role may receive authorisation against the respective policies. Accounting will be used mainly for monitoring usage of resources against SLAs, with the possibility to enable differential charging for their use.
The originality of this activity lies in ensuring that new network services, distinct from the traditional best-efforts IP service based on over-provisioned network capacity, are introduced to meet the requirements for production-level Grid network, based on user and operational needs, assessed in collaboration with GEANT and the NRENs. Such services may comprise established connections between specific end-points at various layers of the network, reservations with guaranteed bandwidth and other QoS parameters (latency, jitter etc), and even scavenger services at less-than-best-efforts that guarantee to complete a transfer within a specified time window, e.g. overnight, despite according any part of the transfer a low level of priority. A portfolio of such services can meet the diverse requirements of a Grid serving a variety of user communities, while making efficient use of the network infrastructure.
This Network Resource Provision activity will introduce a scalable methodology for requirements capture, aggregation and modelling, and the generation of service specifications and agreements. The activity must also incorporate operational and management aspects for ensuring service provision. The services envisioned are not all available at this moment, and additional work is required to bring those services to the network, and more specifically, to make them accessible to Grid middleware in an integrated way. This work is a task within a separate but closely-linked Joint Research activity JRA4 and the Network Resource provision Service activity will exploit the results of this activity.

### 5.B.3.3 Execution plan of the service activity

A study will be performed aimed at capturing the requirements, in terms of network capacity within distinct classes of service, made by the EGEE production Grid of the international wide area network. For example, the following services may be required by EGEE applications from GEANT and the NRENs : access to layer-3 diffserv-based prioritised traffic classes, extended layer-2 VLANs, secure channels. This study will also take into account the experiences of existing Grid and Grid-network projects, such as DataGrid, DataTAG etc.
The deliverables of this activity will be:

**SLRs**
Requirements should be formulated in terms of network SLRs (Service Level Requests) for each user virtual organisation and application provider within EGEE. These SLRs will be commonly defined by user/applications representatives based on their needs, and by network representatives based on available or planned technologies. It is important to develop a planning methodology and model in order to predict aggregate capacities in different traffic classes, based on these network SLRs.

**Modelling**
A planning and modelling methodology will be developed to predict aggregate network service requirements, in terms of capacity within different classes of service, taking the SLRs as inputs. The network requirements model will be regularly updated based on evolution of Grid user base and its requirements. Milestone MSA2.2 "Initial requirements aggregation model, specification of services as SLSs on the networks" correspond to the first definition of the modelling methodology. This methodology will evolve during the project, to follow new application requirements and new services deployed by network providers.The final outputs of the modelling task, combined with negociations and agreements with mainly DANTE and the NRENs, are the SLA and appropriate policies (DSA2.2 and DSA2.3).

**SLSs**
The model will be used to derive an evolving series of SLSs (Service Level Specifications) for the network that has then to be delivered by DANTE and the NRENs. The joint research activities described in activity JRA4 will implement the interfaces to new Grid services required to meet SLSs, in conjunction with the development of the network control plane infrastructure by the network administrations.

**SLAs**
Service specifications will need to be formalized by SLAs (Service Level Agreements) between EGEE and DANTE/NRENs; there may be a chain or hierarchy of SLAs. The provision of the agreed services in terms of network performance delivered must be monitored to ensure SLA adherence. Tools for SLA adherence will be developed by the proposed joint research activity JRA4 in network monitoring.

**Policies**
The SLAs will be expressed in terms of policies covering, amongst others, the dimensions of individual and organizational authority, reservation, prioritization, aggregation and operations.

**Operational Model**
The operational management of EGEE must integrate seamlessly with the operations of the existing GEANT and NRENs. The GEANT network operations are organised on a day-to-day basis by the Network Operations Centre which interacts with similar centres in NRENs and network component suppliers. The interfaces between the Grid operations centres and the network operations centres are critical. Information from daily operational performance must be aggregated for management review of network service provision, and recurrent and systematic failure or weakness in service provision will be addressed by a liaison group that meets regularly to oversee service delivery across the EGEE –DANTE/NRENs interface.

The above items will be re-visited on a cyclical basis to evolve the service provision with both the requirements from the EGEE applications base and the technical capabilities for various services are developed by GEANT and the NRENs.

The milestones and deliverables for this activity are described in Table W below.

| Project Month | Deliverable or Milestone | Item |
|---|---|---|
| M3 | **Milestone** MSA2.1 | First meeting of EGEE-GEANT/NRENs Liaison Board |
| M6 | **Deliverable** DSA2.1 | Survey of pilot application requirements on networks, initial SLRs and service classes. |
| M9 | **Milestone** MSA2.2 | Initial requirements aggregation model, specification of services as SLSs on the networks. |
| M12 | **Milestone** MSA2.3 | Operational interface between EGEE and GEANT/NRENs. |
| M12 | **Deliverable** DSA2.2 | Institution of SLAs and appropriate policies. |
| M24 | **Deliverable** DSA2.3 | Revised SLAs and policies. |

**Table W** ***Milestones and Deliverables of the Network Resource Provision activity***

### 5.B.3.4 Quality of the management

#### *5.B.3.4.1 Management and competence of the participants*

This Network Resource Provision activity (SA2) will be managed by a Network manager funded by the project who reports to the Operations Manager of SA1. He will oversee both network service (SA2) and network development activities (JRA4).
Within Network Resource Provision there are two types of activity:

**Task-oriented activities.** These include ongoing requirements capture, modelling and planning mechanisms.
**SLA-oriented activities**. Formal management of the relationship between EGEE and DANTE and the NRENs. There will be a complex hierarchy of SLAs in place between multiple bodies. These will be managed through normal SLA management mechanisms. EGEE, DANTE, and the NRENs will agree SLA monitoring metrics and implement associated monitoring tools. The results of SLA monitoring will be reviewed on a regular basis via a monitoring unit (quarterly in the first year, and twice yearly thereafter.) This will result in an assessment document which is submitted to the liaison body. The necessary feedback mechanism is the following: (i) If the SLA has been adhered to adequately the body will accept the assessment document which will be entered into the management records. (ii) If there have been SLA failures the liaison body will define appropriate actions to mitigate problems, and receive a subsequent closing report.
The relationship between EGEE, DANTE and the NRENs Policy Committee (representing associated NRENS) is critical. The close link between the pan-European research network and the pan-European research Grid proposed by EGEE is widely recognised, and the planning and execution of EGEE needs to be carefully co-coordinated with the development of the networks in a collaborative fashion. The bodies that operate this network, composed of DANTE and the NRENs, are aware and receptive to the EGEE Grid as a major new capability for the European scientific community, and also as a major new demand on the networks themselves. The network management bodies are committed to develop new services in conjunction with the requirements of the EGEE Grid, and a peer relationship between DANTE/NRENs and EGEE should be fostered. To ensure effective and timely communications an EGEE Network Liaison Board will be created, consisting of a small number of representatives from EGEE, DANTE, and the NRENs, meeting four times per year in the first year and twice per year thereafter. The terms of reference will be determined very early in the project, but will include:

- To assess service provision to EGEE from an end-to-end perspective (where such issues are not directly covered by the SLAs). Where end-to-end service provision problems are occurring to set up appropriate mechanisms (e.g. task forces) to try to resolve such problems, and to receive and assess concluding reports.
- To oversee technical collaboration between EGEE and DANTE/NRENs on the JRAs from both projects, i.e. checking that requirements and deliverables are being appropriately expressed and met.
- To raise forward-looking issues (such as new service requirements) which will affect operational policy in the longer term.

Competence to manage this service activity is demonstrated through the direct participation of representatives from both DANTE and the GEANT-NREN PC (Policy Committee). Individual members of EGEE have extensive experience of use of the wide area network, and are involved centrally in global activities essential to the furtherance of the network sector. This includes experience in end-to-end monitoring, AAA-based network control-plane software development, and Grid network standards development through the Global Grid Forum.
The relation between EGEE, DANTE, and the NRENs will be regulated by a MoU prepared by the projects and that will be made available to the EU.
This activity will be managed by UREC (part of CNRS, participant number 22). UREC is a service entity inside CNRS devoted to network and security consulting, and is involved centrally in global networking through various international network projects and NREN participation. UREC has wide experience in Grid networking, especially provisioning and end-to-end monitoring, and is currently leading the network work package of the DataGrid project.
RRC KI will also participate to this activity. RCC KI provide Russian NREN Operational Center and international connectivity for Russian science (in particular the connectivity with GEANT), and has extensive experience in NOC (Network Operations Centre) operational model and SLA definitions.
GRNET will also participate to this activity helping in SLR/SLS/SLA definitions.

### 5.B.3.5 Justification of financing requested and value for money

The Network Resource Provision service activity requires the manpower resources summarised in Table X below. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%. This activity is under the control of the Network Co-coordinator, who reports to the EGEE Operations Manager in activity SA1. The Network Co-coordinator is also responsible for DANTE and the NRENs liaison, and will organise and participate in the liaison body as described above. UREC will contribute with two people to this activity, of which one is funded by EGEE. RRC KI will contribute with two people to this activity, of which one is funded by EGEE. GRNET will contribute with half a person, funded from its own sources.

| Participant | Description of Role | FTE (EU funded + unfunded) |
|---|---|---|
| CNRS/UREC | Network Co-coordinator overseeing both service (SA2) and research activities (JRA4); responsible for DANTE and the NRENs liaison.<br>Network resource provision requirements<br>SLR/SLS/SLA definitions<br>Operational model | 2 + 0 |
| RCC KI | Network resource provision requirements<br>SLR/SLS/SLA definitions<br>Operational interface between RDIG, Russian network providers and EGEE. | 2 + 1 |
| GRNET | SLR/SLS/SLA definitions | 0 + 0.5 |
| | **Total (FTEs)** | **4+1.5** |

**Table X** ***Manpower requirements of the Network Resource Provision activity.***

### 5.B.3.6 Exploitation of results

The services of GEANT and the NRENs are already available to scientists through the ERA. This activity will manage the way in which services, some of which may be specialised over and above what is generically available on the NRENs, are provided to the Grid-empowered infrastructure constructed by the EGEE project. An example might be, when necessary bandwidth allocation services have been provisioned, the ability to perform a large data transport with guaranteed bandwidth for a fixed timeslot which is created, initiated and controlled through Grid services. These services will be a tightly integrated part of the Grid services offered by the infrastructure and accessible to the user base of that infrastructure.

The terms of service provision to the infrastructure by GEANT and the NRENs will be contained in the Service Level Agreements that are a key output of this activity.

### 5.B.3.7 Summary

| Activity number : | SA2 | Start date or starting event: | | | | Project start | |
|---|---|---|---|---|---|---|---|
| **Participant:** | 22 CNRS/ UREC | 47 RRC KI | 51 GRNET | | | | |
| **Expected Budget per Participant:** | 400 | 74 | 115 | | | | |
| **Requested Contribution per Participant:** | 200 | 37 | 0 | | | | |

**Objectives**

To ensure that EGEE has a mechanism for defining its network requirements and clearly expressing these to GEANT and the NRENs in order to provision a range of network services at various layers of connectivity and with various QoS parameters.

**Description of work**

Capture requirements from EGEE users in terms of network capacity and service class. Perform aggregate modelling, derive Service Level Specifications for network provision, create Service Level Agreements with DANTE and the NRENs, monitor SLA adherence against aggregate traffic (demand) and network performance (supply). Manage relationship between EGEE and DANTE and the NRENS through a formal liaison body.

**Deliverables**

| | | | |
|---|---|---|---|
| DSA2.1 | M6 | (UREC/CNRS) | Survey of pilot application requirements on networks, initial SLRs and identification of service classes |
| DSA2.2 | M12 | (UREC/CNRS) | Institution of SLAs and appropriate policies |
| DSA2.3 | M24 | (UREC/CNRS) | Revised SLAs and policies |

**Milestones and expected result**

| | | |
|---|---|---|
| MSA2.1 | M3 | First meeting of EGEE-GEANT/NRENs Liaison Board. |
| MSA2.2 | M9 | Initial requirements aggregation model, specification of services as SLSs on the networks |
| MSA2.3 | M12 | Operational interface between EGEE and GEANT/NRENs. |

**Justification of financing requested**

Two persons fully funded by EGEE, complemented by one person provided by CNRS/UREC and one person provide by RRC KI. One person fully funded by EGEE, complemented by one person provided by CNRS/UREC, one person provided by RRC KI and half of a person provided by GRNET

## 5.B.4 Overall Implementation and Co-ordination of the Specific Service Activities

### 5.B.4.1 Approach

Rather than take the approach of splitting SA1 into several independent Specific Service Activities we have established it as a single closely interrelated activity with considerable overlap between its constituent parts. Because SA2 is a very specific activity it has been presented separately for clarity. Both of these activities will have to work closely with the Networking and Joint Research Activities and our management structure has been defined to encourage this close working.
The management of these activities are closely aligned with their technical requirements. As has been outlined in SA1 in detail there are three layers of Operations, Support and Management built on top of the resources centres. We believe that this structure is the one most likely to meet the needs of our user base to ensure they get the service they expect from the EGEE infrastructure. By gathering all of these activities under one management we hope to ensure that users in particular no where to turn for support.
Likewise with SA2, we realise that the interfaces between the Grid operations centres and the network operations centres are critical.
The three layers within SA1 are as follows:

- **Layer I Regional Operations Centres** (ROC) which deploy Grid middleware at Resource Centres to connect resources to the EGEE Grid and provide geographically local front line support to both users and Resources Centres on a 24x7 basis. There will be an ROC in each of the nine partner regions participating in EGEE. The ROC mandate includes the support to new Resource centres joining EGEE, the test and certification of those as EGEE nodes, as well as the detailed troubleshooting and middleware upgrades.
- **Layer II Core Infrastructure Centres** (CIC) which provide the basic service infrastructure of the Grid, operating the key services which connect users with resources. The CICs will also support the Regional Operations Centres. The CICs will guarantee 24x7 operations.
- **Layer III Operations Management Centre** (OMC) which manages the operation of the entire EGEE Grid from a single centralised location.

Through SA2 these centres will endeavour to ensure that they can work seamlessly with the operations of the existing research networks. The GÉANT network operations are organised on a day-to-day basis by the Network Operations Centre which interacts with similar centres in NRENs and network component suppliers. In particular, information from daily operational performance must be aggregated for management review of network service provision, and recurrent and systematic failure or weakness in service provision will be addressed by a liaison group that meets regularly to oversee service delivery across the EGEE – GEANT/NREN interface. It is expected this group will contain representatives from all Specific Service Activities presented here.

### 5.B.4.2 Mutual dependencies

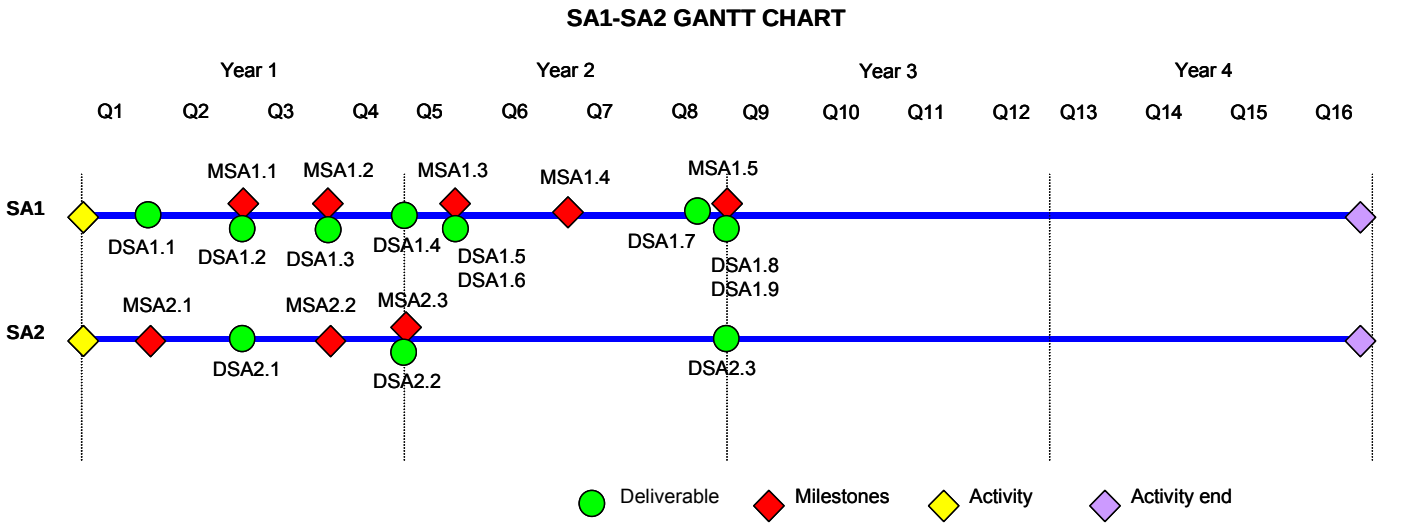
As has been outlined in the preceding section, we have taken the approach with regard to these activities to describe the majority of them within a single activity – SA1. This has been done purposely to optimise the mutual dependencies between them without putting in place extra layers of management which might make this more difficult. Our decision to place the network related activities in a separate SSA was taken because of the specific roles required to achieve this task – the partners of this activity being closely aligned with GEANT in particular. It will be the task of the management within both SAs to ensure mutual dependencies are identified and a continuous and constructive dialogue is established.

### 5.B.4.3 Execution plan

#### *5.B.4.3.1 Execution plan for first 15 months*

The diagram on the next page shows a Gantt chart and Activity Interdependencies diagram for SA1 and SA2. The following describes the execution of the Service Activities in the first 15 months of the project.

- **Project start:** Even before the project official start date, the work to produce a detailed execution and implementation plan for SA1 will be started. This is essential in order that the operational infrastructure can be put in place as soon as possible. This planning will be sufficiently advanced to allow the set up of the initial CIC and ROC centres, and to use them to start to operate the existing LCG service for EGEE. We intend to have all SA2 management functions and staffing in place by the start of the project to ensure a quick start-up phase.
- **PM3:** During the first 6 months the ROCs will engage with a limited number of resource centres to set up support infrastructures and procedures. The CICs will take over the operational aspects of the existing LCG service and operate it for EGEE. The Liaison Board between EGEE and DANTE and the NRENs will be defined and organized, and the first meeting will happen corresponding to the milestone MSA2.1. The collection of application network requirements will have started. The detailed project implementation plan for the first 15 months will be delivered at the end of month 3.
- **PM6:** At the end of month 6 the pilot production grid will be fully operated and managed by EGEE (MSA1.1) and the corresponding release notes will be delivered. Towards the end of this period we will start to deploy the development service in parallel with the pilot production service, to a limited number of resource sites. Application requirements and identification of network service classes will be collected and reported in DSA2.1. First version of network SLRs should be well known at this step.
- **PM9:** The accounting and reporting infrastructure will be implemented in parallel with the setting up of the pilot production service. By the end of month 9 the accounting and resource usage reports will be published on a publicly available web site (DSA1.3). During this time the ROCs will be continuously engaging new resource centres to become operational within EGEE. Initial application network requirements will be aggregated into SLSs for networks. It corresponds to milestone MSA2.2 and it will be shown at the first project review.
- **PM12:** At the end of month 12 a first assessment of the effectiveness of the operation of the grid infrastructure based on the first 6 months operation will be published (DSA1.4) and will be used as a basis upon which to build the detailed planning for the next 12 months. This plan will include defining additional resources that will be included in the grid. During this period the production service will transition from the pilot based on existing middleware to that run on the development system based on EGEE integrated middleware in preparation for the milestone production release (MSA1.3). First SLAs and associated policies will be reported in DSA2.2, and will be matched against prototypes implemented through JRA4. A operational interface defined between OMC, CICs, ROCs and GEANT/NRENs NOCs will be set which correspond to milestone MSA2.3
- **PM15:** The full production grid will be available based on the EGEE middleware release. The goal of at least 20 resource centres should be achieved, together with the full complement of ROCs and CICs, including those in Russia. Provided with this release will be a full set of release notes and the first edition of the Infrastructure Planning Guide (MSA1.3, DSA1.5, DSA1.6). The operational model between EGEE GOC and GAENT/NRENs NOC should be mature by this point. A second phase of SLAs fine grained definition will have started.



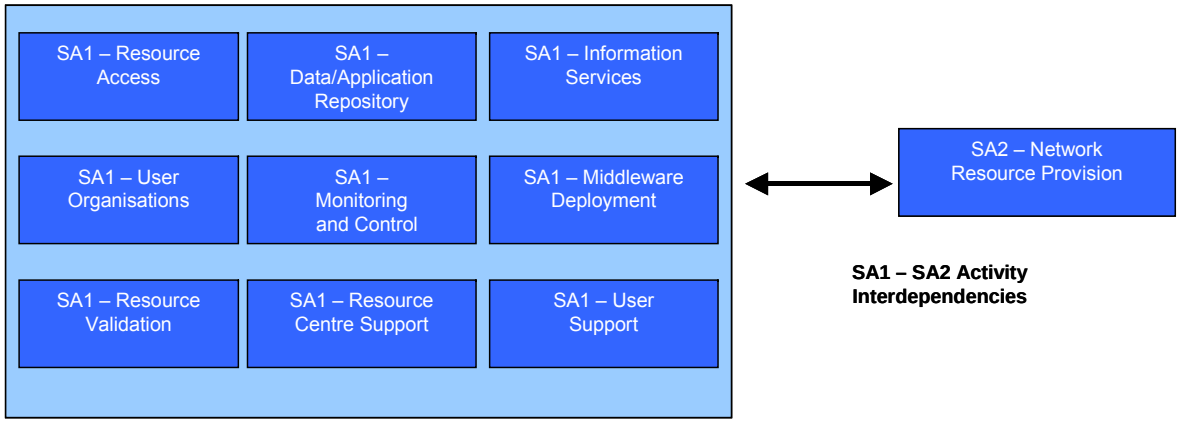




***Figure 16 SA1-SA2 Gantt chart and activity interdependencies***

| Milestones and expected result | | |
|---|---|---|
| MSA1.1 | M6 | Initial pilot Grid infrastructure operational. |
| MSA1.2 | M9 | First review |
| MSA1.3 | M14 | Full production Grid infrastructure (20 Resource Centres) operational. |
| MSA1.4 | M18 | Second review |
| MSA1.5 | M24 | Third review and expanded production Grid infrastructure (50 Resource Centres) operational. |
| MSA2.1 | M3 | First meeting of EGEE-GEANT/NRENs Liaison Board. |
| MSA2.2 | M9 | Initial requirements aggregation model, specification of services as SLSs on the networks |
| MSA2.3 | M12 | Operational interface between EGEE and GEANT/NRENs. |

***Table Y – Summary of SA1-SA2 milestones***

| Deliverables | | |
|---|---|---|
| DSA1.1 | M3 | Detailed execution plan for first 15 months of infrastructure operation. |
| DSA1.2 | M6 | Release notes corresponding to MSA1.1 |
| DSA1.3 | M9 | Accounting and reporting web site publicly available |
| DSA1.4 | M12 | Assessment of initial infrastructure operation and plan for next 12 months |
| DSA1.5 | M14 | First release of EGEE Infrastructure Planning Guide (“cook-book”). |
| DSA1.6 | M14 | Release notes corresponding to MSA1.3. |
| DSA1.7 | M22 | Updated EGEE Infrastructure Planning Guide. |
| DSA1.8 | M24 | Assessment of production infrastructure operation and outline of how sustained operation of EGEE might be addressed. |
| DSA1.9 | M24 | Release notes corresponding to MSA1.5 |
| DSA2.1 | M6 | Survey of pilot application requirements on networks, initial SLRs and identification of service classes |
| DSA2.2 | M12 | Institution of SLAs and appropriate policies |
| DSA2.3 | M24 | Revised SLAs and policies |

***Table Z – Summary of SA1-SA2 deliverables***

Of particular importance in these tables are milestones MSA1.1 and MSA1.3. It is by the attainment of these milestones that we believe the overall success of EGEE will come to be judged.

# 5.C Joint Research Activities

## 5.C.1 Activity JRA1 - Middleware Engineering and Integration

### 5.C.1.1 Scientific and Technology excellence

#### *5.C.1.1.1 Objectives and originality of the joint research activity*

EGEE aims to create a reliable and dependable European Grid infrastructure for e-Science. To date, Grid research projects have developed (and in some cases deployed) middleware following various designs and have exposed the relative advantages of several types of Grid architectures. A *production* Grid infrastructure can be implemented and deployed based on experience from the research projects but aiming at a new level of reliability in the delivery of services to the users of the Grid.
The current state-of-the-art in Grid Computing is dominated by research Grid projects that aim to deliver test Grid infrastructures providing proofs of concept and opening opportunities for new ideas, developments and further research. Examples are the Condor Project, CrossGrid, the EU DataGrid, the Globus Project, GridLab, Legion, NorduGrid, SDSC Storage Resource Broker, Unicore and many more. The Grid solutions provided by the industry are in a similar early stage, like the Sun Grid Engine and Avaki.

Only a few of these solutions were deployed in a production-like environment, and a significant effort is necessary to scale up existing test-beds to production level facilities. This implies not only ensuring the middleware scalability on ever increasing numbers of resources, but also making sure that the entire infrastructure can accommodate thousands of users.
The software developed in these projects generally lacks interoperability among different solutions. Only recently there has been an effort to agree on a unified Open Grid Service Infrastructure (OGSI). OGSI proposes a standard to enable Grid middleware provided by any of the projects to interoperate. Building Grid infrastructures based on components with well-defined interfaces rather than specific implementations should therefore become a reality. However, it will still take a considerable integration effort both in terms of making the existing components adhere to the new standards and deploying them in a production Grid environment.
The objective of the Middleware Engineering and Integration Research Activity is to provide robust middleware components, deployable on several platforms and operating systems, corresponding to the core Grid services identified (cf. Table AA) and developed in earlier projects. This activity aims to do the minimum original implementation of middleware necessary to achieve this goal; instead, the originality of the activity lies in selecting, potentially re-engineering and integrating a set of reliable production-quality services that together form a dependable and scalable infrastructure that meets the needs of a large, diverse e-Science user community. The evolution of such a set of middleware components towards a Service Oriented Architecture (SOA) adopting emerging standards such as OGSI is an important goal of this activity.
Based on an initial set of middleware components, corresponding to existing Grid infrastructures like the DataGrid testbed and the LCG-1 facility, which will be made available to users via SA1 at the start of the project, this activity will

- Select middleware components according to the architecture defined by the Architecture Team(cf. 5.C.5 Overall Implementation and Coordination of the Research Activities) and the requirements of the applications and operations activities. Input from the application groups will be taken into account in this task. Notably, a group within LCG (ARDA[16]) is preparing a document based on experience gathered over the last two years.
- Verify the need to go through a re-engineering process for the selected components and implement such process as needed, to reach production quality and evolve towards SOA. This will be done either within JRA1 itself or in cooperation with the component providers. In case some of the components (or part of them) deemed useful are missing or the cost/benefit ratio in re-engineering them is too high compared to a new development, they will be implemented within the JRA1 itself.

[16] Architectural Roadmap towards Distributed Analysis

- Integrate and test these components to deliver a production quality release, fulfilling the requirements of the applications, which will be deployed by SA1.
- Support, maintain and enhance as needed these components; more than one implementation should be selected for key components in order to verify interoperability of components and their interfaces.
- Support, maintain and enhance these components by organizing and executing defect handling processes

Rapid start-up of this activity is assured by building on the work of FP5 projects such as EU DataGrid and other Grid projects. Such projects have produced deliverables that are excellent starting points for basic end-user and operational requirements, a list of essential grid services, practical organisational structures and teams of dedicated software engineers with knowledge of grid technologies.
Based on our current knowledge, the services necessary to build a production Grid are summarized in Table AA below.

**Table AA** ***Key Grid Services and current state-of-the-art in implementation***

| | ***Service*** | ***Description*** | ***State-of-the-Art*** |
|---|---|---|---|
| **1** | **Resource Access Service** | This service provides an access channel to a given resource for properly authorized work requests.<br>We split resources into computing resources, data storage resources and network resources.<br>• Computing: The service needs to be interfaced to well-known fabric schedulers like PBS, LSF, Maui<br>• Storage: The service needs to interface to mass storage systems, databases, file systems, etc.<br>• Networking: Network resources need to be scheduled, monitored, and accessed.<br>Possible advanced features to improve on include advance reservation/schedule publishing, pre-emption capabilities, etc | Computing: Condor-G, Globus-GRAM, Unicore<br>Storage: SRM, SRB, file systems like /Grid, OGSA-DAI, Spitfire, NeST, GridFTP<br>Networking: GÉANT and NRENs, DataTAG |
| **2** | **Data/Application Repository and Access/Deploy Service** | This group of services deals with issues of Grid data management:<br>• Data Catalogs and Movement services. Interface to the storage resource of the previous service.<br>• Application Catalogs and application deployment service.<br>• Virtual data Catalog and instantiation service. | SRB, SRM, EDG Replica Manager.<br>EDG LCFGng<br>EDG/Globus RLS, Griphyn Chimera<br>AliEn |
| **3** | **Information Collection Service** | Service to gather data on Grid service locations, accessibility in order to find proper services and resources for usage. | Globus-MDS<br>EDG R-GMA |
| **4** | **User ID and Authentication Service** | In order to manage users each VO needs to maintain a user directory. These users need to be authenticated by the Grid services based on their VO membership.<br>Further details of this service will be defined as part of the JRA3 activity of EGEE. | EDG VOMS<br>Globus CAS<br>LibertyAlliance<br>Unicore |
| **5** | **Resource Matchmaking and Brokering Service** | This service makes use of the information of all previous services to match a high level service request based on the user's requirements and membership to the available Grid services and resources.<br>Many aspects and variables have to be taken into account in this process: the status and availability of the various Grid services and resources, the user's capabilities, the resource usage policies imposed by the communities owning these resources, the overall optimization goals.<br>Possible advanced features to improve on include support for advance reservation and co-allocation, job dependencies, integration with the Grid accounting framework, semantic discovery and retrieval of data and software etc | CondorG<br>EDG Resource Broker<br>Eurogrid-Unicore Resource Broker<br>GridLab Broker and Resource Discovery Modules |

| | Service | Description | State-of-the-Art |
|---|---|---|---|
| 6 | **Monitoring and Accounting** | Collection and storage of information on the activities on the Grid, in particular resource usage records. This is a basic pre-requisite for several activities such as *Simulation*, *Accounting*, *Security*, and *Problem Tracking*. | NIMROD-G, EDG RMS, EDG DGAS, MonaLisa |

#### *5.C.1.1.2 Execution-plan of the joint research activity*

To achieve the objectives of this activity, the execution plan is centred on three main tasks: implementing production-quality Core Grid Services, integrating selected components and testing and validation.

**Plan for the first 15 months**

- **Project start:** The management structures described below will be in place. Most of the staff are expected to be in place at the start-up of the project. The initial set of software components corresponding to the ones used by the LCG-1 facility will be made available to users and their support will be ensured.
- **PM3:** Architecture and planning document for Release 1 will be available. The selection of components to be deployed, evolved, and reengineered will be provided (based on requirements from applications and operations). Tools for middleware engineering and integration will be deployed. Software cluster development and testing infrastructure will be in place.
- **PM6:** The integration and testing infrastructure will be in place (aiming at a continuous integration and testing process). A test plan for core components and integration for Release 1 will be available. A design document for the core Grid services will be provided.
- **PM9:** First consistent software of the EGEE components, comprising documentation and test reports will be available and form the Release candidate 1.
- **PM12:** The first certified major release of the EGEE components will be delivered to operations (SA1). This will include documentation, User's and Programmer's guides as well as release notes.
- **PM15:** Architecture and planning document for Release 2. will be available. A design document for the core Grid services for Release2 will be provided (taking into account feedback from deployment as well as evolution of relevant standards).

The creation of a technical architecture is a vital part of the EGEE implementation process, the responsibility for which lies with the Architecture Team, which will have strong representation from this Middleware Engineering and Integration Research Activity. The architecture of the EGEE Grid must take into consideration the properties desirable in a production environment in order to specify services that exhibit robustness, fault tolerance and adherence to standardized interfaces, and these services will need to be well-supported and documented. It is intended to base the architecture of EGEE on the emerging Open Grid Services Architecture (OGSA), which addresses the issue of standardized interfaces on a highly generalized level. This activity will work closely with the service providers through the Global Grid Forum (GGF) to define the standards for the interfaces and components in the EGEE architecture. These interfaces will be refined as more experience is gained by their actual usage in a production environment. The architecture teamwill start from the substantial experience accumulated in EU DataGrid and LCG.
The software planning process will follow the procedures defined by the Quality Assurance (JRA2). However, it is clear from the experience gained in previous projects, in particular within DataGrid, that more attention should be paid to the software development process and to the adoption of an effective iterative cycle of requirement collection, design and planning, implementation and validation taking advantage of users and operation experience and feedback. For these activities we foresee an annual cycle as shown in Figure 17 below.

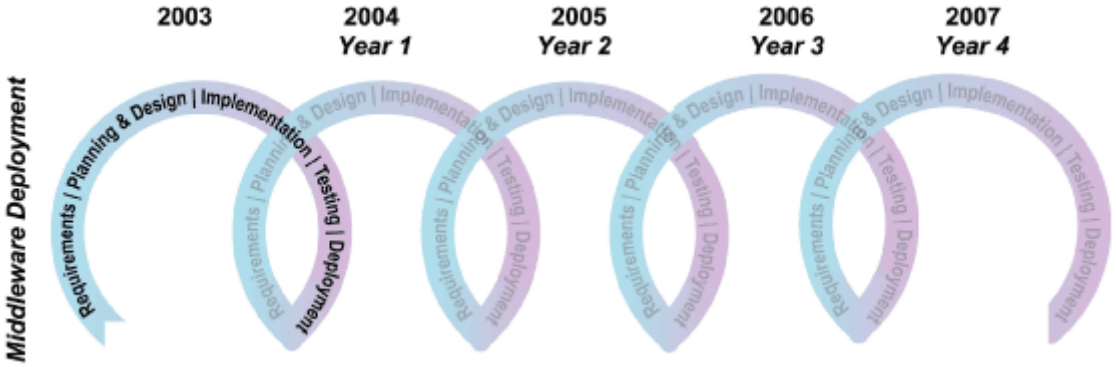



**Figure 17:** ***Schematic Diagram of Middleware re-engineering cycles during a four year programme, of which EGEE represents the first two years. Note that a first cycle is already ongoing in the final phase of DataGrid (2003), which will help ensure continuity with EGEE.***

#### 5.C.1.1.2.1 Implementation Task

The implementation task of this activity will:

- Provide support for components deployed by SA1;
- Evaluate existing Grid middleware against the architecture defined by the architecture team and the requirements from the application and operation activities;
- Select promising components, at least two for the most important services, to demonstrate interoperability;
- If necessary re-engineer components;
- Implement any missing components.

The aim is to provide a set of production-quality components that together form a dependable and scalable infrastructure that meets the needs of the EGEE user community.
The Grid software will consist of many layers each built upon the next lower layer. When the lower layers are unstable, buggy, poorly maintained, or subject to rapid changes, the higher layers can never reach production quality. During the evaluation phase the risk associated with each protocol and service is assessed, and for those deemed mission-critical, the project should ensure that two independent implementations exist, committing EGEE resources, if necessary, to create the second implementation. To avoid vendor lock-in, as throughout EGEE, these protocols must be rigorously defined independently of the implementation.
Often, software packages selected will need to be re-engineered to adhere to the required production-level requirements and to conform to the envisioned SOA. If necessary, re-engineering will take place inside the implementation task itself or appropriate changes will be negotiated with the original providers. The middleware re-engineering activity will address issues found via existing grid projects such as

- reliability & resilience, in particular to allow for failure free operation of services for long periods, thereby avoiding the need for manually restarting services and hence limit manpower needed for operations
- robustness, to be able to handle abnormal situation within services and ensure fault tolerance for services
- security, to provide restricted access to data and guard against denial of Service (DoS) attacks. The security infrastructure needs to integrate with all grid services
- scalability, in that services need to scale up to the requirements of SA1
- enforcement of resource allocation policy and account quotas for utilization of the grid infrastructure (described in NA5 and SA1)
- maintainability, usability, supportability: make life easier for end-users, application developers and site managers. This includes improved integration with application-level tools and resource providers; provide better portals, API's, error reporting, etc.
- standardisation and service orientation, to ensure compliance with emerging standards (OGSA) to provide well defined interfaces and allow interoperation with other implementations

To allow software development in a realistic environment implementation testbeds will be maintained by the implementation task, which follows closely the integrated release produced by the integration task. This allows an early assessment of how new components will behave in the integrated environment as well as the detection of potential integration problems at an early stage.
In order to benefit from common services and reduce specific infrastructure efforts, the development of the different components and packages will follow a uniform way of organizing the software activities. Such activities should all have the same infrastructure in terms of repository, document templates, release management tools, problem reporting tools and all other issue related to process and infrastructure activities.
Furthermore, in order to be consistent with the LCG development, the EGEE middleware project intends to adopt and participate to the modification and maintenance of the existing tools, policies and standards already put in place by the LCG Software Process and Infrastructure project.

#### 5.C.1.1.2.2 Integration Task

A key part of this activity is to bring together a set of Grid services and components to form a functioning and verified Grid to serve its user communities. Middleware components will originate from a variety of sources and their integration is a non-trivial task. A thorough definition of interfaces and adherence to standards will help in facilitating this task.
Grid middleware is typically composed of a complex software stack. EGEE software should not depend on specific versions of underlying software, including operating systems, compilers, interpreters etc…, and it should work on a range of hardware platforms to be selected
A continuous integration procedure will be adopted including nightly builds and automatic installation and testing of the software on a distributed integration testbed consisting of at least three sites. This distributed integration testbed is vital to EGEE in order to assess the impact of wide-area connections from the very beginning and to avoid site-specific solutions.
During the first months of the project, the Integration Task will focus on the set-up of the integration infrastructure including the tools for software management.

#### 5.C.1.1.2.3 Testing and Validation Task

The extensive and thorough verification of the integrated middleware is essential to ensure that the Grid can be deployed on the scale foreseen, and on the broad range of heterogeneous resources employed in the EGEE Grid. This task will assess that all software requirements have been implemented correctly and completely and are traceable to system requirements. To ensure in particular the adherence to application requirements this task will be executed in close collaboration with members of the application activity.
While basic unit testing will be performed within the implementation task, this task focuses on functional testing and regression testing. Test suites for certain components of the software as well as for the integrated software will be developed. These test suites will be complemented with application kernels provided by the application activity.
An automated test procedure will be developed which allows continuous testing of the software integrated and deployed on the integration testbed by the integration task.
Initial testing will be performed on the integration infrastructure. More thorough testing and validation will take place on a separate testing infrastructure which will be, according to the integration testbed, distributed and span at least three sites in three different countries.
During the first months of the project, the Testing and Validation Task will focus on the test plan preparation, on working together with the LCG infrastructure project to learn and, if needed, adapt the tools already available for testing as well as on test data preparation.

These three tasks of JRA1 will be closely related to other activities within EGEE, in particular those for Operations (SA1) and Identification of Applications (NA4). The tasks will run in parallel with the obvious shift due to the time elapsed before the first release candidate of the new EGEE (PM9). The Operation activity (SA1) will start by deploying an existing baseline infrastructure on an initial set of computing resources. At present, release 1 of the LHC Computing Grid (LCG) project software – an integration of middleware from the European DataGrid and U.S. GriPhyn projects – appears to have the most potential to reach production quality.

Adopting this practical approach means EGEE application groups will have access to a working grid infrastructure within the first 6 months of the project while allowing the Middleware Engineering and Integration activity to concentrate on migrating the existing baseline infrastructure to the emerging OGSA standard and ensure the implementation satisfies the high-levels of quality of service foreseen.
The initial set of key grid services which will be subject to re-engineering will be a subset of those described in Table AA, according to the initial baseline release deployed by SA1. This set will in particular include resource access, data access, information collection, user ID and authentication, and resource matchmaking and brokering services. During the first 5 months of the project, components implementing these services will be evaluated, selected, and designed leading to deliverable DJRA1.2 at PM 5. Partial releases of these components will happen as soon as ready on the testbed. At project month 12 we foresee the complete release of the all the major software components (deliverable DJRA1.3) implementing these services at the required level of quality, and including also the remaining services as provided in the initial baseline release deployed by SA1, i.e. not yet re-engineered.
As mentioned before, implementation, integration, and testing will be done on a continuous basis allowing verifying the quality of the envisaged release at early stages. Depending on the level of quality reached, SA1 may deploy these intermediate releases to give application users early access to production quality services.
In the second year of the project, this initial set of re-engineered services will be further evolved, following the current initial list of key services in Table A (i.e. including monitoring and accounting, application repository/deployment) and possibly enriched, if and as needed, with new services according to application and operation requirements.

This activity will generate two major types of deliverables:

1. Design documents for key services, specifying in detail the constraints on how each core service can be implemented;
2. Software releases, including source code, configuration scripts and instructions, unit and integration tests, and user documentation, including installation guides, developers' guides and release notes.

An open source license will cover the software and documentation, and they will be available to other project for other infrastructures.

Starting from these two points, we foresee a detailed schedule for the Middleware Engineering and Integration Research activity in the first two years of the project, as given in table below.

**Table BB** ***Detailed schedule of deliverables and milestones for Middleware Engineering and Integration Research***[17]

| PM | Responsible Group | Deliverable or Milestone | Item |
|---|---|---|---|
| 3 | Architecture Team (cf. 5.C.5)) | Deliverable DJRA1.1 | Document defining architecture and planning for Release 1<br>The partners concerned have agreed that the activities, especially for what concerns design and planning will begin before the EGEE project start date and that a draft of system requirements, architecture and a short list of middleware components will be available for selection soon after project start-up. Input from the application groups is expected to play an important role. The selection of the components to be deployed, evolved , reengineered with the collaboration of the providers will be provided. The documentation of the established agreements with the providers will also be provided. |

[17] Release 2 builds on an upgrade of Release 1 and should therefore be available in a shorter time frame than the first release.

| PM | Responsible Group | Deliverable or Milestone | Item |
|---|---|---|---|
| 3 | Tools support group | Milestone MJRA1.1 | Tools for middleware engineering and integration deployed<br>Code repository, software building and testing tools to be made available to the implementation, integration and testing teams. Such tools will be supported and incrementally improved throughout the project.<br>These tasks will be performed by contributing to the LCG SPI project and using its services that are already widely used by the LCG projects and LHC Experiments.<br>It is important that there is uniformity in the tools and standards at all levels of the software development in all EGEE activities. |
| 3 | Implementation group | Milestone MJRA1.2 | Software cluster development and testing infrastructure available. |
| 5 | Integration and Testing group | Milestone MJRA1.3 | Integration and testing infrastructure in place. Software produced by the implementation group will continuously be integrated and tested. This process will be automated as much as possible.<br>Test plan for core Grid components and overall Integration (Release 1)<br>The test plan will drive the testing activities of the Implementation groups for the individual grid services and the Testing group for the overall integrated software release. The test plan is expected to evolve to be consistent with the software evolution. |
| 5 | Implementation group | Deliverable DJRA1.2 | Design document for the core Grid services (Release 1)<br>This document starts with the requirements, constraints and overall framework laid out in the overall architecture document and describes the design of each grid service as well as which existing components will be chosen or the services will be newly implemented. The resulting specification will contain the details needed by the implementation teams. |
| 9 | Implementation group | Milestone MJRA1.4 | Consistent software corresponding to the first release candidate of the EGEE software<br>This includes the following components:<br>Software in the official repository (integrated with a release-building system);<br>The software passes all unit tests (these tests are included in the official repository) and test report describes results of these tests;<br>Release documentation, comprising installation guide for each SW component as well as release notes.<br>Remaining integration issues with the release candidate will be tackled by the integration team.<br>The integration test suite must be ready in time for the delivery of the software components. |
| 10 | Integration group | Milestone MJRA1.5 | Integrated Release Candidate 1 enters the “bug fix only” final verification and validation period.<br>The Testing team will be in continuous contact with the Integration and Implementation Teams over the entire period to address deficiencies found until a stable release is achieved. Part of the Testing Team’s work is to test integration dependencies, correct installation and configuration, and functionality of each partially-integrated major build during the integration phase. |

| PM | Responsible Group | Deliverable or Milestone | Item |
|---|---|---|---|
| 12 | Middleware and Engineering Integration | Deliverable DRA1.3 | Release 1, first major release of EGEE project software delivered to the Operations activity (SA1) for deployment.<br>The deliverable consists of the following components:<br>Software in the official repository (integrated with an automatic release-building system);<br>Certification that the software passes all unit and integration tests (these tests are included in the official repository);<br>Release documentation, comprising Installation, User's and Programmer's guides and Release Notes. |
| 14 | Architecture Team (cf. 5.C.5)) | Deliverable DJRA1.4 | Document defining architecture and planning feasibility (Release 2).<br>This revised architecture will build on the work of release 1 taking into account feedback from deployment and evolution of associated standards. |
| 15 | Implementation group | Deliverable DJRA1.5 | Design document for each of the core Grid services (Release 2).<br>These revised designs will build on the work of release 1 taking into account feedback from deployment and evolution of associated standards. |
| 18 | Implementation group & Testing group | Milestone MJRA1.6 | Test plan for core Grid component and overall Integration (Release 2). |
| 19 | Implementation group | Milestone MJRA1.7 | Consistent Release Candidate 2 components of the EGEE software components. |
| 20 | Integration group | Milestone MJRA1.8 | Integrated Release Candidate 2 enters the "bug fix only" final verification and validation period. |
| 21 | Middleware and Engineering Integration | Deliverable DJRA1.6 | Release 2, second major release of EGEE project software delivered to the Operations activity (SA1) for deployment. |
| 24 | Middleware and Engineering Integration | Deliverable DJRA1.7 | Final report including assessment of work completed and outstanding issues. |

As shown in the Table above, a large number of milestones are foreseen for this activity which correspond to transition phases and artifacts of the software process.

### 5.C.1.2 Quality of the management

#### *5.C.1.2.1 Management and competence of the participants*

This activity is structured as follows:

- An Implementation group responsible for the re-engineering/development of all the middleware components needed for the EGEE Grid infrastructure;
- An Integration and Testing group responsible for the integration and testing of the components generated by the Implementation group and delivery of Grid software to Operations.

The distribution of the tasks is shown in Figure 18, and summarised in Table CC below. Each group has a manager responsible for the execution of its tasks. Above the two groups is an Engineering Management Team (EMT) to track these two activities and manage the entire middleware engineering process.
Note that the Security team is funded by JRA3 but is described hereafter in Figure 18 and in Table CC in order to have a complete picture of middleware activities, as these teams will work very closely together and will be included in the above-mentioned EMT. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.


**Figure 18:** ***Distribution of middleware activities over Europe. The symbols illustrate regional distribution and do not reflect precise geographic location of activities. The middleware Re-engineering Centres will take responsibility for the following key services: Resource Access (Italy); Data Management (CERN); Information Collection and Retrieval (UK); Resource Brokering and Accounting (Italy); Closely connected to this middleware development is a Quality Assurance team (France) and a Grid Security team (Northern Europe Federation), which also has responsibility for a User ID, Authorisation and Authentication Service as well as Virtual Organisation management tools.***

**Table CC** ***A summary of the tasks of the different partners involved in the Middleware Engineering and Integration Activities.***

| **JRA1** | | |
|---|---|---|
| **Participant** | **Middleware Task/Activity** | **Professional FTE (EU funded + unfunded)** |
| | **CERN** | |
| CERN | Data Management, testing and integration, overall coordination | 16+16 |
| | **Italy/Czech Republic** | |
| INFN | Resource Access<br>Resource Brokering<br>Accounting | 16+8 |
| Datamat S.p.A. | Resource Brokering<br>Accounting | 6+0 |
| CESNET | Logging and Bookkeeping | 4+0 |
| | **UK-Ireland** | |
| CCLRC | Information Collection & Retrieval | 8+0 |
| | **France** | |
| CNRS | Test tools support group | 0+2 |
| | **USA** | |
| UChicago | UChicago | N/A |
| USC | USC | N/A |
| UW-Madison | UW-Madison | N/A |
| **JRA3** | | |
| | **Northern** | |
| KTH/PDC | Security Coordinator | 1 + 2 |
| UvA | Security group for the National VL and Grid project | 2 + 2 |
| UH.HIP | Security Group | 1 + 1 |
| UiB Parallab | Secure software center (Selmer Center). HPC center. | 1 + 1 |

The CESNET participant from the Czech Republic appears in Table CC together with the Italian software cluster, as this cluster will manage the re-engineering of the logging and bookkeeping services.
The US unfunded participation details are not available at the time of the writing, as their own funding is still being negotiated.

#### 5.C.1.2.1.1 Implementation Group

The Implementation work will be executed by several *clusters* of engineers, each cluster is responsible for one or more of the key services that have been identified; a core service will not be split between clusters. Each of the clusters functions autonomously, constrained on two points:

1. The cluster must demonstrate that the software it selects/produces has passed a functionality test suite that includes rigorous static and dynamic analysis tests on basic soundness. The chosen strategy of nightly builds, integration and testing will greatly simplify and streamline this procedure.
2. The software delivered must satisfy all protocol and API constraints specified by the standardization process described above.

Each cluster is located at only one institute and all members of the clusters are full-time dedicated to their position and members of a single cluster only.
The Implementation group has its own management structure composed by a manager responsible for the whole middleware development and each cluster has a leader responsible for the activities within his/her cluster, who reports to the Implementation Manager. Each cluster also has one architect (participating in theArchitecture Team) having significant experience in deployed software, a system administrator, a documentation and quality person (participating in the Quality Assurance activity), a security person (participating in the Security group) and a number of developers dependent on the size of the core services for which the cluster is responsible.
The chosen clusters have a proven track record in software development for grid infrastructures in existing projects such as EU DataGrid, DataTAG and NorduGrid.
The Italian cluster has developed the EDG Resource Broker and is a key participant in the design and implementation of the GLUE schema allowing inter-operability of diverse grid systems. The cluster has also designed a basic grid accounting infrastructure that is currently being integrated in the DataGrid project.
The UK cluster has been responsible for Information Services of the DataGrid project and has a wealth of experience with the MDS system. The team has designed and implemented the first GGF Grid Monitoring Architecture compatible information system, R-GMA, which is currently deployed on the DataGrid and LCG infrastructures.
The Northern Europe cluster includes members from DataGrid security group and individuals that have developed the user authorization and local access policy modules. Participants from the NorduGrid are also involved who have extensive experience in security deployment issues and management concerns for Certificate Authorities.
The CERN cluster has hosted the technical management for the EU DataGrid and EU DataTAG projects as well the data management work package of DataGrid that has developed replication tools (such as the Replica Location Service) in conjunction with the Globus project and experiment-specific grid systems. CERN also leads the LHC Computing Grid project (LCG) and hosts the LCG integration and testing groups.

#### *5.C.1.2.1.2 Integration and Testing Group*

The Integration and Testing group will build and test integrated software releases, and is independent of any of the implementation clusters. These team members are full-time dedicated to their position and the Integration team is separated from the implementation clusters to prevent assumptions in implementation and integration efforts. This implementation/integration split is standard practice in industry.
The Integration and Testing team is also responsible for testing integrated software for scalability, platform independence and stress resilience.
Both the Implementation and Integration and testing groups will use the code repository build system and defect tracking system specified by the Quality Assurance activity. Defects must be raised against responsible individuals in the Implementation clusters who then manage the resolution of those problems. Since each service is the responsibility of a single cluster, the assignment of defects is performed by the leader of the appropriate cluster, who may identify defects concerning the architecture to be addressed by the Architecture Team.
The Implementation clusters, operations groups, and the Applications Interfacing activity will provide tests to the Integration and Testing team. The Quality Group, in consultation with the Implementation, Integration,

Testing, and Operations activities and with the Software Process and Infrastructure project of the LCG, will define a release process (as illustrated by
Figure 19), the conclusion of which will be synchronised to the deployment cycle, with agreed procedures for handover. The primary customer of all releases is Operations, which may have its own set of qualification and acceptance procedures, and may progress a release through defined levels of operational readiness. Through Operations, Applications are requested to perform further qualification.

Software release for deployment by Operations will also be made available to:

1. evaluation groups in the Applications Interfacing activity
2. members of the Grid community through a open software distribution area. This software is the same as that deployed by EGEE sites, but the support to these external communities will be on a best-effort basis.

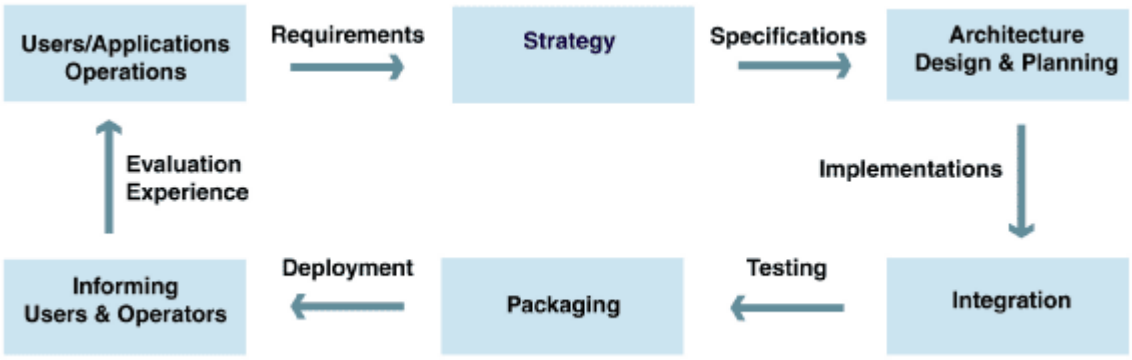



**Figure 19 The "Virtuous Cycle" for EGEE development, emphasizing the steps involved in Middleware reengineering. The sequence from "Requirements" to "Deployment" represents the steps that are carried out by JRA1, with assistance of JRA2 and JRA3.**

#### *5.C.1.2.1.3 Integration and Testing Team Structure*

The Integration and Testing Teams' activities need to be very well coordinated and so both teams are under a common management. The Integration team will be located at a single site and will consist of a team leader, an architect, a quality assurance and documentation person, five integrators, and a system administrator. The Testing team will be distributed over three sites; one main site will include a team leader, four testers, and a system administrator; another site will have one system administrator, and the final site is the Integration Team site, the system administrator here being a shared resource between the two teams.
The system administrators deploy the candidate releases. They diagnose and report installation problems, perhaps providing fixes for them. Multiple sites are needed to make sure that the integration has not inadvertently made integration assumptions that are only valid for one site. Three sites is the minimum for which all basic Grid functionality can be tested.
A tool support group (funded by JRA2) will provide the software configuration, management and build tools needs for the implementation and integration activities. The tools group will be staffed by:

- Software librarian installing software and tools;
- System administrator for servers support (Developer web, CVS, etc.)
- Methodologies and framework support (QA tools, testing frameworks, etc.)

For a total of two people, that will go to contribute to the existing LCG Software Process and Infrastructure project, already supporting the LCG projects.
The Integration and Testing teams will be hosted by the CERN cluster which is described above.

#### *5.C.1.2.1.4 Management*

The Engineering Management Team (EMT) is responsible for managing the middleware engineering process, from requirements collection through design and development to integration and maintenance of the EGEE middleware toolkit. The team will include:

- A middleware engineering and integration activity manager (middleware manager) as leader of this team;

- The Chief Architect (responsible for organising the architecture teamand reporting its activities to the Technical Director);
- The Manager of the Implementation group;
- The leaders of the Implementation clusters;
- The Manager of the Integration and Testing team;
- A Quality and documentation person.

The EMT is responsible for ensuring that the software clusters follow the architecture and design rules, and that they adhere to the software engineering process including quality standards.
The overall management structure of JRA1 is illustrated in Figure 20
Note that teams funded by JRA2 and JRA3 are anyway reported in that figure, in order to have a complete picture of middleware activities, as these teams will also be managed by the above-mentioned EMT.

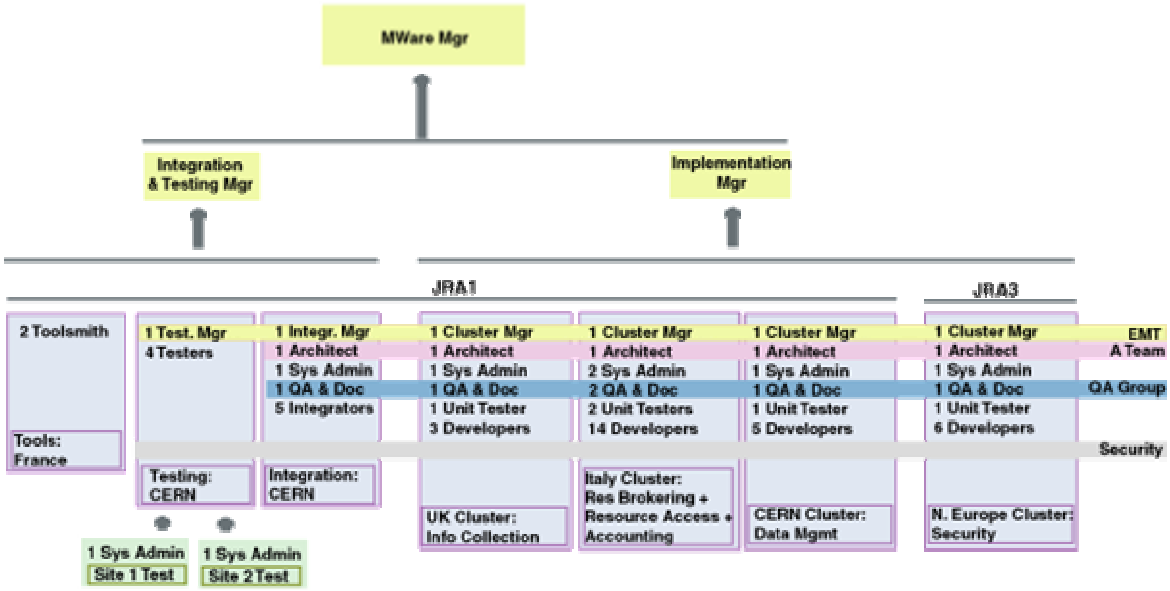



**Figure 20:** ***Management Structure for the Middleware Implementation, Integration and Testing activities***

#### *5.C.1.2.1.5 Interfaces to other activities*

This activity contributes several members of the Architecture Team, namely one architect working full time in the project from each Implementation cluster and one architect working full time in the project from the Integration group. Each of the implementation clusters plus the Integration team and the Engineering Management Team has an individual dedicated to quality assurance and documentation, who will participate in the Quality Assurance activity (JRA2) as well as a security person who will participate in the security group.
Co-ordination with the Operations activity (SA1) will be performed by the Technical Director through the Project Executive Board.

### *5.C.1.2.2 Justification of financing requested*

The financing requested by this activity funds the manpower to perform the tasks of which it is composed. There is clearly a great deal of work to be done in specifying Grid services, designing Grid components, evaluating existing products, re-engineering software components where necessary, implementing original middleware where nothing suitable exists, testing, integrating and validating the whole Grid middleware release. The proposed number of engineers covers a spread of roles and functions and this effort is organized in a viable lightweight structure, with autonomous teams assigned to clearly defined tasks. The decomposition of a sizeable activity into smaller teams allows them to be placed in a variety of locations, not just in the largest of partners as would be required to accommodate a single massive engineering unit.

#### 5.C.1.2.2.1 Required Effort

The manpower for the whole Implementation group, covering management, design, development and unit testing and security (funded from JRA3), is estimated as 53 people (funded + unfunded) per year, structured as four development clusters with composition as described above, among which will be distributed the core services with the effort described in Table DD. The Integration and Testing group, covering tools, building, packaging, integration, testing and bug tracking is estimated at 18 people (funded + unfunded) structured in 3 groups composed as described above. The management will be composed of the Activity Manager, the Integration and Testing Manager and the Implementation Manager. The Architecture Team Chief Architect will complement this team. The estimated efforts are mostly derived from the experience in the same areas done within DataGrid and on the maturity in terms of production-readiness that both software components from DataGrid and from other projects currently show or promise to show in the near future.

| Services | Effort |
|---|---|
| **Information Collection** | 8 |
| **Resource Access, Resource Brokering and Accounting** | 34 |
| **Data Management** | 10 |
| **Security (JRA3)** | 11 |
| **Integration** | 9 |
| **Testing** | 7 |
| **Tools support** | 2 |
| **Chief Architect** | 1 |
| **Activity Manager, Integration and Testing Manager and implementation Manager** | 3 |
| ***Total*** | 85 |

**Table DD** ***Implementation effort (funded and unfunded) for middleware re-engineering***

Summarising we have an estimated total effort of 85 (63 implementation + 16 integration and testing + 2 tools support + 3 management + architect) FTEs per year for the whole middleware re-engineering activities (including teams funded by JRA2 and JRA3) and we believe that the effort is justified given the high-quality software and processes required for the project. It is important to remark that this includes the unfunded contributions from each participating partner that can be considered to be 50% of the required manpower. Each of the clusters/teams will benefit from un-funded resources provided by the involved partners.

### 5.C.1.3 European added value

The middleware building blocks from which to create a Grid of the scale and quality targeted by EGEE do not exist today. What does exist is a set of middleware components from the successful testbed Grid projects described above that addresses many of the key problems and service requirements so far encountered in Grid computing. Although conceived in a research environment and implemented for Grids on a different scale to that which will be created by EGEE, many of these components implement essential core services through effective technology and are therefore excellent starting points from which to produce the middleware required by EGEE. However, there is further work required to achieve the goals of EGEE, namely to construct a pan-European production Grid for eScience, which aspires to a scale and level of quality of service that has not been attempted by any Grid project.

EGEE will, based on its wide experience of existing Grid, take selected middleware products and re-engineer them to meet its requirements. Where EGEE selects a software component for use, following appropriate evaluation, it will be adapted/upgraded/re-configured/re-implemented where this is necessary to meet the required standards of performance, reliability, scalability, portability and security. This will “harden” adopted technologies to the level where they can be deployed in a reliable, large-scale, high-availability Grid. In addition to delivering the components required by EGEE, this brings the further benefit of proving those research concepts and technologies adopted by EGEE in a complete Grid architecture conceived with the operational end-point as its driving force.

The drawing together of re-engineered components will be bound by an extensive and thorough integration and testing process. This will create a complete and verified Grid middleware of operational quality, in which the interoperability of its components has been thoroughly demonstrated, to the extent that the whole is greater than the sum of its parts.
The Grid middleware will be delivered as a deployable software release, which will minimize the need for the Operations activity of EGEE to perform qualification testing of outputs from the Implementation and Integration activity, and facilitate the deployment of evolving releases of Grid middleware across a large infrastructure.
The middleware activity is expected to participate in bodies such as the GGF to ensure EGEE conformance to international standards being defined, and to help evolve those standards as needed.
Finally, the middleware of EGEE will be available to the Grid research community and other interested parties to close the feedback loop with the originators of the technologies on which the EGEE Grid will be based. This will stimulate further development within those communities, but will also build a body of experience in production-quality Grid engineering that will strengthen the capabilities of European Grid research.

### 5.C.1.4 Exploitation of the results

One of the most important EGEE aims is to maintain and extend the good degree of interrelationship between industrial and scientific partners (like in the EU DataGrid), which is necessary on to avoid “privatisation” of the expertise gained throughout the project, without jeopardising the commercial potential.

Moreover, the strong accent that has been put by the overall consortium on a production-like organisation should ensure the implementation of quality requirements that are necessary in order to implement a really *pre-operational* service.

JRA1 exploitation objectives are clearly restricted to individual and integrated middleware components. The exploitation of operational experience gained in using the infrastructure for specific applications is therefore outside the scope of this section.

#### *5.C.1.4.1 Exploitation strategy and risk analysis*

The EGEE proposal is characterised by the declared objective of producing a standardised middleware, or set of middleware components, which can be openly shared with the industrial world, in view of an uptake from the market.

For that reason it is important that the partners define as soon as possible their mutual roles in the next phase. Even if the open-source statement clearly identifies the availability of results for the overall scientific community, this does not prevent the partners to come into more detailed agreements for the activities which are outside this scope but are linked to middleware all the same. Middleware certification, applications toolkit development, support services are activities of such kind that can be pursued also in the logic of public-private partnership. Divergence between the middleware developed by the project and that being introduced by industry would represent a significant risk for the long-term viability of the project.

The other fundamental strategic objective is the positioning with respect to the availability of other Grid middleware components and services. The migration of Globus towards the OGSA paradigm and the announced availability of commercial qualified solutions from main software vendors have to be carefully monitored in order to be ready to eventually re-direct project objectives towards solutions of the widest possible exploitation potential. The risk is that “disruptive” technologies could make parts of the project redundant.

The last point concerns the market potential itself of middleware, in terms of target classes of users / customers. As of today the users’ communities that have been traditionally involved in Europe in support of the specification of Grid middleware are mainly High Energy Physics, Bio-Informatics, Earth Observation like in EU-DataGrid and Medical Simulation and Environment like in EU-CrossGrid. Further to those, there are some experiences of other thematic disciplines, including industrial sectors such as automotive, aerospace, pharmaceutical, which however have been involved more in the experimentation phase using the available middleware than in issuing new requirements. It is therefore crucial, for the widest possible uptake of the middleware, to consolidate from an engineering view point what already exists, but also to consider potential priorities from these additional sectors through an important dissemination activity. Lack of adequate communication with the private sector is a further risk for the project.

In synthesis, the exploitation strategy is based on the following parallel actions:

- defining Partner's mutual roles, obligations and responsibilities in the Consortium Agreement and further refining them according to the evolution of the project and of the external context;
- performing those engineering activities required to qualify project results for an operational, and potentially commercial, context;
- carefully watching technology evolution, both as an obvious driver of cost reduction, and in terms of market positioning;
- implementing preliminary business-case analyses to understand the potential return of investment and the identification of a related institutional scenario among partners;

#### *5.C.1.4.2 Exploitation planning*

A clear activity that shall be carried out during the whole project cycle shall concern the exploitation planning. This will address the following major points:

- Business objective and its management;
- Definition of technology, products and services;
- Market and main competitors;
- Competitive business strategy;
- Selling forecast and financial data.

The exploitation plan will take into account three main stages of expansion with specific near-term, medium-term and long-term objectives:

- Near-term shall correspond to a period between the start of EGEE project activities and the end of the project itself. During these 24 months (2004-2005) the main objective is to develop and validate the refined components with the key users (HEP, BIO, etc.)
- Medium term shall correspond to a period beginning with the end of EGEE project and ending after 2 years (2006-2007). The main objective will be:
    - the installation and pre-operational demonstration of the resulting middleware at selected end-users test sites,
    - the continuous technological evolution follow-up.
- The final stage shall correspond to the commercialisation of the final products to the largest customer community.

### 5.C.1.5 Summary

| **Activity number :** | JRA1 | **Start date or starting event:** | | | | | Project Start | |
|---|---|---|---|---|---|---|---|---|
| **Participant:** | 1 CERN | 4 CESNET | 16 CCLRC | 30 DATAMAT | 31 INFN | | | |
| **Expected Budget per Participant:** | 3119 | 300 | 1138 | 1176 | 1450 | | | |
| **Requested Contribution per Participant:** | 3119 | 150 | 569 | 588 | 1450 | | | |

**Objectives**

- Provide deployable, robust middleware components for the core Grid services
- Integrate grid services to provide a consistent functional basis for the EGEE grid infrastructure
- Verify the middleware forms a dependable and scalable infrastructure that meets the needs of a large, diverse eScience user community

**Description of work**

In an annual cycle perform the following tasks:

- Define overall architecture for grid services
- Design individual grid services within the framework of the overall architecture
- Re-engineer components to provide implementations of defined grid services
- Integrate grid services
- Test grid services and deliver high-quality software release and associated document to operations activity (SA1)

**Deliverables**

| | |
|---|---|
| DJRA1.1 | M3 CERN (Document) Architecture and Planning (Release 1) |
| DJRA1.2 | M5 CERN (Document) Design of grid services (Release 1) |
| DJRA1.3 | M12 CERN (Software) Software and associated documentation (Release 1) |
| DJRA1.4 | M14 CERN (Document) Architecture and Planning (Release 2) |
| DJRA1.5 | M15 CERN (Document) Design of grid services (Release 2) |
| DJRA1.6 | M21 CERN (Software) Software and associated documentation (Release 2) |
| DJRA1.7 | M24 CERN (Document) Final report |

**Milestones[18] and expected result**

| | | |
|---|---|---|
| MJRA1.1 | M3 | Tools for middleware engineering and integration deployed |
| MJRA1.2 | M3 | Software cluster development and testing infrastructure available |
| MJRA1.3 | M5 | Integration and testing infrastructure in place including test plans (Release 1) |
| MJRA1.4 | M9 | Software for the Release Candidate 1 |
| MJRA1.5 | M10 | Integrated Release Candidate 1 enters testing and validation period (Release 1) |

[18] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

| | | |
|---|---|---|
| MJRA1.6 | M18 | Test plan for core Grid components and overall Integration (Release 2) |
| MJRA1.7 | M19 | Software for the second release candidate available |
| MJRA1.8 | M20 | Release Candidate 2 enters testing and validation period (Release 2) |

The successful completion of these milestones will result in reliable production-quality grid services that together form a dependable and scalable software infrastructure that meets the needs of a large, diverse eScience user community.

**Justification of financing requested**

Approximately € 6 Million will be required over two years to re-engineer, integrate and deploy high quality middleware. This cost compares well with the experience of current R&D Middleware development projects. This activity will connect to R&D oriented EU supported initiatives expected with the next IST calls and in particular with the call on GRID-based system for solving complex problems. EGEE once established will offer in fact an ideal test bench for these future projects and benefit in turn from novel solutions and tools. The same will be true with IT industry such as those listed in Table 1b, which have decided to participate to the project unfunded.

The financing requested by this activity funds the manpower to perform the work of specifying Grid services, designing Grid components, evaluating existing products, re-engineering software components where necessary, implementing original middleware where nothing suitable exists, testing, integrating and validating the whole Grid middleware release. This work must be done on an annual basis and support is required to ensure a rapid response to issues found during deployment.

## 5.C.2 Activity JRA2 - Quality Assurance

### 5.C.2.1 Scientific and Technological excellence

#### *5.C.2.1.1 Objectives and originality of the joint research activity*

EGEE aims to provide a production-quality infrastructure integrating a large number of software components provided by different, geographically distributed organizations. The fifth framework Grid projects, notably DataGrid, have defined and deployed the latest generation of Grid software. Building on this work and the experience acquired, EGEE will provide to the Grid applications an environment based on production quality software and facilities available around the clock. The highest priority will be to deliver a system with high quality characteristics, and so a programme of quality assurance is a crucial part of EGEE.

Quality assurance in EGEE is the planned and systematic set of activities that ensure the processes, products and operation services conform to EGEE requirements, standards, procedures, and to the required level of services. Quality Assurance will be a very practical activity and an iterative process with the continuous improvement of the standards or procedures in order to improve the global quality system.

An initial step in defining the QA activity is to select and prioritise the quality objectives that are important in the context of the project: system Reliability, Maintainability, Usability, Efficiency, Portability, Interoperability. The next step is to define quality standards and quality metrics that meet the quality objectives and which enable quality evaluations to be performed.

Quality assurance will be present right from the start in all activities within the EGEE project and integrated in each project activity (management, middleware, operation and assurance), in order to enable the production-quality operations of an international Grid infrastructure. QA materials, standards and procedures provided for DataGrid and LCG will be re-used and adapted to the EGEE context. The basic tools, such materials as documents templates, will be defined in time for project startup.

Commonly accepted international business practice standards dictate compliance with quality management such as the ISO 9001. The EGEE QA activity is inspired by such international standards to provide a structured approach to quality management, and an effective tool for describing and implementing reliable and well-managed Grid services.

In the EGEE QA activity is the definition, implementation and measurement of quality indicators in a Grid environment. The quality and performance indicators defined for the DataGrid project will be a good starting point.
The other main innovation concerns the establishment of a quality organisation adapted to the widely distributed aspect of the project (teams and resources). The quality organisation proposed and described in detail in following sections is composed of:

- A Quality Assurance Management team (QAM): The role of the QAM is to define for the relevant activities the overall standards, procedures and metrics; to make sure they are applied; to evaluate metrics; to report and to propose progress factors.
- A Quality Assurance Group (QAG): The Quality Group is composed of QA representatives from each activity. The main role of QA representatives is to ensure that quality measures as agreed are applied inside their activity group. The execution of the verification and testing activities is the responsibility of the individual activities. The QAM coordinates the QAG.
- Dedicated testing teams under JRA1 (middleware tests and integration), NA4 (Applications Validation), SA1 (Operations Grid Validation).
- A dedicated Methodology and Tools support team hosted by JRA1.

#### *5.C.2.1.2 Quality Assurance for EGEE*

Quality Assurance is the planned evaluation of the adherence to software and operations product standards, processes, and procedures. It ensures standards and procedures are established and are followed throughout the project life cycle. It defines the quality criteria by which the services provided by EGEE can be evaluated and measured as well as clear procedures to define and monitor services (computing service, documentation, users supports etc.) within operations. This activity consists of the regular monitoring of the application of the standards through actions such as: verification of documents, participation in reviews and audits, follow-up of corrective actions and the analysis of quality indicators, users satisfaction enquiries.

#### *5.C.2.1.3 Standards and procedures*

The existence and validation of quality standards for Grids is a critical factor for the wider acceptance of Grid services and infrastructures by industries and businesses.

The main standards and procedures that will be put in place are listed here:

- Document management procedure and document templates
- EU deliverables procedures
- EU Quarterly and annual reporting procedure and EU report templates
- Design standards
- Coding standards, naming conventions, internal code documentation standards, test plan templates and manual style guides
- Release policy
- Tests and validation procedures
- Verification procedure (VV: Verification and Validation activities and associated check list) to be performed during all phases of the project life cycle
- Formal inspection and audit plan and procedures
- Metrics definition and monitoring procedures
- Configuration management procedures
- Non conforming action procedures
- Security Assurance procedures of ensuring that security and integrity requirements are satisfied during all phases of the software life cycle. This activity is related to the JRA3 goals, and the security tests could become part of the verification and validation tests and be executed in a similar manner.
- Risk procedures
- Supplier and Subcontractor control procedures

More information specific to EGEE Operations is given below:

#### *5.C.2.1.4 Quality Assurance for EGEE Grid Facilities Operations*

EGEE will introduce, deploy and evaluate innovative processes, instruments, standards, and best-practices for the Quality Assurance of Grid infrastructures.

Basically the EGEE quality assurance regarding operations will be centred on:

- Establishing plans and guidelines to ensure adequate levels of service
- Defining monitoring and accounting requirements for the Grid facility systems and services
- Specifying the adequate levels of training and skills for technical personnel
- Define the quality metrics by which the Grid facility operation should be evaluated
- Performing acceptance tests on new sites prior to their insertion in the production Grid facility
- Certifying large core data centres. Verifying the Grid facility operation quality level.

The EGEE operations QA will help produce plans and guidelines aiming to set the standards and procedures to be followed in the day-to-day operation with the objective of improving the quality of the services provided. The plans and guidelines will be established in close cooperation with the groups that will implement them.

#### 5.C.2.1.5 Monitoring and accounting Quality for Grid operations

The objective of the Grid facility services monitoring will be to detect possible service deployment problems and middleware failures. Monitoring will cover the Grid facility services availability, behaviour and performance. The network services will also require monitoring in order to verify whether they comply with the service level agreements, to understand how the network capacity is being used and thus identify possible bottlenecks and to identify whether problems noticed at the middleware and application layers are caused by network problems. Monitoring tools must be able to produce detailed historical reports about detected events.
Accounting systems will be deployed in all possible components so that their behaviour can be measured. A system to collect the accounting information from the Grid facility and consolidate it into a database must also be developed. These requirements must be provided to all groups developing or maintaining middleware components since they are crucial in evaluating the behaviour of the Grid facility and the implementation of a system of metrics.
A set of metrics to correctly evaluate the Grid facility operation must be identified. This is a complex task since metrics measuring the Grid facility services behaviour will be influenced by a number of factors some of them external to the project such as some middleware components or the network services. The Grid facility will be built for the users, and therefore it is essential to obtain their opinion about the Grid facility software and services.

#### 5.C.2.1.6 Metrics for Grid Operations

The operations QA will help specify the adequate levels of training and skills required for the Grid facility technical personnel in order to assure proper Grid facility operation. The QA should then verify whether adequate training is being provided to all relevant technical personnel including helpdesk support technicians, system administrators and operators.
Crosschecking enquiries with the metrics will provide a more complete view of the Grid facility operational issues. The enquiries can also identify issues that can pass unnoticed in the metrics evaluation. They can also help establish new metrics or identify components that need to be improved.

#### 5.C.2.1.7 Verification of Grid Operations

Part of the EGEE Quality Assurance system must be a team dedicated to support the validation of new sites and services. New sites and services will require a careful and methodical configuration validation prior to their acceptance in the Grid facility. In this context benchmarking tools will be used to evaluate the site and services performance.
Support centres and large core data centres will require a more thorough certification. The large infrastructures that will provide the core computing, storage services and support services will require a thorough verification through an audit covering all aspects of its operation and functionality. These certifications aiming to pinpoint possible operation/functionality issues or deficiencies will be repeated regularly and whenever the site metrics drops below the minimum quality level accepted.

#### 5.C.2.1.8 Software Quality Engineering

This activity will encourage and support sound Software Engineering techniques in the definition and development of the software, by making available and supporting tools and methodologies to enhance and unify the work of the components, software and operations, of the EGEE project.
The JRA1 Methodology and Tools Support team supports this activity. This team will provide the tools needed by the JRA1 activity (software configuration management and build tools, developers web, testing framework, specifications and design, compilers, programming and debugging, auto documentation, etc.) and QA tools like bug tracking, quality reporting tools, statistical analysis, document management, coding rules checking tool. The complete list of tools supported will be confirmed by the MJRA1.1 milestone: Tools for middleware engineering and integration.

#### *5.C.2.1.9 Tests and validation process*

The schema shown in Figure 21 below summarizes the tests and validation process proposed for the EGEE project. Tests and Validation activities are crucial for EGEE. Dedicated testing teams are provided within the following activities:

- JRA1 (middleware): One testing team and one integration team
- SA1 (Operations): Team dedicated for the Grid Validation
- NA4 (Applications): Team dedicated to Application tests, mainly to develop and perform test cases corresponding to the use cases and a set of typical applications.

Quality group (QAG) representatives will make sure this process will be followed inside each activity and that the input and output from each step conform to the required quality level. The check-lists for VV (Verification and Validation) to be performed during all phases of the project life cycle will be a key tool for this purpose.

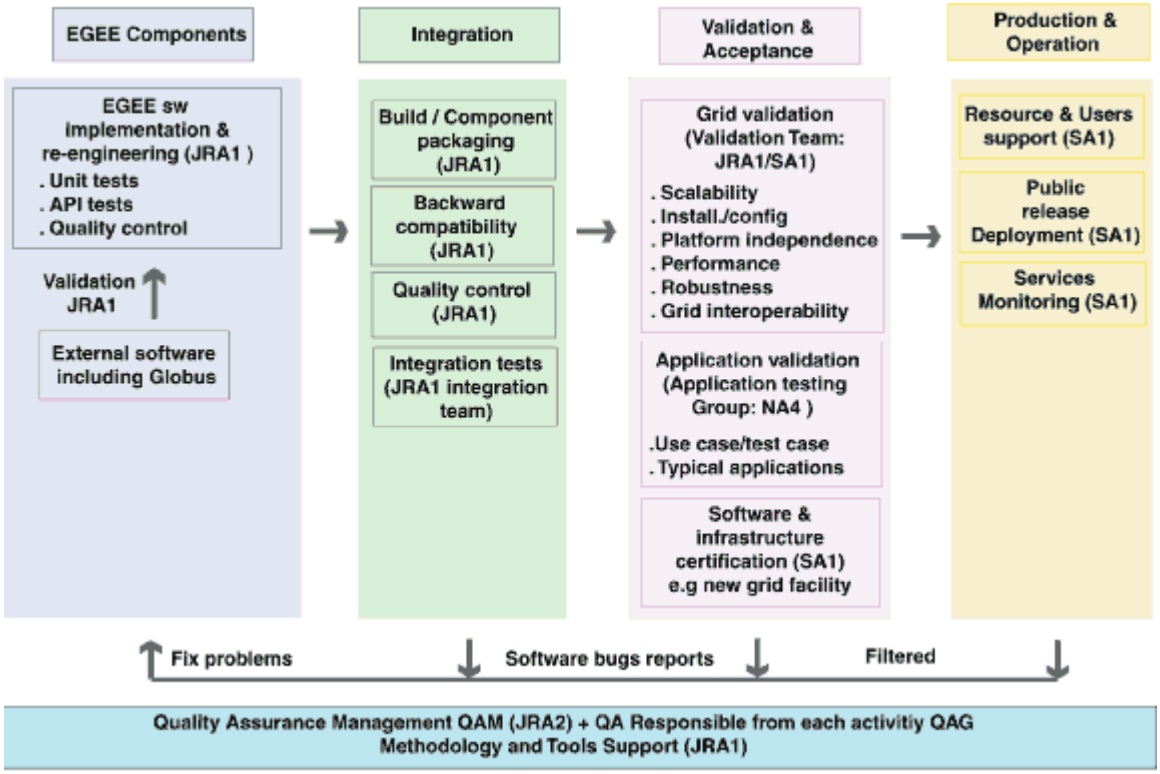



**Figure 21** ***EGEE Tests and Validation process***

#### *5.C.2.1.10 Release strategy*

In order to deliver quality software and services in a stable environment for the EGEE users new versions of the software will be regularly released as shown in Figure 22 below:

- Development Releases. Installed on special development computers. Available to all the EGEE developers that need to run their tests.
- Public Releases. They will be available to any qualified EGEE site that wants to provide Grid services to the users. At any one time there will be one public production releases and one candidate release.

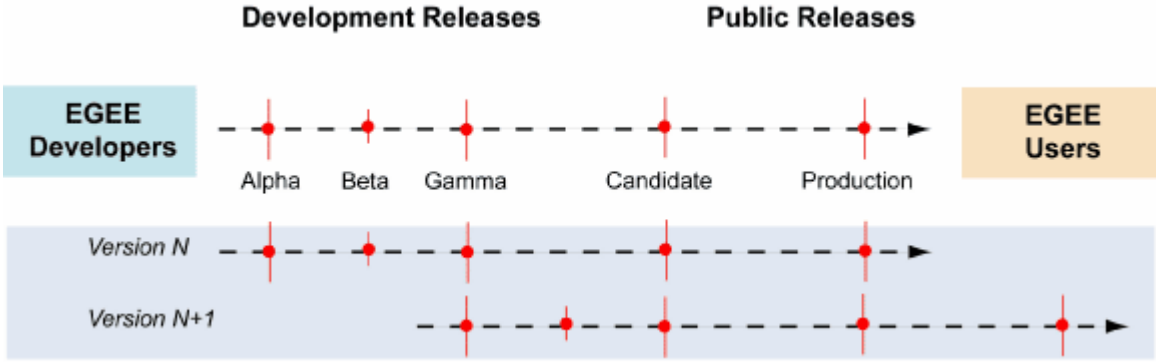



**Figure 22** ***EGEE Software Release Scheduling***

Production releases will be installed progressively on the public Grid nodes available to the EGEE users. Candidate releases will be available to the site administrators. They will want to install them on some Grid nodes for local testing and to allow testing of users applications before the release becomes a production release.

### 5.C.2.2 Execution plan of the joint research activity

The following tables describe (1) the execution plan of the Quality Assurance activities of the project and (2) the deliverables of the project.

**Table EE** ***Execution Plan of JRA2***

| **TASKS** | Internal Artifacts |
|---|---|
| Initialisation Tasks | |
| Task 1.1 Provide Project Quality Plan – (PM 1 to 4) | PQP and related annexes |
| Task 1.1.1 Define Quality objectives | |
| Task 1.1.2 Define Standards and guidelines | |
| Task 1.1.3 Define Metrics | |
| Task 1.1.4 Define the review and audit plan | |
| Task 1.1.5 Define the problem resolution and corrective action | |
| Task 1.1.6 Define the test and validation process | |
| Task 1.1.7 Define main tools, techniques and methodologies | |
| Task 1.1.8 Describe the configuration management principles | |
| Task 1.1.9 Describe the Supplier and Subcontractor control process | |
| Task 1.1.10 Initialize the operations plan | |
| Task 1.2 Provide internal QA website - (PM 3 to 5) | Internal QA website |
| Task 1.3 Prepare and provide the initial training (QA principles, standards, tools, methodologies, etc.) – (PM 5 to 7) | PM7: Provide Training |
| **Recurrent tasks** | |
| Task 2.1 QA activities (PM 1 to 24) | Quarterly report on QA activities and measurement |
| Task 2.1.1 QA overall activities | |
| Task 2.1.2 QAG coordination | |
| Task 2.1.3 Quality metrics centralization and analyses | |
| Task 2.1.4 QA dissemination | |

**Table FF** ***Deliverables of JRA2***

| Month | Deliverables & Milestones | Item |
|---|---|---|
| M04 | DJRA2.1 | (CSSI) Quality Plan for EGEE |
| M05 | MJRA2.1 | (CSSI) Internal QA website deployed (Milestone) |
| M12 | DJRA2.2 | (CSSI) Annual Report on EGEE Quality Status, including software and Grid operations and plans for the second year. |
| M24 | DJRA2.3 | (CSSI) 2nd Annual report on EGEE Quality Status, including software and Grid operations |

### 5.C.2.3 Quality of the management

#### *5.C.2.3.1 Management and competence of the participants*

The activity will be lead by a Quality Assurance Head responsible for the overall quality of the EGEE project and adherence to the quality goals of the project must be an essential goal of the project stake-holders and activity leaders.

The QA Head must be a manager with software engineering experience, working full time for EGEE, supervising all the QA related activities, in the QA groups and in the different activities. She/he makes sure

that QA satisfies the needs of the users. The individual must also spend considerable time fostering the usage of sound QA in the management and development of the other EGEE activities.
The QA Head sits on the Project Executive Board to supervise the project quality evolution and has the authority to act with the activities for all issues concerning QA of the full EGEE project.
The quality organisation is composed by:

- A Quality Assurance Management team (QAM): QAM is composed of the QA head and two quality engineers. The role of QAM is to define with the activities overall standards, procedures and metrics; to ensure they are applied; to evaluate metrics; to report and to propose progress factors. QAM coordinates the Quality Group composed by QA representatives from the activities.
- A Quality Assurance Group (QAG): The Quality Group is composed of the QA representatives from the activities. The main role of QARs is to make sure that quality measures as agreed are applied inside their activity. The execution of the verification and testing activities is the responsibility of the individual activities. The QAG is coordinated by the QA head and will meet monthly.

In detail the QAG is composed by:

- The middleware manager
- One QAR from each implementation clusters
- The QAR from the integration team
- One representative from the Methodology and Support Tools team
- The operations manager, one representative for CIC and one representative for ROC
- One representative from the applications
- One representative from security and network activities

Every activity should have a **Quality Assurance Representative** (QAR) 50% FTE dedicated to quality assurance: one person acting as interface to the QAG. Another 50% per should be devoted to documentation and testing activity.
The QA organisation and composition of the QAG is shown in the figure below.

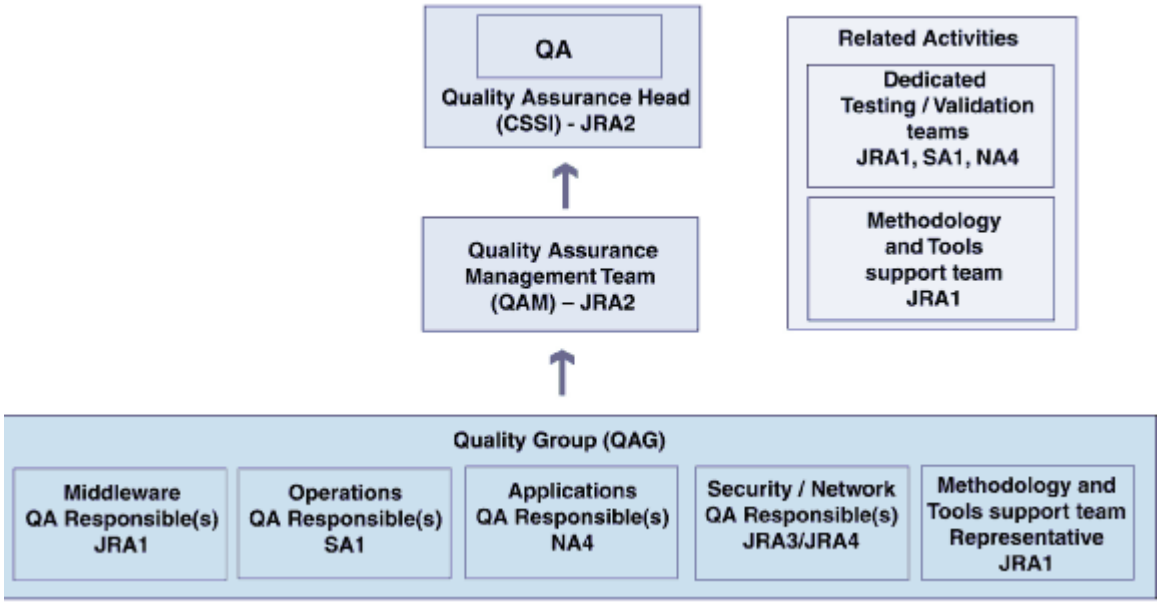



**Figure 23** ***EGEE QA organisation***

An important effort for the test activities is provided directly by the activities. Dedicated testing teams are provided within the following activities:

- JRA1 (middleware): One testing team and one integration team
- SR1 (Operations): Team dedicated for the Grid Validation
- NA4 (Applications): Team dedicated to Application tests, mainly to develop and perform tests case corresponding to the use cases and a set of typical applications.

The activity participants will leverage on current experience in QA including industrial experience and large software projects of comparable scale such as EU FP5 DataGrid and the LHC Computing Grid (LCG) at CERN. In particular, the templates and QA procedures developed with the EU DataGrid project have been adopted by other EU FP5 projects such as CrossGrid and DataTAG.

| **JRA2** | | |
|---|---|---|
| **Participant** | **Quality Assurance activity (Quality Assurance Management team)** | **Professional FTE (EU funded + unfunded)** |
| **France** | | |
| CSSI | Quality management and coordination. Quality Assurance Head in the Project Executive Board. | 1 + 0 |
| CNRS | Quality standards, procedures and verifications | 2 + 0 |

**Table GG** ***Effort (Funded and unfunded) for the Quality Assurance JRA2 activity***[19]

CSSI is a service provider company in the integration and operation of secured intercommunicating IT infrastructures and in the development of scientific, technical and embedded applications. CSSI is responsible for GEANT network operation, with expertise in deployment, quality, operation and security issues. CSSI is also responsible for the Quality Assurance activity of the EU DataGrid project.
CNRS played a major role in DataGrid in particular concerning integration, deployment and operation activities.

### 5.C.2.4 Justification of financing requested

The QA Head, and the QAM team will need to travel for a part of their time in order to personally verify the quality of the different groups at their host locations and to collect feedback and recommendations from them. As much as possible these activities will be done using remote communication and video conferencing but personal contact will be fundamental. Therefore an adequate budget for travelling should be included.
In general there must be a global investment in Quality of at least 10% of the human and financial resources (including the QA resources inside the activities).
The QA Head can ask external consulting and audit activities to be performed on the project for a total of six man-weeks per year. This will provide external and objective recommendations and assessment of the work of the quality team and of the EGEE project in general.

### 5.C.2.5 European added value

The Quality Assurance activity for EGEE will use existing standards and consolidated practices.
The usage on the large scale of software development best practice will contribute to train a community of software developers.
The definition and the exploitation of the “Quality of Service” in the context of EGEE represent a significant step forward in Grids-empowered distributed infrastructure. EGEE will introduce, deploy and evaluate innovative processes, instruments, standards, and best-practices for Quality Assurance of Grid infrastructures.
The existence and validation of quality standards for Grids is a critical factor for the wider acceptance of Grid services and infrastructures by industries and businesses.

### 5.C.2.6 Exploitation of results

The results of the Quality Assurance activity will be exploited via the main technical activities of the proposal, namely grid operations activity (SA1) whereby eScience communities will be given access to verified, high-quality grid service infrastructure by way of production quality grid middleware (JRA1).
The advances made in the field of quality assurance will be exploited via the deliverables of this activity (DJRA2.1/2/3) which will be made available to related EU projects as has been the case with the QA deliverables of the EU FP5 DataGrid project.

[19] The separation between “Funded” and “Unfunded” depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

### 5.C.2.7 Summary

| **Activity number:** | JRA2 | **Start date or starting event:** | | | Project start |
|---|---|---|---|---|---|
| **Participant:** | 22<br>CNRS | 23<br>CSSI | | | |
| **Expected Budget per Participant:** | 400 K | 400 K | | | |
| **Requested Contribution per Participant:** | 200 K | 200 K | | | |

**Objectives**

Foster the production and delivery of quality Grid software and operations. Provide to the Grid applications an environment based on production software and facilities of certified quality.

The programme of Quality Assurance is a crucial part of EGEE and it must be put in place to ensure the production and delivery of adequate Grid software and Grid services.

**Description of work**

The QA Management Team will be in charge of producing and supporting:

- General Project Quality Plan
- Definition and monitoring of standards and procedures
- Measurements and metrics for all Activities
- QA tools (bug tracking, quality reporting tools, statistical analysis, etc.)
- Audits and reports, for all Activities
- Organization of training on the QA and procedures
- Coordinating the Quality Group

A Quality Group composed by Quality Assurance Representatives (QAR), one per activity group

- Dedicated to quality assurance inside the activity group
- Acting as Interface towards the QAM

Managing and completing the group's documentation and testing activity.

**Deliverables**

| | | |
|---|---|---|
| DJRA2.1 | PM 04 | (CSSI) Quality Plan for EGEE |
| DJRA2.2 | PM 12 | (CSSI) Annual Report on EGEE Quality Status, including software and Grid operations and plan for second year |
| DJRA2.3 | PM 24 | (CSSI) 2nd Annual report on EGEE Quality Status, including software and Grid operations |

**Milestones[20] and expected result**

| | | |
|---|---|---|
| MJRA2.1 | PM 05 | Internal QA website deployed |

This activity will produce a quality assurance framework for the whole project encompassing the principle activities of software re-engineering and grid service operations.

[20] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

| **Justification of financing requested** |
| --- |
| France (CNRS and CSSI): CNRS will fund 1 FTE and will provide 1 FTE unfunded. CSSI will fund 1 FTE. The human and financial request is necessary in order to achieve an adequate quality at least 10% of the resources must be invested in Quality assurance activities (including the QA resources inside other activities). |

## 5.C.3 Activity JRA3 - Security

### 5.C.3.1 Scientific and Technology excellence

#### *5.C.3.1.1 Objectives and originality of the joint research activity*

EGEE proposes to create a pan European scale Grid, focused on enabling many different types of eScience applications that make use of an underlying services infrastructure that must be secure, reliable and manageable. EGEE will construct an integrated and scalable infrastructure that must facilitate various different types of applications and access patterns – ranging from single transactions to long lived batch jobs – and that uses different access methods. Security must be included in the architecture *from the start*, and not inserted in at a later point. Moreover, it must be a *distributed* activity, *i.e.*, present in all activities. The security group described here will define a Security Framework and Architecture and a set of high-level policies that will act as guidance to the other activities. It ensures consistency and makes the most visible value-adding service of the Grid, transparent security and single sign-on, available to all other activities.

In parallel to and independent of the EGEE effort, several projects are underway aiming at wide-scale deployment of IPv6 in Europe. However, the middleware deployed at the start of EGEE will have dependencies on IPv4, and in some cases IPv6 may not even be supported. The JRA3 activity must ensure that recommendations and applications are written so that such dependencies on IP protocol version are minimised.

The security architecture will be based on requirements from both Grid users and suppliers, and this activity will define and validate the EGEE security architecture in line with these requirements. It is perceived that a number of security related tasks will be especially challenging when implemented to work across national boundaries and over a wide-ranging geographic area. Many of those tasks need immediate attention, although none are blocking the initial deployment of a Grid at open scientific organisations. To date, the following areas have been identified as being on the critical path for large-scale deployment:

- Basic Security Policy and Incident Response;
- CA Trust Establishment and Policy Management;
- VO Definition, Rights Delegation, and Scalability;
- OGSA Web Services Security and site service access, control and auditing;
- Site Usage Control and Budgeting;
- Secure Credential Storage.

In the following, we list the areas, which will require EGEE activity to reach the maturity level to allow Grid-empowered production services to be deployed across an international community.

It is explicitly foreseen that the requirement gathering and the implementation of the architecture and framework will identify further areas. In particular, the level to which the mentioned open issues can be addressed within the first 2 years described in the work programme will be sufficiently comprehensive to support an industrial-level Grid that will emerge in the future. Based on the architectures developed in the present programme subsequent specific action areas will be identified.

#### *5.C.3.1.2 Basic Security Policy and Incident Response*

Malicious users will certainly be strongly attracted by the enormous computing power made available by the Grid. Strong emphasis will thus be given to such topics as *management of security incidents* and *intrusion detection* since in a Grid environment the security in one site can be compromised by events in other, apparently unrelated, locations. For this reason – and to avoid to further increase the burden on the local site managers – EGEE-wide response teams will coordinate the above activities. It is therefore vital that a common methodology for characterizing and correlating incidents in a distributed system is drafted and deployed early on.

Common incident handling procedures will be designed that address the threats posed by current and future network and host intrusion methods. Sites joining EGEE must adhere to these incident response procedures that will be described in the Security Procedures document. By aggregating information from the Grid Operation centres, the security procedures document will be iteratively revised so as to better respond to new kinds of incidents and intrusion techniques.

#### 5.C.3.1.3 CA Trust Establishment and Policy Management

A European Grid Policy Management Authority is a prerequisite for running a Grid infrastructure both in Europe and worldwide. For establishing a common trust in electronic user identities, the Grid Security Infrastructure relies on trusted third parties, called Certification Authorities (CA) in a Public Key Infrastructure (PKI) environment. It is therefore essential that a network of CA's is established and maintained in Europe, and that sufficient trust emanates from this group of CA's, based on a commonly agreed set of requirements. The following goals will thus be pursued:

- The continued operation of the CA Coordination Group - currently sponsored by the FP5 DataGrid project - and affirmation of this group as the European Grid Policy Management Authority (PMA);
- The introduction of on-line validation methods for long-term credentials issued by the participating Authorities;
- Foster the creation of a GGF-related body for global trust interoperability;
- Further study in the scalability issues involved in extending a de-centralized body of CA's across Europe without sacrificing local authentication capabilities - including the automation of trust evaluation;
- Knowledge transfer from the current European Grid CA operations group to new operational CA centres within the project consortium.

#### 5.C.3.1.4 VO Definition, Rights Delegation, and Scalability

The Virtual Organization (VO) – an abstract entity grouping Users, Institutions and Resources (if any) in a single administrative domain – is one of the central concepts of the Grid environment. Current technology offers support for rather *static* and *large* communities. The assignment of access rights is separated into two parts: local resource administrators grant rights to the VO as a whole, while VO administrators grant them to individual members of the community.
In addition to this paradigm, the European Research community includes many scientists that require collaboration and Grid computing in a more short-lived environment. We think it is vital to explore the feasibility of small (even only two people), short-lived (of the order of few days) and unforeseen (dynamically discovered) VO's. The goal would be to provide a very fine-grained authorization control mechanism, and where applicable based on global standards.

#### 5.C.3.1.5 OGSA Web Services Security and site service access, control and auditing

This area will be concerned with defining security architectures that controls access to Grid resources. Access control architectures include access request, access enforcement and access decision functions.
To implement a site access control policy the site administrator has to configure the Grid services she runs. In a production environment it is important that the method of configuration stays stable and well documented, so the administrators do not have to reconfigure their system at each software upgrade. Therefore it is an important part of this project to adhere to standards in this field (e.g. XACML, SAML, etc.) and we will influence them as needed for the success of EGEE.
Access requests must be allowed to originate from various types of devices. Access enforcement may be implemented at various levels ranging from the networking layer, through site-specific techniques (e.g. Kerberos), up to the application layer.
Access decisions are typically based on policy decisions involving the user identity and user role. Decisions can be made for a current timeslot or a future timeslot (advance reservation). Access decisions bind resources to an identified user for a given amount of time or usage quantity. The binding process will involve one or more stakeholders that may or may not have established trust relationships. Therefore this part of the work will consider existing and upcoming security architectures including Rules Based Access Control (RBAC) systems, Authentication, Authorization and Accounting (AAA) systems and OGSI based security mechanisms. It will consider security architectures that will allow various existing Authentication mechanisms to be used in parallel (e.g. PKI or Kerberos based).

#### *5.C.3.1.6 Site Usage Control and Budgeting*

This area will be concerned with the control of usage of resources, once access to them has been established. This includes interfaces to traditional Usage Control mechanisms such as quotas and limits, and also the extraction and recording of usage for Budgeting, Accounting and Auditing purposes.
The usage limits specified by the security architecture will be capable of being mapped onto a variety of local and operating system-specific limit mechanisms. This will accommodate usage quotas owned either by individuals or by VO's, and specified both in site-specific or Grid-wide protocols. This will include the ability to allow enforcement of quotas across a set of distributed resources.
The site's Usage Control system and its Grid interface also provide the most convenient place to collect usage data, for Accounting and Auditing purposes. We will make this information available to central Auditing services elsewhere on the Grid using standard protocols that we will co-define in the GGF Usage Record and Grid Usage Service working groups.

#### *5.C.3.1.7 Secure Credential Storage*

A problem which hasn't been addressed satisfactorily by Grid projects to date – and which is fundamental in the switch to a production environment – is the conservation of the personal credentials in a secure way (they are usually stored on a desktop or laptop system and their protection is often left to the mechanisms of the operating system only). This already inhibits the acceptance of Grid technology in the world and will be one of the most pressing issues in the EGEE start-up phase. Moreover, portability problems must be addressed. At least the following methodologies will be investigated:

- hardware tokens like smart cards, key buttons, USB tokens;
- portals and online credential/delegation repositories like Genius and MyProxy;
- online CAs that generate a short-lifetime certificate based on a local authentication (e.g. Kerberos).

### 5.C.3.2 Execution-plan of the joint research activity

The tasks of this activity have one common goal: enabling the deployment of production-quality Grid that includes resources and applications that are security-conscious and handle sensitive information. The execution plan detailed below covers only the initial period of 2 years. It is expected that tasks will be added as the Grid matures, and more advanced services, like secure time stamping, verifiable confidentiality and integrity, are required. These will be implemented in the follow-up component to EGEE.

**Plan for first 15 months:**

- **Project start:** The detailed planning of the management structures and functions described in this section will allow the project to become quickly established. To ensure a quick start-up phase, we intend to have all staffing in place by the start of the project. We intend to make sure that our initial plans are well advanced at the start of the project.
- **PM3:** the first two milestones are at the end of project month 3: first, a completed users requirements survey will help to further refine the distribution of effort over action lines; and second, the set up of the Policy Management Authority (PMA) for European CA's. The PMA will also liaison with extra European CA's as necessary.
- **PM6:** at the end of project month 6, two more milestones have been met and the first deliverable is completed. The first milestone is a manual with initial recommendations for OGSA SEC reengineering. The second is a document for security operational procedures and incident handling and a common Grid incident format. The deliverable is the initial Global security architecture document.
- **PM9:** at the end of project month 9 the site access control architecture document will be delivered as well as a milestone recommendations document for secure credential storage.
- **PM12:** based on experience gained since PM6 a first revision of the security operational procedures will be ready. A second milestone is a document describing a framework for the policy evaluation accepted in GridPMA policies and the determination of CA service authorities for EGEE.
- **PM15** the first revision of the Global security document will be well under way. It will be delivered at the end of PM16.

**Table HH** ***Deliverables for Security activity***

| Month | Deliverable or Milestone | Item |
|---|---|---|
| 3 | Milestone MJRA3.1 | Completed user requirements survey defines effort redistribution over action lines. |
| 3 | Milestone MJRA3.2 | Set-up of the PMA for European CA's and liaison with the corresponding extra European ones (document + standing committee) |
| 4 | Milestone MJRA3.3 | OGSA SEC service initial recommendations for reengineering (manual) |
| 5 | **Deliverable** DJRA3.1 | **Global security architecture** (document) |
| 6 | Milestone MJRA3.4 | Security operational procedures and incident handling, definition of a common Grid incident format (document) |
| 9 | **Deliverable** DJRA3.2 | **Site access control architecture** (document) |
| | Milestone MJRA3.5 | Secure Credential Storage procedures (recommendations document) |
| 12 | Milestone MJRA3.6 | Security operational procedures (first revision) (document) |
| | Milestone MJRA3.7 | Framework for policy evaluation accepted in GridPMA policies and determination of the CA service authorities for EGEE (document) |
| 16 | **Deliverable** DJRA3.3 | **Global security architecture** (first revision) (document) |
| 18 | Milestone MJRA3.8 | Security operational procedures (second revision) (document) |
| | Milestone MJRA3.9 | Set-up of accounting techniques and distributed budgets (document) |
| 24 | **Deliverable** DJRA3.4 | **Assessment of security infrastructure (report)** |

| Month | Deliverable or Milestone | Item |
|---|---|---|
| 24 | Milestone MJRA3.10 | Security operational procedures (third revision) (document) |

The security operational procedures document will include the necessary security procedures to qualify centers. It will also define guidelines and test suites for the software.
The EGEE Quality Assurance (JRA2) activity will use these deliverables as a part of the software quality assurance process.

### 5.C.3.3 Quality of the management

#### *5.C.3.3.1 Management and competence of the participants*

The actions required within the security group by definition cover a wide range of expertise. It is also well known that software re-engineering is most efficiently done in a tightly organised group of dedicated persons. Therefore, area experts in the security group should be located at a single place, and where applicable also be co-located with the associated software re-engineering team (following the same pattern of the re-engineering groups from JRA1).
To ensure a consistent EGEE security architecture and interoperable security components, the staff in this dedicated security activity requires its own internal structure, including internal meetings. Given the breadth of security areas that must be addressed, it is foreseen that the individual activities may be located at specific expertise centres, where a specific focal point exists to coordinate and manage the work (located with one of the large expertise groups).
The overall purpose of the JRA3 activity is to "propose, implement and monitor the project's security architecture." The overall software development process described by JRA1 is also adopted by JRA3 (see Table II). The security head leads the whole activity and is a member of the PEB (see NA1, JRA1) as well as the architecture team. The responsibility of day-to-day project management that deals with the activity is delegated to the cluster manager. Given the prior collaborations between people in JRA3, the role of cluster management and security architect has been merged. In the other clusters of JRA1 (see Figure 4 of JRA1) there is a role dedicated to "security" which parallels the arrangement with a dedicated "unit tester" role. The security head animates this group; thus the security head works horizontally among the other JRA activities, while the cluster manager works more vertically within JRA3.
At start-up phase, one of the participants in JRA3 will work in close contact with the software re-engineering teams in JRA1 on the implementation of best practices and to evaluate legacy software.
The effort is evaluated in 12 FTEs per year, as shown in Table II below, due to the wide range of competences and the need to support many diverse activities/groups within EGEE. For certain actions, people not specifically allocated to the JRA3 activity may be asked to act on a temporary basis as consultants.

**Table II** ***Manpower and geographical focal points for security activities***

| | |
|---|---|
| **Security Head** | Ake Edlund, Stockholm |
| **Software Development Cycle Team** | 4 software engineers:<br>Cluster Manager and Architecture — 1 person, Stockholm<br>Sys Admin — 1 person, Bergen<br>QA and doc — 1 person, Amsterdam<br>Unit Tester — 1 person, UH-HIP |
| **Security Architecture and Design Team** | 7 software engineers:<br>Basic Security Policy and Incident Response; CA Trust Establishment and Policy Management; — 1 person, Amsterdam<br>VO Definition, Rights Delegation, and Scalability — 2 persons, Amsterdam<br>OGSA Web services security and site service access, control and auditing — 2 persons, Stockholm and UH-HIP<br>Site Usage Control and Budgeting; Secure Credential Storage. — 2 persons, Stockholm and Bergen |

In EGEE the candidate groups comes from NEG. The cluster has a prominent role in the standard work in GGF and the Internet IRTF AAAARCH group for work on AAA servers and authorization. They are active in authentication policy standardization via the CAOPS and co-founded the GridPMA group. NEG staff sits on the Grid Forum Steering group. Within the EU FP5 DataGrid and DataTAG projects, they were responsible for secure access mechanisms for databases and data management in the Spitfire system, and defined fabric access mechanisms via the LCAS and LCMAPS frameworks that received recognition from large production centres also outside Europe. Both the Dutchgrid and NorduGrid CAs have longstanding experience in supporting a diverse, multidisciplinary user community.
It is implicit in the way that authentication and trust building works, that the policy and trust actions will be a collaborative effort between the JRA3 experts and the existing authentication services in the participating counties in EGEE. Coordination will be centralised in the JRA3 focal point in Stockholm.

### 5.C.3.4 Justification of financing requested

This group will need financing of highly skilled staff (twelve people), including an experienced Security Head who will ensure its central coordination. It is considered extremely important that security expertise is centrally managed, such that the various services remain interoperable. Therefore it cannot be left to the re-engineering teams, who will each focus on the deployability of individual core services. The consistent security and single sign-on is one of the most visible and compelling reasons to join resources via the Grid, and provides end users with immediate benefits in resource exploitation.
It is also the most viable way to ensure that the mechanisms deployed inside EGEE will acquire the international quality recognition required for standardization.
Besides the architectural and scalability issues, the PMA activity will require quarterly or tri-annual meetings with the EGEE national CA managers. This supra-national activity forms the basis of the deployed Grid in Europe and should be supported with appropriate travel funds.

### 5.C.3.5 European added value

The members of this group will use, when possible, consolidated standards and practices. At the same time they will be active in all the relevant standardization bodies (e.g. IETF, GGF) to follow and direct their work. The enforcement of standards and best practices will contribute to train a community of software developers. The specification of minimum requirements for sites, the management of intrusion detection systems and the coordination of security incidents will certainly provide a big leap in the security of the participating sites and in the awareness of users and managers alike.

### 5.C.3.6 Exploitation of results

The work of this activity will result in a grid infrastructure with the following characteristics:

- Increase of the security level of the sites, ensure rapid response to intrusions;
- Sound authentication procedures accepted by sites and users;
- Training of programmers and developers in writing security sound procedures;
- A solid authorization and accounting system.

Such a grid infrastructure will be very attractive to a large user base including business communities. Indeed, insufficient security is seen as one of the major obstacles to the exploitation of existing grid infrastructures. The work of this activity will raise the level of security to new heights thus allowing further exploitation in application domains such as the bio-medical area dealing with patient data for which strict access restrictions exist. The improvements in authentication and authorization will help impose such access restrictions. A solid accounting system will form the basis for the common market of computing power by enabling accurate tracing of consumed resources across many sites.

### 5.C.3.7 Summary

| **Activity number:** | JRA3 | | **Start date or starting event:** | | | Project start | |
|---|---|---|---|---|---|---|---|
| **Participant:** | 35 UH-HIP | 36 FOM | 38 UvA | 39 UiB | 63 KTH | | |
| **Expected Budget per Participant:** | 192 | 400 | 192 | 192 | 390 | | |
| **Requested Contribution per Participant:** | 192 | 200 | 192 | 192 | 390 | | |

**Objectives**

Enable secure operation of a European Grid infrastructure by developing security architectures, frameworks and policies to allow deployment of Grid on a production scale. It specifically includes a requirements cycle, definition of incident response methods and authentication policies, and the consistent design of security mechanisms for all core Grid services. It will also address production needs of resource providers with regard to identity integrity and protection.

**Description of work**

The specific work for the first deployment period consists of: emergency response protocols and information exchange formats; establishing a European Trust infrastructure via a EGEE PMA, defining policy evaluation mechanisms for CA scaling; defining a secure credential storage system; VO management mechanisms and architectures for VO scaling; Authorization and delegation architectures and site access mechanisms; usage control and Grid-wide enforcement of budgets.

**Deliverables**

| | | | |
|---|---|---|---|
| DJRA3.1 | M5 | (KTH/PDC) | Global security architecture (document) |
| DJRA3.2 | M9 | (FOM) | Site access control architecture (document) |
| DJRA3.3 | M16 | (KTH/PDC) | Global security architecture (document - first revision) |
| DJRA3.4 | M24 | (KTH/PDC) | Assessment of security infrastructure (report) |

**Milestones[21] and expected result**

| | | |
|---|---|---|
| MJRA3.1 | M3 | Completed user requirements survey defines effort redistribution over action lines |
| MJRA3.2 | M3 | Set-up of the PMA for European CA's and liaison with the non-European ones |
| MJRA3.3 | M4 | OGSA SEC service initial recommendations for reengineering |
| MJRA3.4 | M6 | Security operational procedures and incident handling, definition of a common Grid incident format |
| MJRA3.5 | M9 | Secure Credential Storage procedures |
| MJRA3.6 | M12 | Security operational procedures (first revision) |
| MJRA3.7 | M12 | Framework for policy evaluation accepted in GridPMA policies and determination of the CA service authorities for EGEE |
| MJRA3.8 | M18 | Security operational procedures (second revision) |
| MJRA3.9 | M18 | Set-up of accounting techniques and distributed budgets |
| MJRA3.10 | M24 | Security operational procedures (third revision) |

This activity will lead to a secure, reliable and manageable underlying services infrastructure for a pan European scale Grid enabling many different types of eScience applications.

**Justification of financing requested**

The consistent security and single sign-on is one of the most visible and compelling reasons to join resources via the Grid, and provides end users with immediate benefits in resource exploitation. Critical obstacles prohibit current Grid deployment at a production-scale, and each of these issues must be resolved as soon as possible to allow wide-scale deployment to continue. The proposed team of 12 security experts is the minimum to ensure that the overall objectives of EGEE are met. It is also the most viable way to ensure that the mechanisms deployed inside EGEE will acquire the international quality recognition required for standardization.

The efforts described here over the next 24 month will not be sufficient to resolve all problems. It should be expected that this work needs to be continued to ensure acceptance of Grid technology in more security-sensitive areas.

Besides the architectural and scalability issues, the authentication activity will require quarterly or tri-annual meetings with the EGEE national CA managers.

[21] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

# 5.C.4 Activity JRA4 - Network Services Development

## 5.C.4.1 Scientific and Technological excellence

### *5.C.4.1.1 Objectives and originality of the joint research activity*

This section presents a Joint Research activity consisting of two main tasks:

- Bandwidth allocation and reservation
- Network performance monitoring and diagnostic tools

These tasks, although aligned to similar tasks for access and monitoring of other resource categories, have a network-specific dimension. Their implementation in the context of the GEANT and the NRENs requires the introduction of new capabilities into the NRENs as part of an extensive development programme spanning the GEANT networks (GN1 and GN2 projects). For both tasks, the introduction of the basic underlying infrastructure into the NRENs is already under way; differentiated services are being introduced and instrumentation of the networks is being put in place. Both will be further developed by the GN2 project to production-level services, in a form suitable for deployment across the network domains of the GEANT/NRENs network.

The activities described here match closely with activities proposed for the GN2 project. EGEE as a major Grid project served by GEANT and the NRENs will collaborate in defining requirements, specifications and interfaces to new services provided by the network.

Full exploitation of these capabilities by EGEE requires their integration into the Grid middleware through appropriate interfaces and mechanisms, to allow automated access to the services provided or information derived. This means

- making it possible for Grid middleware to access service levels and bandwidth reservation through an interface to the control plane of the network, in order to create the connections and flows by Grid applications through the dynamic reconfiguration of the network, and
- creating tools that allow measurements of network characteristics to be presented from a number of perspectives and for various purposes, allowing network performance to act as an input into the way Grid middleware organises and allocates resources to perform a Grid job.

The tasks below will be developed in accordance with the EGEE architecture defined by the Architecture Team, in which the network perspective will be represented by a participant drawn from this activity.

### *5.C.4.1.2 Bandwidth allocation and reservation*

The European Research Area is currently served by a set of NRENS linked via a high-speed pan-European backbone, the GEANT network, constructed and operated by DANTE. The EGEE Grid will use these networks to connect the providers of computing, storage, instrumentation and applications resources with user virtual organizations. Grid demonstration projects have shown that Grid applications can generate very high levels of network traffic that can exceed the current aggregate flows from non-Grid usage, and will therefore demand new and innovative features of GEANT and the NRENs over and above the current best-efforts IP service.

In order to meet the needs of both Grid and non-Grid users of the network, mechanisms will be required to control and balance usage of the network by highly demanding applications, and to categorise and prioritise traffic flows so that they receive the required level of service from the network.

In particular, EGEE will need services to allocate network bandwidth to Grid applications both immediately and in advance, delivering specific levels of service. Allocations must be restricted to authenticated users acting within authorized roles, the services available must be determined by policies derived from SLAs with user organisations, and the aggregate services made available to VOs must be monitored to ensure adherence, along with the performance delivered by the network. For Grid applications to operate efficiently, the assignment of appropriate service levels must be through the interaction of Grid middleware with the network control plane, in accordance with policies agreed by DANTE and the NRENs management, through activity SA2. There will thus need to be a tight coupling between the Grid infrastructure and the network management infrastructure, in terms of access, control and measurement functions. The required services must be available end-to-end across multiple network domains and incorporate features such as advance reservation, authentication, authorization and accounting (AAA), and comprehensive performance monitoring from a number of viewpoints.

The range and specifications of the services offered will be determined by the requirements and specification elements of the Network Resource Provision service activity (SA2). At present we envisage the need potentially to provide and allocate:

- Access to layer-3 (IP) diffserv-based traffic classes
- Layer 2 VPNs, based on MPLS
- Extended layer-2 VLANs, based on gigabit-Ethernet (GE) connections
- Point-to-point switched layer-1 connections (STM-4 to STM-64, 1GE, 10GE)
- Secure channels (required by some applications)
- Scheduling (advance reservation) of all of the above

A distinction is drawn between the layer-3 IP diffserv-based services which are already being implemented as “Premium IP” within GEANT and the NRENs, and circuit emulation at layers 1 and 2, which are available currently in only a very limited way and require more long-term development within the GN2 project. Within the time-frame of this activity, only IP-based services will be available as a reservable resource, with an evolving level of coverage across the networks.

This task is clearly closely related to the resource allocation and reservation function of the middleware engineering and integration activity (JRA1), but caters for the network-specific aspects of bandwidth reservation and the interface to the network control plane. This activity will put in place a Grid service to implement bandwidth and service allocation and reservation across multiple domains through the development of an interface between the required network services, such as those described above, and the layers of Grid middleware that implement co-coordinated global resource allocation and reservation. This task will also work closely with the network management organisations to introduce the required network control plane functions to meet the timescales of this task.

When providing such services, the following issues are important:

- Service level: applications may experience severe performance degradation if the underlying network infrastructure cannot guarantee and maintain a defined level of service.
- Scheduling and advance reservation: in order to make workflow-based reservations of multiple resources, service discovery and resource brokering will take into account network performance and the ability to schedule network transports.
- Security: certain applications require data confidentiality, integrity and/or authenticity at transport level.

#### *5.C.4.1.3 Network performance monitoring and diagnostic tools*

The performance of Grid applications will be closely linked to the performance of the networks that link Grid resources. Because of the distributed systems connected by the Grid and the complex orchestration of resources required by large-scale applications, the Grid will have specific perspectives on the performance characteristics of the networks and appropriate performance monitoring techniques and tools will be required.

Measurement of the performance characteristics of the network and diagnostic tools are needed in a Grid context for several purposes: problem diagnosis and rectification, services to facilitate resource allocation, performance monitoring and, in particular, SLA adherence. Typical clients might be:

- Grid middleware (e.g. resource brokers, data management)
- Grid operations centres and network operations centres (to monitor performance and service level, and to diagnose problems)
- Grid users (to determine when and where problems exist prior to reporting to a support or operations centre)

GEANT and the NRENs are engaged in a programme to instrument their networks, and this programme will be extended within the GN2 project. It is a goal of GN2 to provide an extensive measurement infrastructure compatible across network domains, to provide and publish network performance data.

The network measurement schemes should consider the following points:

- Integration of a heterogeneous set of monitoring infrastructures across authorities must allow each authority to have different outlooks and methodologies for the measurement network characteristics. EGEE will not attempt to standardise implementation of measurements (although it may produce guidelines).
- Measurement infrastructure should be bound to a heterogeneous measurement environment using standardised interfaces giving query/response on a well-defined set of standardised network measurement characteristics, coming from the output of relevant GGF and IETF/IRTF groups wherever possible.

- Measurement interfaces can be made available on the boundary of the domain of any authority by supporting some or all of the interfaces against appropriate authorisation. How an authority chooses to honour the interface (the implementation) can be left to the authority, provided the standardised definition of each published characteristic is adhered to.
- Interfaces (at least) should be defined through an appropriate Grid service architecture (for this the Open Grid Services Architecture is a strong candidate) and a key task will be to decompose the measurement and monitoring functions into appropriate independent Grid services. Higher-level functionality (e.g. a diagnostic tool or an SLA measurement tool) can be built on top of lower-layer Network Grid services.
- Network authorities will only respond to monitoring queries from authorized entities. Guidelines must be developed for *which* roles in *which* organisations will be allowed access to *which* classes of network performance data and through *which* services/tools.

This activity will collaborate with DANTE and the NRENs to define the characteristics that will be measured, and the interfaces through which measurements are published. It will develop the measurements of basic characteristics into derived quantities as required for specific measurement purposes, and create tools and interfaces to make measurement data available to both Grid middleware and human users. Efforts within the NRENs and EGEE will follow the existing initiatives within the networking community, involving Internet2 in the US, amongst others, and the Grid community, led by the GGF.
The definition of a hierarchy of services that access measurements of standardised network performance characteristics through a uniform interface, regardless of how the measurements are made within an individual network domain, will allow the composition of more sophisticated services that can address the various goals of network measurement. Tools will be developed to allow users to identify where and when network performance is affecting their jobs; with this information they may be able to find an alternative time and/or location to perform their tasks. If a problem is more serious or persistent, Grid operations centres will have tools to probe the networks and determine where problems might lie, in order to contact appropriate network management authorities in order to seek resolution; this will improve the ability of the Grid operations centres to address the correct network domain in seeking to resolve a problem affecting Grid performance. The availability of network performance information to Grid middleware will allow the distribution and scheduling of Grid traffic to react to network performance, making the Grid more resilient against network faults or service degradation; this will improve efficiency since pre-emptive action may be taken rather than launching jobs which will fail or stall due to network performance constraints. Finally, the complex interactions that are anticipated between users, applications and resource providers will be specified by Service Level Agreements (SLAs); tools for the measurement of service-level parameters in order to verify SLA-adherence will be constructed based on the same hierarchy of network monitoring services that supports user, operations and middleware monitoring of the networks' performance.

#### *5.C.4.1.4 IPv6 uptake*

An additional task within this activity is to conduct a study of the usage of IPv6 in a Grid context, focussing in particular on the advantages which might be offered to EGEE through its use. This technology will be deployed on GEANT and the NRENs in the time-frame of EGEE, and the implications of the capabilities that it offers must be studied. However, this protocol can only be effectively used when it is available

i) in all domains between end-points of a given path,
ii) within the user's equipment and user's applications.

The roll-out of IPv6 is at different stages in different networks across Europe; although widely available in the GEANT backbone and the backbone of the majority of the NRENs (natively or tunnelled), it is not universally deployed in the metropolitan and local access networks through which EGEE user's and resources access the NRENs. Direct adoption is therefore difficult in a limited coverage scenario.

However, the EGEE Grid should plan for the adoption of this protocol within the time-frame of the project. Initially this will be tackled in the following ways:

- A study will be made of the features of IPv6, seeking those that are of direct benefit to Grids.
- The availability of IPv6 in the NRENs and access networks will be monitored, to provide a picture of the match between geographical coverage and the topology of EGEE resource and user sites.
- Awareness of IPv6 will be promoted internally to:
  - Middleware engineering activities, to avoid dependencies that constrain middleware to operate with only IPv4;
  - Grid operations activities, to understand the benefits of IPv6 usage in operating a large-scale Grid;

- Applications communities, to understand the implications of IPv6 usage by applications.

## 5.C.4.2 Execution-plan for Joint Research Activity

### *5.C.4.2.1 Bandwidth allocation and reservation*

The first step will be to collaborate with DANTE and the NRENs in defining the interfaces for reservation of network bandwidth with specified levels of service, confirming to appropriate standards, and to develop interfaces to EGEE's resource allocation middleware. This will be followed by the introduction of reservation mechanisms within limited parts of the networks, dependent on the extent of coverage of premium IP services. This will be achieved in stages starting with deployment of mechanisms based on existing frameworks, such as GARA, and will leverage from the results of current projects, such as DataTAG, which use such bandwidth reservation frameworks. Initially, the network will be unable to reconfigure itself rapidly in response to reservation requests, and so requests for premium services will be met from static allocations of bandwidth with QoS support reserved for EGEE usage, with reservation controlled by a resource manager. Requests that are 1) in excess of the reservable bandwidth available for that time, and 2) made sufficiently far in advance for the network to be reconfigured will be met by the generation of a request to the networks to increase the premium IP bandwidth along the requested path.
As the ability of the network to reconfigure in order to satisfy resource reservation requests improves, more requests will be met by a "dynamic" response of the networks at key ingress points to allocate appropriate channels. This is important, since the ability to create static allocations of premium bandwidth between network domains does not scale as the number of end-to-end paths between which premium channels are provided increases. This will be evolved to reservation of a network path across a single domain, and ultimately end-to-end reservation across multiple domains.
Milestones and deliverables for the bandwidth allocation and reservation task are given in the Table below.

| Project Month | Deliverable or Milestone | Item |
|---|---|---|
| M6 | **Deliverable** DJRA4.1 | Specification of interfaces<br>i) to network control plane,<br>ii) to global resource reservation middleware<br>for bandwidth allocation and reservation. |
| M15 | **Milestone** MJRA4.4 | Prototype Implementation of bandwidth allocation and reservation service at specific network ingress points using static network configuration. |
| M15 | **Milestone** MJRA4.5 | Specification of end-to-end bandwidth reservation system. |
| M18 | **Milestone** MJRA4.7 | Dynamic re-configuration of key ingress points in response to reservations. |
| M21 | **Deliverable** DJRA4.4 | Implementation of pilot single-domain bandwidth allocation and reservation service in the network core (GEANT and NRENs). |
| M24 | **Deliverable** DJRA4.6 | Report on bandwidth allocation and reservation in EGEE. |

**Table JJ** ***Milestones and deliverables for bandwidth allocation and reservation***

### *5.C.4.2.2 Network performance monitoring and diagnostic tools*

This task will first determine requirements and use cases for the use of network performance data in a number of EGEE functions, such as resource allocation or Grid operations. It will then collaborate with DANTE and the NRENs to define the network characteristics that are measured and to specify appropriate query/response interfaces that will give access to published data, in conjunction with appropriate authorisation. Measurements of basic characteristics can then be used to form composite quantities that are appropriate for specific monitoring purposes. A prototype tool will be developed to access limited measurement data from test measurement nodes within the network core, the experience of which will be used to specify high level monitoring and diagnostic tools. Before the design of the network-wide measurement infrastructure is completed by the GN2 project, the set of network measurements will be reviewed in collaboration with DANTE and the NRENs. This task will work with the middleware engineering

activity to integrate network characteristics into the resource allocation function of the middleware In the form of a service to provide network performance data.

The milestones and deliverables for the network performance monitoring and diagnostic tools task are given in the table below.

| Project Month | Deliverable or Milestone | Item |
|---|---|---|
| M3 | **Milestone** MJRA4.1 | Definition of initial network performance metrics and composite measurements required. |
| M6 | **Milestone** MJRA4.2 | Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations. |
| M9 | **Deliverable** DJRA4.2 | Definition of standardised network measurement query/response interfaces, with adequate authorization. |
| M12 | **Milestone** MJRA4.3 | Prototype tool to access network performance metrics from a limited set of measurement points. |
| M18 | **Milestone** MJRA4.6 | Specification high-level monitoring and diagnostics tools. Revision of network performance metrics. |
| M21 | **Deliverable** DJRA4.5 | Service to supply network performance information to resource brokering middleware. |
| M24 | **Deliverable** DJRA4.7 | Report on network monitoring within EGEE. |

**Table KK** ***Milestones and deliverables for the network performance monitoring task***

#### *5.C.4.2.3 IPv6 uptake*

This task has a single deliverable, shown in table below.

| Project Month | Deliverable or Milestone | Item |
|---|---|---|
| M18 | **Deliverable** DJRA4.3 | Report on implications of IPv6 usage for the EGEE Grid. |

**Table LL** ***Milestones and deliverables for the network performance monitoring task***

### 5.C.4.3 Quality of the management

#### 5.C.4.3.1 *Management and competence of the participants*

The tasks presented in this activity, and the accompanying joint research activity, were formulated with the active participation of DANTE and the NRENs, and are closely linked to the foreseen programme for the evolution of their networks. These bodies are of course those that operate the networks, which are in themselves a very sophisticated and high quality infrastructure, and so their participation in an infrastructure project such as EGEE is highly valued.

The development work is placed with appropriate network-aware partners capable of producing industrial-quality software to integrate bandwidth reservation and network monitoring services as a Grid resource. The lead partner in this activity until 30th Sept 2004 is University College London (UCL, participant number 19). From 1st October 2004 the leadership will transfer to the University of Edinburgh (UEDIN, participant number 17) when the Network group led by Professor P.Clarke will move from UCL to Edinburgh. The Group has an established network research group and close relationships with DANTE and a number of NRENs.

The Group was also a participant in the network work package of the DataGrid, in which it is highly active in the field of network monitoring. The group is also investigating Quality of Service and bandwidth reservation mechanisms through the DataTAG and MB-NG projects, and now the new Optical Networking projects including ESLEA; an important goal of the latter is to examine existing resource allocation frameworks, such as GARA, in the context of differentiated services on a high-speed managed-bandwidth network.

UREC (part of CNRS, participant number 22) is also playing a role in this activity. UREC is a service entity inside CNRS devoted to network and security consulting, and is involved centrally in global networking through various international network projects and NREN participation. UREC has wide experience in Grid

networking, especially provisioning and end-to-end monitoring, and is currently leading the network work package of the DataGrid project.
DANTE is the organisation charged with constructing and operating the GEANT pan-European backbone, and has done so very successfully, in collaboration with the full set of European NRENs. DANTE is leading the formulation of the GN2 project proposal, which contains a number of components with a strong correspondence to the activities described here. DFN, the German NREN, is also participating in this activity on an unfunded basis. The close collaboration of the networks with EGEE on the activities described will be furthered by participation of DANTE with one FTE in activity JRA4. GARR, the Italian NREN, is also participating in this activity, helping in network monitoring and bandwidth allocation and reservation tasks.
This activity will be run by an Activity Manager at UCL, who is experienced in both network technology and project management. This activity will also provide a networking representative to the architecture task force, a role occupying up to 50% of working time and filled by an engineer experienced in both network technologies and software design. The Activity Manager reports to the Networking Co-coordinator in SA2, and the work of JRA4 is overseen formally by the EGEE-network liaison body as described in activity SA2.

### 5.C.4.4 Justification of financing requested

This joint research activity will have close links with the FP6 GN2 project; there are corresponding activities within the GN2 project plan with shared goals, that complement the work described here by implementing key services within GEANT and the NRENs, such as new network services, their reservation and network performance monitoring. The GN2 project will propose significant resources to accomplish these complementary activities, managed within GN2 but liaising with JRA4 to ensure convergent requirements, specifications, implementation and delivery. Activities of the two projects with shared goals will be overseen formally through the liaison body described in SA2, but also managed through direct contact between activity managers. The close collaboration between the EGEE and GN2 projects will ensure that new services are developed with their applicability to Grids as a prime requirement.
This activity itself is small on the scale of the total EGEE project, but has set itself realistic goals in a defined role, that of enhancing the degree of integration of network services into the EGEE Grid. The total effort in this activity is 7.5 FTEs. The separation between “Funded” and “Unfunded” depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%. In total, UCL (and then UEDIN) will employ three people to work on this activity, of which 1.5 are funded by EGEE; the remainder will be funded from the UK national eScience programme. UREC will contribute two people to this activity (50% funded by EGEE). DANTE (participant number 68) will contribute one person to this activity (50% funded by EGEE). DFN will participate with 0.5 FTE effort, funded from its own sources. GARR will contribute one person to this activity (50% funded by EGEE).

| Participant | Description of Role | FTE (EU funded + unfunded) |
|---|---|---|
| UCL until 30Sept 2004, and then UEDIN from 1st October 2004 | Management of the activity<br>Bandwidth Allocation and Reservation task<br>Network performance monitoring and diagnostic tools | 1.5+1.5 |
| CNRS/UREC | Network performance monitoring and diagnostic tools | 2 + 0 |
| DANTE | Bandwidth Allocation and Reservation task<br>Network performance monitoring and diagnostic tools | 1 + 0 |
| DFN | Network performance monitoring and diagnostic tools | 0+0.5[22] |
| GARR | Bandwidth Allocation and Reservation task<br>Network performance monitoring and diagnostic tools | 1 + 0 |
| | **Total (FTEs)** | **5.5+2.0** |

**Table MM** ***Manpower requirements for the Network Services Development activity***.

[22] The matching funded effort for partner DFN is described and accounted for under NA5.

### 5.C.4.5 European added value

Grid applications are likely to make heavy demands on GEANT and the NRENs, in terms both of capacity and quality of service. These demands cannot be met simply through providing the traditional best-efforts IP service at a level of capacity that far exceeds the likely demand, i.e. over-provisioning. They will only be met by providing new services that allocate and reserve bandwidth and deliver specified service levels to Grid applications.

Resource allocation and advance reservation are not restricted to networking and will be presented to the Grid user as a global resource service covering network, storage and computing. However, networking resource must be allocated end-to-end across multiple domains, which creates a complex problem of co-ordination and dynamic re-configuration of resources within a number of administrative domains. The control structures and network models implied by offering differentiated services with end-to-end resource allocation and advance reservation and allocation are not completely understood today. The granularity of resource reservations in terms of bandwidth and duration is important, together with required QoS (Quality of Service) parameters. It is in order to deal with the resource allocation problem in the networking domain that this task is formulated in a networking-specific activity, which will have a clear focus, make use of network-experienced engineers and have the strong participation of the networks themselves

GEANT and the NRENs are currently engaged in the introduction of differentiated services (diffserv) on the existing IP-based networks, so that flows can be guaranteed a desired Quality of Service (QoS). However, these initial services are offered in a static configuration only, and the configuration cannot respond to service requests dynamically. These services must be accessible in an automated way, so that Grid middleware can reserve network services in order to meet the requirements of a Grid application.

It is clearly only possible to operate a Grid, which is heavily dependent on the network that links its distributed users and resources, if the Grid operational management has a view on the performance of the network, in order to understand how users and applications may be affected, and to determine which network management authority can resolve such faults as may arise. Visibility of network performance can allow problems to be identified and resolved early in order to minimise the impact on the performance of Grid applications.

Equally, in a distributed Grid operating over a network where multiple paths exist and capacity on any single path is constrained, a detailed view on network performance can allow intelligent middleware to make efficient use of the distributed resources in order to circumvent network performance problems at known locations or times. Network performance measurement is therefore vital to the operation and exploitation of computing Grids.

Such a vision of coherent network monitoring for a range of purposes is already thoroughly adopted by both the networking and Grid research communities; the Internet2 project has an end-to-end performance initiative, of which network performance measurement is an important part , and the Global Grid Forum has a network measurement working group, which has already begun to standardise the measurement characteristics relevant to Grid applications and middleware and to survey the tools available for network measurement. Several EGEE partners, including Dante, the NRENs and UCL, are involved in both of these research areas. The network administrative authorities have begun the instrumentation of their networks, but the full value of this instrumentation will only be realised by building a hierarchy of services to allow Grid users, operations and middleware to access measurements of the underlying network characteristics in a way that matches their perspective on the services provided by the network.

### 5.C.4.6 Exploitation of results

The results of the bandwidth allocation and reservation task of this activity will be the means to enable the Grid-empowered infrastructure to schedule network transports with specified Quality of Service parameters, with the necessary bandwidth and service classes then reserved on the networks. This will open the way for a more effective utilisation of non-standard (premium and less-than-best-efforts) services of the networks, the levels and terms of which will be defined by the Network Resource Provision activity SA2.

The results of the Network performance monitoring and diagnostic tools task will be new channels for accessing information on network performance and characteristics. This is sensitive information and will only be released to authorised recipients through suitable tools and interfaces, which will utilise the authentication and authorisation mechanisms of the Grid infrastructure. High-level information may be available to users who will receive an overview of general network conditions that will indicate where network performance might affect Grid performance. More detailed information would be restricted to infrastructure operations centres to allow a more diagnostic view of the network, with the addition of logging tools to allow fault-tracing.

Network performance data at a lower level will be used as input to Grid middleware for scheduling and data transport services, and this greater level of information on network performance could be expected to improve the performance of these functions, to the general benefit of the Grid user base.

### 5.C.4.7 Summary

| **Activity number:** | JRA4 | | **Start date or starting event:** | | | | | Project start | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Participant:** | 19 UCL* | 22 CNRS/ UREC | 68 DANTE | 69 DFN | 70 GARR | 17 UEDIN* | | | | | |
| **Expected Budget per Participant** | 44 | 400 | 186 | 100 | 215 | 247 | | | | | |
| **Requested Contribution per Participant** | 44 | 200 | 93 | 0 | 107.5 | 247 | | | | | |

* Owing to the JRA4 work transfer between UCL and UEDIN on 1st October 2004, the budget figures have been revised to reflect this.

**Objectives**

- To develop interfaces to the network control plane to allow Grid middleware to make immediate and advance reservations of network connectivity specified in terms of bandwidth, duration and quality of service.
- To develop services that provide access to standardised network performance characteristics, and to compose higher-level services that provide end-to-end measurements of the network for the purposes of application performance determination, fault identification and diagnosis, resource allocation and SLA adherence monitoring.
- To study the benefits and availability of IPv6 in the context of the EGEE Grid.

**Description of work**

This activity includes two tasks: resource allocation/reservation and network performance monitoring, which have a network-specific dimension. These tasks are aimed at the evolution of research-level techniques into production-level Grid services, requiring development of what is currently available and implementation of appropriate interfaces, followed by deployment across the network domains of the GEANT/NREN network.
Interfaces will be constructed permitting Grid middleware to access service levels and bandwidth reservation via the control plane of the network, in order to create the connections and flows by Grid applications through the dynamic reconfiguration of the network.
Tools will be developed to measure network characteristics thus allowing network performance to act as an input into the way Grid middleware organises and allocates resources to perform a Grid job.

**Deliverables**

| | | | |
|---|---|---|---|
| DJRA4.1 | M6 | (UCL) | Specification of interfaces for bandwidth reservation services |
| DJRA4.2 | M9 | (UEDIN) | Definition of standardised network measurement query/response interfaces |
| DJRA4.3 | M18 | (UEDIN) | Report on implications of IPv6 usage for the EGEE Grid |
| DJRA4.4 | M21 | (UEDIN) | Implementation of single-domain bandwidth reservation pilot service |
| DJRA4.5 | M21 | (UEDIN) | Service to supply network performance information to resource brokering middleware |
| DJRA4.6 | M24 | (UEDIN) | Report on bandwidth allocation and reservation |
| DJRA4.7 | M24 | (UEDIN) | Report on network monitoring |

| **Milestones and expected result** | | | |
|---|---|---|---|
| M3 | MJRA4.1 | M3 | Definition of initial network performance metrics and composite measurements required. |
| M6 | MJRA4.2 | M6 | Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations. |
| M12 | MJRA4.3 | M12 | Prototype tool to access network performance metrics from a limited set of measurement points |
| M15 | MJRA4.4 | M15 | Prototype bandwidth reservation within static network configuration |
| M15 | MJRA4.5 | M15 | Specification of end-to-end bandwidth reservation system. |
| M18 | MJRA4.6 | M18 | Specification of high-level monitoring and diagnostic tools. Revision of metrics. |
| M18 | MJRA4.7 | M18 | Dynamic re-configuration of key ingress points in response to reservations. |

**Justification of financing requested**

This activity will employ 7.5 FTEs from the EGEE partners UREC, UCL, DANTE, DFN and GARR. This activity will perform three valuable tasks, as described, that are complemented by developments of GEANT and the NRENs, and will represent network related issues within the EGEE Architecture Team.

## 5.C.5 Overall Implementation and Co-ordination of Research Activities

### 5.C.5.1 Relevance to the objectives of the Research Activities

#### *5.C.5.1.1 Architecture Team*

The Architecture Team defines the overall architecture for the Grid infrastructure produced, deployed and operated by the project. This architecture must satisfy the requirements as gathered from the application groups (NA4) and Grid Operations groups (SA1) and adhere to the overall project strategic directions as defined by the External Advisory Committee.

The Architecture Grid Team will develop an overall architecture for the project. These services will be designed by the middleware re-engineering groups (JRA1) and deployed and operated by the operations groups (SA1) for use by the user communities (NA4).

The overall approach is to define a service oriented architecture that will allow different implementations of Grid services to inter-operate by adhering to agreed interfaces, service levels and protocols. The EGEE Grid infrastructure will provide the mechanisms for various middleware implementations supporting disparate resources to exchange data, information and user applications. The architecture will follow and enhance the evolving standards of bodies such as Global Grid Forum (GGF) while JRA1 will provide a concrete implementation that can be deployed by SA1.

The architecture will undergo major revisions on an annual basis as part of the annual cycle of the project. These revisions will take into account feedback from project stakeholders concerning the previous version that has been deployed on the Grid infrastructure. Minor revisions will also be made during each annual cycle based on feedback during development, integration and usage. For the first annual cycle of the project, the architecture team will take input from the final/recent deliverables of running or completed Grid projects such EU DataGrid, EU CrossGrid, EU DataTAG and the LHC Computing Grid project that have all deployed significant Grid facilities.

The Architecture Team members will participate to GGF groups to ensure the EGEE architecture remains mainstream and conforms to evolving international standards. Where appropriate, the EGEE Architecture Team will actively participate in the standard definition process.

The Architecture Team will produce a description of the architecture in terms of software models (using standard modelling techniques like UML), deployment scenarios and explanatory documentation. To ensure the architecture addresses the requirements, walkthroughs driven by a selection of use cases will be performed and recorded. The architecture model will define standard interfaces for the core Grid services. As part of the deliverable, abstract interface implementations (e.g. header files which may well be obtained by reverse engineering existing Grid infrastructures considered appropriate) will be included. Such interface specifications will be used by implementers (i.e. JRA1 and any external groups or alternative implementation providers) to ensure consistency and compliance to the agreed standards. Any request for changes to such interfaces must be made to the Architecture Team who will determine if the changes are accepted or rejected in consultation with the appropriate GGF bodies.

The Architecture Team will continue to produce an architecture model deliverable each year until the end of the project.

Further to discussions, it was decided that the architecture group would be implemented as the project Technical forum (PTF), described below:

The PTF will:

- Merge requirements and use cases from the application, security, and operations groups.
- Manage the evolution of the requirements and use cases.
- Prioritize the requirements and verify if (and how) the defined use cases are satisfied by the EGEE architectural design.

- Review the grid service specifications and control changes to those specifications and external interfaces.

- Seek and promote common solutions where commonalities exist in the middleware or application domains.

- Promote convergence with other grid projects by incorporating requirements from external projects using (or hoping to use) EGEE software and by discussing the EGEE design with other projects.

Decisions:

The PTF moderator reports directly to the project technical director. An agenda for each meeting will be published prior to each meeting. Minutes of all meetings will be kept with decisions made during the meeting clearly indicated. The minutes will be made available to all members of the project.

Decisions and recommendations will be made by clear concensus of the PTF representatives. If a concensus cannot be reached then the topic will be revisted at a later meeting after soliciting outside advice. If no concensus can be reached, the moderator will make the decision and the minutes will reflect the major issues for and against the decision. Such decisions should be reviewed by the technical director and the PEB.

Notes:

* The initial collection of requirements and use cases is expected to be done within each activity group although the PTF will by necessity work in parallel with each activity.

* Input from outside application groups (e.g. ARDA, GAG) will be actively solicited, but formal representation is through the appropriate application representative.

* JRA1 is responsible for the middleware services architecture and design and changes to the internals thereof. The PTF controls changes to external service specifications and interfaces.

* Input from external projects is expected to happen after the first set of requirements, use cases, and design are completed.

* The PTF is not formally responsible for any EGEE deliverables (specifically the architecture or evaluation documents), but will help those responsible and review where appropriate.

* The group will meet monthly (in person at CERN) with additional meetings called when deemed necessary by the PTF members.

#### *5.C.5.1.2 Project technical forum composition*

All of the members of the PTF (see Figure 24) should have significant experience with either developing or using grid systems. Application representatives should additionally have an excellent understanding of the computing needs of their field and of the methods typically employed by scientists working within that field.

The PTF should consist initially of a moderator and representatives from:

- middleware re-engineering (JRA1)
- applications (NA4)
- operations (SA1)
- security (JRA3)
- networks (SA2 & JRA4)

The number and profile of the representatives from each activity will be re-evaluated periodically to ensure that the PTF accurately reflects the focus within the project.

Other project members can be invited to the PTF meetings as required by the agenda.

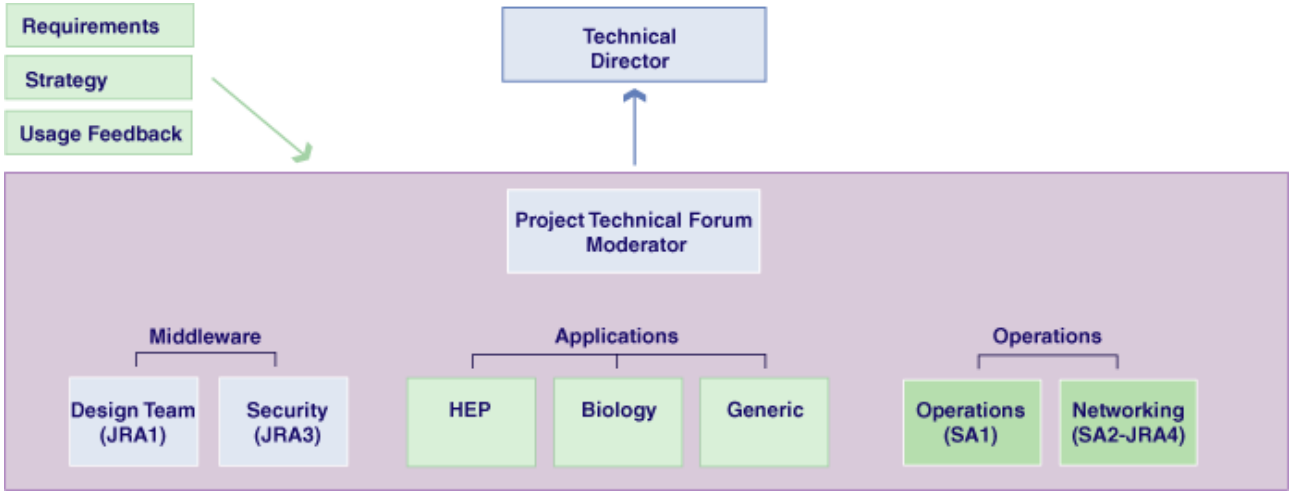



**Figure 24:** ***Project Technical Forum composition***

### 5.C.5.2 Execution plan for first 24 months

Figure 25, on the next page, shows a Gantt chart and Activity Interdependencies diagram for JRA1 to JRA4. Although funding in this proposal is only sought for the first 24 months of the EGEE I3 we expect its final duration to extend to 48 months. Our detailed planning at this stage only extends to the first 24 months. At project month 18 we intend to submit a second proposal addressing the latter 24 months of the project with detailed planning based on our experiences in the first 24 months. The first 24 months of the project from the standpoint of the Joint Research Activities will progress as follows:

- **Project start:** The detailed planning of the management structures and functions for the various engineering, integration, testing, security and quality groups described in JRA1 through JRA4 will allow the project to become quickly established. We intend to have all management functions and staffing in place by the start of the project to ensure a quick startup phase. Each of the four joint research activities begins at the start of the project. We are committed to ensuring our initial plans are at an advanced stage by the time the project starts, in particular for what concerns requirements and middleware design (building on the final deliverables of EU FP5 projects such as DataGrid) as well as OGSA architecture status.
- **PM3:** The first milestones for JRA1 and JRA3 occur at the end of PM3. JRA1 will have put in place the basic software engineering tools required by the middleware groups and produced the first overall architecture outline document for the grid middleware services. JRA3 will set-up the body to bring together the Certification Authorities.
- **PM6:** This milestone is shared by activities JRA1 to JRA4 and represents a key transition in year one of the project from design phase to the implementation and integration phase.
- **PM12:** This point represents the middle of the project (considering the initial phase of 24 months). This is an important stage for the Joint Research activities because the first release of the new EGEE middleware adhering to the OGSA standard will have completed integration and testing in preparation for handing over to the SA1 activity for deployment.
- **PM18:** The project will be mature by this point. Each of the activities will have developed to a stable position. Work will be well underway on the second major release of the EGEE software taking into account the feedback from the deployment of the first release to produce revised architecture and design for the various grid services.
- **PM24:** At this point the second major release of the EGEE middleware will be handed over to the SA1 activity for deployment. If, for whatever reason, no further funding is forthcoming, this point will mark the end of the project and the second major EGEE middleware software release will be available for further exploitation.

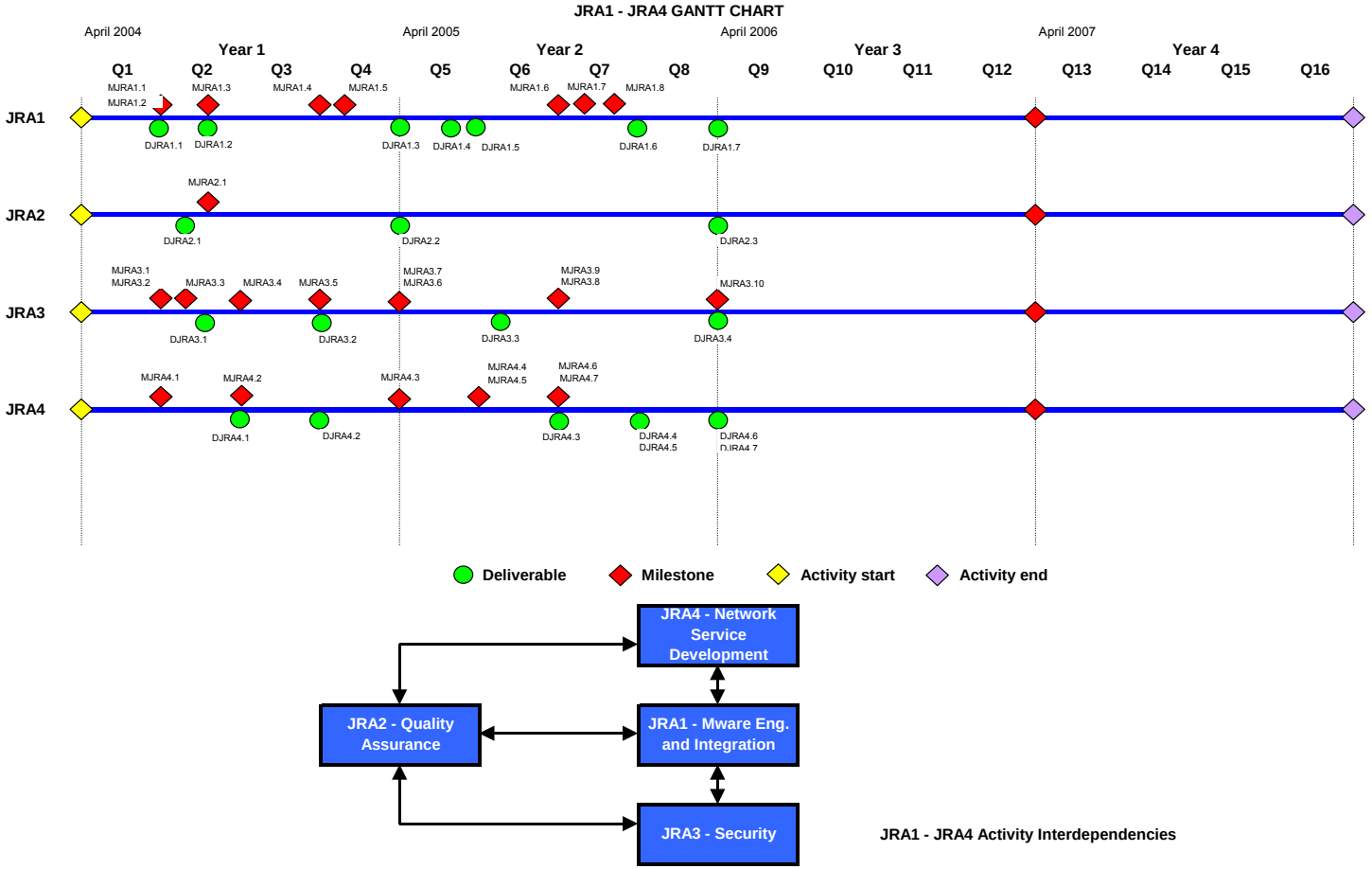



**Figure 25** ***JRA1-4 Gantt chart and activity interdependency diagram***

| | | |
|---|---|---|
| MJRA1.1 | M03 | Tools for middleware engineering and integration deployed |
| MJRA1.2 | M03 | Software cluster development and testing infrastructure available |
| MJRA1.3 | M05 | Integration and testing infrastructure in place including test plans (Release 1) |
| MJRA1.4 | M09 | Software for the Release Candidate 1 |
| MJRA1.5 | M10 | Integrated Release Candidate 1 enters testing and validation period (Release 1) |
| MJRA1.6 | M18 | Test plan for core Grid components and overall Integration (Release 2) |
| MJRA1.7 | M19 | Software for the second release candidate available |
| MJRA1.8 | M20 | Release Candidate 2 enters testing and validation period (Release 2) |
| MJRA2.1 | M05 | Internal QA website deployed |
| MJRA3.1 | M03 | Completed user requirements survey defines effort redistribution over action lines |
| MJRA3.2 | M03 | Set-up of the PMA for European CA's and liaison with the non-European ones |
| MJRA3.3 | M04 | OGSA SEC service initial |
| MJRA3.4 | M06 | Security operational procedures and incident handling, definition of a common Grid incident format |
| MJRA3.5 | M09 | Secure Credential Storage procedures |
| MJRA3.6 | M12 | Security operational procedures (first revision) |
| MJRA3.7 | M12 | Framework for policy evaluation accepted in GridPMA policies and determination of the CA service authorities for EGEE |
| MJRA3.8 | M18 | Security operational procedures (second revision) |
| MJRA3.9 | M18 | Set-up of accounting techniques and distributed budgets |
| MJRA3.10 | M24 | Security operational procedures (third revision) |
| MJRA4.1 | M03 | Definition of initial network performance metrics and composite measurements required. |
| MJRA4.2 | M06 | Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations |
| MJRA4.3 | M12 | Prototype tool to access network performance metrics from a limited set of measurement points. |
| MJRA4.4 | M15 | Prototype bandwidth reservation within static network configuration. |
| MJRA4.5 | M15 | Specification of end-to-end bandwidth reservation system. |
| MJRA4.6 | M18 | Specification of high-level monitoring and diagnostic tools. Revision of metrics. |
| MJRA4.7 | M18 | Dynamic re-configuration of key ingress points in response to reservations |

**Table NN** ***Summary of JRA1-JRA4 milestones***

| | | |
|---|---|---|
| DJRA1.1 | M03 | Architecture and Planning (Release 1) |
| DJRA1.2 | M05 | Design of grid services (Release 1) |
| DJRA1.3 | M12 | Software and associated documentation (Release 1) |
| DJRA1.4 | M14 | Architecture and Planning (Release 2) |
| DJRA1.5 | M15 | Design of grid services (Release 2) |
| DJRA1.6 | M21 | Software and associated documentation (Release 2) |
| DJRA1.7 | M24 | Final report on middleware re-engineering |
| DJRA2.1 | M04 | Quality Plan for EGEE |
| DJRA2.2 | M12 | Annual Report on EGEE Quality Status, including software and Grid operations and plan for second year |
| DJRA2.3 | M24 | 2nd Annual report on EGEE Quality Status, including software and Grid operations |
| DJRA3.1 | M05 | Global security architecture |
| DJRA3.2 | M09 | Site access control architecture |
| DJRA3.3 | M16 | Global security architecture (first revision) |
| DJRA3.4 | M24 | Assessment of security infrastructure report |
| DJRA4.1 | M06 | Specification of interfaces for bandwidth reservation services |
| DJRA4.2 | M09 | Definition of standardised network measurement query/response interfaces |
| DJRA4.3 | M18 | Report on implications of IPv6 usage for the EGEE Grid |
| DJRA4.4 | M21 | Implementation of single-domain bandwidth reservation pilot service |
| DJRA4.5 | M21 | Service to supply network performance information to resource brokering middleware |
| DJRA4.6 | M24 | Report on bandwidth allocation and reservation |
| DJRA4.7 | M24 | Report on network monitoring |

**Table OO** ***Summary of JRA1-JRA4 deliverables***

### 5.C.5.3 Joint Research Activities Final Summary

Overall, the ensemble of the research activities which has been presented in this section has been designed with three clear goals in mind:

1. To provide production quality core Grid services for the EGEE I3 infrastructure;
2. To provide a quality assurance framework that can be used throughout the project covering all aspects of middleware engineering, service operations and general project management;
3. To provide the most secure Grid environment possible in which a multitude of user communities and application domains can share resources and infrastructure according to their needs.

Each of the activities presented has key links into other activities integrated by EGEE. These links include:

- **JRA1:** Will work closely with the service activities to deliver production quality middleware and ensure the feedback from operations staff is taken into account in the overall software lifecycle. At the same time this activity will seek to gather information from the networking activities in the form of end-user feedback. Interaction with all activities of the project at the architecture level is inherent in the composition of the Architecture Team
- **JRA2:** The quality assurance activity, by definition, interacts with all activities of the project. In particular for Operations (SA) the quality criteria and their measurement will be a point of contact with the resource centres and Operations management team;
- **JRA3:** The security activity is designed to link to all of the technical activities in order to ensure the secure integration of the middleware, infrastructure and resource centres;
- **JRA4:** The network services development interfaces directly with the other joint research activities and implements new developments that will be migrated to the network provision activity (SA2). Externals links to GEANT and the NRENs will be inherent in the staffing of this activity.

It is hoped that it has been demonstrated in the preceding sections how, without the Joint Research Activities, while the Specific Service Activities will create a production Grid infrastructure, this work will only move towards emerging standards (OGSA) and reach the highest-quality to meet the needs of users from across the European Research Area if significant effort is put into producing a well engineered set of middleware Grid services.

We believe that the success of these joint research activities will be key to realising the expected growth in the user base and total computing resources of the Grid.

# 6 Project resources and budget overview

## 6.A Overall budget for full duration of the project

Please refer to table 3 on page 24.

## 6.B Budget for the first reporting period plus 6 months

Please refer to table 3bis on page 30.

## 6.C I3 management level description of resources and budget

Below is a table summarising the effort foreseen for each activity[23]. The detailed roles of the personnel involved are described in the text of the appropriate section of chapter 5.
The table shows FTEs (Full Time Equivalent) of manpower for each partner in each activity for the two years (24 person months = 1 FTE) of the project. The separation between "Funded" and "Unfunded" depends on the accounting model chosen by each partner. For Full Cost (FC and FCF) model partners, the funded effort is reimbursed at 50%.

| Activity | Federation | Partner | Funded Effort in FTEs | Unfunded Effort in FTEs |
|---|---|---|---|---|
| **NA1** | | 1. CERN | **6** | **0** |
| **NA2** | UK / Ireland | 17. UEDIN | 0,5 | 0,5 |
| | CERN | 1.CERN | 2 | |
| | | 32. TERENA | 3 | |
| | Italy | 31. INFN | 1 | 0,5 |
| | Germany/Switzerland | 28. FZK | 0,5 | 0,5 |
| | Northern Europe | 33. VUB | 0,5 | 0,5 |
| | South-East Europe | 49. CLPP BAS | 0,7 | 0,7 |
| | | 50. UCY | 0,7 | 0,7 |
| | Central Europe | 2.GUP | 0,05 | 0,05 |
| | | 5. BUTE | 0,09 | 0,09 |
| | | 6. ELUB | 0,09 | 0,09 |
| | | 8. MTA-SZTAKI | 0,1 | 0,1 |
| | Russia | 41. IHEP | 0,53 | |
| | | 42. IMPB RAS | 0,83 | 0,82 |
| | | 43. ITEP | 1,05 | |
| | | 44. JINR | 1,33 | |
| | | 45. KIAM RAS | 0,8 | |
| | | 46. PNPI | 0,53 | |
| | | 47. RRC KI | 1,33 | |
| | | 48. SINP-MSU | 2,68 | |
| | **Total** | | **18,31** | **4,55** |
| **NA3** | UK / Ireland | 17. UEDIN (NeSC) | 3 | 3 |
| | Central Europe | 2. GUP | 0,1 | 0,1 |
| | | 3. UNIINNSBRUCK | 0,1 | 0,1 |
| | | 4. CESNET | 0,86 | |
| | | 5. BUTE | 0,16 | 0,16 |

[23] The figures shown are rounded for simplicity.

| | | | | |
|---|---|---|---|---|
| | | 6. ELUB | 0,17 | 0,17 |
| | | 8. MTA-SZTAKI | 0,5 | 0,5 |
| | | 11. ICM | 0,27 | 0,27 |
| | | 12. PSNC | 0,27 | 0,27 |
| | | 13. II-SAS | 0.9 | |
| | Germany/Switzerland | 28. FZK | 1 | |
| | Italy | 31. INFN | 0,5 | 0,5 |
| | Northern Europe | 34. KU-NATFAK | 0,05 | 0,05 |
| | Russia | 41. IHEP | 1.35 | 0 |
| | | 42. IMPB RAS | 0,2 | 0.2 |
| | | 43. ITEP | 0.67 | |
| | | 44. JINR | 0.65 | |
| | | 46. PNPI | 0.53 | |
| | | 47. RRC KI | 0.53 | |
| | South East Europe | 51. GRNET | 1.25 | |
| | | 52. TAU | 0,36 | 0,36 |
| | | 53. ICI | 1,46 | |
| | **Total** | | **17.88** | **8.68** |
| **NA4** | | 1. CERN | 4 | 4 |
| | Central Europe | 4. CESNET | 1,6 | |
| | | 8. MTA-SZTAKI | 0,2 | 0,2 |
| | UK / Ireland | 17. UEDIN | 0,5 | 0,5 |
| | France | 22. CNRS | 10 | |
| | | 23. CSSI | 2 | |
| | | 24. CRSA | 2 | |
| | Germany/Switzerland | 26. DKRZ | 1 | |
| | | 27. FhG | 1 | |
| | Italy | 31. INFN | 4 | 2 |
| | North Europe | 36. FOM | 2 | |
| | Russia | 41. IHEP | 0.8 | |
| | | 42. IMPB RAS | 0,3 | 0.3 |
| | | 43. ITEP | 1 | |
| | | 44. JINR | 0.8 | |
| | | 46. PNPI | 0.8 | |
| | | 47. RRC KI | 1 | |
| | | 48. SINP-MSU | 1 | |
| | South West Europe | 56. CSIC | 2 | |
| | | 59. UPV | 2 | |
| | **Total** | | **42. 6** | **7** |
| **NA5** | | 1. CERN | 1 | 1 |
| | South East Europe | 51. GRNET | 1 | |
| | Italy | 31. INFN | 1 | 0,5 |
| | Germany/Switzerland | 28. FZK | | 0,5 |
| | France | 22. CNRS | 0 | 0,2 |
| | | 70. GARR | | 0,5 |
| | South West Europe | 56. CSIC / 71. RED.ES | 1 | |
| | UK / Ireland | 18. PPARC | 0,2 | |
| | | 69. DFN | 0,5 | |
| | **Total** | | **3,7** | **1,7** |
| **SA1** | | 1. CERN | 9 | 9 |
| | UK-Ireland | 16. CCLRC | 19 | |

| | | | | |
|---|---|---|---|---|
| | | 15. TCD | 1 | 1 |
| | France | 22. CNRS | 14,75 | |
| | | 20. CEA | 2,25 | |
| | | 21. CGG | 1,8 | |
| | | 23. CSSI | 1,75 | |
| | Germany/Switzerland | | | |
| | | 25. DESY | 3,75 | |
| | | 27. FhG | 5,75 | |
| | | 28. FZK | 3,75 | |
| | | 29. GSI | 1,75 | |
| | Italy | | | |
| | | 31. INFN | 20 | 8,5 |
| | | 64. ENEA | 1 | |
| | | 65. UniCal | 0,5 | 0,5 |
| | | 66. UniLe | 0,5 | 0,5 |
| | | 67. UniNa | 0,5 | 0,5 |
| | Northern | 36. FOM | 2 | |
| | | 37. SARA | 4 | |
| | | 40. VR | 3 | 3 |
| | South East | | | |
| | | 51. GRNET | 4 | |
| | | 49. CLPP-BAS | 1 | 1 |
| | | 53. ICI | 2 | |
| | | 52. TAU | 1 | 1 |
| | | 50. UCY | 1 | 1 |
| | South West | | | |
| | | 57. IFAE | 2,3 | 2,3 |
| | | 54. LIP | 4 | |
| | | 55. CESGA | 1,25 | 1,25 |
| | | 56. CSIC | 4,4 | |
| | | 58. INTA | 2,2 | |
| | Central Europe | | | |
| | | 3. UNIINNSBRUCK | 0,4 | 0,4 |
| | | 2. GUP | 0,85 | 0,85 |
| | | 4. CESNET | 1,76 | |
| | | 7. KFKI-RMKI | 0,96 | |
| | | 8. MTA-SZTAKI | 0,09 | 0,09 |
| | | 9. NIIF | 0,64 | |
| | | 10. CYFRONET | 0,85 | 0,85 |
| | | 11. ICM | 0,74 | 0,74 |
| | | 12. PSNC | 0,74 | 0,74 |
| | | 14. JSI | 0,88 | |
| | | 13. II SAS | 2,4 | |
| | Russia | | | |
| | | 41, IHEP | 5,25 | |
| | | 42. IMPB RAS | 0,5 | 0,75 |
| | | 43. ITEP | 5,25 | |
| | | 44. JINR | 5,25 | |
| | | 45. KIAM RAS | 3 | |
| | | 46. PNPI | 2 | |
| | | 47. RRC KI | 0,9 | |

| | | | | |
|---|---|---|---|---|
| | | 48. SINP-MSU | 6 | |
| | **Total** | | **160,14** | **36,29** |
| **SA2** | | | | |
| | France | 22. CNRS/UREC | 2 | |
| | South East Europe | 51. GRNET | 0 | 0,5 |
| | Russia | 47. RCC KI | 2 | 1 |
| | **Total** | | **4** | **1,25** |
| **JRA1** | | | | |
| | | 1. CERN | 16 | 16 |
| | Italy/Czech Republic | | | |
| | | 31. INFN | 16 | 8 |
| | | 30. DATAMAT | 6 | 0 |
| | | 4. CESNET | 4 | 0 |
| | UK / Ireland | | | |
| | | 16. CCLRC | 8 | 0 |
| | France | | | |
| | | 22. CNRS | 0 | 2 |
| | USA | | | |
| | | 60. UChicago | 0 | N/A |
| | | 61. USC | 0 | N/A |
| | | 62. UW-Madison | 0 | N/A |
| | **Total** | | **50** | **26** |
| **JRA2** | France | 23. CSSI | 1 | 0 |
| | | 22. CNRS | 2 | 0 |
| | **Total** | | **3** | **0** |
| **JRA3** | Northern | 63. KTH/PDC | 1 | 2 |
| | | 38. UvA | 2 | 2 |
| | | 35. UH.HIP | 1 | 1 |
| | | 39. UiB Parallab | 1 | 1 |
| | **Total** | | **5** | **6** |
| **JRA4** | UK / Ireland | 19. UCL | 1,5 | 1,5 |
| | | 68. DANTE | 1 | |
| | Italy | 70. GARR | 1 | |
| | France | 22. CNRS/UREC | 2 | |
| | | 69. DFN | | 0,5 |
| | **Total** | | **5,5** | **2** |
| | **Grand Total** | | **317,13** | **93,47** |

# 7 Ethical Issues

This proposal does not raise any ethical issues directly. The Grid empowered infrastructure has clear analogies with communication systems such as conventional telephones and the Internet. In both cases the communication services provided are of generic and neutral value. Applications using, for example, biomedical Grids will in some cases have to pay particular attention to ethical and confidentiality issues. As part of the EGEE technological development appropriate levels of security and confidentiality will be implemented and offered to the end users. However, ultimate responsibility will in these cases remain with the application communities of the end-users of the EGEE infrastructure.

| **Does your proposed research raise sensitive ethical questions related to:** | **YES** | **NO** |
|---|---|---|
| Human beings | | **X** |
| Human biological samples | | **X** |
| Personal data | | **X** |
| Genetic information | | **X** |
| Animals | | **X** |

# 8 Other Issues

## 8.A Gender Issues

Most of the partners in EGEE are scientific organizations with an established policy of equal gender opportunities. CERN, the leading partner, has an excellent record history with an equal opportunity programme established long time ago.
Other EU-funded Grid projects, such as DataGrid and DataTAG count female staff in key technical and managerial positions. The EGEE management will strive to ensure equal opportunity, according to EU rules and guidelines, when hiring the new project staff.
Grid technology has an impact on Gender issues, as it is an enabling technology that, like the Web, makes new ways of working possible. In particular, the Grid provides remote access to data and computer power and can also facilitate remote access to scientific instrumentation and enhance teleconferencing capabilities. All these benefits can contribute to help to reduce the burden of child rearing on scientifically active parents, and the aggravating effects these burdens can have in practice on equal gender opportunities in scientific careers. These benefits extend to persons with limited mobility, whatever the cause.

## 8.B Third party countries

Given the international and global scope of the Grid empowered infrastructure proposed, it will be essential to associate to the project collaboration from third party countries. Both US and Russian institutes are proposed as full partners and their collaboration is essential for the success of the project. The proposed activities for US and Russia are detailed in Appendix 5. On the basis that EU funding for Russian partners can be provided in certain cases, the corresponding budgets for these countries have been included in the overall EGEE project budget and specified in each activity. Other non-EU countries are planning to participate unfunded and are listed in table 1b. Cooperation with the SEE-GRID project is under way and an MoU between EGEE and SEE-GRID will be signed. In SEE-GRID all the Western Balkan Third countries participate including Albania, Bosnia-Herzegovina, Croatia, Former Yugoslav Republic of Macedonia (FYROM) and Serbia & Montenegro.

# 9 Appendix A – Consortium description

Description and Curriculum Vitae of key personnel of each partner in the EGEE Consortium.
GOV: Governmental Organisation
PRIV-P: Private Organisation, Public
PRIV-NP: Private Organisation, Non-Public

## Partner 1: CERN

*European Organisation for Nuclear Research, GOV*

CERN, funded by 20 European nations, is constructing a new particle accelerator on the Swiss-French border on the outskirts of Geneva. When it begins operation in 2007, this machine, the Large Hadron Collider (LHC), will be the most powerful machine of its type in the world, providing research facilities for several thousand High Energy Physics (HEP) researchers from all over the world.
Four experiments designed and prepared by large international collaborations formed by over 2000 scientists and engineers coming from more than 50 institutes will collect data for a long period of time (more than 10 years). Thousands of physicists around the world will need access to the huge amounts of data that will come out of the instruments (about 10 Petabytes a year). The data will be a goldmine for finding traces of new exotic fundamental particles of matter.
The computing capacity required for analysing the data generated by the experiments at the LHC machine will be several orders of magnitude greater than that used by current experiments at CERN. It will therefore be necessary to use in an integrated way computing facilities installed at several HEP sites distributed across Europe, North America and Asia.
CERN has chosen Grid technology to solve this huge data storage and analysis challenge and the CERN management has decided to refocus on the GRID the entire computing pans for the evolution of CERN computing.
CERN has a long tradition of collaboration with industry in the IT domain often in the framework of EU supported research programmes.
CERN is in a unique ideal position to be a research centre with the flexibility and the skills to embark in advanced RTD projects, but with severe industrial production service requirements.
Its primary mission is in fact to build and operate very large and sophisticated particle accelerators. This imposes very strict quality and production requirements.
CERN is operated by 2'700 permanent staff coming from the 20 member states. It has a yearly budget of about 1000 M CHF.

**Fabrizio Gagliardi**

Degree in Computer Science from University of Pisa awarded in 1974. Over 25 years of experience in computing applied to physics. Professional experience in international computing projects at CERN, in the CERN member states and in USA.
From 1996 to 1999 he led the Data Management services of the Information Technology division, and from 1998 to 2000 he was in charge of the CERN participation to the EU project Eurostore. In July 1999 he was appointed responsible for the IT divisional industrial technology transfer programme. He is a Member of the International Advisory Committee of the Global Grid Forum.
From January 2001 to March 2004, he led the EU DataGrid project.
He is the overall project manager of the EGEE project.

## Partner 2: GUP

*Johannes Kepler Universität Linz*
*Institut für Graphische und Parallele Datenverarbeitung, GOV*

The Institute of Graphics and Parallel Processing (GUP) at the Johannes Kepler University Linz is well-known for its expertise in combining computer graphics on the one hand with parallel and distributed processing on the other hand. While the application of realistic and real-time computer graphics demands ever more computational power, parallel and distributed processing in its various forms, from instruction level

parallelism to grid environments, offers the only possibility to satisfy these graphics needs. For all these research topics, GUP has established a significant degree of expertise. In terms of co-operation, GUP is engaged in several national efforts, such as the Austrian Centre for Parallel Computing and the Austrian Grid Consortium, and national and international research projects, e.g. with partners in Hungary, France, Belgium, and Germany. The Grid Visualization Kernel (GVK) as developed by GUP represents a sophisticated middleware extension for visualization services. The first prototype is being applied within the EU CrossGrid project for biomedical applications, concentrating on one particular graphical representation within the VTK environment.

**Dieter Kranzlmüller** Is a professor of Computer Science at GUP, who has worked in parallel computing and computer graphics since 1993, with a special focus on parallel programming and debugging. His interests include parallel and distributed software development with emphasis on grid and cluster computing and parallel computer graphics with aspects covering computer graphics software and hardware as well as Virtual Reality. He has participated in several national and international research projects with partners in France, Hungary, Germany, Italy, and Belgium. He has co-authored around 120 scientific papers in journals, and conference proceedings. He has presented his scientific results in lectures and interactive demonstrations.

## Partner 3: UNIINSBRUCK

*University of Innsbruck, GOV*

The Distributed and Parallel Systems Group at the Institute of Computer Science, University of Innsbruck is developing a comprehensive application development system and tool set for the Grid. The main objective of this project is to enable the knowledge-based support of workflow construction and execution in a Grid computing environment. In order to achieve this objective the consortium members will develop a system that will enable users to:
semi-automatically compose a workflow of Grid services,
execute the composed workflow application in a Grid computing environment,
monitor the performance of the Grid infrastructure and the Grid applications, and
analyze the resulting monitoring information.

Our research will close the gap between monitoring and workflow construction, assisting users in workflow composition and execution by employing a semantic description of existing services and by recording and evaluating all performed activities for future use. Hence, the system will be able to learn how to perform tasks (parts of applications) and subsequently will employ this knowledge in workflow construction. It will also monitor, measure, and analyze the Grid services of a workflow application. During runtime, important information about performance and fault behaviour will be collected. This information will be carefully examined in order to improve future composition of Grid workflow applications and their runtime behaviour (e.g. with regard to performance or fault tolerance). Our proposed Grid application development system will be highly user-friendly in order to simplify the development of Grid applications and to unleash the full potential of Grid infrastructures.

The DPS group comprises one full professor, 3 postdoctoral and 10 doctoral students and one full time system administrator. More information about the research, projects, and research staff of the DPS can be found at http://dps.uibk.ac.at.

**Thomas Fahringer** received his master and Phd degree in computer science from the University of Technology in Vienna in 1988 and 1993, respectively. From 1988 until 1990 he worked as a research scientist at Carnegie Mellon University, Pittsburgh, USA. Thereafter, he returned to Austria to become an assistant professor at the University of Vienna. His main research focus was on modeling and prediction of parallel computers and high performance applications. He continued his research at NASA/ICASE in Langley, Virginia where he conducted research on programming paradigms for distributed and parallel systems. Since 1994 Fahringer has carried on his work at the Institute for Software Technology and Parallel Systems, University of Vienna. In 1998 he successfully passed his habilitation to become an associate professor at the University of Vienna. Since 2003 Fahringer is a full professor of computer science at the

Institute of Computer Science, University of Innsbruck. He is currently forming a new research group that builds a comprehensive and state-of-the-art Grid application development environment which is centered around novel software tools, programming paradigms, and Grid middleware. Fahringer was involved in numerous national and international projects including the Esprit PPPE project (Esprit III P6643) and the Esprit Apart working group (Esprit 29488). At present he is a workpackage leader in and the IST APART working group (IST-2000-28077). He also participates in the EU EGEE project (EU contract 508833) and IST Gridstart initiative. He has a major role in developing the Austrian Grid with the goal to provide a large number of application groups with a state-of-the-art Grid infrastructure. Recently Fahringer and his research group joined the Central European Grid Consortium which has been established as a partnership among the central European countries to develop a Grid infrastructure and to jointly participate in European Grid projects. He has published approximately 60 reviewed papers including 2 books, 20 journals, and 2 best paper awards (ACM and IEEE).

## Partner 4: CESNET

***PRIV-P***

The CESNET was established in 1996 by all the universities of the Czech Republic and the Academy of Science of the Czech Republic with the goal to research, develop and operate advanced network technologies and applications. Since 1997, the Association has operated the TEN-34 CZ (later TEN-155 CZ) network, serving the needs of science, research and education, to which members of the Association and other institutions complying with the network Acceptable Use Policy were connected. Since 2000, the Association has been engaged solely in the operation of the academic network (NREN CR - National Research and Education Network) and focused more also on research and development of applications that need the high capacity low latency network. Since 1998, the Association also encompasses Grid related activities in the Czech Republic, building a kind of national grid based on the PC cluster technology. Currently, the Association operates almost 400 CPU distributed cluster, half of which was directly purchased and the second half is operated for specific scientific groups like computational chemistry, material sciences, engineering.
The Association has been involved in many international projects, e.g. Geant, Scampi and DataGrid within the 5th Framework Program. It is also member of several international bodies, e.g. Terena, Dante and CEENet.
The Association ensures its activities with subsidies and partial compensation of expenses related to these activities. The Association's objective is not to generate any profit.

**Ludek Matyska** is associate professor in Informatics, working for CESNET, the nation wide academic network provider. He serves on the Executive Board of the research activities of CESNET as an alternate principal investigator of the CESNET Research Intent. He was working in the area of metacomputing and Grids since 1996, when he lead the first Czech project targeted to connecting academic high performance centers through the high speed network. Nowadays he leads projects like MetaCenter (national academic heterogeneous Grid, CESNET), DiDaS (Distributed Data Storage, CESNET and Masaryk University) or Hardware token authentication infrastructure for MetaCenter (CESNET and Masaryk University). He leads Czech teams within EU projects DataGrid and GridLab and also within the 6FP project EGEE and NoE Coregrid. He serves as a member of several scientific boards of different Czech universities.
His research interests lie in the area of large distributed computing and storage systems, with a specific emphasis on their management and monitoring. He also works in the area of high speed network applications, with emphasis on collaborative work support.

**Ales Krenek**, since graduation in 1995 he works in Supercomputing Centre of Masaryk University in Brno at several positions, currently as a researcher. He is about to finish his PhD studies in Computer Science at the Faculty of Informatics, Masaryk University Brno, in the subject of real-time computational support for haptic interfaces. He participates in the MetaCenter project since 1996, where he gradually took over the information services and user accounting systems. He has been member of the Workload Management System working group in the EU DataGrid project, where he got the position of the chief developer of the Logging and Bookkeeping Service. He is also member of the Testbed workpackage in the EU GridLab project. Since April 2004, he participates in the EU EGEE project, within the JRA1 group. Since 1999 he regularly served as a member of the Organizing committee of the international Sofsem conference.His

research interests are Grid infrastructure monitoring, resource management, Grid information services and databases.

**Miroslav Ruda**, work since 1995 in Supercomputing Center of Masaryk University Brno, currently as a chief system administrator and researcher. He is involved in leading Czech grid activity—project MetaCenter from 1996. Since 2001 is member of Workload Management System working group in EU project DataGrid, since 2002 is leading Testbed workpackage of EU project Gridlab.
His research focus is in Grid middleware, resource monitoring and resource management, and security.

## Partner 5: BUTE

*GOV*

Budapest University of Technology and Economics (BUTE) is the largest and oldest technical university in Hungary. The University, during its history over 220 years has been the forerunner in implementing new ways of thinking in academic work. BUTE is Hungary's most prestigious technical university, with seven faculties (schools) and over 12000 students and 3000 staff. As one of the first Hungarian institutions connecting to the Internet over a decade ago, BUTE positions information technology high on its priority list. Grid- and Meta-computing is an ever growing research activity among students and professors.

The Department of Control Engineering and Information Technology (DCEIT) (formerly Department of Process Control) was established in January 1964, and it was joined to train engineers for the research and industry of instrumentation and process control in the frame of the Department of Measurement and Instrumentation and Department of Automatization.
Starting with research in the field of control theory 40 years ago, since then it has diversified its research objectives and has become a well respected center of computer applications. According to the main research directions and courses being taught, the Department has formed five groups concerning control theory, instrumentation, robotics, software engineering, digital design and computer architecture.

The Department (along with 12 other departments) is responsible for the educational programs in both Sections of the Faculty of Electrical Engineering and Informatics.

The Department offers both core courses witch are taken by the students in the first four semesters, and courses for special fields of interest witch are taken in the last semesters before graduation. About 50 students graduate from the Department each year, 10% of them came from abroad. In addition 5-6 students study in the postgraduate (doctoral) program at the Department. The research work at the Department covers broad fields. Faculty members have been doing collaborative research with institution abroad and founded research supported by the government. In addition, contracts for applied research and development strengthen the ties to the industry.

The Department has strong international relations, in particular, to German universities. Faculty members also maintain ties to universities in France, the United Kingdom, Italy and the U.S.A. In the framework of these co-operations, faculty members have been on sabbatical leave from both sides.

The Centre of Information Technology (CIT), at the BUTE was founded in 1998. Its main goal is to enhance the education of information technology through strong industrial relations and research and development work.

The creation of the Centre as a comprehensive, university level organizational unit was justified by the fact that computer science and information technology has become an integral part of university education. Furthermore, the role of computer knowledge in higher education was increased by the explosive development of information technology, as well as the spread of technologically based convergence. The market has needed of those engineers, and more particularly of those computer science experts who have this modern knowledge at their disposal, and who are capable of constantly renewing it.

The primary role of CIT is project initiation and management. Industry partners and CIT create projects that are well suited for carrying out in University environment. The Centre takes part in project management and

also in scientific-engineering work. Workforce is recruited partly from CIT's own staff, and also from the University (professors and students).
The Centre of Information Technology is negotiating with numerous information-communications companies of outstanding significance in order to achieve a level of cooperation which would not only ensure support for the Centre, but would also extend to cooperation in matters of research-development, broad scale education, seminars, acquisition of additional degrees, etc. Preparation for such enterprises is a time intensive activity, and so the Centre is progressing only by degrees with regard to these questions.

**Dr. Imre Szeberényi**

EDUCATION:

| | |
|---|---|
| PhD in Informatics | 2003 |
| Master of Science in electrical engineering, | 1983 |

EXPERIENCE:

| | |
|---|---|
| Budapest University of Technology and Economics, | 1983- present |
| Dep. of Control Engineering and Information Technology | |
| Research fellow, advisor | |
| subjects: - Computer programming, Operating systems, System integration | |
| projects: - operating system research, networking | |
| Technical University of Budapest, Centre of Information Technology | 2004- present |
| Deputy Director for Education | |
| Technical University of Budapest, Centre of Information Technology | 2002- 2003 |
| Deputy Director for R&D | |
| Technical University of Budapest, Centre of Information Technology | 1998- 2002 |
| Consulting, system integration and specification | |
| Mate Ltd | 1995 - 1999 |
| System designer, software programmer | |
| project: design of visualisation system for Budapest-Hegyeshalom railway line | |
| Technical University of Budapest, University of Economics, Eötvös Lóránd University of Sciences, József Attila University of Sciences, IBM Hungary, | |
| FEFA Foundation - joint venture | 1992 - 1995 |
| System designer, software programmer | |
| project: design of high output IBM RISC/6000 cluster system for parallel processing | |
| TMG-Itec Gmbh, Germany | 1992 - 1996 |
| Software programmer | |
| Project: Profibus interface firmware development | |
| Hungarian Police | 1992 |
| Consulting | |
| Project: - Comparative analysis of proposed models of information system | |
| MERTCONTROL Quality Control Co. | 1991 |
| Software programmer | |
| Project: - Registering system for standards | |
| Ozd Metallurgical Company | 1990 |
| Software programmer | |
| Project: - Process control system for oxygen plant | |
| Oroszlány Coal Mine, Dorog Coal Mine, Pindingshan (China) Coal Mine | 1988 - 1992 |
| Software programmer | |
| Project: - Safety control system for collieries | |
| Development Lab of VIDEOTON | 1988 |
| Consulting and software development | |
| Project: - 2D/3D Tektronix workstation emulation and user interface design | |
| Technical University Budapest, UNIDO project | 1986 |
| Software programmer | |
| Project: - CAD education system | |

## Partner 6: ELUB

*Eötvös Loránd University, Faculty of Informatics*
*Department of Information Systems, GOV*

The Faculty of Informatics is one of the new Faculties of Eötvös Loránd University, it was actually founded in the autumn of 2003.
The Faculty is responsible for the education in computer science, information science, information technology, geo-informatics and teacher training in informatics.
The rough numbers of yearly enrolled students are the following: about 400 students in computer science, 140 students in teacher training and 20 PhD students.
The faculty consists of 8 departments, having 90 faculty members altogether working on them.
The research areas of the Faculty cover among others numerical analysis, computer algebra, geo-informatics and a large spectrum from computer science and information technology: software development methodology, programming languages, artificial intelligence, advanced databases, intelligent information systems, distributed and component based computing and data management.
Grid computing and grid technology is a common research area of two departments of the Faculty: Department of Information Systems and Department of Programming Languages.

Department of Information Systems
The origin of this department is dated back to 1983, when the research activity in databases started at the Computing Centre of the University. The research group then, headed by András Benczúr introduced database and networking courses into the education and performed intensive research in relational database technology. The present Department was established in 1996. It is responsible for teaching of database technology, networking and distributed systems, neural computing and modelling and its application in intelligent information systems.
The current research topics are semi-structured and XML databases, distributed and component based database management, data mining, visual information systems, self developing networks and neural modelling.

**András Benczúr**

Graduated at the Eötvös Loránd University Budapest, Faculty of Sciences,
mathamatics M.Sc. 1967
Candidate of Science in Math. 1978. Thesis: On Recovery of Database Systems
Doctor of Science in Math. 1989. Thesis: Performance Evaluation Model of Database Management Systems based on Kolmogorov's algorithmic Entropy

Awards
Farkas Gyula Award (award of the Bolyai János Math. Society in appl. math.) 1974
Kalmár László Award(award of the Neumann János Computer Society in theoretical computer science) 1974
Award of the Hungarian Academy of Science, 1989

Cuurent position
Full professor at the Dept. of General Computer Science of the Eötvös Loránd University (since 1992)
Chair of the Department of Information Systems

Past positions
Assistant research worker 1967-69, CAI of HAS (Computer and Automatization Institute of the Hungarian Academy of Sciences)
Research worker 1969-78, CAI of HAS
Head of department 1975-78, CAI of HAS
Senior research worker, head of department 1979-81, Resaerch Institute of Computer Applications
Head of the Sytem Development Department of the State Peoples Register Office, 1982-1983
Vice director of the Computer Center of the Eötvös Loránd University 1983-92
Full Professor1990-

Visiting professor, University of North Carolina at Charlotte, 1992-93
Acting Chair of the Catching up with Europian Higher Education State Fund (CEF), 1993-1998.
Head of the Institute of Informatics, Eötvös Loránd University, 1996-97.
Dean of the Faculty of Science, Eötvös Loránd University, 1997-2001.

Membership in professional committees
Member of the Committe on Computer Science of the HAS, 1980- secretary, 1993-
Member of the Board on Math. and Comp. Sciences of the National Postgraduate Degree Granting Board, 1982-1994.
Member of the Editorial Board of the Alkalmazott Matematikai Lapok (Letters on Applied Mathematics), 1980-, editor in chief, 1991-
Member of different committees of the Bolyai János Math. Society
Vice Chair of the John von Neumann Computer Society, 1995-2000.
Chair if the Scientific Committee of Information and Computer Science of the Hungarian Academy of Science, 2000- .
Member of the organizing committees of several national and international conferences

Teaching experience
Since 1971 in chronological sequence:
Statistical programming packages
programming languages (FORTRAN, COBOL)
Courses on probability theory and math. stat.
Data structures
Courses on the principles of database systems
Codasyl databases (IDMS)
Courses on the theory of relational databases
Information systems (principles, planning and design)
Information theory, Kolmogorov complexity

Practical experience
Member and later leader of several projects made for contracts to develop databases, computerized information systems, statistical data processing .
Participation in the development of the Hungarian Peoples Register System.
Consultant in information sytem design and database management system applications.

## Partner 7: KFKI RMKI

*GOV*

The KFKI Research Institute for Particle and Nuclear Physics (RMKI) of the Hungarian Academy of Sciences became an independent legal entity on 1st January 1992 in accordance with the directive issued by the president and the general secretary of the Hungarian Academy of Sciences. Earlier, in the 1975-1991 period, RMKI, as an institute with the same name as today, worked within the framework of KFKI (Central Research Institute for Physics). At that time KFKI comprised four, later five research institutes. KFKI itself was founded in 1950.

RMKI at present has 130 employees, including a 100 research staff. Its main activities are the following:

Experimental Particle Physics:
- Electron-positron (LEP at CERN) physics in the 100-200 GeV energy range;
- Neutrino physics (Gran Sasso);
- Low energy antiproton physics (CERN AD);
- High energy heavy ion collisions (CERN SPS and BNL RHIC);
- Detector building: preparatory stydies for CMS and ALICE at LHC;
- Multiparticle phenomenology;

Theoretical Physics:

General relativity and gravitation;
Field theory and particle physics;
High energy heavy ion collisions;
Few body problems;

Materials Science:
Thin films, heterostructures, multilayers, coatings;
Basic processes of ion implantation, defect structures;
Porous and large surface systems;

Space Physics:
Solar wind with planets and solar system bodies;
Physics of the geospace;
Spacecraft instrumentation;

Plasma Physics:
Tokamak edge plasma physics;
Laser physics (laser plasmas, spectroscopy);

Biophysics:
Nuclear analysis of biological samples (PIX, XRF);
Computational neuroscience

As the performance of local area networks has increased the decentralization became a major issue in computing. In order to satisfy all demands of the various research groups in RMKI the balance between desktop and central computing resources has shifted. The different research groups have their own computing facilities managed by themselves. The interoperability is provided by the common network infrastructure ranging from high speed islands over local area network up to dial-up connection maintened by the local network staff. The network segments are connected to the central router of the KFKI campus managed by the Computer Networking Center. The wide area network connectivity is provided by the services of HUNGARNET - the Hungarian Academic Network having ATM technology based connection to the European research network, GEANT at Vienna with a speed of 2,5 Gbps for the Hungarian academic and education community.

RMKI has joined the international Grid network by installing an LHC Computing Grid cluster of 100 nodes in 2003-2004 and a RHIC Grid cluster of 40 nodes in 2004. Grid, of course, goes far further than high energy physics. Participation of RMKI in the GRID project means access to an enormously enhanced batch computing system for everybody working in RMKI. Although --- true to its name --- the main research topic of the institute is experimental and theoretical particle and nuclear physics, we host many scientists, theoreticians and experimentalists, working outside this field and needing high computing power: field theorists, biophysicists, plasma physicists, and material scientists. All of them profits from a local GRID cluster.

RMKI's home page is http://www.rmki.kfki.hu.

**József Kadlecsik**

Education: Physicist MSc, Roland Eötvös University, Budapest, Hungary, 1988.
Employment: KFKI Research Institute for Particle and Nuclear Physics,
Computing Network Centre, 1988-
Present position: Deputy Division Head
Tasks: Network security, central server management
Committee membership:
Hungarian Internet Society (1998-)
Internet Society (1998-)
Netfilter core team (2001-)
HTASC (HEPCCC Technical Advisory SubCommittee) (2001-)
Programming experience:
Reduce, Rlisp

shell, Perl és Pike scripting
C
Activity:
Linux kernel programming (2000)
Special E-mail handling system on the KFKI campus (2000)
Security manager of the KFKI campus and KFKI RMKI (1999)
Participation in joint projects SUE and ADSM of the Information Technology (IT) division of CERN (1996)
System management of the central servers of KFKI (1994)
Computing algebra research on DAAD Fellowship at the GMD Institute
(Bonn, 1992-1993)

## Partner 8: MTA-SZTAKI

*GOV*

The Computer and Automation Research Institute (SZTAKI), Hungarian Academy of Sciences is a national research centre of information technology, computer science and their related fields. Primarily, the technical-scientific and mathematical issues of informatics are investigated, with consideration and attention to fields related to the above fundamental questions, potentially endowing them with incentive, disciplinary bases. Above pursuing comprehensive basic- and applied research, the transmission of the acquired particular experience to R&D, system design and system integration, furthermore, to consulting and software development is a major obligation. EU named SZTAKI a Centre of Excellence.
The Budapest University of Technology and Economics, Eötvös Loránd University of Sciences, the Computer and Automation Research Institution, Hungarian Academy of Sciences and the National Information Infrastructure Development Office established the Hungarian GRID Competency Center. It provides users' interface, information systems, resource brokers, resource allocation, job- and workflow-management, fault tolerance. With the help of the GRID technology, research centers and students of countries with limited financial resources may have the access to immense information capacity.

**Prof. Dr. Peter Kacsuk** is the Head of the Laboratory of the Parallel and Distributed Systems in the Computer and Automation Research Institute of the Hungarian Academy of Sciences. He received his MSc and doctorate degrees from the Technical University of Budapest in 1976 and 1984, respectively. He received the kandidat degree from the Hungarian Academy in 1989. He habilitated at the University of Vienna in 1997 where he is a private professor. He is a part-time full professor at the University of Westminster and at the University of Miskolc. He served as visiting scientist or professor several times at various universities of Austria, England, Germany, Spain, Australia and Japan. He has been published three books, two lecture notes and more than 120 scientific papers on parallel logic programming, parallel computer architectures, parallel software engineering and Grid tools. He was the chair of the Performance Monitoring Working Group of the European Grid Forum and currently he is the co-chair of the Performance Monitoring Working Group of the Global Grid Forum. He is a member of the Project Technical Board of EU DataGrid project led by CERN, as well as of the Scientific Advisory Board of the Hungarian CERN Committee. He is the leader of the Grid Monitoring Work Package of the EU APART-2 project and member of the Board of Directors of the EU COST MetaChem project.

**Ferenc Vajda** is a research advisor at the Computer and Automation Research Institute of the Hungarian Academy of Sciences and a habilitated professor at the Faculty of Electronic Engineering and Informatics, Budapest University of Technology and Economics. He was postdoctorate fellow at the McMaster University (Hamilton, Ontario, Canada) in 1971-73, visiting professor at the Florida International University (Miami, Florida, USA) in 1983-85 and distinguished visiting professor at The George Washington University (Washington D.C., USA) in 1988-90.He was the director of the Institute of Informatics (Steven Szechenyi College, Győr) in 1991-94 and the director of the Research Institute for Measurement and Computing Techniques, Hungarian Academy of Sciences in 1992-97. He has a university Ph.D. course on Grid computing at the Budapest University of Technology and Economics and presented several tutorials on Grid computing, most recently at the international WWW2003 Conference with Peter Kacsuk.. He has published seven textbooks and technical books and more than hundred papers in periodicals and conference proceedings. He is the holder of 28 patents.

## Partner 9: NIIF

*Office for National Information Infrastructure Development, GOV*

The National Information Infrastructure Development (NIIF) Program and its managing organisation, the NIIF Office, are the creators, developers, and operators of the academic and research network in Hungary. The information infrastructure established and continuously upgraded within the frameworks of the NIIF Program provides global communication possibility of highest international standards for some 600.000 users within more than 700 institutions The Program plays an outstanding role in the wide national dissemination of leading edge Internet technologies and applications, as well as in establishing the Information Society in Hungary. Traditionally, the most advanced networking technologies and services first appear within the NIIF network in the country. DWDM, IPv6, MPLS-VPN, and multicasting are just a few examples. Therefore the Program serves as a driving force in the development of information technology and telecommunication industry in the whole country.

As a result of the continuous development activity during the last decade within the Program, the countrywide gigabit networking infrastructure of the research and higher education community is acknowledged to belong to the leading edge of Europe and beyond.

The NIIF network and the involved information services are, in every respect, equivalent to the similar networks and services of the most advanced European countries. In the fall of 2003 the NIIF network reached 10 Gbit/sec international transmission speed together with the leading European research networks. The Hungarian research network, similarly to all of its European partners, is connected to the EC-supported Pan-European research backbone, GEANT.

The national network of NIIF provides not just Budapest, but also more than 30 regional centers with high speed Internet connectivity by serving the wide communities of research, education, and public collections in the country.

The NIIF Program has achieved a number of considerable results also in the various areas of introducing up to date networking services and applications within Hungary. Some outstanding such results are as follows:

establishment of supercomputing in the country, including the in-house development of the nationwide ClusterGrid technology, based on interconnecting hundreds of PCs during the nights and the week-ends, and providing supercomputing power for the researchers by this way;

building up a countrywide IP telephony system;

development of a nationwide videoconferencing system;

introducing a countrywide directory service.

The NIIF community participate at numerous international projects, among others several EU-supported ones (GÉANT, 6NET, SEEREN, EGEE etc.). Besides the technical benefits of these international activities, a considerable amount of EU resources are also involved in financing the Hungarian development efforts.

Since 1 January 2004 the NIIF Program is operated under the aegis of the Hungarian Ministry of Communications and Informatics. This also means that within the frameworks of the Hungarian Information Infrastructure Strategy, the Program also serves as the framework of developments in the following areas:

further leading edge development of the networking infrastructure,

developing advanced middleware infrastructure,

widening of the possibilities of network-based co-operation,

extending the high performance computing infrastructure based on supercomputing.

In close relation with the above objectives, a major goal is to actively participate in international co-operation. All of these provide outstanding conditions of high international standards for research and development as well as for fruitful innovation in the country, by contributing to the overall development of information technology and applications in Hungary.

The success of the NIIF Program is based on accumulated expertise, organizational skills and management experiences, international co-operation, and financial stability. The achieved results are enormously contributing to the establishment of the Information Society in Hungary, and to nationwide attaining of the goals stemming from the eEurope action plan. The results are serving not only the academic and research community but also the development of the entire national economy.

Phone:: + 36 1 4503060, E-mail: iroda@niif.hu, Web: http://www.niif.hu/

**Dr. Tamás Máray**

Education:

Doctorate degree in computer science Technical University of Budapest 1992

Thesis: System software design for graphical workstations

Master of Science in informatics Technical University of Budapest 1988

Thesis: UNIX networking

Employment record:

Technical director, NIIF (National Information Infrastructure Development Office) 2001 - present

Project manager 1994 - 2001
National Information Infrastructure Development Office
(Development and operation of the Hungarian Academic and Research Network (HUNGARNET) IP backbone.)
Budapest

Professor of Informatics 1992 - present
Technical University of Budapest
Faculty of Electrical Engineering and Informatics
Subjects: computer networks, networking protocols, system integration, software engineering

Professional experience:

Software engineering for
Telematika Co., Budapest, HU 1995
Bertelsmann Co., Gutersloh, DE 1991

Consultancy for the
NATO Scientific Programme, 1999 - present
European Commission, DG-XII, Etcetera project 1995
European Commission, DG-XIII, INCO-Copernicus 4th Framework Programme 1996
European Commission, DG-XIII, FEMIRC project 1998
European Commission, DG-INFSO, Grid systems 2003

Hungarian Police 1996
National Committee for Technological Development, Hungary 1997
Hungarian State Railways 1996-1997
Hungarian Stock Exchange 1995

Program Committee member of the NETWORKSHOP (annual Hungarian conference on networking) 1996-present
CEENET (Central and East European Network Coordination Committee) Hungarian representative 1997-present
Speaker of the NATO International Advanced WWW Workshop in Budapest 1995

## Partner 10: CYFRONET

*GOV*

Academic Computer Centre CYFRONET AGH is one of the biggest Polish supercomputer and networking centres, established over 30 years ago. It constitutes the separate organizational entity of the AGH - University of Science and Technology in Cracow.
CYFRONET is the leading unit in development of the Metropolitan Area Network (MAN) of the City of Cracow and the Małopolska Region. The CYFRONET's mission is to offer access to its computational

facilities & network services to universities and research institutes and to perform research activities in the area of high performance computers (HPC), computer networks and telecommunication.
CYFRONET takes part in several projects within the EU 5FP (especially important is CrossGrid project - CYFRONET is its coordinator) and within 6 FP - CYFRONET takes part in the prestigious EGEE (Enabling Grids for E-science in Europe) project. CYFRONET took part in establishment of the Cracow Centre for Telemedicine and Preventive Medicine.
CYFRONET is involved in the important Polish national project PIONIER, the goal of which is an establishment of the teleinformatic structure for the whole country.

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

## Partner 11: ICM
***GOV***

Interdisciplinary Centre form Mathematical and Computational Modelling is afiliated at the University of Warsaw. It is a high performance computing centre and educational and research institute.

As a computing centre, it operates the academic university network, provides computing resources of all major computing platforms (CRAY, NEC, SGI, SUN, Linux clusters) to the scientific community, scientific software and electronic scientific libraries, operates Academic Scientific TV and the Festival of Science, provides the weather forecast for Central Europe.

As a scientific centre, it contributes or leads numerous academic and commercial projects and performs its own scientific research in applied mathematics, informatics, biomolecular physics, theory of complex systems, meteorology, including 5 EU funded projects in 5th and 6th FP.

ICM runs the Joint Graduate College with Heidelberg University and performs courses and classes in informatics, computational sciences, mathematics and biophysics for undergraduates and graduates.

**Wojciech Wislicki**:
Physicist, dr hab., assistant professor at Soltan Institute for Nuclear Studies, 22 years of experience in experimental particle physics, applied mathematics and theory of complex systems, lecturer at ICM and ICM-Heidelberg Graduate College; lead four projects in particle physics, one joint project ICM-Boeing, locally coordinates Crossgrid and EGEE at ICM.

## Partner 12: PSNC
*Poznan Supercomputing and Networking Centre, GOV*

PSNC was established in 1993 by the State Committee for Scientific Research. PSNC today employs over 100 people in four departments: Applications, Supercomputing, Network Services and Networking Department.
From the very beginning PSNC served as the HPC service provider and the operator of Poznan Metropolitan Area Network (POZMAN). Today PSNC is also the operator of Polish National Research and Education Network POL-34/622, operator of PIONIER network, operator of the Polish international link to the European

GEANT network and is the national networking centre for excellence. PSNC is also the Centre of Excellence of Sun Microsystems Inc. and the official Cisco Networking Regional Academy.
Each of the departments has an active computer science research group working on such aspects of the computer science as: middleware, tools and methods for Grid computing, resource management for Grids, large scale Grid applications (Application Department), user accounting on the Grid, Grid security mechanisms and policies, Grid fabric management tools (Supercomputing Department), application portals, Grid portals, multimedia services, mobile user support technologies and services, digital libraries (Network Services Department), tools for network management, optical networks, QoS management (Networking Department). All the departments cooperate strongly with other institutes across Poland, Europe and the Atlantic on Grid-related projects.
PSNC is the main author of the national IST and GRID-related program, called 'PIONIER - Polish Optical Internet, Applications, Technologies and Tools' for the Polish national information infrastructure, which has been accepted by the Polish Parliament for the years of 2001-2005.
PSNC has been involved in building the European Grid Forum (EGrid). The first EGrid workshop has been held in Poznan, in April 2000. Originally EGrid was an initiative started by some of the proposers (ZIB, Lecce and PSNC) but evolved very rapidly to a large forum, with several working groups and over 200 people from Europe involved. From the very beginning PSNC was co-leading the organization while having still better and better co-operation with other European centres and industrial partners.
Our institution participates in numerous projects e.g: European: GRIDLab (IST-2001-32133, PSNC is the project coordinator), CrossGRID (IST-2001-32243), GRIDStart (IST-2001-34808), EGEE (IST-2003-508833), CoreGrid and national (founded by Polish State Committee for Scientific Research): PROGRESS, Virtual Laboratory, CLUSTERIX - National CLUSTER of LInuX System, SGIGRID - High Performance Computing and Visualisation with the SGI GRID for Virtual Laboratory Applications. PSNC leads the researches in the area of new generation networks. We contribute in European projects: SEQUIN (IST-1999-20841), 6NET (IST-2001-32603) and ATRIUM (IST-1999-20675). PSNC takes an active part in many international conferences and forums, including the Global GRID Forum. Finally, several portals and information systems are developed and managed by PSNC: Joshua portal content management framework, dLibra digital library framework, Multimedia City Guide, Poznan Education Service, Polish Educational Portal „Interkl@sa", WBC Regional Digital Library, EBSCO Publishing, LDAP project and Interactive TV. CoreGRID., Vlab – Architecture of Virtual Laboratories.

**Norbert Meyer** (NM) received the M.Sc. degree in Computer Science from the PoznaUniversity of Technology in 1993 and Ph.D. degree at the same university. Currently he is Head of the Supercomputing Department in Poznan Supercomputing and Networking Center (http://www.man.poznan.pl). His research interests concern resource management in GRID environment, GRID accounting (Global Grid Forum), data management, technology of development graphical user interfaces and network security, mainly in the aspects of connecting independent, geographically distant Grid domains. NM is the co-author of the CERT POL-34 organization (http://cert.pol34.pl). NM is the workpackage leader and member of the Steering Group of the CrossGridproject (IST-2001-32243). He participated in several national projects concerning HPC technology, being co-author of the projects: PROGRESS (co-founded by the State Committee for Scientific Research and SUN Microsystems), VLAB - High Performance Computing and Visualisation for Virtual Laboratory Applications and Clusterix - National CLUSTER of LInuXSystems. He is also author and co-author of several reports and papers (50+) in conference proceedings and professional journals.

**Pawel Wolniewicz** Graduated from Poznan University of Technology and received M.Sc. in computer science in 1997. In 2003 he presented and defended his Ph.D. thesis in computer science at the Institute of Computing Science, Poznan University of Technology. Currently, he works for Poznan Supercomputing and Networking Centre, Poznan, Poland. His research interests include grids, distributed environments and scheduling.

## Partner 13: II-SAS
***GOV***

Institute of Informatics (www.ui.sav.sk) is one of more than 50 scientific and research institutes of Slovak Academy of Sciences, Bratislava, Slovakia, with 85 employees and 10 departments. The scope of activities of Institute of Informatics includes scientific and research work in computer science, informatics, information technology, control theory, robotics and artificial intelligence.

II-SAS has been involved in numerous national and international projects like COPERNICUS, ESPRIT, EUREKA, IST 5FP, NATO, etc. It is also the organizer of international conferences and workshops. The Institute is the editor of the journal Computing and Informatics. II-SAS has been participating in EU-IST projects related to the EGEE project proposal:
datA fusioN for Flood Analysis and decision Support (ANFAS, 2000-3)
A Platform for Organisationally Mobile Public Employees (Pellucid, 2002-4)
Development of Grid Environment for Interactive Applications (CROSSGRID, 2002-5)

II-SAS Expertise :
II-SAS is developing a web based collaborative environment for establishment and operation of Virtual Organization for flood forecasting (FloodGrid). The relationships between models to be used in the system are highly dynamic (models need to be selected and their parameters need to be adjusted according to the time-varying conditions). Setup and steering of such coupled simulation will require cooperation between distributed teams and individuals from different areas. Establishment of such organization would not be possible without new emerging technologies like Grid, collaborative problem solving environments and scientific portals.
II SAS will become the local Grid support center for Slovakia and will interface to the regional Operations Center located in Poland. II SAS will organize training for prospective users of Grid technologies, including EGEE-specific issues and will provide a local helpdesk for Slovakia.

**Dr. Ladislav Hluchy** is the director of II SAS since 1992 and Head of the Department of Parallel and Distributed Computing. More than 27 years of experience in parallel and distributed computing. Participation in 7 EU funded projects. Author and co-author of more than 150 published papers and two patents. Member of IEEE and Editor in chief of journal Computing and Informatics.

**MSc. Jan Astalos** is an assistant to Dr. Hluchy and will be his deputy for coordinating SA1 activities at II SAS. Member of the Department of Parallel and Distributed Computing at the Institute of Informatics SAS. Experienced in HPCN, dynamic load balancing and monitoring for high performance computing systems, grid computing. Author and co-author of more than 25 published papers.

## Partner 14: JSI

*GOV*

The leading Slovenian National Science Institute, including computing research, Grid research and service provision to academic partners. The Experimental Particle Physics Department is an active member of the ATLAS collaboration at CERN, participating in data challenges based on computing on the Grid. Pilot installation of a Grid enabled computing node in Slovenia.

**Prof. Dr. Marko Mikuž**
Head of Department of Experimental Particle Physics and leader of the Institute's team at CERN. Member of the ATLAS collaboration since 1996. Founding member of the Central European Grid Council.

## Partner 15: TCD

*GOV*

Trinity College is a university in the liberal arts tradition established in 1592 by Queen Elizabeth I. The Computer Science Department came into being in 1969 and today consists of more than 50 academic staff, 15 support staff and 170 postgraduate students. It runs the most comprehensive range of full-time and evening courses of any university in Ireland covering all aspects of Computer Science and Information Systems. Overall the department teaches over 2000 students in its 8 undergraduate and 4 postgraduate degree courses. Research groups made up of staff and post-graduate students are active in a broad range of projects undertaken in association with national industry and European research consortia. Over the years, research carried out within the department has spawned a number of campus companies that have been highly successful both in Europe and the USA.

TCD will be the Regional Operations Centre in SA1, for Ireland. Grid-Ireland is the national grid authority for Ireland, see http://www.grid-ireland.org/. It has implemented a dedicated infrastructure of grid gateways that execute middleware based on the DataGrid software. Grid-Ireland does not provide compute resources, rather these are provided by member institutions. An aggregate of 1-2k CPUs is planned by the five major sites, see CosmoGrid (http://www.cosmogrid.ie/) and BCRI (http://www.bcri.ucc.ie/). TCD has managed the grid support layer, on behalf of Grid-Ireland, for Irish academic and research institutions since 1999. This includes user and deployment support, and national services such as certification, grid information, etc. Dr.Brian Coghlan leads the group at TCD.

**Brian Coghlan**, B.E., M.A., Ph.D, see http://www.cs.tcd.ie/coghlan/, is a Senior Lecturer in the Department of Computer Science, TCD. He is a joint leader of the Project Technical Forum (PTF) and is the instigator of and responsible for its grid activities. This group, comprising 8 academics and over 20 postgraduate students, has extensive expertise in the grid arena. It is a participant in the EU DataGrid project (monitoring, security, testbeds), the EU CrossGrid project (monitoring, testbeds), and the Irish CosmoGrid and WebCom-G projects. CAG provides grid management for Grid-Ireland, of which Dr.Coghlan is a founding Director. He is a member of the Institution of Electrical Engineers, and a Professional Chartered Engineer (C.Eng.).

**John Walsh**, B.A. (Mod), M.Sc., is the Grid Manager for Grid-Ireland. He was previously system administrator and network manager for the Dublin Institute of Advanced Studies (DIAS. He will be the lead person for TCD in SA1.

## Partner 16: CCLRC

*GOV*

CCLRC (http://www.cclrc.ac.uk/) owns and operates the Rutherford Appleton Laboratory in Oxfordshire, the Daresbury Laboratory in Cheshire and the Chilbolton Observatory in Hampshire. These world-class institutions support the research community by providing access to advanced facilities and an extensive scientific and technical expertise, including:
ISIS, the world's most powerful pulsed neutron and muon source - for research into the atomic structure of materials;
the Synchrotron Radiation Source, the UK's brightest source of ultraviolet light and X-rays - for research in materials and life sciences;
the Central Laser Facility, high-power state-of-the-art laser facilities - for research in fundamental and applied science and engineering;
satellite and ground based instrumentation, testing and data analysis for earth observation, astronomy and planetary science;
co-ordination and support of the UK particle physics research programmes at CERN and elsewhere;
computing, networking services and user support, and research in theoretical and computational science;
microelectronics facilities for the design, procurement, testing and commissioning of new devices and systems;
micro- and nano-structures research facilities;
research into alternative energy production, radio communications and radar;
advanced detector and instrumentation systems.
In addition to providing large scale facilities and expertise in support of research in the UK, the CCLRC is also the UK gateway to international facilities (ILL and ESRF) and the UK Government shareholder in Diamond, a new synchrotron light source being built at the Rutherford Appleton Laboratory.
Among the large facilities and services that CCLRC runs are: HPCx, Europes largest academic supercomputer; the National Computational Chemistry Software Service, the Atlas DataStore, a and the UK Tier1 Centre for the LHC Computing Grid. CCLRC has worked on many EU Framework Programme projects, often as leader or coordinator. It is a collaborator on a wide range of e-Science and Grid projects in astronomy, chemistry, computational science, computing science, biology, environmental science and materials science and particle physics. In the latter area it is the. CCLRC plays a leading role in the UK's Core e-Science Programme, running its Grid Support Centre, coordinating the National Grid Service as well as participating in projects such as the UK Digital Curation Centre.
Dr John Gordon is Deputy Director of the CCLRC e-Science Centre, Director of the UK's Grid Support Centre, and Deputy Project Leader of GridPP, the UK's largest e-Science project. After a PhD in particle

physics and post-doc work, he spent the 80's and 90's running large computing services for a variety of disciplines. Since 2000 he has worked on e-Science and Grid projects including the European DataGrid, the LHC Computing Grid, and the UK's National Grid Service. He also manages staff working on a variety of other grid development and deployment projects. He will be leading the CCLRC work on SA1.

**Dr Robin Middleton** has a BSc in physics, a PhD in particle physics and is based in the Particle Physics Department (PPD) at CCLRC (Rutherford Appleton Laboratory site). He has worked extensively for over 10 years in the field of real-time systems for data selection in HEP experiments. In this context, he led the RAL participation in the EU funded SISCI project to develop software infrastructure for a high performance network. He was secretary to the UK Particle Physics Computing and Networking Advisory Panel for a number of years and he led the UK involvement in the EU DataGrid project, representing the UK on its Project Management Board (chairman for 2002). He currently leads the DataGrid group at RAL and serves on the Management Board of the GridPP project with responsibilities in middleware and finance. He will be leading the CCLRC work on JRA1.

## Partner 17: UEDIN

*The University of Edinburgh, PRIV-P*

UEDIN is represented in the EGEE project by the National e-Science Centre:
UK National e-Science centre
The National e-Science Centre (NeSC) was established by the UK Department of Trade & Industry and the Joint Research Councils (EPSRC, PPARC, NERC, MRC, BBSRC, CCLRC & ESRC) in August 2001, to lead and provide a focus for the UK e-Science initiative. As well as the National Centre (which is hosted jointly by the Universities of Edinburgh and Glasgow), there are eight regional centres around the UK, plus Rutherford and Daresbury. In 2002, the e-Science Programme established a further seven Centres of Excellence.
For further details:

NeSC website: http://www.nesc.ac.uk/
University of Edinburgh website: http://www.ed.ac.uk/
University of Glasgow website: http://www.gla.ac.uk/

NeSC's mission:
To stimulate and sustain the development of e-Science in the UK, to contribute significantly to its international development and to ensure that its techniques are rapidly propagated to commerce and industry.
To encourage the interaction and bi-directional flow of ideas between computing science research and e-Science applications
To develop advances in scientific data curation and analysis and to be a primary source of top quality systems and repositories that enable management, sharing and best use of research data.
As such it is a national UK facility, and not simply another research project within the University of Edinburgh. The project, to build the Grid – a second generation Internet capable of sharing compute resource, huge datasets (TBytes) and very high bandwidth communication (SuperJANET) – is at the leading edge of the rapidly evolving discipline of IT. The project is interdisciplinary, bringing together research resources on an International scale and covers the whole range of academic endeavour – from particle physics to social sciences. The potential pool of 'contacts' for staff members at NeSC is the whole UK academic community, as well as international links in both research projects and software development.
The project is highly visible, both nationally and internationally, and the e-Science Institute – one arm of NeSC which deals with conferences, training and community building, and is the only one in the UK – had over 6,800 visitors attending a variety of the 197 events held to early 2004. In that time eSI delivered over 16,000 delegate days. Because of the amount of money already invested by the Government in the project, £98M in the first tranche and £114M in the second, there is strong pressure on the project to deliver and there is continuous communication (daily) between project members and the UK e-Science Directorate (at the DTI and EPSRC). The Centre faces outwards, and all staff members – from the Director to the Receptionist – have frequent and regular interactions with senior members of the UK funding councils, and other high profile visitors including company directors and research directorates from overseas.
We have established an e-Science Institute training team, led by John Murison, funded by JISC, the UK e-Science Core Programme, PPARC and the European Union IST Framework Programme 6 through the EGEE project.

**Professor Malcolm Atkinson** PhD, FBCS, FRSE Director of the National e-Science Centre Leader of EGEE NA3 - User Training and Induction.
Malcolm Atkinson is the Director of the National e-Science Centre. He began his career in computing in 1966. He first worked on systems software and compilers and then on computer aided design platforms. This led to an abiding interest in discovering how we can make it much easier to build large systems.
Pursuing this goal he has led UK funded research projects continuously since 1978, and a 6-year European project. Results include the development of orthogonal persistence, culminating in PJama developed jointly with SunLabs in the late 90s; a variety of specialised adaptive indexing mechanisms, flexible software architectures, distributed event mechanisms, software development platforms and safe object-oriented system evolution technology.
He has recently led research into the use of digital infrastructure to support human communication goals, a project investigating general infrastructure for observing and analysing remote user behaviour, and a project investigating adaptive indexing of scientific data. A recent line of research was investigating distributed systems to observe, measure and interpret the usage patterns from large communities of users, such as e-Scientists sharing a Grid infrastructure. Currently he is PI of the OGSA-DAI project (see http://www.ogsadai.org.uk/).
He has worked at seven universities: Glasgow, Pennsylvania, Edinburgh, UEA, Cambridge, Rangoon and Lancaster; and for two companies: Sun Microsystems (at SunLabs in California) and O² (an Object-Oriented DB company in its early years in Versailles). He led the development of the Department of Computing Science in Glasgow to a research rating of 5*. He has more than 100 publications.

## Partner 18: PPARC

*GOV*

The Particle Physics and Astronomy Research Councilis the UK's strategic science investment agency. By directing, coordinating and funding research, education and training in particle physics and astronomy, PPARC delivers world-leading science, technologies and people for the UK.

Guy Rickett is the Head of PPARC's e-Science Programme which comprises GridPP (part of the LHC Computing Grid), AstroGrid (the UK's Virtual Observatory infrastructure), UK computing projects for ATLAS, CMS and LHCb, and other e-science projects. He is also Secretary to the PPARC Science Committee. Guy Rickett is PPARC's representative on the EGEE Collaboration Board.

## Partner 19: UCL

*University College London, GOV*

UCL [www.ucl.ac.uk] is a partner in EGEE responsible for network services development. UCL has a long history of internet work, and this is focused in a “Network Centre of Excellence” [www.ucl.ac.uk/grid] which comprises of members of the Departments of Computer Science (CS), Electrical Engineering (EE) and Physics (PHYS) and vitally, has strong participation from the network and media groups in the central Education & Information Support Division (EISD). The strengths and specialities of these groups mean that our expertise is both deep and broad, ranging from pure research through demanding and internationally recognised applications, to the management of very large production networks. UCL is, naturally, already very strongly involved in many and varied, high-profile Grid projects, and the wider implementation of the Grid.
We are looking at specific research issues concerned with the provision of scaleable, controllable, robust, flexible and secure network services for the Grid and the enabling of e-Science. Current areas of active work include:
The EGEE JRA4 activities in network services for network performance monitoring and bandwidth allocation and reservation
Quality of Service (QoS) control across multi-domain IP-based network environments.
Traffic Engineering (TE) and Traffic Conditioning (TC) for congestion control and as a tool for providing resource management and QoS control.

Network resource management and network service scheduling for Grid applications.
High-capacity, multipoint data transport to allow Grid applications to make use of network resources in an efficient way when transferring large amounts of data (e.g. LHC data replication).
Grid network monitoring and publication to information services and interactions with middleware.
IPv6 deployment and technology trials including wireless networking (wide area and local area networking)
Active Networking
Optical Networking
Provision of a security infrastructure

**Javier ORELLANA**

WORK EXPERIENCE
Jul/02 – Present: University College London. Dept. of Physics & Astronomy. Network Research Engineer. Network design, implementation and testing. Project management. Projects involved in currently:
• DataTAG (www.datatag.org): development of a High Performance IP Network. Deployment of a transatlantic link between CERN (Geneva) and StarLight (Chicago) to provide end-to-end IP Quality of Service (QoS) using mechanisms like differentiated services. Multiplatform solution: Cisco, Juniper & Alcatel.
• MB-NG (www.mb-ng.net): Managed Bandwidth Next Generation. Deployment of end to end IP QoS in a WAN across UK. Cisco specific platform: edge devices 7600 series routers and 12000 series in the core.
• Software development for running network services like bandwidth brokering between different administrative domains.
Oct/01 – Jun/02: Band-X. London. Internet Exchange. IP Quality Consultant. Working in the Global IP Routed Dept.
• Development of software systems running on UNIX for collection of the network performance metrics. Passive and Active measurements.
• Infrastructure design for the IP Routed platform.
• Consultancy in Network Performance (IP QoS) for customers running applications such as VoIP or Media Streaming over Internet.
Jan/00 – Sep/01: TeleCity Plc. London. Internet Infrastructure. Technologist. Developing services & solutions to provide connectivity for the customers (ISPs/Telcos).
• Development of software systems for collection of the network performance metrics. IP Exchange/Multihome solutions. BGP engines. Analysis of network performance and measurement of IP QoS metrics.
• Network design (MAN/WAN) & project development. Switching/Routing solutions. Projects: TeleHouse/Telecity connections (London Docklands) and AMSIX/SARA/TeleCity (Amsterdam).
• Added value services: Monitoring Systems, Security, …
CV Javier Orellana Pag.: 2
Dec/96 – Dec/99: Spanish Economic Ministry. Spanish Commercial Office and Spanish Tourist Office in London. IT Manager.
Spanish Economic Ministry. Spanish Commercial Office in Moscow. Moscow (Russia). IT Manager: same activities as in London

FORMAL EDUCATION
2001 – 2002: Communications Engineering Doctorate (EngD) in the IP QoS

area (not complete). Communications Engineering Department in the University College London.
• Software for Network Services: communication software development (UML / Java).
• Network Performance: Mathematic modelling of Queue Systems.
• Research orientated to multiclass traffic systems and class based queues (Diffserv/IntServ). Network simulations implemented using different simulators like ns-2 or SSF.
1991 - 1992: Degree Final Project “Array Processing and Communications”. Qualification: A
1985 - 1991: Telecommunication Engineer. Higher Technical School of Telecommunication Engineering in Barcelona (Catalonia Polytechnic University).
1981 - 1985: High School. Unified Science Centre. High School in Tarragona.

PROFESSIONAL CERTIFICATIONS
03 / 2000: ICND: Interconnecting Cisco Network Devices. CCNA: CISCO Certified Network Associate.
09 / 2000: PRINCE 2 Methodology for Project Management.

## Partner 20: CEA

*French Atomic Energy Commission, GOV*

CEA is a key player in fundamental and applied research, development and innovation in the fields of energy, information technologies, communication and health. Ever since it was created in 1945, it has successfully responded to major scientific challenges in many fields, including the French nuclear power generation program, nuclear deterrence, micro- and nanotechnologies, astrophysics, medical imaging, Toxicology, biotechnologies, etc.

CEA's ability to develop and innovate is the result of its long-standing policy of organized co-operation between engineers and researchers and its recognition on high-level fundamental research that is vital to the emergence of new concepts. CEA also has outstanding high-performance tools to conduct its research programs (supercomputers, research reactors, major physics equipments, high-power lasers, etc.).
It also maintains close relations with other research organizations and universities to co-ordinate research share the expertise and optimize resources, always with the objective of
Carrying out high-level scientific research.

Today, CEA is recognized not only for its expertise in the many areas of research and development, but it is also considered to be a driving force for innovation and technological dissemination through its involvement in the industrial and economic environment and many national and international partnerships.

The DAPNIA is a CEA’s department in which field of excellence are theoretical and experimental research in Astroparticle, Elementary Particle & Nuclear Physics, Astrophysics cosmology and material sciences, instrumentation.
Staff employed by CEA: 15000

**Joseph Le Foll**, leader of the CEA/DSM/Dapnia computing team which is in charge of providing computing power and tools to the DAPNIA staff. He is also the computing coordinator in the department. He has 30 years of experience in computing science and computing management.

## Partner 21: CGG

*Compagnie Générale de Géophysique, PRIV-NP*

CGG is a global participant in the oilfield services industry, providing a wide range of seismic data acquisition, processing and geosciences services and software to clients mainly in the Oil&Gas exploration and production business. It is also a manufacturer of geophysical equipment.

Data Processing and Reservoir services is a Strategic Business Unit of CGG dedicated to deliver to its clients sharp and reliable images of geological structures from seismic data processing. The staff of about 1000 work in 25 Processing Centers around the world, using more than 17000 PC Linux cpus, 30 Tflops in every day operations. The Technology Division, located in Massy, France, has consistently been at the forefront of efforts to push back the limits of computing capacity. CGG received in 2003 the prestigious “Dell Centers for Research Excellence” award, which acknowledges CGG's innovative worldwide use of high-performance computing cluster (HPCC) technology.

**Dominique Thomas** is graduated from Ecole Centrale in France, in 1978. After a position of scientific programmer at Control Data Corporation, working for nuclear and naval industries, he joined the Oil&Gas Research at TOTAL. There he successfully introduced computer sciences research technologies into industrial context, such as Interactive Graphics in 81, UNIX and RDBMS in 83, Object Oriented Programming (OOP) in 86. Then as Expert and Technical Director at IPS, a Software Service Company, he deploys X11-Motif, OOP and Quality Assurance (ISO 9000) in various scientific and technical organizations.

He joined CGG in 1992 and represents CGG in the International Organization POSC (Petrotechnical Open Software Corporation) where he promoted state of the art technologies in data modelling and distributed systems.

Now in the Technology Division of CGG Data Processing, as Software Development Manager, Dominique Thomas is leading a team of 70 high tech software developers and continues to introduce innovative technologies in the Company: JAVA and parallel programming on SMP machines in 97, cluster of PC Linux in 2000. In 2003, CGG is at the top of industrial private companies in HPC, using 16000 cpus / 30 Tflops PC cluster in every day operations.

Current R&D focus is on GRID technology in the HPC domain and high- end 3D volume, real time, visualization in the interactive domain.

## Partner 22: CNRS

*Centre National de la Recherche Scientifique, GOV*

The CNRS, (French National Centre for Scientific Research) is a public organisation for scientific and technological research and is under the authority of the Ministry for Research (http://www.cnrs.fr).
While its budget represents one-fourth of total civil research spending in France, the CNRS is also the largest fundamental research organisation in Europe. Its own laboratories as well as those it maintains jointly with universities, other research organizations, or industry are located throughout France, but also overseas with international joint laboratories located in several countries.
Measured by the amount of human and material resources it commits to scientific research or by the great range of disciplines in which its scientists carry on their work, the CNRS is clearly the hub of research activity in France. It is also an important breeding ground for scientific and technological innovation.

8 scientific departments and 2 national institutes cover all scientific fields : Physique Nucléaire et Corpusculaire (PNC), Sciences Physiques et Mathématiques (SPM), Sciences et Technologies de l'Information et de la Communication (STIC), Sciences Pour l'Ingénieur (SPI), Sciences Chimiques (SC), Sciences De l'Univers (SDU), Sciences De la Vie (SDV), Sciences de l'Homme et de la Société (SHS); Institut national de physique nucléaire et de physique des particules (IN2P3) et Institut National des Sciences de l'Univers (INSU). The CNRS encourages cooperation between scientific fields and have several interdisciplinary programmes. Among these interdisciplinary programmes, IN2P3 and SC are jointly involved in R&D activities on partitioning and transmutation to promote new methods for studying the scientific aspects of reactor safety and the safety of nuclear waste disposal.

**Dr Guy Wormser**,
Directeur de Recherche au CNRS, Laboratoire de l'Accelerateur Lineaire d'Orsay.
PhD in 1984 in Universite Paris XI Orsay in High Energy Physics.
Scientific Representative of CNRS in the DATAGRID project (2000-2004) and in EGEE.
Deputy director of National Institute for High Energy and Nuclear Physics (IN2P3) (1999-2003)
Chair of the DATAGRID Project management Board (2003-2004).
Chair of the High Energy Physics Computing Coordination Committee (2001-2004).
Chair for the International High Energy Physics Computing Coordination Comittee (2004-).
French Representative in the LHC Computing Grid Overview Board (2002-).
Role in EGEE: co_chair of the Industry Forum and chair of the EGEE Generic Applications Advisory Panel (EGAAP)

## Partner 23: CSSI

***PRIV-NP***

CS is a key player in design, build and run of applications and systems. We are firmly positioned at the top of our industry, ranking first in France for industrial and critical applications and third in computing infrastructure services. We assist our customers over the long term by providing solutions that are ideally suited to their needs and resources.

Strategy
To design, build and run industrial and critical applications,
To design, build and maintain critical systems,
To build, run and develop IT infrastructures and applications management.

Mission
Nearly 70% of CS's work involves projects that span several years. CS builds long-term relationships with its customers and provides them with the solutions that are best suited to their needs and resources.

**Michel Philips**
EDUCATION
1984 : Engineer ENSEEIHT (Ecole Nationale Supérieure d' Electrotechnique, d'Electronique, d'Informatique et d'Hydraulique de Toulouse)

Computer Sciences: specialized in Artificial Intelligence and Databases.

Functional skills : Team Management, Project Management, Systems specification and conception, software sciences, OO design, AI, quality control and management, Data Bases.

Technical skills: Languages : C, C++, JAVA, SQL, PASCAL, FORTRAN, LISP, SMALLTALK

Data bases: Oracle, Ingres, Gbase

Methods and tools: HOOD, MERISE, SADT, MS PROJECT, GAM T17, DOD 2167A

Systems: UNIX, Windows, Multics, Symbolics, MS DOS, MAC OS

Platforms: SUN, HP 9000, PC, MACINTOSH

WORK EXPERIENCE
09/2001 – today : Manager of the Applicative Software Department (Aix-en-Provence).
Industrial and R&D projects (Grid Computing)

1986 to 09/2001 main missions => DCN INTERNATIONAL, IBM, …

Project Manager : Realisation of various high tech missions. Embedded software, data bases, software specification, conception, coding, qualification and tests, object oriented technologies, expert systems, numerical calculationetc. teams management and projects follow up.

## Partner 24: CRSA

***PRIV-P***

Chairman: François GREIVELDINGER

General Manager: Jean-Hubert SCHMITT

Executive Manager: Philippe DUBEAUX

This company with a capital of 350 000 Euros is a subsidiary of the École Centrale Paris. It was created in 1986 with assistance from the Association des Centraliens and the Société des Amis de l'École Centrale.

Centrale Recherche S.A. is a tool for the development of research at the École. Its vocation is to promote the skills of the research teams of the École in industry and to capitalize on the results obtained. It plays a part in prospecting, negotiating and managing relationships which bring together the Research Centre laboratories and outside partners who wish to work with the École.

Centrale Recherche S.A. relies upon the scientific and technical potential of the laboratories to propose contracts to industry. In return, Centrale Recherche S.A. provides these laboratories with additional personnel and equipment.

An agreement exists between Centrale Recherche S.A. and the ECP where all the research is carried out.

In particular, the areas of scientific development and research remain the sole responsibility of the École which is free to accept or refuse any of the contracts proposed by Centrale Recherche S.A.

Centrale Recherche S.A. works with about two hundred partners: industrials (including a significant proportion of small and medium size companies), public or private research centers and government administrations.

**Christian Saguez**
Graduated from Ecole Centrale de Paris in 1972
Docteur es-Sciences in applied mathematics (Optimal control of free boundary systems )
Presently :
.Professor, in charge of the Applied Mathematics Department at Ecole Centrale de Paris
.Member of the French Academy of Technologies (President of the Information Technology Committee)

He has been successively :
. Director for industrial and international relations - INRIA.
. CEO of the company SIMULOG, specialized in Scientific Computing
. Director of the industrial relations and the subsidiaries - CNES.
. Scientific Director - C-S

## Partner 25: DESY

*Deutsches Elektronen-Synchrotron, PRIV-P*

DESY was initially established in 1959 as a practical physics facility for German colleges and universities. Over the years it has developed into a research centre of international renown and its facilities are now open to scientists not only from Germany, but from all over the world. More than 1200 physicists from 25 countries are currently working on the four HERA (Hadron-Elektron-Ring-Anlage) experiments. A further 2200 guests

from 33 countries come to DESY every year in order to conduct experiments in various areas of physics, chemistry, molecular biology, material science and medicine at the Hamburg Synchrotron Radiation Laboratory HASYLAB. DESY not only offers first-class research opportunities in particle physics at HERA; the synchrotron radiation generated by the storage rings DORIS and PETRA has also become an important and popular research tool since the mid-1960s. Furthermore Astro-Particle-Physics and Theory plays an important role at DESY. DESY, which has 1500 employees, is located in Hamburg and in Zeuthen near Berlin.

**Volker GUELZOW**, born in 1956, studied Mathematics and Physics at the University of Göttingen from 1976-1982. In 1982 he received his Diploma in Mathematics. In 1987 he received his Dr. Rer. Nat. from University of Göttingen. From 1982 till 1986 he worked as scientist at the German Aerospace Establishment where he became in 1986 a group leader in the computer centre. From 1988 to 2001 he worked as Senior Scientist and head of the application software department at the German Climate Computer Centre. In 2001 he moved to the University of Kiel, where he became the director of the computer centre. Since end 2001, when he moved to DESY, he is responsible for the central computer division.

## Partner 26: DKRZ

*PRIV-P*

DKRZ is a national German facility. Its mission is to provides-state-of-the-art super-computing data service and other associated services to the German and also the international scientific community to conduct top of the line Earth System and Climate Modelling." DKRZ operates a fully scalable supercomputing system designed for and dedicated to earth system modelling. The current hardware environment known as HLRE (HöchstLeistungsRechnersystem für die Erdsystemforschung), has been installed in and constantly upgraded since January 2002. It is composed of 24 NEC SX-6 parallel vector computer nodes, a balanced system of high performance data servers, including a multi-petabyte mass storage archive, a visualisation system and post processing facilities. Associated services provided by DKRZ include general user support as well as specific support in scientific computing, e.g. helping the community to adapt climate codes to the existing hardware architecture.
In close cooperation with its partner organisations the Max Planck Institute for Meteorology and the Model&Data Group DKRZ plays an active role within the German e-science initiative.
Additional information about the services of DKRZ can be found at http://www.dkrz.de/.

**Joachim Biercamp** is manager of the department for scientific computing, user-support, and visualization of DKRZ. He has got a Ph .D. in Oceanography and has more then 15 years of experience in the fields of super computing and scientific computing.

## Partner 27: FhG

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., PRIV-P

FhG is a link between science and industry, that is between the research and the application of its results. It was founded in Munich in 1949 as a non-profit registered association. The organization takes its name from Joseph von Fraunhofer (1787-1826), the successful Munich researcher, inventor and entrepreneur. The Fraunhofer-Gesellschaft is an autonomous organization with a decentralised organisational structure, which currently maintains 58 research institutes and a patent office in locations throughout Germany. Whilst the administrative headquarters are in Munich, the legally non-independent research institutes operate from different locations in 15 of the German Länder, where they carry out their respective work in close partnership with industry. A staff of approximately 13.000, the majority of whom are qualified scientists and engineers, work with an annual research budget of about one billion Euro.

Today Fraunhofer-Gesellschaft is the leading organization of institutes of applied research and development in Europe. The employees carry out research and development projects on a contract basis on behalf of industry, the service sector and government. Future-oriented strategic research commissioned by the government and public authorities are carried out with the aim of promoting innovations in key technologies

with an economic and social relevance in the next five to ten years. Working within the framework of the European Union's research and technological development programs, the Fraunhofer-Gesellschaft collaborates in industrial consortia on technical issues ultimately destined to improve the competitiveness of European industry. Commissioned by customers in industry, Fraunhofer scientists provide rapid, economical and immediately applicable solutions. Work focuses on specific tasks across a wide spectrum of research fields including communications, energy, microelectronics, manufacturing, transport and the environment. When required, several institutes collaborate on an interdisciplinary basis to develop system solutions with a wide range of applications. The clients receive advanced technical know-how and very exclusive services.

Fraunhofer Institut Algorithmen und Wissenschaftliches Rechnen - SCAI is a competent partner for customers from industry and science in Scientific Computing and offers tailored solutions for optimization problems in the production and sales end. SCAI engages in the solution of application problems in industry by means of model engineering. Using mathematical and IT methods, the data are processed for simulation on a high-performance computer. SCAI's special strength lies in coupled simulation. SCAI also offers its services in the field of visualization of simulation results. SCAI has a strong commitment to Grid Computing - GGF cochair, EuoGRID, Grid Testbeds for KMUs.

SCAI Bioinformatics offers clinicians and clinicals researchers integrated IT infrastructures, with special competence in the fields of structured data recording and the management of data and results, as well as the organization of projects.

**Horst Schwichtenberg** in 1985 graduated with a Diploma of Mathematics from University of Bonn. Since 1985 he has been working as a scientist at the German National Research Center for Computer Science (GMD,) Institute for Algorithms and Scientific Computing, now Fraunhofer Institute SCAI. At the beginning of his career his research area were hierarchical methods for solving partial differential equations and and parallel algorithms with main focus on parallel local memory machines. Since 1995 he has been working on Cluster Computing with later focus on grid Computing. He was responsible leader of various projects funded by the German governement and the European Commission and thus gained experience in project management.
Since 2001 he has taken over the position as head of the IT-group of SCAI.

## Partner 28: FZK

*Forschungszentrum Karlsruhe, PRIV-P*

FZK in the Helmholtz association is one of the largest national research centres in Germany with currently about 3500 staff running a broad spectrum of highly multidisciplinary research programmes. This is reflected by its participation in the Helmholtz research fields “Health”, “Energy”, “Earth and Environment”, “Key Technologies” and “Structure of Matter”. Research and development is planned and performed in a matrix structure of programme management groups and scientific institutes providing the varying specific expertise requested by the programme. A broad scientific and technical infrastructure is the backbone of comprehensive, long-term interdisciplinary research in all FZK programmes aiming for excellence and international competitiveness.
FZK has an imposing infrastructure at its disposal for close cooperation with universities, institutions of higher education and industry. Having proposed the German D-Grid initiative FZK has established a good contact to all relevant academic and industrial parties in the German Grid Computing scene. Through the GridKa Grid computing centre there is not only a close working relationship to 42 particle physics institutes all over Germany but as well to CERN and the other Tier-Centres in Europe, United States and Asia-Pacific. FZK leads the German federation and will significantly contribute to EGEE with its know-how and resources.
FZK is actively contributing to the Global Grid Forum (GGF) conferences and working sessions and is supporting the GGF as a Silver Sponsor.

**Dr. Marcel Kunze**
Heading the department for Grid Computing and e-Science at Forschungszentrum Karlsruhe Dr. Marcel Kunze is speaker of the program topic “Grid Computing” in the Helmholtz association.
He received a Diploma degree in Physics at Karlsruhe University in 1985. In the following years he was delegated to CERN to head a group for the construction of the trigger system and data acquisition for PS 197. After his graduation in 1990 he went to Bochum University where he started to work in the field of

neurocomputing, in close collaboration with the institute for neuroinformatics. In 1996 he received his habilitation on the use of artificial neural systems in particle physics. As an associate professor he was teaching particle physics, informatics and software design. In 2002 Dr. Kunze joined Forschungszentrum Karlsruhe.
He is member of the advisory committee of the CHEP and ACAT conference series and a member of Deutsche Physikalische Gesellschaft, Deutscher Hochschulverband and Global Grid Forum.

## Partner 29: GSI

*Gesellschaft für Schwerionenforschung, PRIV-P*

GSI is member of the Helmholtz Association - Germany's largest research institution. With a yearly budget of 70 Mio Euro and 850 employees, including 250 scientists and engineers, GSI runs an accelerator facility for ion beams which is unique world-wide. Over 1000 non-resident scientists per year from 150 institutes out of over 30 countries use the GSI facilities. The research program comprises a broad spectrum ranging from nuclear physics, plasma physics, and material research to biophysics and nuclear medicine. Presumably best-known results are the discovery of six new chemical elements with atomic numbers 107 till 112 and the development of a new tumor therapy using ion beams. In February 2003, the German Federal Government gave green light for a future international "Facility for Antiproton and Ion Research" (FAIR) which will use the existing GSI accelerators as injector.

GSI has a long tradition of providing IT infrastructure to the users of its facilities. The computing resources consist of a general purpose batch cluster optimized for high throughput computing, a cluster optimized for parallel processing as well as several tape robots for the storage of huge amounts of experiment data. The Grid activities at GSI have three objectives: to build a tier-2 centre for the CERN based heavy ion experiment Alice, to support the simulation for the future GSI experiments CBM, Panda and SuperFRS, and to plan the Grid infrastructure, especially a tier-0 centre for these experiments.

**Peter Malzacher** is the head of the Grid and Data Management group of the DVEE department at GSI. The mission of this group is to provide the tools for the simulation and analysis of heavy ion experiments at GSI and to build a tier-2 analysis centre for the CERN heavy ion experiment Alice.
He received a PhD in physics at Frankfurt University in 1986. Since 1987 – with a one year interruption for a visit at FNAL – he is working in various positions for IT at GSI. He is teaching computer science and software design for physicists at the Frankfurt University.

## Partner 30: DATAMAT

*PRIV-NP*

Datamat S.p.A. (http://www.datamat.it), is a key player in the Software & IT Services sector in Italy. The company, established in 1971, is specialized in the development and supply of mission critical solutions and services for Bank, Finance, Insurance, Defence, Space, Public Administration, Healthcare, Telecommunication, Media, and Utilities.
Datamat is organised into three independent divisions and it is very active in basic R&D particularly within European programmes.
Datamat is also certified to NATO AQAP (for military programs) and ISO 9001 standards.
Grid activities are run in Datamat by a dedicated R&D group already involved in other Grid research projects, either already successfully concluded, like DataGrid (http://www.eu-datagrid.org) and SpaceGRID (http://www.spacegrid.org), or on-going, like CrossGrid (http://www.eu-crossgrid.org), EGEE (http://www.eu-egee.org), THE VOICE (http://www.esa-thevoice.org) or currently under negotiation in the context of FP6, like NextGRID and AKoGriMo .

**Stefano Beco**
Manager of Datamat Grid R&D Group, he has a Doctor's Degree in Electronic Engineering from the University of Rome "Tor Vergata", Italy. His skills and competencies include project management, interoperability protocols, user services, and software languages and operating systems. Since end of 2000, he is the Programme Manager of Grid activities in Datamat, Task Manager in EU DataGrid WP1 / WP9 (EC

5FP IST Project), Task Manager in EU CrossGrid WP3 / WP5 (EC 5FP IST Project) and Project Manager in SpaceGRID and THE VOICE (ESA funded projects).

## Partner 31: INFN

*Istituto Nazionale di Fisica Nucleare, GOV*

INFN (http://www.infn.it/), is a governmental research organization, which promotes co-ordinates and funds nuclear and high-energy physics research. It is organized in 4 National Laboratories, 19 Sections fully integrated in the Physics Departments of the major Universities, 11 Sub-sections, one National Center, the Central Administration and the President Operational Bureau.
INFN carries out its research activity in collaboration with international institution at the most important national and international Laboratories (CERN, DESY, Grenoble, GranSasso, Frascati, Fermilab, SLAC). Considerable is the INFN effort in the R&D of new technology and innovative instrumentations needed to fulfill its own mission. For example in the computing field INFN has deployed one of the first wide area network spread all over Italy, INFN has been in charge of running the GARR, the Italian academic and research network, until it became an independent consortium.
In the field of distributed computing, INFN, since 1998, started deploying a Wide Area CONDOR Pool using more than 200 CPUs distributed all over Italy. An R&D project was then launched to evaluate the use of GRID technologies to face the stringent requirements of the High Energy incoming LHC experiments with respect to the computer power and data storage. INFN has contributed to European project DATAGRID and DATATAG (GLUE) already completed, is active in the Cern LCG project, has deployed the INFN production GRID which puts together the computer resources of more then 16 sites corresponding to more than 1000 CPU's.
INFN is also committed in the transfer of know-how, methodologies and technologies developed by its research activities towards other research fields, such as medical science, cultural heritage and environment, and industry, and carries on its research and development activities in close collaboration with university.

**Mirco Mazzucato**
Present position: INFN Director of Research
Current Activities:
Project Manager of the INFN Grid Project
Chairman of the Grid Deployment Board and INFN representative in the CERN LHC Computing Grid project
Member of the Management Boards of the FP5 European Projects DataGrid and DataTAG and of the Executive Committee of the FP6 Grid infrastructure project EGEE
Head of the Research Unit 4 of the FIRB MIUR Grid.it project
Italian Delegate at the European IST Committee
Coordinator of the Italian Grid for Business, Industry, Government, eScience & Technology initiative
General Chair of the Computing in High Energy Physics (CHEP) Conference 2000
Member of the SC2002 program committee at Baltimore (US)
General Chair of the GRID Forum General program 8-10 October 2001, Frascati, (Rome Italy),
Chair of the Third DataGRID Project Conference, 3-5 October 2001, Frascati, (Rome Italy)

## Partner 32: TERENA

*Trans-European Research and Education Networking Association*, PRIV-NP

TERENA, founded in 1986 as RARE, is the association in which research and education networking organisations from countries in and around Europe collaborate. Its current membership encompasses 32 NRENs, two international members (CERN and ESA) and eleven associate members. TERENA's work falls into four main categories: fostering new initiatives; developing, testing and promoting new technologies and services through the TERENA Technical Programme; knowledge transfer; and promoting members' interests.

Much of the work is undertaken through the TERENA Technical Programme, which is defined by the senior technical managers of the member organisations, and overseen by a smaller group of specialists in the TERENA Technical Committee. TERENA employs a number of staff who support the activities on a day-to-

day basis. The TERENA Technical Programme is executed through projects and task forces working in areas of common interest. Seminars, workshops and other events are organised to disseminate results throughout the NREN community and beyond. In addition, TERENA liaises and co-ordinates activities with similar organisations in North America (Internet2 and CANARIE), the Asia-Pacific region (e.g., APAN) and Latin America.

TERENA has extensive experience and skills in co-ordinating complex technical activities and disseminating information. Since 1996, TERENA has co-ordinated or been a partner in many EU-funded projects, including the SERENATE project on foresight studies, the COM-REN project on the Compendium of NRENs and a large number of technology-oriented projects.

Detailed information about TERENA can be found at: http://www.terena.nl/

**John Dyer** is the Chief Technical Officer at TERENA. He is responsible for managing the Technical Programme and the technical staff at the Secretariat.

After leaving full-time education, John took many short term posts, including two years as a professional staff photographer. He then took up an administrative position in the contracts department of a large organisation for a period of nine years before returning to full-time education once again.

He studied Physical Sciences at Oxford Polytechnic (now Oxford Brookes University) where he was awarded a B.Sc with First Class Honours. His Final Year Project was in the area of Nuclear Science with a particular emphasis on automation of data capture and handling techniques.

In 1983, he joined Green College of Oxford University where he undertook research, working in the Department of Paediatrics at the John Radcliffe Hospital in Oxford on the topic of Microelectronic Sensors for measurement of clinically important blood constituents. This included design and fabrication of semiconductor and thick film sensors for use in the laboratory. He also designed and built digital monitoring equipment based on Texas Instrument hardware.

In 1986, John moved to the Joint Network Team and became responsible for full-screen services , working on the X Window System and other related areas. He remained with the organisation when it became UKERNA in 1994, managing the development programme and the SuperJANET applications programme before being appointed Business Development Director. As Business Development Director he was commissioned to undertake a study into the future architecture of UK Academic Networking which is summarized at http://www.ja.net/documents/net_arch.html.

John joined TERENA on a permanent basis in April 1999, after being on secondment to the organisation between July 1996 and September 1997. His main interests are in on-line information discovery and management, security issues, optical networking technology and business aspects of technological innovation. He successfully completed a Masters degree in Business Administration (MBA) during 2001.

**Licia Florio** has been working for TERENA since October 2001 as Project Development Officer, to assist Task Forces and projects. She is responsible for the task force on mobility, TF-Mobility, which covers mobile agents'
authentication, wireless networking, roaming, security issues in the mobile communication and marginally mobile IP. She is also the secretary of TF-AACE task force, which is focused on issues related to deployment of Authentication, Authorisation and other Security related services among the European NRENs and research community.

Licia is coordinating the 2002 GNRT edition (the 2001 edition is on-line at
GNRT-2001) , whose result will be an on-line user-guide to Network Resources Tools.

Licia is in charge of some TERENA's Minor projects, middleware related, like Adding Certificate Retrievalto OpenLDAP and Directory Schema Registry.
Licia is involved in GRID, as TERENA's observer.

Before joining TERENA, Licia worked as analyst/programmer for Omega Generation , an Italian IT company, which works chiefly on European Projects.

Licia was born in 1972 in Italy and in 1998 she graduated in Computer Science at the University of Bologna. A publication about her thesis can be found in Computer Communication magazine (November 2000). Her main interests are about security in Web application and Java based application, pki and digital signature.

## Partner 33: VUB

*Vrije Universiteit Brussel, GOV*

The departments of the Vrije Universiteit Brussel that are most involved in the project are the Inter University Institute for High Energies (IIHE) and the Group HELIOS (web.iihe.ac.be).
The IIHE (VUB-ULB) is a collaboration that started in 1970 between the Vrije Universiteit Brussel (www.vub.ac.be) and the Université Libre de Bruxelles (www.ulb.ac.be), the two Brussels universities. IIHE(VUB-ULB), next to participating in the H1 experiment in Desy- Hamburg and the Amanda – Ice Cube project is also a participant in the LHC project CMS. In Belgium the IIHE(VUB-ULB) has always been at the forefront in computing and datacommunication, exploiting its own servers and networking facilities while also connecting to the university ICT infrastructure.
The group HELIOS (www.iihe.ac.be) at the University of Brussels ("Vrije Universiteit Brussel" ) has grown out of the ICT expertise gained in a High Energy Physics research institute.
HELIOS is specialising in the study and realisation of telematics applications and services, as well as the various underlying network infrastructures and with a special interest in international standardisation. The group has a very strong collaboration with the department "Service Télématique et Communication" of the "Université Libre de Bruxelles".
The group is actively involved in a vast research and development program as well as in many teaching, training and consultancy activities in private and public institutions.

**Rosette Vandenbroucke** was ICT manager at the Inter-University Institute for High Energies of the Vrije Universiteit Brussel and the Université Libre de Bruxelles [IIHE (VUB-ULB)] for thirty years. She is heading a small research group specialising in information and communication technologies (computer networks, telecommunication infrastructures, protocols, standards, telematic applications and services, multimedia, broadband networks …).
Among several projects with the non-academic world, she was involved in an e-Government project with the administration of the "Provincie Vlaams Brabant" to offer a networking infrastructure and start new services for 130 administrative entities.
She participated in European Commission programmes: VALUE, TELEMATICS, IST, and in research projects with the Belgian Federal Government (OSTC/DWTC) and Flemish Region (IWT).
Outside of the academic world, Rosette Vandenbroucke conducts consultancy activities, seminars and training on topics related to Information and Communication Technologies.
Today, Rosette Vandenbroucke works for the R&D Department of the Rectorate of VUB for the DISC project with ULB (Decision, Information, Science, Communication); she is an expert to the Government of the Brussels Region, and she is Project Manager of the BEGrid, the Belnet Grid Initiative, to develop a Belgian national Grid infrastructure.

## Partner 34: KU-NATFAK

*GOV*

The faculty of science hosts among other disciplines IT-research and particle physics. Danish activities on Grid development and deployment are centred on the Niels Bohr Institute (NBI) and Institute for Informatics (DIKU). The faculty has recently established a new position with the mandate to coordinate the Grid activities at the University. The position is shared between KU-NATFAC and NBI.

In connection with the participation in the ATLAS experiment, the experimental high energy physics group is heavily involved with the development of the infrastructure which will be necessary to cope with the enormous data flow from the experiment, and how the subsequent storage and analysis of that data is most efficiently carried out. The group has in this context been instrumental in the creation of the NorduGrid project and in the development of the ARC Grid-toolkit deployed on many PC-cluster. The activities are lead by the John Renner Hansen.

DIKU is responsible for the newly established DK-GRID which will be the future organizer of Danish Grid development, deployment and contact to industry.

Important web sites related to the Danish contribution to EGEE:
KU-NATFAK: http://www.nat.ku.dk/
NBI: http://www.nbi.dk/
NorduGrid: http://www.nordugrid.org
DK-GRID: http://www.dcgc.dk/
Contact person: Professor Lic. Scient John Renner Hansen

**John Renner Hansen** has been active in experimental high energy physics and distributed computing in various forms since 1980, which is documented in more than 300 peer reviewed publications in top scientific journals. Initiated the Nordic Grid collaboration, NorduGrid, and was its spokes person from 2000 to 2003. Other present key positions:

Director of the Danish Center for CERN Experiments (ICE) and the project leader of the Danish contribution to the ATLAS experiment.
Danish delegate to the Global Science Forum consultative group on the Future of High Energy Physics.
Danish delegate to the European Strategy Forum on Research Infrastructure - ESFRI
Danish delegate to the programme committee of the FP6 Specific Programme “Structuring the European Research Area”
Since 1999 member of the Danish Natural Science Research Council and its Chairman since 2001

## Partner 35: UH-HIP

*The Helsinki Institute of Physics, GOV*

HIP is a physics research institute that is operated jointly by the University of Helsinki, the Helsinki University of Technology and the University of Jyväskylä. The research activity at the institute covers an extensive range of subjects in theoretical physics and experimental subatomic physics. The mandate of the institute is to carry out and facilitate research in basic and applied physics as well as in physics research and technology development at international accelerator laboratories. The institute is responsible for the Finnish research collaboration with CERN.

Among the main research fields, HIP has formed a dedicated Technology Programme to concentrate on computing and engineering research related to physics experiments. Currently, the Technology Programme has committed itself fully on the global Grid initiative. Within the programme context, HIP DataGrid project has participated in Grid middleware development efforts in EU DataGrid, especially in the security area. Moreover, the group is represented in LCG deployment board, contributes to NorduGrid ARC development, and provides computing resources connected to NorduGrid. The programme is involved with other Finnish research groups around Grid computing, namely CSC, HIIT and VTT, and helps in the ongoing efforts to form a national Grid initiative. The programme is seeking also industrial collaborations in the area of Grid to pursue technology transfer activities.

HIPs role in EGEE : JRA3: Defininig security policies and architecture for the whole project, coordinating security related testing activities.

More information on HIP Technology Programme can be found at http://www.hip.fi/research/technology/index.html

**Miika Tuisku**, Project Manager at HIP
Mr Miika Tuisku holds a MSc in Computer Science from Helsinki University of Technology. Prior joining HIP Technology Programme in 1999 he worked in Nokia Research Center at Helsinki and in various small IT start-ups. Mr Tuisku is representing Finland in Enabling Grids in E-Science in Europe (EGEE) project and in the North European Grid (NEG) federation. His research interests lie in the area of enabling Grid and ubiquitous multiplatform services using ICT-technologies.

## Partner 36: FOM (NIKHEF)

*PRIV-P*

The National Institute for Nuclear Physics and High Energy Physics has been involved in grid research through various projects. It was one of the prime partners of the European DataGrid Project and among other things involved in WP4 for Grid Fabric research. Moreover NIKHEF is in the centre of eScience in The Netherlands and DutchGrid, the platform for Grid Computing and Technology was born here. Open to all institutions for research and test-bed activities, the goal of DutchGrid is to coordinate the various deployment efforts and to offer a forum for the exchange of experiences on Grid technologies. The DutchGrid CA is housed at NIKHEF and provides authentication services to the Dutch research community for X.509 certificates for grid use. Recently a new initiative, the GridForum Nederland, was started which serves primarily information dissemination among scientific and industrial partners in The Netherlands. NIKHEF also participates in the Virtual Laboratory for eScience VL-E project and leads two sub-programs in this project. Moreover NIKHEF represents The Netherlands in the North European Grid consortium. The institute houses one of the larger grid infrastructures in the country and hosts many central grid services for the EDG development testbed, the application testbed and the LCG production grid. It has played a leading role in the debugging and testing of grid software for those projects.

NIKHEF participates in EGEE through NA4 (applications), SA1 (site operations), and JRA3 (security), building on expertise developed during participation in the EDG project. Applications work will build on our ongoing participation in the D0 experiment and collaboration with Dutch national institutes such as KNMI, and on anticipated collaboration with current astrophysics initiatives. Site operations focuses on continued operation of our LCG Core Site, and on developing a ROC infrastructure together with our partner SARA. Security focuses on essential contributions to the EGEE middleware through our participation on the middleware design team.

For more information see http://www.nikhef.nl/

**Dr. David Groep** obtained a PhD in physics from the University of Utrecht, working on software frameworks for electron-scattering experiments. He has since worked on grid-computing in the context of various Dutch and European projects. He is the chair of the European Grid PMA for authentication, and the architect of the authorisation services in the EU DataGrid. He established the authentication infrastructure for Grid computing in the Netherlands and is a founding member of the European Grid-CA coordination group and the security team. He is active in various GGF security groups on trust management and site authorisation. Nationally, he currently leads the validation program of the Dutch Virtual Laboratory for e-Science project.

**Dr. Jeff Templon** obtained a PhD in nuclear physics from Indiana University. He had postdoctoral appointments in nuclear physics at NIKHEF (Amsterdam) and the MIT Laboratory for Nuclear Science (Cambridge), followed by four years as a Professor of Physics at the University of Georgia (Athens, USA). Dr. Templon had been strongly involved in software projects throughout all these appointments, most notably pioneering work in using Linux as a scientific-computing platform (at MIT) and general scientific-computing work in Hall A at Jefferson Lab (Newport News, VA, USA). Since 2001 he is staff physicist at NIKHEF working on grid computing. He was on the European DataGrid Project Architecture Task Force, a co-editor of the HEPCAL documents (part of the base requirements of the EGEE Grid middleware) and currently serves as Experiment-Independent Expert on the LHC Computing Grid Applications Group (GAG) at CERN.

## Partner 37: SARA

*PRIV-P*

SARA Computing and Networking Services is an advanced center of expertise in High Performance Computing and Networking (HPCN) and infrastructure services. SARA is committed to e-Science, as high-end facilitator of advanced and innovative services, based on grid technology. As a national supercomputing center, SARA concentrates on challenges in scaling experimental environments to high-end production services. The expertise of SARA is applied to advanced technologies in the areas of Computing, Storage, Visualization and Networking.

Since 1985 SARA provides the Dutch National Supercomputing service, hosting and managing the national supercomputer, software, storage facilities and network infrastructure. In addition SARA supports all users of the national supercomputer by documentation, courses and assistance in programming, optimization and parallelization problems. In November 2000 a new national supercomputer system named 'TERAS' was installed, a 1024-CPU SGI Origin 3800. In September 2003 the system has been upgraded by addition of 'ASTER', a 416-CPU SGI Altix 3700.

Besides the national supercomputer, SARA hosts various other supercomputer systems, large Linux clusters, large storage systems and a CAVE virtual reality facility. Furthermore, SARA has large experience and expertise in High Performance Networking, and is responsible for the management of the National Research Network SURFnet.

In the last years SARA has gained vast expertise in the area of Grid technology, through participation in projects like EU DataGrid (FP5) and NL-Grid. SARA is currently involved in a number of international e-Science projects including DEISA (EU FP6), HPC-EUROPA (EU FP6), EGEE (EU FP6), and national projects like Virtual Lab e-Science, GigaPort Next Generation and NL-Grid.

SARA's role in EGEE: SA1: Hosting the Northern Regional Operations Center.

More information on SARA can be found at http://www.sara.nl

**Jules Wolfrat**, Systems Expert and Grid Expert at SARA
Jules Wolfrat has a PhD in Physics. He has 19 years of experience in managing compute facilities for scientific and technical applications. He has led several projects for the introduction of new compute facilities at SARA, one of them the first large distributed memory system at SARA, an IBM 76 node system. He also participated in software development projects. He has experience in High Performance Networking, e.g. connecting systems to a HIPPI network and tuning of network applications. He has several years of experience as a manager of a department of about 20 systems and application specialists. In recent years he was involved in the European DataGrid project and the NL-Grid project.

## Partner 38: UvA

*University of Amsterdam, PRIV-P*

The Advance Internet Research (AIR) group embedded within the informatics institute of University of Amsterdam, consists of 10 researchers. The UvA is a principal contractor for the EU DataTAG project. UvA is both a lead partner in the Dutch Virtual Laboratory for E-sciences (VL-E) project and the GigaPort - Next Generation project. Within these projects the AIR group has a strong focus on cross-domain interactions between Grid resource and the handling of dynamic user communities. As part of these projects the UvA has established relationships with various national and international industrial parties to apply its research to Grid and Network technology developments. Within the GigaPort NG project the AIR group researches optical networks. The focus here is in particular on its control plane, the interaction between control-planes of different networks, the protocol performance when links are deployed at extreme high speeds across large distances and finally the integration of optical networks as a grid resource. The AIR group is active in multi-domain Authentication, Authorisation and Accounting (AAA) for various types of resources used by different types of user communities. Several AIR group members are co-authors of standards related documents that emerge from the IRTF, IETF and GGF. In collaboration with SurfNET and NIKHEF, UvA has capabilities to use a number of high-speed optical test bed installations, connecting to other European and trans-Atlantic networks. The UvA contributes to the EGEE Joint Research Activity 3 (JRA3).

**Cees de Laat** is senior scientific staff member of the Informatics Institute at the University of Amsterdam. De Laat received a PhD in Physics from the University of Delft. He has been active in data acquisition systems, heavy ion experiments and virtual laboratories. Over the past seven years he has been investigating applications for advanced research networks. Current projects include optical networking, lambda switching and provisioning, policy-based networking and Authorization, Authentication and Accounting architecture research. He participates in the European projects DataTAG, EGEE, NEXTGRID and the Dutch ASCII DAS

project. He is responsible for the research on the Lambda switching facility ("NetherLight"), which is currently operational in Amsterdam as a peer to StarLight in Chicago. He oversees and implements research projects in the GigaPort Networks area in collaboration with SURFnet. He currently serves as Grid Forum Steering Group member, Area Director for the Peer-to-Peer area and GGF Liaison towards the IETF. He is co-chair of the IRTF Authentication, Authorization and Accounting Architecture Research group and member of the Internet Research Steering Group (IRSG). <http://www.science.uva.nl/~delaat>.

**Leon Gommans** received his BSc in Computer Science from the College of Advanced Technology in Hilversum in 1981. Ever since Leon has been active in computer networking. He started as network development engineer for ADP Network Services, where he worked on network processor code and traffic monitoring and analyses programs for wide area networks. In 1986 he joined Computervision where he was responsible for the design, implementation and support of Unix based CAD/CAM systems of large enterprises. In 1992 he joined Cabletron Systems where he helped to start the Benelux sales office in 1992 as technical manager. In 1996 he became a ranking member of the Cabletron Systems EMEA organization where he was responsible for the introduction of innovative network products thru several programs for strategic customers and the academic world. In 1998 he became active in the IETF and IRTF within the area of Autentication, Authorization and Accounting (AAA) where is co-author of several RFC's. He left his industrial carreer in 2001 as member of the CTO office and became Sr. Researcher at the University of Amsterdam where he coordinates the activities of the research group in the area of AAA.

## Partner 39: UiB

*University of Bergen, GOV*

The University of Bergen is host to one of the 4 HPC centres comprising the Norwegian Meta Centre. Bergen Center for Computational Science (BCCS) are the research group responsible for the day to day running of the HPC center in Bergen. BCCS have a successful track record in parallel and distributed computing dating back to 1986.

BCCS currently maintain and run an IBM Regatta system and a 32 node linux cluster, with some 32 terabytes of storage.

UiBs role in EGEE: Participant in JRA3 – security infrastructure.

More information about BCCS at UiB can be found at http://www.bccs.no/

**Jeremy Cook**, Principal Scientist at BCCS
Jeremy Cook received a Ph.D from UMIST, University of Manchester, in 1986. In the mid 80s he carried out research with cluster and distributed computing and was one of the early users of hypercube systems. His research has also covered neural computing, structural analysis, and image processing, all in connection with parallel and distributed computing. Dr Cook's parallel computing experience covers both MIMD and SIMD systems.

Current interests are focussed on Grid computing and Grid portals.

## Partner 40: VR

*Vetenskapsrådet, GOV*

Vetenskapsrådet is hosting the Swedish National Infrastructure for Computing (SNIC) which is a meta centre for high performance computing. The SNIC task is to coordinate and develop and operate high end computing resources for Swedish research. Networks, data storage, computers, visualisation equipment and Grid technologies are combined to create a simplified, unified and transparent access to HPC resources.

Through affiliation contracts the 6 major HPC centres in Sweden have joined SNIC. The SNIC member centers are serving academic as well as commercial users and have proven track records in HPC related

development areas such as construction and operation of large scale PC-clusters and storage systems, Middleware for GRID Security and Portals for HPC systems. SNIC is also hosting the SweGrid production test bed consisting of 6 100 node PC-clusters with large scale storage facilities. The SweGrid nodes are connected through the Swedish University Network Backbone (SUNET) which is currently operating at 10 Gbit/s. SweGrid is providing resources to LCG and NorduGrid.

SNICs Role in EGEE: SA1: Hosting the Northern Regional Operations Center

More information on SNIC can be found at http://www.snic.vr.se/

**Anders Ynnerman**, director of SNIC
Professor Anders Ynnerman received a Ph.D. in physics from Gothenburg University. During the early 90s he was doing research on large-scale simulations atomic systems at Oxford University, UK, and Vanderbilt University, USA. In 1996 he started the Swedish National Graduate School in Scientific Computing, which he directed until 1999. From 1997 to 2002 he directed the Swedish National Supercomputer Centre. Since 2002 he is directing the Swedish National Infrastructure for Computing (SNIC). Ynnerman is representing Sweden and the Nordic region in several international collaborations, such as the project Enabling Grids for E-science in Europe (EGEE). His current research-interest lies in the area of visualization of large scale data sets. Since 1999 he is holding a chair in scientific visualization at Linköping University. In 2000 he founded the Norrköping Visualization and Interaction Studio (NVIS). NVIS currently constitutes the largest focal point for research and education in computer graphics and visualization in the Nordic region.

## Partner 41: IHEP

*Institute for High Energy Physics, GOV*

IHEP (also known as Serpukhov) is among the leading Russian centers in elementary particle physics. It was founded in October 1963. On October 14, 1967 the proton accelerator with 70 GeV beam energy, which was the largest at that time, was put into operation. All leading institutes of Russian Federation and other republics of CIS took part in the investigations at this machine. Right here a wide international collaboration in the field of high energy physics with participation of scientists from Europe and the USA has been established, and it still continues at present.
The fundamental discoveries, recognized throughout the world, have been made at the IHEP accelerator. They are:
Observation of two antinuclei and 19 elementary particles, among which are high spin resonances, the particles with properties of new form of matter (glueballs), and exotic states.
Discovery of the scale invariance of hadronic interactions. These results, together with the analogous ones obtained at SLAC for the electron interactions, have been an experimental foundation for the quark theory of elementary particle structure.
Discovery of the growth of the hadronic interaction total cross sections (Serpukhov effect).
Confirmation in polarization experiments of the important role played by spin at high energies.
Discovery of the beam RFQ field focusing principle realized at IHEP and now successfully applied in numerous laboratories around the world.
Eight discoveries, made at IHEP, have been registered at the State Register of Discoveries of Russian Federation. Nine series of scientific works of the IHEP scientists have been marked with the highest government awards. Many results, obtained at IHEP, are widely used in other fields of science and technology.
At present the IHEP 70 GeV accelerator complex is a base to provide a wide research program on the meson spectroscopy, search for exotic particle states (glueballs, hybrids, multiquark mesons and baryons), polarization studies, rare kaon decay observation, and investigations of the neutrino interactions. More than 175 experiments have been approved at IHEP since 1967.
The new accelerator complex - 3 TeV UNK project is under construction at IHEP. A decision has been taken to complete near future the construction of the first UNK stage - the 400-600 GeV proton accelerator.
The Institute participates in both national and international cooperation in high energy physics. The scientific program is carried out by the scientists from Joint Institute for Nuclear Research, Institute of Theoretical and Experimental Physics, Institute for Nuclear Research, Lebedev Physical Institute, Konstantinov Nuclear Physics Institute, Budker Institute of Nuclear Physics, Skobeltsyn Institute of Nuclear Physics at Moscow

State University, Russian Research Center "Kurchatov Institute", Moscow Engineering Physics Institute, Yerevan Physics Institute, Kharkov Institute of Physics and Technology, and CERN. The physicists from Germany, Japan, and the USA participate in the research program as well.
The structure of the Institute is determined by the main trends in the scientific activities. The main goal of the investigations at IHEP is to clarify the nature of the inter-quark forces at large distances, and consequently to understand the basis of nuclear energy, for which they are responsible.

**Vadim Petoukhov** (Vadim.Petoukhov@ihep.ru) received diploma degree in computer science at Moscow Engineering and Physics Institute. He is head of Mathematical and Computer Division in IHEP. He has extensive experience in grid technologies and in providing computing and networking services. Vadim Petoukhov is also coordinator of GRID project in Agency of Atomic Energy.

## Partner 42: IMPB-RAS

*GOV*

E-mail: com@impb.ru
Internet sites: www.impb.ru, www.jcbi.ru
Address: Institutskaya Str., 4, Pushchino, Moscow Region, 142290, Russia
The Institute was founded in 1972, now it involves 140 employees, 70 of them are research scientists. All laboratories are well equipped with up-to-date personal computers, connected with 100 Mbps network. The Institute is also equipped with Linux cluster, including 32-processors. Full-scale Internet facilities are available, the Institute is official Internet-provider of Pushchino Research Center.
Fundamental research: The Institute studies biological objects by means of mathematics and computer science.
Applications: The Institute develops novel information technologies to be applied in biomedicine.
Keywords:applied mathematics, bioinformatics, mathematical modeling, data processing, parallel computing, telecommunications, telemedicine
The Institute works in collaboration with many foreign research institutions, including the National Center for Bioinformatics (USA), New York University (USA), Michigan University (USA), the Institute of Genetics and Molecule and Cell Biology, Strasbourg (France), Nancy University (France), Medical University of Freiburg (Germany), etc.
Many projects of the Institute were supported by Russian Foundation for Basic Research and by foreign foundations, such as NIH, CRDF and ISF (USA), INTAS (EC), CNRS (France) and others.
The Institute performs the following research programs:
Analysis and annotation of databases on molecular biology and biomedicine.
In the framework of the "Human Genome" project software for genome annotation was developed, such as GREAT, CASSANDRA, etc.
The Institute deals with unique problems of revealing the spatial structure of proteins and protein complexes by means of X-ray diffraction.
Computations of biomacromolecule hydration give unique information which can open up all-new avenues for drug design.
The Institute works on the frontier of the method of molecular dynamics.
Novel approaches to the problem of molecular visualization were developed in the Institute.

**Victor Lakhno**, director of IMPB RAS
Graduated from the Moscow Institute of Physics and Technology in 1975, PhD since 1978, Doctor of Science since 1988.
Head of the Sector of Quantum-Mechanical Systems.
Research interests: Theoretical and mathematical physics, computational biology.
Main achievements: New types of polaron excitation in condensed media, magnet systems and electrolytes; new types of electron bound states in clusters; polaron superexchange theory at transfer via electron extended states in proteins, theory of charge transfer in DNA.
E-mail: lak@impb.ru

**Mikhail Ustinin**, vice-director of IMPB RAS
Graduated from the Moscow State University (Physical Department) in 1981, PhD since 1990.

Head of the Department of New Information Technologies.
Research interests: Data processing in medicine and biology, computational biology.
Main achievements: Digital system for medical X-ray diagnostics, program for integrated MRI and MEG analysis.
E-mail: ustinin@impb.ru, u_m_n@mail.ru

## Partner 43: ITEP

*Institute for Theoretical and Experimental Physics, GOV*

ITEP is a multiprofile center for research and education. It's activity is focused on study of the fundamental properties of matter and their use for the development of new technologies, in particular ecologically-safe sources of energy, energy-saving equipment, telecommunications and medicine.
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The main fields of research include theoretical and mathematical physics, astrophysics, high-energy (elementary particle) physics, nuclear physics, plasma physics, solid-state physics, nanotechnologies, reactor and accelerator technoligies, medical physics, computer science.

ITEP has a broad and effective educational program, mostly at the graduate, postgraduate and postdoctoral levels, which allows to prepare qualified specialists in science, finances, business and engeneering.

ITEP is participating in all LHC Collaborations - ATLAS, CMS, ALICE and LHC-b.

EGEE Project leader in ITEP **Vladimir Gavrilov** has graduated from Moscow Physics Technical Institute (1974). Candidate of Science, Research in the field of high energy nuclear physics performed on 10 GeV/c proton beam at ITEP proton syncrotron (1977). Doctor of Science, thesis on “Experimental Study of High Energy Hadron Interactions with Nuclei” (1987).
Recent Research Experience:
The D0 proton-antiproton experiment (E740) at Fermi National Accelerator Laboratory. Leader of ITEP group.
The CMS experiment at the LHC. Leader of ITEP group.
For the moment Dr. Vladimir Gavrilov is Head of the Laboratory of Experimental High Energy Physics at Institute of Theoretical and Experimental Physics.

## Partner 44: JINR

*Joint Institute for Nuclear Research, GOV*

JINR is an international intergovernmental organization located in Dubna, not far from Moscow, was established within the framework of the Convention signed by the Plenipotentiaries of the governments of the Member States in March 1956 in Moscow. The Joint Institute was created in order to unify the intellectual and material potential of Member States to study the fundamental properties of matter. JINR has at present 18 Member States.
JINR is now a large multi-branch international scientific centre with activities incorporating fundamental research of the structure of matter, development and application of high technologies, and university education in the relevant fields.
The structure of JINR is determined by scientific specialization. JINR has 7 Laboratories and 2 Divisions: Bogoliubov Laboratory of Theoretical Physics, Veksler and Baldin Laboratory of High Energies, Laboratory of Particle Physics, Dzhelepov Laboratory of Nuclear Problems, Flerov Laboratory of Nuclear Reactions, Frank Laboratory of Neutron Physics, Laboratory of Information Technologies, Division of Radiation and Radiobiological Research, University Centre.
The main fields of the Institute's research are: theoretical physics, elementary particle physics, relativistic nuclear physics, heavy ion physics, low and intermediate energy physics; nuclear physics with neutrons; condensed matter physics; radiation biology and radiobiological research; networking, computing and computational physics; educational programme.

The principal facilities of the Institute for experimental investigations are: nuclotron, U-200, U-400 and U-400M heavy ions cyclotrons, IBR-2 pulsed reactor with neutron, synchrophasotron, phasotron, computer centre.
BROAD INTERNATIONAL COOPERATION is one of the most important principles of the JINR activity. Almost all investigations are carried out in a close collaboration with JINR Member States' scientific centers as well as international and national institutions and laboratories in the world.
A fruitful scientific cooperation is under way with CERN and with many physics laboratories in USA, France, Germany, Italy, Switzerland and other countries. Dubna specialists participate in the experiments performed at the CERN and USA accelerators: LEP, SPS, and Tevatron. New detectors for LHC (CERN) are being designing.
JINR has bilateral agreements, protocols and other documents concluded with 712 institutions in 57 countries.

EGEE project leader in JINR **Vladimir Korenkov** has graduated from Moscow State University (Department of Computing Mathematics & Cybernetics, 1976). Candidate of Physics and Mathematics (1985), deputy Director of the Laboratory Information Technology of JINR, head of the Department «Distributed Informational - computational systems» of International University «Dubna». He is head of project “Computing & Networking at JINR” and leads the activity in the field of Grid technology.

## Partner 45: KIAM RAS

*Keldysh Institute of Applied Mathematics (Russian Academy of Sciences), GOV*

KIAM RAS was founded in 1953 to solve complex mathematical problems involved in national projects of space exploration, atomic and thermonuclear energy application, etc. This goal was meant to be achieved by developing appropriate computer hardware and software facilities. The Institute founder and first director (1953-1978) was President of the USSR Academy of Sciences Mstislav Keldysh.
The Institute has been an initiator in utilizing computer facilities in the USSR. The first serial computer was installed at the Institute and the first national team of engineers was formed to perform pioneer work for the development of computer software.
The activity in the field of Grid technology began in 1998 on the basis of different software: Globus toolkit, batch processing system OpenPBS, DQS and Condor. Our experimental testbed constructed from two distributed nodes is used for software development, testing and elaboration.
Ongoing researches are aimed at futher development of the Grid middleware in direction of resource usage optimization and quality of service enabling by means of automatic job scheduling. We have implemented Grid Dispatcher with the new architecture that includes:
- the new component of local resource management that forecast future resource usage in a batch system;
- the global scheduler that implements algorithms for job distribution taking into account the load of each resource;
- information service, oriented on event monitoring in local systems.

These works are supported by the Russian Foundation for Basic Research and the Ministry of Science and Education.

EGEE project leader in KIAM RAS **Dmitry Koryagin** has graduated from Zhukovski Air Force Engineering Academy (1959). Candidate of Technical Sciences (1965), doctor of Physical and Mathematical Sciences (1984). The laureate of the Council of Ministers Premium (1986). Dmitry Koryagin is the professor of the system programming department at the Moscow State University and Science vice Director of KIAM RAS.
In 1993 he initiated works on KIAM corporative information network creation, which today contains over 400 personal computers, workstations and servers. Since 1998 he leads the activity in the field of Grid technology.
Personal page: http://www.keldysh.ru/Dir_board/koryagin.html
E-mail: koryagin@keldysh.ru

## Partner 46: PNPI

Petersburg Nuclear Physics Institute, *GOV*

PNPI is situated in Gatchina, 40 kilometers away from St.-Petersburg. Main directions of the scientific research activity in PNPI are high energy physics, neutron physics, condensed matter physics, theoretical physics, molecular and radiation biophysics and information technologies application and development. Our institute is the participant of much international collaboration including the LHC project, where PNPI takes part in creating detectors for the CMS, ATLAS, Alice and LHCb experiments. To support the research activity in PNPI, there is a local network of more than 700 PCs and a computational cluster dedicated to HEP data analysis. Staff of the institute includes more than 600 scientists and about 1000 engineers.
We have been working with Grid software for more than three years so far. Starting with the Globus Toolkit 1.1 in early 2001 we now running the full set of LCG software. We have launched a small Grid testbed with several academical institutions in St.-Petersburg and our plans include integration with other scientific organizations as a part of the Russian Data-Intensive Grid (RDIG) consortium.

**Prof. Yury Ryabov** is a leader of PNPI Information Technologies and Automation Division (ITAD). He's been taking part as a leader from PNPI in Atlas DAQ, DCS and TRT production DB development. He also has wide experience in network development, under his supervision was developed an academical network in St.-Petersburg – ROKSON, which includes over 40 academical and educational institutions. He is a chairman of the Center of Scientific Telecommunications of St.-Petersburg branch Russian Academy of Sciences. His activity also includes deployment of the Grid technologies in the framework of the ROKSON infrastructure.
Yu.Ryabov is a professor of St.-Petersburg State University.

**Jr. scientist Andrey Kiryanov** has wide experience in Grid software and cluster management. In 2002 he was taking part in EDG WP4/Installation task. He has developed the WP4/Installation proposal for the Global Schema and the WP4/Installation Software Repository. Technical notes about this work are available via the CERN EDMS: https://edms.cern.ch/document/372744 and https://edms.cern.ch/document/372735 and are now used in CERN Quattor product. In 2003 he was working for LCG C&T group and has developed the WMT visualization tool which is widely used in LCG Test Suite.

## Partner 47: RRC KI

*Russian Research Centre (Kurchatov Institute*), *GOV*

RRC KI (http://www.kiae.ru) - the first state national research Centre of Russia - was established on the basis of the I.V. Kurchatov Institute of Atomic Energy (former Laboratory № 2 of the USSR Academy of Sciences founded in 1943) in November 1991 in accordance with Decree of the President of Russia. The Centre is placed under the direct authority of the Government of Russia and does not enter either the Russian Academy of Sciences or any branch Ministry.
At present the object of the RRC KI activities is a complex solution to the problems of safe and environmentally friendly power generation on the basis of nuclear fission and fusion reactions, pursuance of fundamental physical research and development in this and adjacent fields. The basic activities of RRC KI are nuclear power and fuel cycle, controlled thermonuclear fusion and plasma processes, nuclear and molecular physics, solid state physics and superconductivity, as well as some new contemporary directions:
extensive research in natural science including biology, chemistry, micro fabrication technologies, medicine, material study;
research works in the field of defense technology conversion, scientific support of implementation of the research results in various national economy branches;
research and development in the area of microelectronic technology and information systems.
In particular RRC KI has one of the largest operational centres of NREN in Russia, support the .ru domain zone.

EGEE project leader in RRC KI **Alexey Soldatov** has graduated from Moscow Institute of Engineering Physics in 1974, theorist, doctor of Physical and Mathematical Schiences (1987), professor of Moscow Physical Technical Institute. The current post is R & D Director of RRC KI. E-mail: saa@kiae.su

Alternate EGEE project leader in RRC KI **Vladimir Dobretsov** has graduated from Moscow Physical Technical Institute in 1987, theorist, candidate of Physical and Mathematical Schiences (1997). The last five years he has been working as both developer and manager doing various information and network projects in RRC KI. E-mail: dvy@relcom.ru

## Parner 48: SINP MSU

*GOV*

SINP of MSU is an independent institution for research and education forming part of the MSU structure.
SINP is an institute known over the world in the field of high energy physics, physics of nuclei and space. Wide- scaled investigations of a space and space medium influence on materials and on spacecraft equipment are carried out at this Institute.
The Institute carries out both theoretical and experimental fundamental and applied researches regarding high energy physics, processes of interaction between radiation and substance, nanoelectronics, development of telecommunication and information technologies, applies up-to-date physical methods in student practical works at the nuclear physics division (NPD) of the physical faculty of MSU.
SINP participate in the leading international collaborations: CERN, DESY, BNL, FNAL, RUNJOB, ATIC and others.
SINP has a high-developped computer infrastructure which meets the main computation and information requirements of the Institute as a whole and the ones of its units. A number of scientific data bases has been created, including the data bases of international projects. The data base on photo nuclear reactions as well as the one on space physics (project BAFIZ-2) are among them. SINP has been one of the leader in the establishments of the Russian regional center for processing and analysis of data from the accelerator LHC (CERN, Switzerland). Within the scope of this largest international project a powerfull computational cluster has been established.

**Dr. Viatcheslav A. ILYIN**, Deputy Director, is one of the leading scientists of SINP. He was educated in Physics Faculty of Moscow State University. Master thesis on renormalizations in quantum field theory in 1975. PhD thesis on “Algebras of observables in S-matrix axiomatic quantum field theory” on 1980. Doctor degree on “Theoretical analysis of collision processes at high energies and development of software for its automatizing” in 1997. He is a author more than 100 publications. The main his interests are: computing in theoretical high energy physics, collider phenomenology. Now he is Project Manager of EGEE in Russia.

**Dr. Alexander P. KRYUKOV**, Senior Researcher, is one of the leading scientists of SINP. He was educated in Physics Faculty of Moscow State University. Master thesis on diffraction scattering in quantum field theory in 1977. PhD thesis on “Computer Algebra Methods and their Application in High Energy Physics” on 1988. He is a author more than 60 publications. The main his interests are: computing in theoretical high energy physics, collider physics, computer algebra. Now he is Team Leader of EGEE project in SINP.

## Partner 49: CLPP-BAS

*Also IPP-BAS, Institute for Parallel Processing, Bulgaria, GOV*

IPP is founded in 1985 http://www.bas.bg/clpp/index.html IPP has a leading position among the scientific institutions in Bulgaria in the fields of computer science and scientific computations. It performs research, consultations, projects and high quality education. The activities of IPP are oriented mainly to the creation and usage of advanced mathematical and computer technologies. The IPP fundamental results are motivated by the developed new methods, algorithms and software as well as by introduced advanced information technologies and computer facilities. IPP staff members have always been actively participating in the formation of Bulgarian National strategy, priorities and policy in these areas. Nowadays IPP consists of six divisions. The total staff of IPP is 112 persons including one academician, one corresponding member of the Academy, six full professors, 24 associate professors, 39 research assistants and 20 university educated specialists.
Central Laboratory for Parallel Processing and Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences established and coordinate the BgGrid activity, in collaboration with other institutions from Academic, Research and Industry of Bulgaria. Main objectives of the BgGrid initiative are to facilitate the application of grid technologies within educational, research, and governmental institutions, to promote

and support the development of the Bulgarian Grid infrastructure and the Bulgarian national research and education network, to represent and coordinate the Bulgarian Grid community initiatives in the international R&D co-operation. An aggregate of 8 G4 CPUs/site will be available from the 2 major sites in BAS (IPP and INRNE).IPP-BAS will become the local support center and interface with the regional deployment and support centre run by GRNET.
IPP has been, and still is, an active participant in a number of research and educational projects of the EU programs INCO-COPERNICUS, TEMPUS, PECO, GO EAST GO WEST, etc. as well as in NATO Scientific Programs. A lot of the scientists of the Laboratory have been on long-term specialization in USA, UK, Denmark, France, Germany, the Netherlands, etc. IPP is one of the few Centres of Excellence in the field of Informatics in Central and Eastern Europe. In January 2001 officially started the prestigious Project "Bulgarian Information Society - Center of Excellence for Education, Science and Technology in 21 Century (BiS-21)" supported by the European Commission within the Fifth Framework Program.

**Prof. DSC Ivan Dimov** is a director of the Central Laboratory for Parallel Processing of the Bulgarian Academy of Sciences and head of the Center of Excellence BIS-21. He became PhD in Mathematical modelling in Faculty of Electronics, Moscow Energy Institute, Russia, 1980 and DSc in Numerical Analysis in Faculty of Electronics, Department of Numerical Analysis, Moscow Energy Institute, Russia, 1984. He was an assistant researcher in Numerical Analysis at the Institute of Mathematics, Bulgarian Academy of Sciences, Sofia, Bulgaria, 1982-1985, an associate professor in Numerical Analysis at the institute of Mathematics, Bulgarian Academy of Sciences, Sofia, Bulgaria, 1985-1990, an associate professor in Parallel Algorithms, head of the Laboratory of High-Performance Systems and Parallel Algorithms, Deputy Director of the Center for Informatics and Computer Technology, Bulgarian Academy of Sciences, Bulgaria, 1990-1995. From 1995 to 1996 he was deputy director of the Central Laboratory for Parallel Processing (successor of CICT). From 1996 he is professor in Mathematical Modelling, BAS, Bulgaria and director of the Central Laboratory for Parallel Processing, Bulgarian Academy of Sciences, Bulgaria. From 2000 he is head of the Bulgarian Information Society Centre of Excellence for Education, Science and Technology in 21 Century, Bulgaria. He participated in several R&D projects in Europe: Joint project between the Institute of Parallel Information Systems, CNR - Italy and the Center for Informatics and Computer Technology, B A S (1991 - 1994); Joint project between the National Environmental Research Institute, Roskilde - Denmark and IPP - B A (1993-1995); Joint project between IMAG and CICT - B A S (1993-1996); joint project between the University of Liverpool, the University of Newcastle and IPP - B A S (1994-1996); COPERNICUS Project # CP 94682: Parallel computation of spectral portraits of matrices and application to system stability analysis; Joint project between the National Environmental Research Institute, Roskilde - Denmark and IPP (1996-1998); INCO-COPERNICUS Project # 960237 (1997-1999); EC Project # ICA1-CT-2000-70016 "Bulgarian Information Society Center of Excellence for Education, Science and Technology in 21 Century" (2000-2003) He supervised six graduate students and six PhD students, authored more than fifty research papers and is editor of six books. He gave numerous talks in scientific conferences.

## Partner 50: UCY

*University of Cyprus, GOV*

The Dept. of Computer Science is one of the four departments of the School of Pure and Applied Sciences at the University of Cyprus. The Department has a full-time staff of 17 faculty members, 5 visiting-faculty members, 5 teaching-staff members, over 40 full-time researchers, over 200 undergraduate and 100 postgraduate students. The Department attaches major importance on research and development in areas like Distributed Systems and Networking, Fixed and Mobile High-Speed Networks, Middleware, Intelligent Systems, Medical Informatics, Web Mining, etc. Strong emphasis is put on competitive research that can benefit the local industry. Departmental computing resources include: five symmetric multiprocessor servers running AIX, Solaris and Linux, interconnected via Gbit Ethernet; one graduate research lab with 20 AIX (IBM 43P) and 5 Sun (Sun Blade) workstations; three undergraduate labs for programming and digital design with 20 IBM PC's each; a number of research laboratories focusing on Networking, Mobile Computing and High-Performance Systems, etc. These Laboratories are connected with the Cyprus Research and Educational Network (CYNET), hosted at the University of Cyprus and participating in the Geant Consortium. Currently, the Department runs a large number of research programs funded by the European Union through the IST-FP5, IST-FP6, and the EUMEDIS programs. The High-Performance Computing Laboratory has been established in May 2001. Currently, the Laboratory has a full-time staff of five Research Associates, three part-time Research Assistants, and a number of student assistants. It runs and operates two high-speed

clusters hosting the Cypriot node of the large European Grid testbed. The Laboratory represents the focal point of Cy-Grid, a forum for promoting Grid activities in Cyprus, and anticipating the provision of European-Grid access to a number of private and public institutions and research units of Cyprus. Currently, the Laboratory participates to a number of Research Projects and Working Groups, focusing on:
• Grid Computing (IST Project CrossGrid; funding source: EU)
• Performance Analysis (IST Working Group APART; funding source: EU)
• Web Technologies (Project eRACE; funding source: Republic of Cyprus. Project WebC-MINE; funding source: Republic of Cyprus.
Furthermore, the Laboratory is involved in projects working on Distributed 3G Network Simulations (IST Project Seacorn; funding source: EU) and mobile services for the health sector (Project Ditis; funding source: Republic of Cyprus).
The High-Performance Computing Laboratory has been coordinating the Cyprus Grid (CyGrid) activity, in collaboration with other Laboratories and Institutions from Academic, Research and Industry of Cyprus. Main objective of the CyGrid initiative is to coordinate Cypriot research groups and institutions that have expressed an interest in Grid or Grid-related technologies, to provide support and know-how transfer, to diffuse Grid technologies in other Cypriot scientific and research sectors. Currently, HPCL runs two Grid testbeds: one is the official CyGrid testbed that runs in production mode, and the second is experimental and is being used for research and development. HPCL supports and administers the national services including CyCA, the Certification Authority of CyGrid. UCY has participated in the IST CrossGrid project and has gained significant experience in operating a Grid.

**Marios Dikaiakos**, PhD, UCY. Head, High -Performance Computing Lab, Dept. of Computer Science. He will be leading the overall activity with the support from professional personnel from UCY and other institutes. Marios Dikaiakos, holds a Dipl.-Ing. in Electrical Engineering from the National Technical University of Athens, Greece (summa cum laude, 1988), an M.A. and a Ph.D. in Computer Science from Princeton University, USA (1991 and 1994 respectively). Dr. Dikaiakos is an Assistant Professor of Computer Science at the University of Cyprus since 1998, where he heads the High-Performance Computer Systems Laboratory. Before that, he worked at Princeton University (Research Assistant, 1988-1993), the Paris Research Laboratory of Digital Equipment Corporation (Fall 1990), the University of Washington in Seattle (Research Associate, 1994, 1995), and the University of Cyprus (Visiting Assistant Professor, 1996). Currently, Dr. Dikaiakos leads the Grid Computing activities at the University of Cyprus, in the context of the CrossGrid, APART, and EGEE programs. From 2000 to 2002, Dr. Dikaiakos served as Delegate of Cyprus to the IST Committee, the high-level body overseeing the IST Program of the European Union under FP5. He has also served as a Reviewer and External Evaluator for the IST Program (KAI, KAII, KAIV, Grid Technologies), and a consultant on Internet Security for the Public Power Corporation of Greece. He was Program Chair of the 2nd European Across Grids Conference. His research interests include Middleware for the Grid and the Web, Adaptable Services, Mobile Agents and Web Characterization.

## Partner 51: GRNET

*Greek Research & Technology Network, PRIV-P*

GRNET S.A. (www.grnet.gr) was founded in 1998 and is a state owned company under the supervision of the Hellenic Ministry of Development - General Secretariat of Research and Technology.
Its main mission is the provision of high-quality international and national infrastructure services (networking – grid) to the Greek Academic & Research institutions and to support Research and Educational activities of the public and private sector. In addition, GRNET promotes and disseminates the use of ICT in the public and private sector towards a knowledge-based Information Society (eGovernment, eLearning and eBusiness).
GRNET played a leading role in the establishment of the Hellas Grid Task Force (http://www.hellasgrid.gr), which was ratified by the Ministry of Economic & Finance in 2002. The basic objectives of the Hellas Grid initiative were to propose the nationwide strategy and steer the operation of the national infrastructure. Furthermore the HellasGrid Task force systematise the procurement of 5 main resource islands all over the country (Athens (2), Thessaloniki, Patras and Heraclion-Crete), complemented by existing academic and research infrastructures. An aggregate of 640 CPUs and 10 TB of storage will be available from the major sites by the second year of the project. In EGEE, GRNET will undertake the Regional Operation Center for

SEE, and also serve as the leading networking, training and dissemination institute. Hellasgrid partners will provide resources through the third parties mechanism.
HellasGrid consists of representatives from multiple disciplines such us High Energy Physics, Bio Computing, Meteorology, Earth Sciences, Virtual Collaboration Environments etc. Key institutions are among others the National Centre of Scientific Research Demokritos (http://www.demokritos.gr), the University of Athens (http://www.uoa.gr), the Aristotle University of Thessalonica (http://www.auth.gr), the National Technical University of Athens (http://www.ntua.gr), the University of Macedonia (http://www.uom.gr), the Foundation for Research and Technology Hellas (http://www.forth.gr) and the National Observatory of Athens (http://www.noa.gr).
HellasGrid Task force members participated in FP5 Grid projects including CrossGrid, GRIA, and GRIDLAB. The HellasGrid members also run the national services such as the HellasGrid Certification Authority and information. There is significant experience deploying the Globus middleware with the IST Datagrid extensions.

**Dr. Fotis Karayannis** received the Dipl.-Ing. Degree from the Department of Electrical and Computer Engineering, National Technical University of Athens, Greece, in 1994. He completed his Ph.D. in January 1999 in the Computer Science Division of the same university in the fields of Integrated Communications and Management of Broadband Networks. He has been a research associate both at the Telecommunications Laboratory and the Institute of Communications Systems and Computers of National Technical University of Athens (ICCS) from 1994 to 1999 participating in multiple RACE, ESPRIT and ACTS projects. In the ACTS MISA he was the technical leader in Software Development and Integration Work Package. He has also worked on behalf of NTUA as an associate in internal projects with OTE for the specification of the Management System of national SDH network, INTRACOM in the software design of a distributed management system for radio and microwave networks. 1999 he joined the Army's Special Force for Research and Informatics. He then worked for OTE Consulting (now TEMAGON), where he participated in European Research projects (Eurescom, IST) and in particular in the IST WINMAN project. From 9/2000 he has been working for the Greek Research and Technology Network (GRNET) as the Technical Development Manager dealing with the development of the next generation infrastructures (networking and Grid services) for the Greek Academic and Research Institutes. During 2002 he took over the responsibility of representing South East Europe (Bulgaria, Cyprus, Greece, Israel, Romania) in the Executive Committee of the EGEE project- Enabling Grids for E-science in Europe. In January 2003 he was appointed the Coordinator of the Scientific Committee of the Greek National Grid Initiative – Hellasgrid Task Force, Secretariat for the Information Society, Ministry of Economy and Finance. In 2003 he also undertook the coordination of Grid GRNET activities & projects, participating in GRNET Strategic Planning Team. He is a regular reviewer of IEEE Communications magazine and other IEEE magazines and conferences related to control and management planes of broadband and grid networking. He has been proposed by EU as a reviewer for the Framework Programme 6 in the area of Research Infrastructures (Network Communication and Development-Grids). He has authored more than 30 articles in international books, journals and conferences.

## Partner 52: TAU

*Tel Aviv University, PRIV-P*

TAU is the largest university in Israel, located in the heart of the major urban and commercial area of Israel. http://www.tau.ac.il. TAU has played a leading role in getting all Israeli universities to agree to the establishment of the Israel Academic Grid (IAG) http://iag.iucc.ac.il. IAG is defined as a project within IUCC (Inter University Computing Center) http://www.iucc.ac.il/, the Israeli NREN. The IUCC is an independent legal entity, hosted by TAU. IUCC is the coordinating body of computing resources in Israeli academia and its contact point to international computing. It is a member of GEANT. In addition to its PC island, it maintains three super-computers for the use of Israeli academia. An aggregate of 350 CPUs and 18 TB of storage will be available from the major sites.
TAU will be responsible for SA1 and NA3 activities of EGEE in Israel. Some of the burden will be shared by the IUCC that will be responsible for certification in Israel and for coordination of activities between all the participating institutes. Grid nodes participating in EGEE will be located at TAU, at the Weizmann Institute of Science, at the Technion, Israel Institute of Technology, and possibly at other universities in Israel. All these institutes collaborate within the newly founded IAG mentioned above.

**Prof. David Horn**, School of Physics and Astronomy, TAU. He will be leading the overall activity within EGEE in Israel. He is also the chairman of the steering committee of IAG. Prof. Horn received his Ph.D. in Physics in 1965 from the Hebrew University in Jerusalem, Israel. He has done theoretical and phenomenological research in High Energy Physics since the early 1960s. He has joined the TAU faculty in 1967 and was appointed Professor of Physics in 1972, and incumbent of the Jaupart Chair in Theoretical Physics of Particles and Fields in 1974. Prof. Horn has been a frequent visitor to centers of excellence in Physics such as Caltech, CERN and SLAC. He has served as Vice-Rector of Tel Aviv University in 1980-3, as Chairman of the School of Physics and Astronomy in TAU during 1986-9, and as Dean of the Raymond and Beverly Sackler Faculty of Exact Sciences in TAU during 1990-5.He has played leading administrational roles also outside the framework of TAU. He has been the President of the Israel Physical Society during 1985-8. He has served as Chairman of the Israel Commission for High Energy Physics throughout 1983-2003. As such he has also been the Israeli Observer at CERN Council during 1991-2003. Prof. Horn has been the Chairman of the Israel Liaison Committee to IUPAP, 1985-1992, and served as a member of the Executive Committee of the European Physical Society during 1989-92. He has also served as a member of the Israel Council for Higher Education, 1987-1991.
The academic research of Prof. Horn in High Energy Physics resulted in one book and 110 journal articles. In the late 1980s he has switched his research focus to Neural Computation, a field in which he has additional 90 publications. He has had numerous graduate students and maintains active research and teaching careers in parallel to his interest in furthering initiatives in scientific research and development. He has been Director of the Adams Super Center for Brain Studies in TAU 1993-2000, fostering multidisciplinary activities in this area, and served as Chairman of the Interdisciplinary Center for Technological Assessment and Forecasting at TAU during 2000-4. In 2003 he has started his initiative of creating the IAG and he serves now as its chairman. His personal website is http://neuron.tau.ac.il/~horn.

## Partner 53: ICI

*PRIV-P*

National Institute for Research & Development in Informatics – ICI, http://www.ici.ro/, Bucharest was created in 1970. Since then the institute has been acting as a leading unit in Romanian IT Research and Development. Six Academy awards were granted to the National Institute for R & D in Informatics - ICI people for their results. In 1999, ICI was ranked first among R & D Romanian organizations, in the EC survey "Impact of the enlargement of the European Union towards the associated central and eastern European countries on RTD - innovation and structural policies" (p.194, Office of official publications of the EC, 1999). Since 2000 the institute is certified ISO-9001. Currently the institute is subordinated to the Ministry for Communication and Information Technology.
The institute is located in an eight-store building in a residential area of Bucharest, with an useful surface of about 3,500 square meters.ICI is coordinating the RoGRID Consortium set-up in 2002 at the initiative of the Ministry for Communications and Information Technology. It includes University Politehnica of Bucharest (UPB), University of Bucharest (UB), National Institute for Physics and Nuclear Engineering (NIPNE), National Institute for Aerospace Research Bucharest (INCAS), Institute for Nuclear Research Pitesti (ICN), Software Company SIVECO Bucharest. An aggregate of 77 CPUs and 4,2 TB of storage will be available from the major sites. Integration of the Operations, support and maintenance team of the national grid initiative in Romania will be coordinated by the ICI institute http://www.ici.ro/ located in Bucarest leading the RoGrid consortium.
Main projects started in 2002 at the RoGRID level and supported by the National Research Programmes refer to: the strategy of Grid development in Romania, a metropolitan area Grid infrastructure, development of Grid technologies and applications pilot for high performance computing in nuclear physics, complex distributed high performance system for process modelling.
The national education and research networking infrastructure (including RoEduNet and RNC networks) connecting more than 750 organizations and 230.000 individuals, provides the main support for the Grid infrastructure development. For 2003 the connectivity between these two networks will be up-grated to 1 Gbps, while the GEANT connectivity will be up-grated to 622 Mbps. Grid infrastructure is under development at UPB, ICI, NIPNE, INCAS.
This integration with the regional and pan-European effort requires 1 FTE/Year funding by EGEE plus 0,2 for travel and other expenses (total 1,2 funded). This is translated in 3 local FTEs per year with the Institute's yearly rate.

**Gabriel NEAGU** is senior researcher and Head of Department for Large scale projects in the National Institute for R&D in Informatics (ICI) Bucharest. He has been working in this institute since 1974 and during his professional career he reached an extensive experience in research and development activities for IT systems in industry and administration. He has a Ph.D. in Applied Informatics at University "Politehnica" Bucharest. Since 1985 he is member of Scientific Council of ICI. He is Associate professor at University "Politehnica" and University "Valahia" Targoviste. He is author/co-author of more than 40 papers published in national and international journals and proceedings. He was IPC member and/or session chair at 12 international conferences. His international experience includes also local coordination for several EU funded research projects (e.g. EU/ INCO COPERNICUS MULTISERVE Project 1454; EU/INCO COPERNICUS RaPOrt Project 1191; EU/FP5 NASTEC Project IST-2000-29556, IDEALIST project IST-1999-14184) and participation as IT consultant in some others international projects like FP5/ENLARGE Project IST-2000-29381, EU/PHARE projects RO 9713.01 and RO 9804.05.01. He is evaluator expert for FP5/FP6 projects and member of FP6 Experts Group of the Romanian Ministry for Education and Research. Since May 2002 he is member of Executive Committee of the RoGRID Consortium as the National Initiative inGrid domain. In 2002 he coordinated the research project for drafting the National Strategy forGrid development in Romania. Head of Department for Large scale projects in the National Institute for R&D in Informatics (ICI) Bucharest. He will be leading the overall activity with the support from professional personel from RoGrid.

## Partner 54: LIP

*PRIV-P*

LIP focuses on particle physics and instrumentation technologies, including embedded processors, data transmission equipment and data acquisition systems. It maintains a flexible portfolio of technology development, technology transfer and dissemination, which includes Positron Emission Mammography and Grid Computing.
SA1: Quality Assurance of operational techniques and run the backup Operations Team for Southwest Europe.

**Gaspar Barreira** began his scientific career at the Nuclear Physics Center of the University of Lisbon. He was director of the microprocessor laboratory of the International Theoretical Physics Centre in Trieste. His main area of research is High Energy Physics and associated instrumentation. Presently he is research co-ordinator and director at LIP. He is a research scientist with extensive experience in the fields of data acquisition systems, trigger technologies and data transmission technologies. He is the Portuguese representative at the High Energy Physics Computing Co-ordination Committee (HEPCCC), at the CERN LHC Computing Grid Deployment Board and LHC Resource Review Board. He has been involved in several European and international computing projects. Presently he is also one of the directors of the Portuguese academic research network (FCCN).

**Jorge Gomes** is a LIP senior computing research scientist, with experience in telecommunications, networking, security, and Grid technologies. He has been involved in several national and international projects on data acquisition systems, networking and grid technologies. Presently he is head of the LIP computer centre in Lisbon and responsible for the LIP participation in the CrossGrid project where he is testbed deputy and responsible for the testbed verification and quality control. He is also working on the deployment of the Portuguese LHC computing infrastructure.

## Partner 55: CESGA

*Supercomputing Center of Galicia, PRIV-P*

CESGA provides horizontal services in High Performance computing, High Throughput computing and Regional Networking services to scientific, technological and industrial users. It will apply its wide experience in operational services, user support and adaptation of applications to EGEE.
SA1: Development, adaptation, deployment and operation of Monitoring and Accounting Components.

**Ignacio López Cabido** is the Technical Manager at the Supercomputing Center of Galicia (CESGA). He obtained his B.S. in Physics from the Universidad Complutense de Madrid and his Ph.D. in Physics from the University of Santiago de Compostela. He worked as a senior system engineer for Fujitsu Spain for more than 5 years in the High Performance Computing group, specialized in vector and parallel supercomputing systems. After that, he moved to his actual position at CESGA, having more than 10 years of experience managing computing and networking resources, and have acquired extensive knowledge and experience in the areas of resource monitoring, administration (focused on obtaining maximum performance) and accounting for all systems mentioned above. CESGA (www.cesga.es) is a Limited Company providing horizontal services to different institutions with varied scientific research and development interests (computational chemistry, meteorology, high-end computing architectures and methods, telecommunications technologies, particle physics, engineering, etc.). Also he participates in several projects related to Grid technologies, including the Crossgrid

## Partner 56: CSIC

*GOV*

CSIC Largest scientific research institute in Spain. Experience in grid projects (CrossGrid) and applications in several scientific areas. Promoter of the Spanish grid initiative, IrisGrid.
NA4- the Centro Nacional de Biotecnologia will collaborate with CNRS on applications for genomics and proteomics.
SA1- the Instituto de Fisica de Cantabria and the Instituto de Fisica Corpuscular will provide a secure high availability CA service and VO management.
The two other activities come from the participation of the Spanish NREN, RedIRIS:
NA5- RedIRIS support project activity on international cooperation especially through the organization of the European
EInfrastructure reflection group and the production of a series of eInfrastructure White Papers and roadmaps.

**José María Carazo**
Master in Physics in 1981, to be followed by a PhD in Molecular Biology at the University Autonoma of Madrid (UAM) in 1984. He is the person in charge of Biocomputing Unit of National Centre for Biotechnology (CSIC). This Unit is an interdisciplinary team of people working on Computational and Structural Biology and Bioinformatics, and managing the Spanish national node of the EMBnet (European Molecular Biology Network). The Biocomputing Unit is also an international partner of the NPACI (National Partnership for Advanced Computational Infrastructure) funded by the National Science Foundation (NSF).

## Partner 57: IFAE

*PRIV-P*

IFAE focuses on particle physics while maintaining a flexible portfolio of activities in technology innovation and transfer (e.g. pixel detectors for mammography, synchrotron light sources, cluster computing, DataGrid, CrossGrid). IFAE coordinates the Southwest region.
SA1: Its Port d'Informació Científica Division (PIC), with collaboration of the CIEMAT, will host the Southwest Operations Team and a Petabyte-level data facility.

**Manuel Delfino** is Professor of Physics at the Universitat Autonoma de Barcelona, Spain (UAB) and Adjoint Researcher at the Institut de Física d'Altes Energies (IFAE) in Barcelona. He is currently the Director of the Port d'Informació Científica (Scientific Information Port) in Barcelona and the Coordinating Principal Investigator of the LHC Computing Grid Project in Spain. He was on leave during 1999-2002 serving as Leader of the Information Technology Division of CERN, the European Organization for Nuclear Research based in Geneva, Switzerland.

Prof. Delfino holds a B.S. in Applied Mathematics, Engineering and Physics, an M.S. in Physics and a Ph.D. in Physics with a minor in Computer Science, all from the University of Wisconsin in Madison.

Prof. Delfino's research results in particle physics include the first direct evidence for weak neutral currents between electrons and positrons using the MAC detector at the Stanford Linear Accelerator Center and precision measurements of Z boson decays to leptons using the ALEPH detector at CERN. On the scientific instrument side, he participated in the development of the first large scale gas calorimeters in the 1980s and more recently in development of the ATLAS Scintillating Tile Calorimeter.

In addition, Prof. Delfino has devoted a large effort in his career on integrating distributed computation into scientific activities. He lead the ALEPH FALCON quasi-online data processing facility based on a farm of loosely coupled commercial processors and he was the spokesperson of the CERN RD-47 project which served as proof of concept for building large-scale processor farms using inexpensive Personal Computers. While at CERN, he helped to launch the EU DataGrid and the LHC Computing Grid projects.

Prof. Delfino proposed in 2001 the creation of the Port d'Informació Científica (PIC), an innovative center focused on providing Grid-enabled resources for data-intensive scientific computing. PIC was created in October 2002 and is currently funded through a collaboration agreement between CIEMAT (Ministry of Education and Science, Spain), DURSI (Department of Universities and Research, Catalonia), UAB and IFAE.

## Partner 58: INTA

*GOV*

INTA is a multi-disciplinary institute with core activities in aerospace and experience in High Performance Computional environments. Its Centro de Astrobiología (CAB, associated to the NASA Astrobiology Institute) focuses on research in fundamental biology related to search for life in extreme environments.
SA1: CAB's Advanced Computing Lab will host middleware deployment operations and assist in root-cause problem analysis in application interfacing.

**Ignacio Martin Llorente**
Ph. D. in Physics (Computer Architecture) by Universidad Complutense de Madrid (UCM) in 1995 and Executive M.B.A. by Instituto de Empresa in 2003. Current Positions: Associate Professor of Computer Architecture and Technology in the Department of Computer Architecture and System Engineering at UCM and Senior Scientist at Centro de Astrobiología (CAB) at CSIC-INTA, associated to NASA Astrobiology Institute. Several appointments since 1997 as a Consultant in High Performance Computing and Applied Mathematics at ICASE at NASA Langley Research Center. Research areas: Information Security, High Performance Computing and Grid Technology. Leader of the Distributed Systems Architecture & Security Group at UCM and the Grid Technology Group at CAB. Coauthor of 3 books and more than 75 articles in journals and international conferences.

## Partner 59: UPV

*Universidad Politecnica de Valencia, GOV*

UPV has large experience in the field of Parallel and Distributed Computing and its application to several fields (ehealth, simulation in engineering, etc.) and technology transfer. This expertise has been applied in different European projects since the 3rd European Framework Programme (Hipercosme, HiperTTN, DISMEDI, VRSUR, EUTIST-M, TT@MED, etc.).
NA4: Support to the identification, interfacing and evaluation of Grid medical applications.

**Prof. Dr. Vicente Hernández** is the leader of the “High Performance Networking and Computing Group” (http://www.grycap.upv.es/) from the Computer Science Department of the Valencia University of Technology (UPV). He has large experience in Parallel and Distributed Computing, Numerical Methods and Computer Applications, Applied Matrix Analysis, Control Systems and Signal Processing. He has managed several

European projects from the III, IV and V Framework Programmes (HIPERCOSME, VASSES, ASTEX, HIPERPLAST, HIPERWATER, HIPERCIR, HIPERTTN-UPV, EUTIST-M, DISMEDI, VR-SUR, TT@MED and IDEAS) and national projects (the most recent entitled GRID-IT, http://www.grycap.upv.es/GRID-IT). He is also author and co-author of more than 150 papers in national and international journals and conference proceedings. Currently, he is the vice-chancellor of Research and Innovation of the UPV. He is the main researcher for the UPV in the EGEE project.
Ignacio Blanquer

**Dr. Ignacio Blanquer** is an Assistant Professor at the Computer Science Department of the Valencia University of Technology in Spain. He has been involved in High Performance and Computing and Networking since 12 years ago. He has participated in the technical part in 4 European and 3 national projects related to medical image processing, subject in which he obtained his Phd, as well as in several projects related with the promotion and transfer of IT medical applications, participating in the coordination of the EUTIST-M cluster of projects. He is a member of the Network Centre for Biomedical Research in Valencia and also works in the Institute for the Applications of Advanced Information and Communication Technologies (ITACA) as a researcher. Currently he is participating in the application of GRID technologies in medicine, being the alternate for the UPV in the coordination of this activity in the EGEE (Enabling GRID for E-science in Europe) project.

## Partner 60: University of Chicago

*PRIV-P*

Founded in 1890, the University of Chicago is located in Chicago, Illinois in the United States of America. The University of Chicago includes an undergraduate College, four graduate divisions, and six professional schools as well as libraries, laboratories, museums, clinics, and other institutions; nursery and K-12 schools; a continuing-studies program; and an academic press. There are programs on the Hyde Park campus and programs around the world. More than 2,100 full-time academic staff teaches or conducts research at the University. There are a total of 13,234 enrolled students, including 4,216 in the undergraduate College. There are 403 nondegree students on the Quads, and then there are 318 students enrolled at the Graduate School of Business campuses in Barcelona and Singapore.

Advanced computation has had a profound impact on the conceptualization and analysis of problems across a broad spectrum of intellectual activity. The Computation Institute (CI) of the University of Chicago (University) and Argonne National Laboratory (Argonne) addresses the most challenging problems arising in the use of strategic computation and communications. The CI focuses on research and education that weaves together advanced computation with experimental threads in the biological, physical, social, and financial sciences, as well as in the humanities and the arts. It emphasizes innovative applications of large-scale computation, simulation and modeling, visualization, and data analysis. The CI fosters study in the economic, social, and cultural impact of computation and information technology. The CI will enhance study related to large-scale computation at both the University and Argonne and materially increases the depth and scope of their impact in this emerging area of science and technology. At its core, the CI recognizes that the applications of computation feed back to have important impact on the evolution of the discipline of computer science, and that the fabric of such interdisciplinary study is locked in a dynamic co-evolution with fundamental advances in both computer science and the application field.

The CI fosters research and educational initiatives with a focus on major projects and collaborations between computer scientists and other disciplinary scientists. Projects of the CI are of significant scope. They require sustained multidisciplinary collaborations and are aimed at broadly advancing a field via multiple results, significant software, and education of students. Projects generally require access to computational resources and infrastructure beyond that normally available to a single investigator. They often create unique resources or opportunities for the University and the Laboratory with a sustained research and educational benefit.

**Ian T. Foster**
Professional Preparation

| | | |
|---|---|---|
| University of Canterbury, New Zealand | Computer Science | BS (Hons I), 1977-1979 |
| Imperial College, London, England | Computer Science | PhD, 1986-1988 |

Argonne National Laboratory (ANL) Computer Science Postdoc, 1989-1990

Appointments

2000-present Arthur Holly Compton Professor, Computer Science, University of Chicago (UC)
1998-present Senior Scientist, Mathematics and Computer Science Division (MCS), ANL
1999-present Executive Committee, Computation Institute, UC
1999-present Associate Director, MCS, ANL
1999-present Steering Committee, Global Grid Forum
1996-1999 Associate Professor, Computer Science, UC
1992-1998 Scientist, MCS, ANL
1990-1992 Assistant Scientist, MCS, ANL

Synergistic Activities

Pedagogical: Development of widely used texts: Strand: New Concepts in Parallel Programming (Prentice Hall, 1990), Designing and Building Parallel Programs (Addison Wesley, 1995: www.mcs.anl.gov/dbpp), The Grid: Blueprint for a Future Computing Infrastructure (Morgan Kaufmann, 1999 & 2004: www.mkp.com/grid); A Parallel Computing Handbook (Morgan Kaufmann, 2003); also, teaching of numerous tutorials.

Research tools: Development of software tools and systems that have seen extensive use in research and teaching, including: Program Composition Notation compiler and runtime system, Parallel Spectral Transform Shallow Water Model, Nexus communication library (www.mcs.anl.gov/nexus), Globus distributed computing toolkit (www.globus.org).

Service: Including: numerous program committees and review committees; chair of numerous technical workshops and conferences, including IEEE HPDC ’98, IEEE Frontiers ’99; Software Architect, 1995 I-WAY, ACM/IEEE SC’95; SC’XY steering committee, 1999-present; Editorial Board, IEEE Trans. on Parallel and Distributed Systems, 1997-present.

Leadership: Convenor and member of the Steering Committee, Global Grid Forum, an international organization focused on standards and best practices in “Grid” computing (www.gridforum.org).

Awards and Honors: InfoWorld Innovator, 2003; MIT Technology Review, one of “Ten Technologies That Will Change the World,” 2003; University of Chicago Distinguished Service Award, 2003; Federal Laboratory Consortium Technology Transfer Award, 2002; Lovelace Medal, 2002; Fellow British Computer Society, 2002; R&D100 “Most Promising New Technology” Award, 2002; Gordon Bell Award, 2001; Global Information Infrastructure “Next Generation" Award, 1997; Best Paper Award, 1995 Supercomputing Conference; British Computer Society Award for Technical Innovation, 1989.

## Partner 61: USC

*University of Southern California, PRIV-NP*

The Information Sciences Institute is part of the University of Southern California's Viterbi School of Engineering. Founded in 1970, ISI's research mission is focused on computer systems. With over 300 researchers, research at ISI has made fundamental contributions to computer networking, intelligent systems, robotics, and Grids.

**Dr. Carl Kesselman** is Fellow in the Information Sciences Institute at the University of Southern California. He is the Director of the Center for Grid Technologies at the Information Sciences Institute and a Research Associate Professor of Computer Science at the University of Southern California. He received a Ph.D. in Computer Science from the University of California, Los Angeles, a Master of Science degree in Electrical Engineering from the University of Southern California, and Bachelors degrees in Electrical Engineering and Computer Science from the University at Buffalo.

Dr. Kesselman's current research interests are all aspects of Grid computing, including basic infrastructure, security, resource management, high-level services and Grid applications. He is the author of many significant papers in the field. Together with Dr. Ian Foster, he co-leads the Globus Project™, one of the leading Grid research projects. The Globus project has developed the Globus Toolkit®, the de facto standard for Grid computing.

Dr. Kesselman received the 1997 Global Information Infrastructure Next Generation Internet award, the 2002 R&D 100 award, the 2002 R&D Editors choice award, the Federal Laboratory Consortium (FLC) Award for Excellence in Technology Transfer and the 2002 Ada Lovelace Medal from the British Computing Society for significant contributions to information technology. Along with his colleagues Ian Foster and Steve Tuecke, he was named one of the top 10 innovators of 2002 by InfoWorld Magazine. In 2003, he and Dr. Foster were named by MIT Technology Review as the creators of one of the "10 technologies that will change the world."

## Partner 62: UWM

*Wisconsin-Madison University, GOV*

For more than 150 years, UW-Madison researchers have followed a commitment to the expansion of knowledge and the greater public good. They have built one of the most productive and vibrant enterprises in all of higher education.

Funding

Nationally, UW-Madison currently ranks second among public universities and third among all universities for research expenditures. In 2002-03, UW-Madison received more than $583 million in extramural research awards, which fund a diverse range of programs from the liberal arts to the hard sciences. Among faculty, 53.2 percent won research awards during 2002-03, with the average award amounting to $192,492.

Harnessing ideas

UW-Madison has a proud tradition of putting research to work. It is home to the oldest patenting agency associated with a university campus, the Wisconsin Alumni Research Foundation. In 1999, WARF ranked third among all campus-based patent agencies with a total of 278 inventions disclosed. The university also has an active research park that, as of 2002, is home to 107 businesses and 4,000 employees. Since 1990, more than 100 new Wisconsin companies have originated from UW-Madison innovations.

Research centers

One of the hallmarks of UW-Madisons diverse research enterprise is its array of interdisciplinary research centers. The centers bring teams of researchers to bear on challenges from cancer prevention to the development of computer microchips. Prominent research centers include
the Biotechnology Center, the Center for Dairy Research, the Institute for Research on Poverty, the Space Science and Engineering Center, the Wisconsin Center for Film and Theater Research, and the Wisconsin Primate Research Center.

Centers bring together faculty from related disciplines to work on common problems. A recent hiring initiative has helped bolster those efforts by building faculty teams around topics that cut across traditional disciplines. More than 100 faculty positions have been created in high-impact fields like genomics, nanotechnology, entrepreneurship and global cultural studies.

Student involvement

Research is integrated with the other core goals of teaching and public service. UW-Madisons extensive undergraduate research program awards competitive grants of up to $4,000 to more than 100 students annually. Public service also is expected of faculty through the venerable "Wisconsin Idea," which holds that the boundaries of the university are the boundaries of the state and beyond.

**Miron Livny**

Professional Preparation

| | | |
|---|---|---|
| Hebrew University in Jerusalem | B.Sc.: Physics and Mathematics, *Cum Laude* | July 1975 |
| Weizmann Institute of Science | M.Sc.: Computer Science | March 1978 |
| Weizmann Institute of Science | Ph.D.: Computer Science | February 1984 |

Appointments

| | |
|---|---|
| 1995 | Professor, Computer Sciences Department, University of Wisconsin-Madison |
| 1989 | Associate Professor, Computer Sciences Department, University of Wisconsin-Madison. |
| 1984 | Assistant Professor, Computer Sciences Department, University of Wisconsin-Madison. |

Related Publications

[1] "Condor and the Grid", Douglas Thain, Todd Tannenbaum, and Miron Livny, in F. Berman, A. J.G. Hey, Geoffrey Fox, editors, *Grid Computing: Making The Global Infrastructure a Reality*, John Wiley (2002).

[2] James Frey, Todd Tannenbaum, Ian Foster, Miron Livny, and Steven Tuecke, "Condor-G: A Computation Management Agent for Multi-Institutional Grids," *Journal of Cluster Computing* volume 5, (2002).

[3] Sechang Son and Miron Livny, "Recovering Internet Symmetry in Distributed Computing", *Proceedings of the 3rd International Symposium on Cluster Computing and the Grid*, Tokyo, Japan, May (2003).

[4] Douglas Thain, John Bent, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau and Miron Livny, "Pipeline and Batch Sharing in Grid Workloads", in Proceedings of the Twelfth IEEE Symposium on High Performance Distributed Computing, Seattle, WA, (2003)

[5] Tevfik Kosar and Miron Livny, "Stork: Making Data Placement a First Class Citizen in the Grid", *Proceedings of 24th IEEE Int. Conference on Distributed Computing Systems (ICDCS2004)*, Tokyo, Japan, March 2004

[6] John Bent, Douglas Thain, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau, and Miron Livny, "Explicit Control in a Batch Aware Distributed File System", *Proceedings of the First USENIX/ACM Conference on Networked Systems Design and Implementation*, San Francisco, CA, March 2004.

Synergistic Activities

Research tools: DeNet - a Discrete Event Simulation Environment; DEVise - a Visual Data Exploration Environment; Condor - a High Throughput Computing System.
Service: NSF National Resource Allocation Board; Program Committee of VLDB, SIGMOD, HPDC, CCGrid, SIGMETRICS and others.

## Partner 63: KTH

*PDC at the Swedish Royal Institute of Technology, GOV*

PDC (www.pdc.kth.se) located at KTH is the lead center for high-performance computing and storage for the Swedish academic community. PDC is co-located with KTH's Network Operations Center, KTHNOC, www.noc.kth.se, that operates the Swedish University Network (SUNet) and the Nordic University network (NorduNet). PDC has considerable expertise and experience in development and implementation of solutions for computer systems security, tools for cluster administration and operations, middleware for Grids, performance engineering for scientific applications, and user training and support.
Staff at PDC and the department for Numerical Analysis and Computer Science (NADA) wrote a version of Kerberos V from the ground up. This version of Kerberos V, Heimdal, www.pdc.kth.se/heimdal, is an Open Source version that has been adopted by the FreeBSD community. It is included in Linux distributions by Debian and FreeBSD. Also, a free version of AFS, ARLA, www.stacken.kth.se/projekt/arla, has been developed at KTH. PDC has used Kerberos and AFS for thousands of local and remote users for over a decade.
PDC's first experience with Grid middleware was in 1997 through participation in the development of the first Globus (www.globus.org) release and in the Globus test bed GUSTO, and by contributing to the first live demonstration of Globus at SC97. PDC has also participated in the European JACO3 (JAva and CORBA based COllaborative Environment for COupled Simulations) project for Grid computing with off-the-shelves middleware technologies, see www.ercim.org/publication/Ercim_News/enw45/priol.html. In the area of Grid security the interoperability between Grid and Web Services frameworks and Kerberized environments is part of current efforts at the center. Other efforts include techniques for credential-based file system access, development of trust models for dynamic VOs, scalable models for user account management and the study of expressiveness of authorization policy in proposed assertion languages such as [SAML] and [XrML].
PDC has a proven record of successful early deployment of computer systems based on innovative technologies and of software development, and education and training for such systems. It operates several clusters, e.g. a 90-node Itanium2 cluster with Myrinet interconnect for the Swedish National Infrastructure for Computing, a 200 node IA32 cluster for the Stockholm Bioinformatics Center, and a 100 node cluster for SweGrid, a consortium including six university sites. PDC is connected to Sunet's 10 Gbps backbone, and to Nordunets λ-link to Amsterdam (SARA).
PDC is a founding member of the Nordic Grid Consortium, the European Grid Support Center, and the Globus Alliance.

In EGEE PDC will take part in activity SA1 as a regional operations centre.

**Prof. Lennart Johnsson**
At ASEA AB (now ABB), Dr. Johnsson implemented one of the first commercial strength sparse-matrix packages, and led the development of systems for real-time supervision, control, and optimization of electric utility network operations, and for industrial process control. Within five years after entering the market for control centers for electric utilities, ASEA AB was a world leader with a revenue of about $50M (1987 dollars) for this product area and over 200 people engaged.
In 1982 at Caltech Dr Johnsson in collaboration with Dr Fornberg of the Applied Mathematics Dept. Introduced one of the first courses in the US on large-scale scientific and engineering computation on scalable parallel architectures. Revisions of this course were later introduced by Dr Johnsson at Yale University (1983) and Harvard University (1990). At Yale University, both faculty and graduate students attended the course the first time it was taught. It was one of very few courses related to parallel architectures, their programming and use. At the University of Houston Dr Johnsson introduced a course on Advanced Networking addressing issues in the design and use of high-performance networks.
Some of the results of Dr Johnsson's research on network routing influenced the definition of the primitives in the MPI standard (some of which carries the names given to the primitives in Dr Johnsson's research predating the MPI standard). Vendors such as Intel and IBM used algorithms devised by Dr Johnsson and his students in implementing the standard, and heavily influenced the Connection Machine Run-Time System.
At Thinking Machines Corp., Dr. Johnsson led the design, development, and maintenance of the Connection Machine Scientific Software Library (CMSSL) and part of the Connection Machine Run-Time System (CMRTS). The CMSSL included several novel features, such as algorithm selection at run-time, and multiple-instance functionality for consistency with languages with array syntax.
Jointly with Rice University and Baylor College of Medicine Dr Johnsson established the Texas GigaPoP and was responsible for the first MPI applications for Globus demonstrated at SC97. He also lead the effort at two of five institutions performing an interactive, collaborative VR demonstration at Alliance '98. This demonstration motivated the Nordunet leadership to establish permanent connectivity to the Abilene and vBNS networks and significantly increased Nordunet transatlantic capacity (from 34 Mbps to three OC-3 connections and then upgraded in stages to 2.5 Gbps by 2001).
Johnsson also actively contributed to establishing the European Grid Forum that soon merged with the US Grid Forum to the Global Grid Forum. Dr Johnsson is a founding member of the Nordic Grid Consortium and the European Grid Support Center and a Member of the Strategy Council of the Gelato federation.

**Dr Åke Edlund**
Åke Edlund has over six years experience of IS/IT, of which more than four has been in managing and leading roles. In addition ÅkeEdlund has more than six years experience of research in scientific computing, specializing in parallel computers.
Prior to his engagement as chief architect at Sony Ericsson Mobile Communications, ÅkeEdlund worked as Solution Manager at Alzato (developing a novel real-time database), an Ericsson Business Innovation venture, as Product Manager for Cult3D (software for interactive 3D on the Internet) at Cycore, and as a consultant with Parallel Consulting Group, Stockholm (computer security).
He has a deep working experience in computer security on protocol and organizational level. He has created and reviewed security organization plans for a number of international companies throughout the years 1997-2004. Also, he has build a good knowledge of computer security for global IS/IT systems and for software development as responsible product manager and architect.
Åke Edlund has a research background in applied mathematics, super computing and quantum chemistry and holds degrees from the Technion - Israel Institute of Technology (PhD) and Uppsala University (Tekn.Lic, MSc). Research stations were at Technion - Israel; Uppsala University - Sweden; and at University of California at Berkeley, and Rice University - USA. Main contribution was a generic parallel multidimensional solver for quantum physics applications.

**Dr. Per Öster**
Per Öster, associate director of PDC KTH, has a 15-year working background in the areas of high-performance computing technologies and applied mathematics. He has a BSc in physics from Uppsala University and a PhD in physics from Chalmers University of Technology and Göteborg University. Per Öster has been responsible for technical computing and consultant in applied mathematics at the Volvo Data Corporation. Per Öster has lead the participation of PDC in a number of EU projects e.g., manager of the

Swedish node, PDCTTN, in the HPCN Technology Transfer Node Network and he has worked for the EU as evaluator and reviewer in IST program of the 5th framework.

**Olle Mulmo**
After obtaining his masters degrees in Engineering Physics (1997) and Computer Science (1998) Olle Mulmo spent two years at Argonne National Laboratory, working in the Globus Project (software and application development). He worked together with external application projects and adapted their code for Globus' widely distributed test bed. He contributed to the proof-of-concept implementation of hierarchial collective MPI operations, laying the foundation for the much appraised MPICH-G2 implementation.
Het worked another two years at iD2/Smart Trust (Stockholm) as a software architect for PKI product development. He is currently employed as applications expert on security and grid technologies at the Royal Institute of Technology (Stockholm) and is advisor to local and national grid projects.

## Partner 64: ENEA

*Ente per le Nuove Tecnologie, l'Energia e l'Ambiente*, *GOV*

ENEA, the Italian National Agency for New Technologies, Energy and the Environment is a public undertaking operating in the fields of energy, the environment and new technologies to support competitiveness and sustainable development.
ENEA is mainly called upon:
to promote and carry out basic and applied research and innovation technology activities, also through prototypes and product industrialization;
to disseminate and transfer technologies, encouraging their use in productive and social sectors;
to provide high-tech services, studies, tests and evaluations to both public and private bodies and enterprises.
To these aims and in the sectors falling within its areas of competence, ENEA:
carries out complex research, development and demonstration projects, mainly technology and engineering — based, sets up and operates major scientific apparatus;
assesses the level of advanced technologies development, as well as their economic and social impacts, also on demand by public administrations;
promotes collaboration with foreign bodies and institutions, also for defining technical regulations and participation to major research programmes and international organizations, providing its expertise;
promotes, fosters and supports innovation technology processes in the national production system, especially in small and medium — sized enterprises;
collaborates with regions and local administrations to promote productive development of local resources, through joint actions;
promotes technical and professional training and competency of researchers, also through ad-hoc agreements with national and international universities.
In the specific field of interest of this project, ENEA currently operates its own production GRID with an overall power of several hundred Gflops. Heterogeneous computing resources (IBM SP, Linux clusters, SGI systems), located in 6 main research Centres are currently put together. These computing resources are used in various scientific applications, such as: neural networks, material sciences, biotechnologies, computational chemistry, combustion, image processing, climate modelling, etc. ENEA has taken part in several national and international research projects on this subject.

**Ing. Silvio Migliori** graduated in Nuclear Engineering at the University of Rome "La Sapienza". Since 1983 he has been working for ENEA, and since 1995 as Assistant to the Director of the Computer Science Department. He contributed to the development of new technologies in the field of traditional and parallel computing, leading to the set-up of "ENEA-GRID" infrastructure.

## Partner 65: UniCal

*Università degli Studi della Calabria, GOV*

MIUR /HPC Center of Excellence:
Funded in 2001 by the Italian Ministry of University and Research with the aim to provide hardware, software and expertise for different applications of parallel supercomputing, HPCC is one of the leading research

institutes centred on parallel and distributed processing research and development. HPCC is interdisciplinary since it coordinates resources and competencies of different scientific areas that are already active at the University of Calabria. Under this respect, two are the main activities to be performed in the Center: development of applicative software of general interest, i.e. to be used within different disciplinary contexts; realization of applicative projects by the different research groups joining the Center (design of parallel computing systems and algorithms, computational physics, computational chemistry, computational fluid dynamics, simulation of complex phenomena); the different groups will make available their specific competencies and experiences in the field of high-performance computing, related to each different disciplinary framework.
HPCC aims to promote the diffusion and dissemination of advanced techniques in the field of compute-intensive numerical simulation and the production of tools, environments and infrastructures for innovative technology transfer. Under the viewpoint of the computing equipment, the interdisciplinary collaboration is achieved and promoted by the establishment of a network of parallel multiprocessor machines, all connected by a high-speed network (on site departmental grid). HPCC boasts experience on software and algorithms within the following research lines: Turbulence in Astrophysical and Laboratory Plasmas; Computational and Theoretical Chemistry; Models for Simulation of Acentric Complex Phenomena; Parallel Computational Fluid Dynamics; Computational Optimization for Large-Scale Systems.

**Lucio Grandinetti**
Full Professor at the Department of Electronics, Informatics and Systems of University of Calabria, Italy, since 1986. Scientific director of the Parallel Computing Laboratory (PARCOLAB) at the University of Calabria. Scientific Director of the Center of Excellence on High Performance Computing (HPCC) at University of Calabria. Co-director of the project SPACI (Southern Partnership for Advanced Computational Infrastructure) aimed to build a geographic GRID in Southern Italy (partners involved: University of Naples and University of Lecce) and financed by the Italian Government. Co-director of NATO ARW on Software for Parallel Computation, Italy (1992) and NATO ARW on High Performance Computing, Italy (1996); member of several organizing and scientific committees of international conferences on high-performance parallel computing (e.g. EUROPAR, HPCN Europe, PARCO). Member of the IEEE Technical Committee on Parallel Processing.
His areas of expertise are the design of numerical algorithms for parallel and distributed computer systems, modelling and simulation of large scale systems, numerical optimization methods for complex problems, software engineering aspects related to parallel processing. He has been and currently is involved in research projects sponsored and financed by the National Research Council of Italy, by CEC, and by Italian Ministry of Research. He has been evaluator and reviewer of CEC Research Projects in the IT Programme ESPRIT, during 1993 and 1995. He has also been evaluator and reviewer of ESPRIT projects in the 4th framework Programme. He has been evaluator of research projects in the 5th Framework Programme (INFOSO Programme) and is currently reviewer of a few projects in the same Programme.
He is co-author of more than 60 papers in refereed journals, and co-editor of several books on numerical methods for non-linear optimization, computational engineering, parallel algorithms and software for vector and parallel computing.
He is member of the editorial board of the following international journals:
- Parallel Computing (Elsevier)
- Optimization Methods and Software (Taylor and Francis)
- International Journal on Computing (Ukraine).

He is co-Editor of the book series "Scientific and Engineering Computation" published by MIT Press, Boston (USA). He has received several administrative and managing appointments at the University of Calabria, Italy (Department's Chairman, Member of Administration Council) and currently is Vice-Rector of the same University (since November 1st, 1999).

## Partner 66: UniLe

*Università degli Studi di Lecce, GOV*

ISUFI/CACT: Involved in several Grid technology development and application projects, (Dynamic Grid Environments for Earth Observation Systems, http://sara.unile.it/sara, for Bioinformatics http://sara.unile.it/big, for Atmospheric and Climate Modeling, http://krono.le.isac.cnr.it, for Diesel Engine chamber geometry Simulation, http://www.klimt.unile.it/des). Experience in middleware development

(Extension of current globus MDS in the context of the GridLab European project, http://www.gridlab.org, WP10, to support better resource brokering). Development of advanced grid portals & libraries (GRB project, http://sara.unile.it/grb, to provide high-level globus services), unified grid-dbms systems, http://gandalf.unile.it/grelc.html), and advanced globus GSI enabled web services (GSI plugin for the gSOAP Toolkit to allow mutual authentication/authorization, delegation and connection caching, http://sara.unile.it/~cafaro/gsi-plugin.html).

**Giovanni Aloisio** is currently Full Professor of Information Processing Systems at the Department of Innovation Engineering of the University of Lecce (Italy) and Director of the ISUFI/CACT (Center for Advanced Computational Technologies) of the University of Lecce. His research interests are in the area of High Performance Computing, Distributed and Grid Computing. As director of the ISUFI/CACT and as an international partner of the US National Partnership for Advanced Computational Infrastructure (NPACI), he leads joint research projects on Grid both at national and international level. He was a co-founder of the European Grid Forum (Egrid) now merged into the Global Grid Forum (GGF). He recently founded SPACI (Southern Partnership for Advanced Computational Infrastructures), a consortium among University of Calabria, University of Lecce and University of Naples "Federico II", funded by the Italian Ministry of Education, University and Technological Research, to pursue excellence in the field of Computational Science and Engineering. He is member of IEEE Computer Society and holds a permanent visitor position at CACR Caltech.

## Partner 67: UniNa

*Università degli Studi di Napoli "Federico II", GOV*

Dept. of Mathematics and Applications: Experience in middleware development, parallel scientific libraries. It has been involved in many application projects in Computational Science in collaboration with Center of Parallel Computing and Supercomputers of Italy National Research Council (CPS-CNR) now Institute of High Performance Computing and Networking branch of Naples (ICAR-CNR).

**Almerico Murli** is Full Professor of Numerical Computing at University of Naples "Federico II" (ITALY) and director of the Center for Research on Parallel Computing and Supercomputers (CPS) now the Institute of High Performance Computing and Networking , Branch of Naples, of the CNR (ICAR – CNR). His area of expertise is Scientific Computing and the development of methods, algorithms and software for solution of scientific applications on high performance architectures including parallel, distributed and grid computing.
He has been and is currently involved in research projects sponsored by National Research Council of Italy, by EC, and by Ministry of Research. He is co-author of more than 80 papers in refereed journals, and co-editor of several books on numerical software, parallel computing and nonlinerar optimization.

## Partner 68: DANTE

*PRIV-P*

DANTE was established in Cambridge in 1993. It was founded by National Research and Education Networks (NRENs) from across Europe to organise, manage and build international networking services on their behalf. As its name suggests, DANTE's objective is to provide pan-European data communications networks, employing state-of-the-art technology and operating at the highest speeds. The network currently operated by DANTE is called GÉANT (Gigabit European Academic Network). GÉANT covers more countries at higher bandwidths than any other network existing today.

GÉANT is only the latest in a succession of highly advanced Europe-wide data networks DANTE has managed, following in the footsteps of EuropaNET, TEN-34 and TEN-155. DANTE has an enviable record of success in delivering and operating these networks. As a result of this experience, during its ten years of operation DANTE has developed considerable knowledge and expertise in the technical and commercial disciplines required to provide high-speed international networks ahead of the market. Based in Cambridge, UK, with less than 30 employees, DANTE currently manages an annual turnover of approximately 50 M Euro. DANTE's specific focus on providing advanced pan-European research networking services makes the company unique and is key to its success.

DANTE staff is divided into three functional groups specialising in different areas but working closely with one another.

The Administrative group is responsible for providing the functional areas of finance, office computer systems, personnel and administration as well as public and external relations, and has proven skills in project and financial management and external relations.

The Network Engineering and Planning team is responsible for the engineering of all network related issues and for the introduction of new services. Initially, new services undergo a pilot phase, after which they are handed over to the Operations group. This team also leads the GÉANT Test programme (TF-NGN) and its members have proven expertise in various fields such as IPv6, Multicast, Multi-Protocol Label Switching (MPLS) and Quality of Service (QoS).

The Operations group has responsibility for the installation, good operation and performance of network services provided, or managed, by DANTE. This includes the provision of support for large international projects and GRIDs. Its members are also in charge of the traffic-reporting activities of DANTE, as well as of such services as statistics collection and the deployment of new services, such as IPv6.Bul

Detailed information about DANTE can be found at: http://www.dante.net

**Tomaz Kalin** joined DANTE in September 2002. He has worked in the networking area for more than 30 years. He started in 1972 in the COST 11 Project "European Informatics Network" as Assistant to the Director, and later as the Project Leader of the successor project COST 11bis. In the eighties and early nineties he was the Head of the Jozef Stefan Institute in Ljubljana and taught at the Computer Science Department of the University of Ljubljana.

He later served as the Secretary General of TERENA, and for the last two years before joining DANTE, he was appointed to the position of the State Secretary in the Ministry of Information Society in Slovenia, responsible for telecommunications.

## Partner 69: DFN

*Verein zur Förderung eines Deutschen Forschungsnetzes e.V. (DFN-Verein), PRIV-NP*

The DFN-Verein is an association under German law. Its membership comes from research and academic organisations (including industrial research) and comprises at present roughly 400 member institutions. Its main task is to provide for its clients a data communication infrastructure with the best technical architecture available.

At present DFN-Verein offers a gigabit network (Gigabit-Wissenschaftsnetz G-WiN) and complementary communication services. About 700 institutions from science, research and higher education are connected directly. The total volume currently transferred over the network exeeds one PByte per month.

Operational services are financed by payments from participating institutions. There are access charges directly dependent on access capacity. There is also a volume dependent element. Presently, all capacity in the core network is provided by a contract with T-Systems, whereas access links are provided by a large variety of operators. There has been start up money from the federal government; however currently there is no subsidy by the German government for the operation of the network.

**Klaus Ullmann**
Mr. Ullmann is the Technical Director of DFN and will represent DFN in EGEE on management and commercial issues. Mr. Ullmann has been Technical Director of DFN-Verein for more than twenty years. He has a degree in physics from the Technical University Berlin.

Born 5 November 1948
Study of Physics (1968 – 1974)
Diploma in Physics (Theoretical Solid State Physics) (1975)
Member of a network development team in the Hahn-Meitner Institute (1975 – 1978)

Project Leader of a regional network for the Berlin Universities and research establishments (1978 – 1982)
Head of the Planning Team for the German Research network DFN (1982 – 1983)
Managing Director of DFN (1984)
Member of the Executive Committee of RARE (European umbrella organisation of NRENs) (1984 – 1986) and President of RARE (1986 – 1990)
Chairman of the DANTE Board (1994 – 2002)

## Partner 70: GARR

*PRIV-P*

Consortium GARR is an Association under Italian law. It was established by the national Academic and Research Community. Its member institutions are the Italian Universities and the main governmental Research organizations as CNR (the Italian National Research Council ), ENEA (Italian National Agency for New technologies, Energy and Environment) and INFN (Italian National Institute of Nuclear Physics).

The aim of Consortium GARR is to plan, manage, and operate the GARR network, the Italian National Research and Education Network, implementing the most advanced technical solutions and services. It supplies the Italian Academic and Research Community with connectivity to the GARR backbone. Also, Consortium GARR provides its member istitutions with the main Operational and Application Networking Services.

GARR network is based currently on a lambda 2.5Gbps infrastructure and 28 PoP's, interconnecting a total of 300 universities and research laboratories with access speed ranging from 2 to 1Gbps. On the 6th May 2003 GARR was the first National Research Network in Europe connected at 10Gbps to GEANT.

GARR is member of Terena and of NREN Consortium. Its members are actively involved in Research and Development European projects like 6NET, EUMEDCONNECT, ALICE and in international task forces like TF-NGN and IETF.

Detailed information about GARR can be found at:
http://www.garr.it/

**Enzo Valente** is the general manager of Consortium GARR and will have overall responsibility for the GARR participation in the EGEE project, in particular for management issues.

**Claudia Battista** is Chief Technical Officer of Consortium GARR. She has a degree in Physics from the Rome University “La Sapienza” and has worked for GARR for more than 15 years. She coordinates the Network Engineering and Planning activities together with the Research and Development activities implemented on GARR network infrastructure.

**Mauro Campanella** has worked in the networking and computing area for more than 15 years. He has a degree in Physics from the University of Milan. He is in charge for the technical coordination of GARR R&D activities. He is involved in the development and implementation of QoS on GARR network and handles problems in the provisioning of end-to-end services which require different kinds of QoS technologies.

**Laura Leone** joined GARR in 2001 as Network Engineering. She has a degree in Engineering from the University “La Sapienza” in Rome. She is involved in the development and implementation of QoS, Premium IP services on GARR network and handles problems in the provisioning of end-to-end services which require technologies such as MPLS.

**Gloria Vuagnin** has a PhD in Physics. She worked for about 10 years on High Energy Physics experiments gaining experience on the needs, in term of computing, storage and networks of that field. She is involved in the development and implementation of QoS on GARR network and handles problems in the provisioning of end-to-end services which require different kinds of QoS technologies.

## Partner 71: RED-ES

*Entidad Pública Empresarial RED.ES*, *GOV*

The "entidad pública empresarial RED.ES" ("RED.ES" – http://www.red.es) is a public entity which belongs to the Spanish Ministry for Industry, Tourism and Commerce ("Ministerio de Industria, Turismo y Comercio" – MIN – http://www.min.es), through its State Department for Telecommunications and Information Society ("Secretaría de Estado de Telecomunicaciones y para la Sociedad de la Información" - SETSI - see http://setsi.min.es).

The main duty of RED.ES is to promote the development of Information Society. For this purpose, RED.ES:

a) manages the Registry for domain names under ".es" (http://www.nic.es);
b) has put in place a "Telecom and Information Society Observatory" (http://www.observatorio.es) and advices the Government in matters related to these fields;
c) manages several programs related to the promotion of the Information Society, such as "Internet for Schools" (http://www.internetenlaescuela.es) or "Internet for rural areas" (http://www.internetrural.es);
d) promotes the digitalization of the Spanish cultural heritage (http://www.patrimonio.es);
e) provides several e-government services to public administrations; and
f) manages the Spanish NREN, RedIRIS

**Dr. Diego Lopez**
Dr. Diego R. Lopez is the responsible for Middleware and Applications of RedIRIS (the Department of RED.ES in charge of the management of the Spanish NREN). Dr. López earned his BSc in Physics at the University of Granada in 1985 and his PhD in Physics at the University of Seville in 2001. He is the chairman of the TF-AACE group of TERENA and one of the main architects of TACAR, the Academic CA repository used by the EUGridPMA. Dr Lopez is also one of the European representatives at the MACE (Middleware Architecture Committee for Education) of Internet2.

**Antonio Fuentes**
Antonio Fuentes is a System Engineer at RedIRIS. He qualified as a Computing Engineer (University of Murcia) in 1999, and is now preparing his PhD in the Data Mining and Distributed Computing Department of the Universidad Complutense de Madrid. He has previously worked as system manager in Airtel (a Spanish telecommunication company) and at the University of Murcia. He is the coordinator of the infrastructural services of the national grid initiative IRISGrid.