

**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.: *(to be completed by Commission)*

Related to other Contract no.: *(to be completed by Commission)*

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Start date of contract: *(to be completed by Commission)*

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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. EGEE roles: <b>NA1:</b> Coordinating partner responsible for overall project management <b>NA4:</b> Lead partner for High energy physics applications interface <b>NA5:</b> Lead partner for establishment of international cooperation in domains such as policy agreements <b>SA1:</b> Overall responsibility for grid operations hosting grid operations centre <b>JRA1:</b> 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 Technische Informatik und Telematik Linz, Austria	GUP	1	24	Main operator for the eastern part of Austria, major academic HPC and networking center, participant of EU research projects. EGEE Roles: <b>SA1:</b> Local support center for Austria and interface to Regional Operations Center in Poland. <b>NA2:</b> Contribution to dissemination efforts in Austria. <b>NA3:</b> 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: <b>SA1:</b> 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. <b>NA3:</b> 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, SCAMP1, EU-DataGrid). <b>SA1:</b> Local support center for the Czech Republic, direct application support <b>NA3:</b> Assistance to the Hungarian major dissemination and training CE center esp. with training for prospective users of Grid and EGEE technologies <b>NA4:</b> Provision of a local helpdesk for the Czech Republic <b>JRA1:</b> 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. EGEE roles: <b>NA2:</b> Participate in exchange and dissemination of good practice. <b>NA3:</b> Produce training and course material.

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
6	Eotvos Lorand University Budapest, Hungary	ELUB	1	24	ELUB is one of 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. General: Eötvös Loránd University is one of 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. Role: 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. Activities: <b>NA2:</b> Support partner for dissemination and outreach in the Central European Region start: 7 end: 24 <b>NA3:</b> 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. Operating GRID station. Expected <b>SA1</b> 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 Tudományos Akademia Szamiasztechnikai 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. Activities: <b>NA2:</b> Lead partner for dissemination and outreach in the Central European Region start: 7 end: 24 <b>NA3:</b> Lead partner for user training and induction in the Central European Region start: 1 end: 24 <b>NA4:</b> Support partner for KFKI-RMKI in particle physics applications <b>SA1:</b> 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. EGEE roles: <b>SA1:</b> 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.

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
10	Akademickie Centrum Komputerowe CYFRONET akademii Gorniczko-Hutniczej im.St. Staszica w Krakowie- Cracow Poland	CYFRONET	1	24	<p>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</p> <p><b>SA1:</b> 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</p> <p><b>Role</b></p> <ul style="list-style-type: none"> <li>- ROC - organization definition, contacts with CERN and CEGC partners;</li> <li>- supporting middleware validation &amp; deployment to the Resource Centre; assist the latter to deploy Grid middleware;</li> <li>- 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 &amp; accounting tools to the Resource Centre;</li> <li>- together with the applications validate new middleware releases and documentation provided by the integration team;</li> <li>- collaboration in producing release notes for the services and middleware.</li> </ul> <p>(It is assumed, that other two ROC members will provide:</p> <ul style="list-style-type: none"> <li>- main user &amp; administrator support including call center, to deal with technical problems from local users and Resource Centre;</li> <li>- the Grid operations training for staff at Resource Centre.)</li> </ul>
11	Warsaw University Interdisciplinary Centre for Mathematical and Computational Modelling- Warszawa - Poland	ICM	1	24	<p>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.</p> <p><b>EGEE specific:</b></p> <p><b>SA1:</b> Infrastructure operations, support and services for ROC</p> <p><b>NA3:</b> Dissemination and feedback for potential commercial grid users</p>
12	Institute of Biorganic Chemistry PAN, Poznan Supercomputing and Networking Center - Poznan Poland	PSNC	1	24	<p>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.</p> <p><b>SA1:</b> 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</p>
13	Ustav Informatiky, Slovenska Akademia vied - Bratislava Slovakia	II-SAS	1	24	<p>SAS is the leading Grid center in Slovakia. Participation in international projects (CROSSGRID, Pellucid). EGEE roles:</p> <p><b>NA3:</b> II SAS will organize training for prospective users of Grid technologies, including EGEE-specific issues.</p> <p><b>SA1:</b> II SAS will become the local support center for Slovakia and will interface to the Regional Operation Center.</p>
14	Jozef Stefan Institute - Lyubljana, Slovenia	JSI	1	24	<p>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.</p> <p><b>SA1:</b> JSI will become the Local Support Centre for Slovenia and will interface to the CEG Regional Operations Centre located in Poland.</p>

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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 <a href="http://www.grid-ireland.org/">http://www.grid-ireland.org/</a> . It has experience in monitoring, security and testbeds in both DataGrid and CrossGrid. Its role in EGEE is: <b>SA1:</b> 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. <b>SA1:</b> One of four Core Infrastructure Centres (CIC) and the Regional Operations Centre (ROC) for UK/Ireland Region. <b>JRA1:</b> 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. <b>NA2:</b> Partner providing key support for Dissemination and Outreach <b>NA3:</b> Lead partner with overall responsibility for User, Training and Induction <b>NA4:</b> 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. <b>JRA4:</b> 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. <b>SA1:</b> 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: <b>SA1:</b> 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. Participation in EGEE: <b>NA4:</b> Overall responsibility for applications coordination. Lead partner for biology/health applications interface. <b>SA1:</b> Responsible for the operation of one Core Infrastructure Center. Responsible for the operation of one Regional Operation Center. <b>SA2:</b> Leader of this service activity related to network operation. <b>JRA2:</b> Participation to ensure QA in tools , processes and software <b>JRA4:</b> 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. <b>SA1:</b> Under the lead of CNRS, participation to the operation of one Regional Operation Center. <b>JRA2:</b> Responsible for the organization of the quality insurance activity on the project (QA manager). <b>NA4:</b> 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.) <b>SA1:</b> Dissemination , industry Forum , Generic applications <b>NA4:</b> 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. Role in EGEE <b>SA1:</b> Partner of the German ROC <b>SA2:</b> 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. Role in EGEE <b>NA4:</b> Identification and adaptation of early user applications from earth system research
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. Role in EGEE <b>NA4:</b> 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. Role in EGEE <b>NA4:</b> 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 <b>SA1:</b> Support Centre, CPU and Storage provision; Involvement of FhG/SCAI and FhG/ITWM



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28	Forschungszentrum 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. Role in EGEE <b>SA1</b> : Lead partner of the German ROC <b>NA2/NA3</b> : Regional Grid user support centre
29	Gesellschaft Schwerionenforschung 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. Role in EGEE <b>SA1</b> : Partner of the German ROC
30	DATAAMAT S.p.A., Roma, Italy	DATAAMAT	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). EGEE role: <b>JRA1</b> : 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). EGEE roles: <b>NA2</b> : dedicated tutorials and training sessions, demo test bed equipped with the GENIUS portal for the Italian community. <b>NA3</b> : Application developer training for the Italian community. <b>NA4</b> : Lead Partner for general applications interface (not HEP and Biology). <b>NA5</b> : Involved in infrastructure reflection group <b>SA1</b> : Overall responsibility for EGEE ROCs and grid operations in Italy. Host of a Core Infrastructure Center (CIC). <b>JRA1</b> : 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 ( <b>NA2</b> ) 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. EGEE role: <b>NA2</b> : 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. <b>NA3:</b> 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. 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. Role in EGEE: <b>JRA3:</b> Contributor to UserID, Authentication service re-engineering tasks and overall Security Architecture and Design
35	University of Helsinki, Helsinki, Finland	UH HIP	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. <b>NA4:</b> Application identification and support centre for the countries in the Northern European Grid (NEG) consortium <b>SA1:</b> 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. <b>JRA3:</b> 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.
36	Foundation for Fundamental Research on Matter, Utrecht, Netherlands	FOM	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. Role in EGEE <b>SA1:</b> Responsible for one of Regional Operations Centers in Northern region, level-2 support. 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. <b>JRA3:</b> 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.
37	Stichting Academisch Rekencentrum Amsterdam, Amsterdam, Netherlands	SARA	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. <b>JRA3</b> - Participation in security architecture definition and development.
38	Universiteit van Amsterdam, Amsterdam, Netherlands	UvA	1	24	
39	University of Bergen, Norway	UiB	1	24	

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
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. <b>SA1:</b> Hosting the Northern Regional Operations Center <b>Largest particle collider center in Russia.</b> Participation in LCG and EDG; Traditions in international cooperation. Expertise in GRID deployment and GRID applications. <b>EGEE roles:</b> <b>NA2:</b> Translation of the main EGEE documents in Russian; Preparation and support of WEB site; To attract some scientific organizations of Ministry for Atomic Energy o joint EGEE. <b>NA3:</b> Training of the users for GRID Middleware; Prepare the course material and support distributed courses; <b>NA4:</b> Testing of the Grid software for LCG - 1. <b>SA1:</b> Support on 24 x 7 basis Region Operation Center at IHEP; Responsibility for grid operations centre; Resource Centre.
41	Institute of High Energy Physics - Protvino Moscow Region Russia	IHEP	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. <b>EGEE roles:</b> <b>NA2:</b> operate the dissemination Web site, based on the existing Joint Center for Computational Biology and Bioinformatics. Support of computational and information databases in biology and metabases on Internet bioresources. Involve other biological institutions in the RDIG EGEE infrastructure. <b>NA3:</b> Produce training and course materials on GRID in biology. Training and induction of users in biology. <b>NA4:</b> Support of pilot applications in the fields of biomolecular structure reconstruction, molecular dynamics and E-cell project. <b>SA1:</b> Support of 24x7 specified functions of Region Operation Center for biology, specialized in bioinformatics. Resource Center, starting from 2 <sup>nd</sup> year of the project. 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. <b>EGEE roles:</b> <b>NA2:</b> 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; <b>NA3:</b> Produce training and course material, training of users from Russian nuclear centers. <b>NA4:</b> Management of LHCb and ALICE VOs in Russia, Support of ATLAS and CMS pilot applications; Identify early users; Introduction of new user communities. <b>SA1:</b> Provide some 24x7 basic functions of ROC, also remote backup function for Russian CIC and ROC. Resource Center from 2 <sup>nd</sup> year of the project.
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. <b>EGEE roles:</b> <b>NA2:</b> operate the dissemination Web site, based on the existing Joint Center for Computational Biology and Bioinformatics. Support of computational and information databases in biology and metabases on Internet bioresources. Involve other biological institutions in the RDIG EGEE infrastructure. <b>NA3:</b> Produce training and course materials on GRID in biology. Training and induction of users in biology. <b>NA4:</b> Support of pilot applications in the fields of biomolecular structure reconstruction, molecular dynamics and E-cell project. <b>SA1:</b> Support of 24x7 specified functions of Region Operation Center for biology, specialized in bioinformatics. Resource Center, starting from 2 <sup>nd</sup> year of the project. 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. <b>EGEE roles:</b> <b>NA2:</b> 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; <b>NA3:</b> Produce training and course material, training of users from Russian nuclear centers. <b>NA4:</b> Management of LHCb and ALICE VOs in Russia, Support of ATLAS and CMS pilot applications; Identify early users; Introduction of new user communities. <b>SA1:</b> Provide some 24x7 basic functions of ROC, also remote backup function for Russian CIC and ROC. Resource Center from 2 <sup>nd</sup> year of the project.
43	Institute of Theoretical and Experimental Physics, Moscow Russia	ITEP	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. <b>EGEE roles:</b> <b>NA2:</b> operate the dissemination Web site, based on the existing Joint Center for Computational Biology and Bioinformatics. Support of computational and information databases in biology and metabases on Internet bioresources. Involve other biological institutions in the RDIG EGEE infrastructure. <b>NA3:</b> Produce training and course materials on GRID in biology. Training and induction of users in biology. <b>NA4:</b> Support of pilot applications in the fields of biomolecular structure reconstruction, molecular dynamics and E-cell project. <b>SA1:</b> Support of 24x7 specified functions of Region Operation Center for biology, specialized in bioinformatics. Resource Center, starting from 2 <sup>nd</sup> year of the project. 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. <b>EGEE roles:</b> <b>NA2:</b> 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; <b>NA3:</b> Produce training and course material, training of users from Russian nuclear centers. <b>NA4:</b> Management of LHCb and ALICE VOs in Russia, Support of ATLAS and CMS pilot applications; Identify early users; Introduction of new user communities. <b>SA1:</b> Provide some 24x7 basic functions of ROC, also remote backup function for Russian CIC and ROC. Resource Center from 2 <sup>nd</sup> year of the project.

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44	Joint Institute for Nuclear Research, Dubna Russia	JINR	1	24	<p>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.</p> <p>EGEE roles:</p> <p><b>NA2:</b> 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.</p> <p><b>NA3:</b> Organize the Grid tutorials, training and education for EGEE user community in CIS countries. Support of distributed courses on the project.</p> <p><b>NA4:</b> Support ATLAS, ALICE, CMS and LHCb pilot applications; Identify early users; Introduction of new user communities.</p> <p><b>SA1:</b> 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 1<sup>st</sup> year of the project.</p>
45	Keldysh Institute of Applied Mathematics of Russian Academy of Sciences Moscow – Russia	KIAM RAS	1	24	<p>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.</p> <p>EGEE roles:</p> <p><b>NA2:</b> 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.</p> <p><b>SA1:</b> Provide some functions of Russian CIC (adaptation of MW to local environments, recommendations for improvements of GRID infrastructure). Resource Center from 2<sup>nd</sup> year of the project.</p>
46	Petersburg Nuclear Physics Institute of Russian Academy of Sciences - Gatchina, Leningrad district - Russia	PNPI	1	24	<p>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</p> <p>EGEE roles:</p> <p><b>NA2:</b> Support Web site and Web-based tools for dissemination in institutions in St-Petersburg region, organize presentations and showcases for St-Petersburg region.</p> <p><b>NA3:</b> Provide user training and GRID tutorials for St-Petersburg region.</p> <p><b>NA4:</b> Support HEP pilot applications (ATLAS, CMS, ALICE, LHCb) for St-Petersburg region, identification of early users.</p> <p><b>SA1:</b> Provide 24x7 basic functions of Russian ROC for St-Petersburg region. Resource Center from 2<sup>nd</sup> year of the project.</p>

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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. EGEE roles: <b>NA2:</b> 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. <b>NA3:</b> Training of the users for CA and Security, prepare training and course material, support distributed course on these topics. <b>NA4:</b> Support of ALICE pilot applications. Lead partner for Nuclear Fusion GRID applications in Russia. Identification of early users. Introduction of new user communities. <b>SA1:</b> Provide some Core infrastructure services: GRID monitoring and control. Resource Center from 2 <sup>nd</sup> year of the project. <b>SA2:</b> 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. EGEE roles: <b>NA2:</b> 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. <b>NA4:</b> Management of CMS VO in Russia; Support of ATLAS, ALICE and LHCb pilot applications; Introduction of new user communities. <b>SA1:</b> Provide Russian Core Infrastructure Center. Management o Russian federation. Middleware deployment and resource induction. Resource Center from the end of 1 <sup>st</sup> 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 <b>NA2:</b> Dissemination plan for the SEE federation. Provide dissemination and outreach activities in Bulgaria and Romania <b>SA1:</b> 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. <b>NA2:</b> Identify target user communities and applications relevant to the region. Provide dissemination and outreach activities in Greece, Cyprus and Israel. <b>SA1:</b> 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.

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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. <b>SA1:</b> 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. <b>SA2 :</b> participation to SLA definitions. <b>NA3:</b> 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. <b>NA5:</b> GRNET support project activity on international cooperation especially through the organization of the European infrastructure reflection group and the production of a series of elnfrastucture White Papers and roadmaps.
52	Tel Aviv University, Tel Aviv, Israel	TAU	1	24	TAU is a major university in Israel coordinating Israeli grid collaboration (Israel Academic Grid-IG) together with the IUCC, Israel's NREN, that will be responsible for technical aspects and coordination of grid related activities. <b>SA1:</b> 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 <b>NA3:</b> 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. <b>SA1:</b> 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 <b>NA3:</b> Provide training sessions in Romania and Bulgaria covering the RoGRID partners and BGConsortium. 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. <b>SA1:</b> 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. <b>SA1 :</b> Development, adaptation, deployment and operation of Monitoring and Accounting Components

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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. <b>NA4-</b> The Centro Nacional de Biotecnología will collaborate with CNRS on applications for genomics and proteomics. <b>SA1-</b> The Instituto de Física de Cantabria and the Instituto de Física 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 : <b>NA5-</b> 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. 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. <b>SA1:</b> Its Port d'Informació Científica Division (PIC), with collaboration of the CIEMAT, will host the Southwest Operations Team and a Petabyte-level data facility.
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. <b>SA1:</b> 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 Computational 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. <b>SA1:</b> 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, DISMED, VRSUR, EUTIST-M, TT@MED etc.). <b>NA4:</b> 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. <b>JRA1:</b> 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. <b>JRA1:</b> 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). Developer of core Grid technology used by EGEE. Experience in international collaborations including UK eScience, DataGrid, and GridLab. EGEE roles: <ul style="list-style-type: none"> <li>• Develop, implement and operate a transatlantic VDT testing facility for the Virtual Data Toolkit.</li> <li>• Support the deployment and trouble shooting of the VDT in EGEE.</li> <li>• Bug fixing and functionality enhancement of EGEE software.</li> <li>• Design of EGEE software system (2004).</li> <li>• Participate in EGEE technical meetings, present seminars and tutorials, and visit EGEE sites to facilitate technology exchange.</li> </ul>
62	The Board of Regents for the University of Wisconsin System - Madison USA	Wisconsin-Madison Univ.	1	24	Lead partner of the Condor project. <b>JRA1:</b> 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
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 <b>JRA3:</b> 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.  EGEE roles: <b>SA1:</b> 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.  EGEE roles: <b>SA1:</b> 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.  EGEE roles: <b>SA1:</b> 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  EGEE roles: <b>SA1:</b> 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. <b>JRA4:</b> 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



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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. <b>JRA4</b> (special activity) network services development. <b>NA5</b> - 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. It is involved in many EU projects including GEANT, 6Net, EcSIRT and EumedConnect. <b>NA5</b> : 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. <b>JRA4</b> : participation to bandwidth allocation and reservation task and network performance monitoring and diagnostic tools task

**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
		<b>Research Institutes involved in the programme of work</b>
BELNET, Belgium	BELNET	Networking (deployment, new networking developments); Grid deployment
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 descriptonal 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 conjunction 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 conjunction 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.
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 include 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.
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
University of Tromsø, 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
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

Organisation (name, city, country)	Short name	Short description (i.e. fields of excellence) and specific roles in the consortium
Turkish Academic Network and Information Center, Ankara Turkey	TANIC	Coordinator of the TR-Grid initiative and operating the National Research and Education backbone network
HealthGrid association	HEALTH GRID	Association to promote the usage of grid technology in health. Participation to the deployment of grid biomedical applications
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
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.
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.
The Danish IT centre for educational research	UNI*C	UNI*C ( <a href="http://www.unic.dk/generell/english/index.htm">http://www.unic.dk/generell/english/index.htm</a> ) has a long experience in preparing and executing courses around IT and will work with KU-NATFAK on training and education within activity NA3
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
University 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.
Research 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.

Organisation (name, city, country)	Short name	Short description (i.e. fields of excellence) and specific roles in the consortium
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 2 <sup>nd</sup> 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 2 <sup>nd</sup> 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.
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 Piraeus	UNIP	UNIP 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 2 <sup>nd</sup> Hellasgrid node in Athens area as part of SA1 and NA3 activities.
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. <b>SA1</b> : coordinate the development and deployment of the UK's Southern Regional tier-2 centre for the LHC
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. <b>SA1</b> : 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. <b>SA1</b> : coordinate the development and deployment of the UK's London 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 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. <b>SA1</b> : coordinate the development and deployment of the UK's Scottish Regional tier-2 centre for the LHC
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 <a href="http://www.whiterose.ac.uk/HPDGrid.cfm">http://www.whiterose.ac.uk/HPDGrid.cfm</a> - 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 host one of the four core nodes of the UK e-Science Grid. <b>SA1</b> : Coordinate development and deployment of Grid infrastructure in the White Rose Universities
<b>Research Institutes interested in the programme of work</b>		
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).
Universitaet Innsbruck, Institut fuer Experimentalphysik	UIBK-EXP	Statistical data analysis, exp. data acquisition systems of high energy physics experiments.
<b>Industrial participants (letters of support)</b>		
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
<b>Networking activities</b>		
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.
<b>Specific Service activities</b>		
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, SLSSs, SLAs, Policies.
<b>Research activities</b>		
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 €).

Part. Number	Part, Short name	Cost Model	Amounts (€)	Networking activities (NA)										Specific service activities (SA)					Research activities (JRA)					Total expected	Max Community Contribution								
				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					3 119 000													8 149 000			
			req. contrib	1 745 000	485 000		800 000	200 000		3 230 000		1 800 000						3 119 000															8 149 000
2	GUP	AC	exp. budget		10 000	20 000				30 000		95 000																				125 000	
			req. contrib		10 000	20 000				30 000		95 000																					
3	UNINNSBRUCK	AC	exp. budget			10 000			10 000		78 000																						88 000
			req. contrib			10 000				10 000		78 000																					
4	CESNET	FCF	exp. budget	6 000		80 000		80 000		166 000		332 000					300 000																798 000
			req. contrib	6 000		40 000		40 000		86 000		166 000					150 000																
5	BUTE	AC	exp. budget		18 000	17 500				35 500																							35 500
			req. contrib		18 000	17 500				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																							
7	KFKI-RMKI	FCF	exp. budget	6 000						6 000		176 000																					182 000
			req. contrib	6 000						6 000		88 000																					
8	MTA-SZTAKI	AC	exp. budget	6 000	20 000	41 000	20 000			87 000		18 000																					105 000
			req. contrib	6 000	20 000	41 000	20 000			87 000		18 000																					
9	NIIF	FC	exp. budget	6 000					6 000		113 000																						119 000
			req. contrib	6 000					6 000		56 500																						
10	CYFRONET	AC	exp. budget								168 500																						168 500
			req. contrib								168 500																						
11	ICM	AC	exp. budget	6 000		26 000				32 000		140 000																					172 000
			req. contrib	6 000		26 000				32 000		140 000																					

Part. Number	Part. Short name	Cost Model	Amounts (€)	Networking activities (NA)										Specific service activities (SA)						Research activities (JRA)						Total expected	Max Community Contribution			
				NA1	NA2	NA3	NA4	NA5	All NA	SA1	SA2	All SA	JRA1	JRA2	JRA3	JRA4	All JRA													
12	PSNC	AC	exp. budget req. contrib			26 000									26 000	146 000	146 000											172 000		
13	II-SAS	FCF	exp. budget req. contrib	2 000		90 000									92 000	231 000	231 000												323 000	
14	JSI	FC	exp. budget req. contrib	6 000											6 000	162 000	162 000												168 000	
15	TCD	AC	exp. budget req. contrib	6 000											6 000	192 000	192 000												198 000	
16	CCLRC	FC	exp. budget req. contrib	6 000											6 000	3 720 000	3 720 000				1 138 000								4 864 000	
17	UEDIN	AC	exp. budget req. contrib	6 000	106 000	684 000	94 000								890 000														890 000	
18	PPARC	FC	exp. budget req. contrib	6 000										8 000	14 000														14 000	
19	UCL	AC	exp. budget req. contrib	6 000											6 000														291 000	
20	CEA	FC	exp. budget req. contrib	6 000											6 000	285 000	285 000												291 000	
21	CGG	FC	exp. budget req. contrib	6 000											6 000	315 000	315 000												321 000	
22	CNRS	FCF	exp. budget req. contrib	6 000			2 000	40 000							6 000	2 710 000	400 000										400 000		5 950 000	
23	CSSI	FC	exp. budget req. contrib	6 000			377 000								6 000	1 355 000	200 000										400 000		2 955 000	
24	CRSA	FC	exp. budget	6 000			188 500								390 000	150 000											400 000		1 083 000	
				6 000			384 000								390 000												200 000		390 000	









Part. Number	Part, Short name	Cost Model	Amounts (€)	Networking activities (NA)								Specific service activities (SA)						Research activities (JRA)						Total expected	Max Community Contribution					
				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 req, contrib	6 000						6 000						6 000									390 000		396 000			
64	ENEА	FC	exp. budget req, contrib	6 000						6 000						6 000	186 000									192 000		192 000		
65	UniCal	AC	exp. budget req, contrib													99 000	99 000	99 000									99 000		99 000	
66	UniLe	AC	exp. budget req, contrib													99 000	99 000	99 000									99 000		99 000	
67	UniNa	AC	exp. budget req, contrib													99 000	99 000	99 000									99 000		99 000	
68	DANTE	FC	exp. budget req, contrib	6 000						6 000						6 000	186 000								186 000		192 000		192 000	
69	DFN	AC	exp. budget req, contrib	6 000						6 000			107 500	107 500	113 500	113 500										100 000		273 500		273 500
70	GARR	FC	exp. budget req, contrib	6 000						6 000			100 000	100 000	106 000	106 000										215 000		321 000		321 000
<b>Totals</b>															6 000												107 500		113 500	
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				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	6 415 000	9 533 000	13 963 500	237 000				5 876 000	400 000	1 166 000	681 500								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 €).

Part. Number	Part. Short name	Cost Model	Amounts (€)	Networking activities (NA)								Specific service activities (SA)					Research activities (JRA)					Total expected	Max Community Contribution			
				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					1 949 375					5 093 125					
			req. contrib	1 090 625	303 125		500 000	125 000		2 018 750	1 125 000					1 949 375										
			exp. budget		6 250	12 500				18 750	59 375											78 125				
2	GUP	AC	req. contrib		6 250	12 500			18 750	59 375																
			exp. budget			6 250			6 250			48 750														
			req. contrib			6 250			6 250			48 750														
3	UNNINSBRUCK	AC	exp. budget	3 750		50 000	50 000		103 750	207 500					187 500						498 750					
			req. contrib	3 750		25 000	25 000		53 750	103 750					93 750											
			exp. budget		11 250	10 938				22 188												22 188				
4	ELUB	AC	req. contrib	3 750	7 500	10 938			22 188																	
			exp. budget			10 938				22 188												22 188				
			req. contrib	3 750	7 500	10 938				22 188																
5	KFKI-RMKI	FCF	exp. budget	3 750					3 750	110 000											113 750					
			req. contrib	3 750					3 750	55 000																
			exp. budget		12 500	25 625	12 500		54 375	11 250												65 625				
6	NIIF	FC	req. contrib	3 750	12 500	25 625	12 500		54 375	11 250																
			exp. budget							70 625												74 375				
			req. contrib	3 750	12 500	25 625	12 500		54 375	11 250																
7	CYFRONET	AC	exp. budget						105 313												105 313					
			req. contrib						105 313																	
			exp. budget	3 750		16 250			20 000	87 500												107 500				
8	ICM	AC	req. contrib	3 750		16 250			20 000	87 500																
			exp. budget																							
			req. contrib	3 750		16 250			20 000	87 500												107 500				
9	MTA-SZTAKI	AC	exp. budget	3 750					54 375	11 250																
			req. contrib	3 750					54 375	11 250																
			exp. budget																							
10	MTA-SZTAKI	AC	req. contrib	3 750					54 375	11 250																
			exp. budget																							
			req. contrib	3 750																						
11	MTA-SZTAKI	AC	exp. budget	3 750					54 375	11 250																
			req. contrib	3 750																						
			exp. budget																							
11	MTA-SZTAKI	AC	req. contrib	3 750					54 375	11 250																
			exp. budget																							
			req. contrib	3 750																						
11	MTA-SZTAKI	AC	exp. budget	3 750					54 375	11 250																
			req. contrib	3 750																						
			exp. budget																							
11	MTA-SZTAKI	AC	req. contrib	3 750					54 375	11 250																
			exp. budget																							
			req. contrib	3 750																						

Part. Number	Part. Short name	Cost Model	Amounts (€)	Networking activities (NA)										Specific service activities (SA)					Research activities (JRA)					Total expected	Max Community Contribution			
				NA1	NA2	NA3	NA4	NA5	All NA	SA1	SA2	All SA	JRA1	JRA2	JRA3	JRA4	All JRA											
12	PSNC	AC	exp. budget req. contrib			16 250				16 250					16 250	91 250										107 500		
13	II-SAS	FCF	exp. budget req. contrib	1 250		56 250				56 250					144 375	144 375											201 875	107 500
14	JSI	FC	exp. budget req. contrib	3 750											101 250	101 250											105 000	
15	TCD	AC	exp. budget req. contrib	3 750											50 625	50 625											123 750	54 375
16	OCLRC	FC	exp. budget req. contrib	3 750											120 000	120 000											3 040 000	123 750
17	UEDIN	AC	exp. budget req. contrib	3 750	66 250	427 500	58 750			58 750					556 250	556 250											556 250	1 521 875
18	PPARC	FC	exp. budget req. contrib	3 750				5 000							8 750	8 750											8 750	6 250
19	UCL	AC	exp. budget req. contrib	3 750				2 500							6 250	6 250											181 875	185 625
20	CEA	FC	exp. budget req. contrib	3 750											3 750	3 750											181 875	185 625
21	CGG	FC	exp. budget req. contrib	3 750											89 063	89 063											181 875	92 813
22	CNRS	FCF	exp. budget req. contrib	3 750			1 250 000	25 000		1 275 000					1 943 750	1 943 750											3 718 750	102 188
23	CSSI	FC	exp. budget req. contrib	3 750			625 000			625 000					971 875	971 875											676 875	1 846 875
24	CRSA	FC	exp. budget	3 750			117 813			117 813					93 750	93 750											243 750	340 313

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





Part. Number	Part. Short name	Cost Model	Amounts (€)	Networking activities (NA)							Specific service activities (SA)				Research activities (JRA)					Total expected	Max Community Contribution						
				NA1	NA2	NA3	NA4	NA5	All NA	SA1	SA2	All SA	JRA1	JRA2	JRA3	JRA4	All JRA										
			req. contrib	3 750	43 750					47 500	120 000												167 500				
			exp. budget	3 750	43 750					47 500	120 000													167 500			
50	UCY	AC	req. contrib	3 750	43 750					47 500	120 000													167 500			
			exp. budget	3 750	43 750					47 500	120 000														167 500		
51	GRNET	FCF	req. contrib	3 750		150 000		143 750		297 500	484 375	71 875												853 750			
			exp. budget	3 750		75 000		71 875		150 625	242 188														392 813		
52	TAU	AC	req. contrib	3 750		43 750				47 500	119 688														167 188		
			exp. budget	3 750		43 750				47 500	119 688															167 188	
53	ICI	FC	req. contrib	3 750		87 500				91 250	239 375														330 625		
			exp. budget	3 750		43 750				47 500	119 688															167 188	
54	LIP	FCF	req. contrib	3 750						3 750	301 875														305 625		
			exp. budget	3 750						3 750	301 875															154 688	
55	CESGA	AC	req. contrib	3 750						3 750	98 438														102 188		
			exp. budget	3 750						3 750	98 438															102 188	
56	CSIC	FC	req. contrib	3 750			218 750	143 750		366 250	396 875														763 125		
			exp. budget	3 750			109 375	71 875		185 000	198 438															383 438	
57	IFAE	AC	req. contrib	3 750						3 750	175 625															179 375	
			exp. budget	3 750						3 750	175 625															179 375	
58	INTA	FC	req. contrib	3 750						3 750	196 875															200 625	
			exp. budget	3 750						3 750	196 875															200 625	
59	UPV	FC	req. contrib	3 750			208 750			212 500																212 500	
			exp. budget	3 750			104 375			108 125																108 125	
60	University of Chicago	FC	req. contrib																								
			exp. budget																								
61	USC	FC	req. contrib																								
			exp. budget																								

Part. Number	Part. Short name	Cost Model	Amounts (€)	Networking activities (NA)							Specific service activities (SA)					Research activities (JRA)							Total expected	Max Community Contribution									
				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 req. contrib	3 750																			243 750			247 500							
				3 750																				243 750			247 500		247 500				
64	ENEA	FC	exp. budget req. contrib	3 750														116 250									120 000						
				3 750															116 250									120 000					
65	UniCal	AC	exp. budget req. contrib																	58 125								61 875					
																					58 125								61 875		61 875		
66	Unile	AC	exp. budget req. contrib																										61 875				
																														61 875		61 875	
67	UniNa	AC	exp. budget req. contrib																											61 875			
																														61 875		61 875	
68	DANTE	FC	exp. budget req. contrib	3 750																											61 875		
				3 750																											61 875		61 875
69	DFN	AC	exp. budget req. contrib	3 750										67 188																			
				3 750										67 188																			
70	GARR	FC	exp. budget req. contrib	3 750																													
				3 750																													
<b>Totals</b>																																	
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				745 000				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				432 188				19 916 875	

**Table 4: Deliverables List**

Deliverable No <sup>1</sup>	Activity No <sup>2</sup>	Deliverable title	Lead participant	Delivery date <sup>3</sup>	Estimated indicative resources	Nature <sup>4</sup>	Dissemination level <sup>5</sup>
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	Infrastructure 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	PP
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	M06	139.4K	R	PU

<sup>1</sup> Deliverable numbers in order of delivery dates: D1 – Dn

<sup>2</sup> Activity that will produce this Deliverable

<sup>3</sup> 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.

<sup>4</sup> Please indicate the nature of the deliverable using one of the following codes:

**R** = Report **P** = Prototype **D** = Demonstrator **O** = Other

<sup>5</sup> 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 <sup>1</sup>	Activity No <sup>2</sup>	Deliverable title	Lead participant	Delivery date <sup>3</sup>	Estimated indicative resources	Nature <sup>4</sup>	Dissemination level <sup>5</sup>
DJRA3.2	JRA3	Site access control architecture	FOM	M09	238.91K	R	PP
DJRA4.2	JRA4	Definition of standardised network measurement query/response interfaces	UCL	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	UCL	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 <sup>1</sup>	Activity No <sup>2</sup>	Deliverable title	Lead participant	Delivery date <sup>3</sup>	Estimated indicative resources	Nature <sup>4</sup>	Dissemination level <sup>5</sup>
DJRA4.4	JRA4	Implementation of single-domain bandwidth reservation pilot service	UCL	M21	321.23K	P+R	PU
DJRA4.5	JRA4	Service to supply network performance information to resource brokering middleware	UCL	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	UCL	M24	200.77K	R	PU
DJRA4.7	JRA4	Report on network monitoring	UCL	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

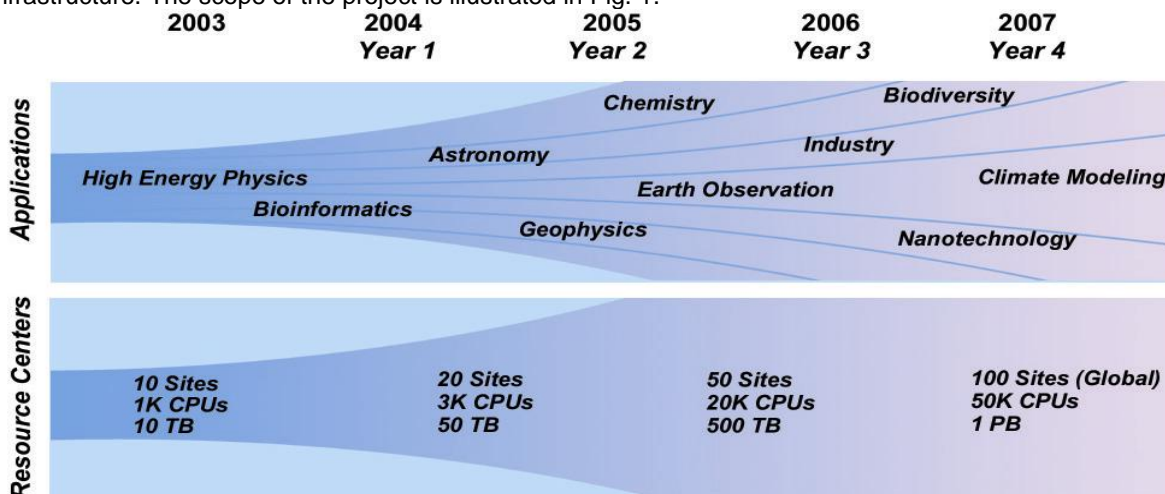
## 2 Objectives of the I3

### 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](http://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.

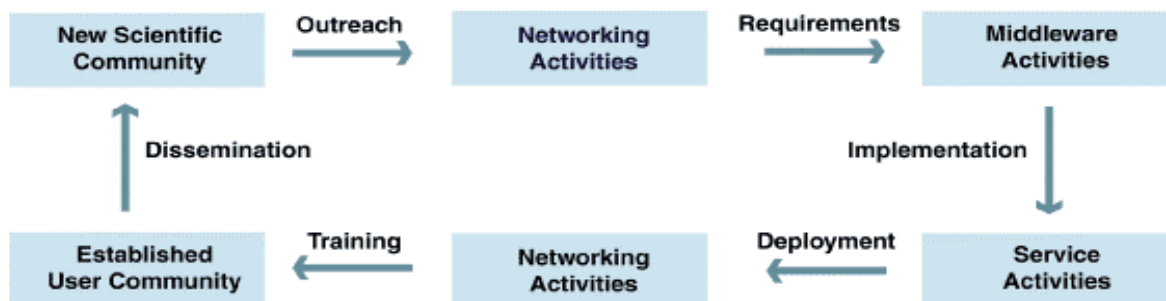
### The EGEE Mission

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;
- Biannual 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 lead 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 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.

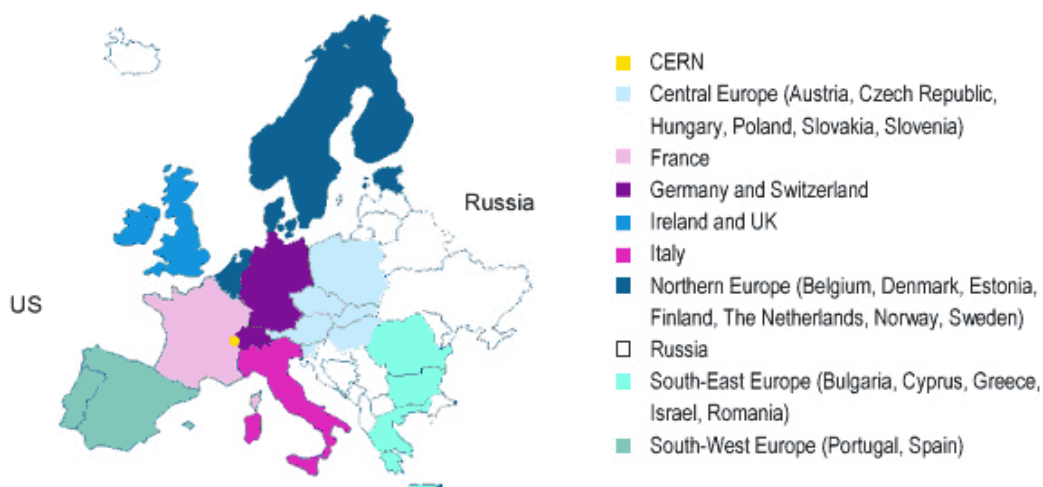
This competitive advantage will translate into benefits for smaller, less-well resourced sites in the European Research Area to access computing power that would otherwise be unaffordable. The competitive advantage will also ensure more efficiently managed computing resources and avoid unnecessary duplication 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: Map of the partner regions of EGEE. Details of representation for each partner country and region can be found on [www.cern.ch/egge](http://www.cern.ch/egge)**

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 EGEE 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 CCSI 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 and deliverables over full project duration

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
M04	DNA5.1.1	eInfrastructure reflection group meeting and associated White Paper
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	MJRA4.2	Definition of initial network performance metrics and composite measurements required.
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	MJRA4.2	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
M12	DNA5.3	Progress report on International Cooperation Activities
M12	DJRA1.3	Software and associated documentation (Release 1)
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
M21	DJRA1.6	Software and associated documentation (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

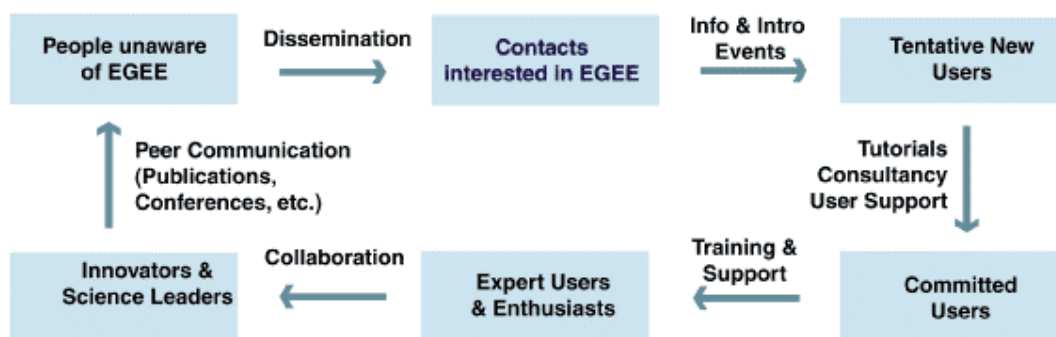
## 5 Detailed implementation plan

### 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 both 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.

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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](http://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 + unfunded)
CERN	Project Director	1.0 + 0.0
CERN	Technical Director	1.0 + 0.0
CERN	Financial Administrator	1.0 + 0.0
CERN	Administrative Assistant	2.0 + 0.0
CERN	Project Secretary	1.0 + 0.0
<b>total</b>		<b>6.0 + 0.0</b>

**Table B NA1 effort (funded and unfunded) 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. Fredrik Hedman 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. Guy Wormser has been designated for this position.
- A Network Head responsible for network provision and developments for the grid infrastructure. Mr. Franck Bonassieux 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](http://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.

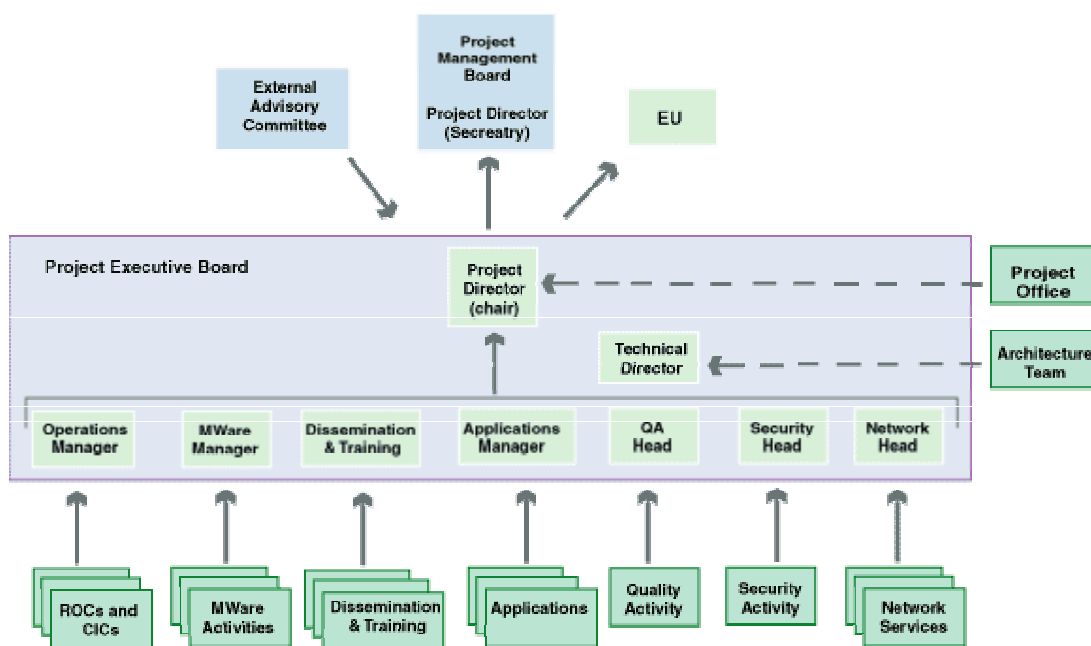
The Project Director will agree and prepare the agenda for the PMB meetings with the PMB chair. The PMB chair will be elected at a simple majority vote by the PMB members. He or she will be in charge for a 6-month term. The Project Director will act as PMB deputy chair when required.

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. CES NET	6. ELUB	7 KFK- RMK I	8. MTA - SZT AKI	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 CCL RC	17 UE DIN	18 PPA RC	19 UCL	20 CEA/ DSM	21 CG G	23 CSSI	24 CRS A	25 DES Y	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 DAT AMA T	32 TER ENA	33 VUB	34 KU- NATF AK	35 UH- HIP	37 SAR A	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 GRN ET	52 TAU	53 ICI	54 LIP	55 CES GA	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 INT A	59 UPV	63 KTH	64 ENE A	68 DAN TE	69 DFN	70 GAR R			
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<sup>6</sup> 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.**

<sup>6</sup> 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.

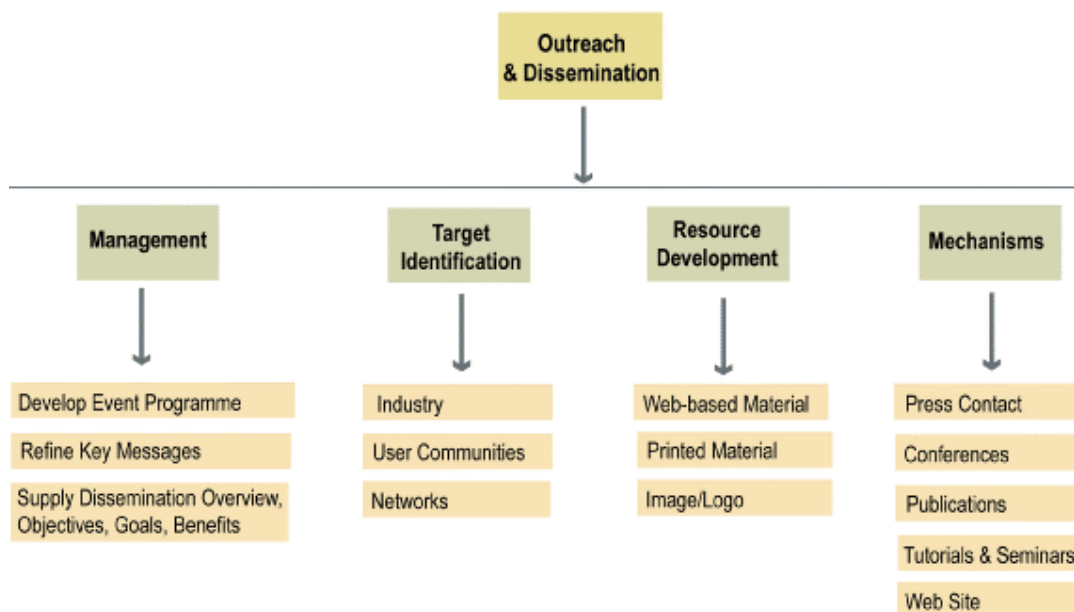
The central purpose of this activity is to ensure that as many potential users of EGEE as possible are aware of the services available and that they know how to become an EGEE user. The challenge is to reach new communities, such as new research disciplines, new industrial and commercial groups and branches 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

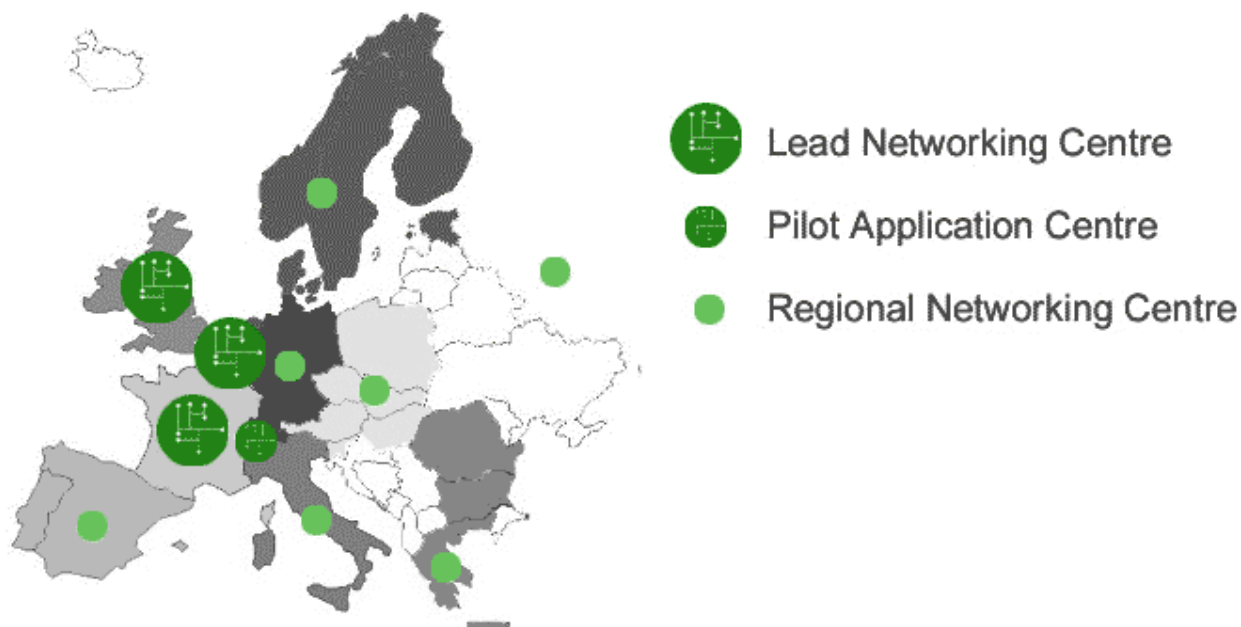
The success of these events will be measured by the number of participants who are induced to progress towards a closer relationship with EGEE, as shown in Table A. The percentages represent the proportion of new participants from industry, business and government.

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 3<sup>rd</sup> 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 exist 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), Israeli 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](http://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](http://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](http://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](http://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 infrastructure 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	
<b>UK &amp; IRELAND</b>	<b>0.5</b>	<b>0.5</b>	17. UEDIN	0.5	0.5
<b>France</b>					
<b>Italy</b>	<b>0.5</b>	<b>0.5</b>	31. INFN	0.5	0.5
<b>Germany/Switzerland</b>	<b>0.5</b>	<b>0.5</b>	28. FZK	0.5	0.5
<b>Northern Europe</b>	<b>0.5</b>	<b>0.5</b>	33. VUB	0.5	0.5
<b>South-East Europe</b>	<b>1.4</b>	<b>1.4</b>	49. CLPP BAS	0.7	0.7
			50. UCY	0.7	0.7
<b>Central Europe</b>	<b>0.33</b>	<b>0.33</b>	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
<b>Russia</b>	<b>8.17</b>	<b>1.2</b>	41. IHEP	0.53	
			42. IMPB-RAS	0.45	1.2
			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	
<b>Total</b>	<b>17.93</b>	<b>4.43</b>			

**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.

<b>Item</b>	<b>Cost (K€)</b>
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
<b>Total</b>	<b>155</b>

**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 SZTAK I	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<sup>7</sup> 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.

<sup>7</sup> 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

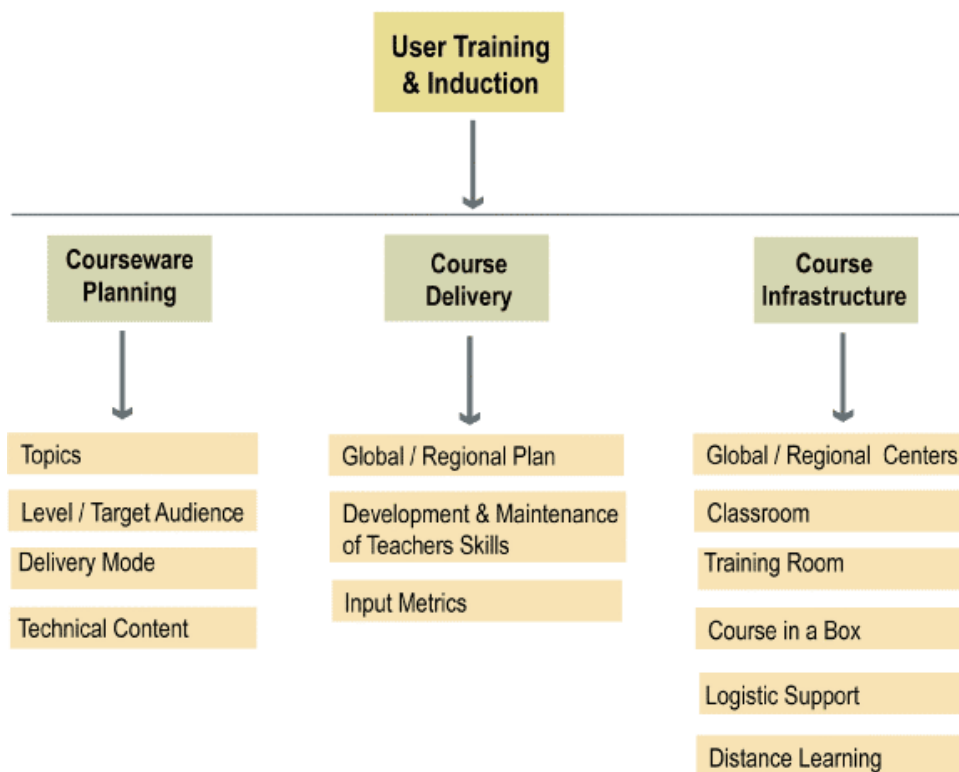
There will be need for training at a variety of levels:

- 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 run 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€)
	<b>UK &amp; Ireland</b>			
17	UEDIN (NeSC)	72	72	699
	<b>Central Europe</b>			
2	GUP	4.8	4.8	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	27		45
	<b>Germany &amp; Switzerland</b>			
28	FZK	24		100
	<b>Italy</b>			
31	INFN	12	12	100
	<b>Northern Europe</b>			
34	KU-NATFAK	16	16	100
	<b>Russia</b>			
41	IHEP	8.4	24	26.6
42	IMPB RAS	2.4	7.2	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	RRCKI	12.7		10
	<b>South East Europe</b>			
51	GRNET	30		120
52	TAU	8.75	8.75	70
53	ICI	35		70
	<b>Total</b>	<b>353.05</b>	<b>179.75</b>	<b>1,590.2</b>

**Table G Summary of Effort and Funding Sought<sup>8</sup>**

	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.

<sup>8</sup> The cost of employing personnel varies for each partner

### 5.A.3.4 Summary

Activity number :	NA3	Start date or starting event:				Project start			
		2	3	4	5	6	8	11	12
Participant:		<b>GUP</b>	<b>UINNS BRUC K</b>	<b>CESNE T</b>	<b>BUTE</b>	<b>ELUB</b>	<b>8 MTA SZTAK I</b>	<b>ICM</b>	<b>PSNC</b>
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:		<b>13 II-SAS</b>	<b>17 UEDIN</b>	<b>28 FZK</b>	<b>31 INFN</b>	<b>34 KU- NATFA K</b>	<b>41 IHEP</b>	<b>42 IMPB RAS</b>	<b>43 ITEP</b>
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:		<b>44 JINR</b>	<b>46 PNPI</b>	<b>47 RRCKI</b>	<b>51 GRNET</b>	<b>52 TAU</b>	<b>53 ICI</b>		
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<sup>9</sup> 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.

<sup>9</sup> 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.

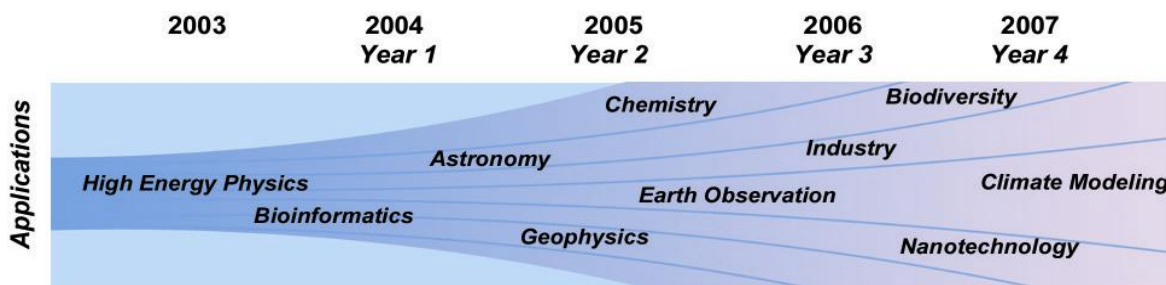
## 5.A.4 Activity NA4 - Application Identification and Support

### 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 and dates 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 or 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/unfunded 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 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 a 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 (funded and unfunded)*

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;

#### **Unfunded 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 2FTE. Central Europe, Germany, Northern Europe with 1 funded FTE each will complement the effort as described above.

Unfunded 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	NA4 overall manager. Chair of the DataGrid management board. In charge of the CNRS effort in DataGrid and EGEE
Vincent Breton	CNRS-France	NA4 Bio-Med Application manager. Responsible of Bio applications in DataGrid. Founder of HealthGrid association.
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

Application domain	Partner	FTE per Task(funded)
	UPV (59)	0,9
	IMPB RAS(42)	0,3
HEP	CERN (1)	4
	IHEP(41)	0,4
	ITEP(43)	0,5
	JINR(44)	0,4
	PNPI(46)	0,4
	RRC KI(47)	0,5
	SINP-MSU(48)	0,5
Generic	INFN (31)	2
	CESNET(4)	0,8
	MTA(8)	0,2
	DKRZ(26)	0,5
	FhG(27)	0,5
	FOM(36)	1
NA3 Liason	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	2 (2)
36-FOM	2
41-IHEP	1.6
42-IMPB RAS	1.3
43-ITEP	2
44-JINR	1.6
46-PNPI	1.6
47-RRC KI	2
48-SINP-MSU	2
56-CSIC	2
59-UPV	2
Totals	41.4 (7.7) 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<sup>10</sup> 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.

<sup>10</sup> 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, CSIC/Rediris, 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 CND 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 PM21. 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).
- 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.5.2 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.5.3 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) <sup>11</sup>
CERN	1.0 + 1.0
GRNET	1
INFN	0.5 + 0.5
CSIC	1
DFN	0.5 + 0[2]
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 a 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 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.

<sup>11</sup> The numbers shown have been rounded for simplicity. See the NA5 activity summary table for exact figures.

**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.5.4 Summary

<b>Activity number :</b>	NA5	Start date or starting event: Project start								
<b>Participant:</b>	1 CERN	18 PPAR C	22 CNRS	28 FZK	31 INFN	51 GRNET	56 CSIC	69 DFN	70 GARR	
<b>Expected Budget per Participant:</b>	200	8	40	100	100	230	230	107.5	100	
<b>Requested Contribution per Participant:</b>	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	M6	(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<sup>12</sup> 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).

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<sup>12</sup> 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

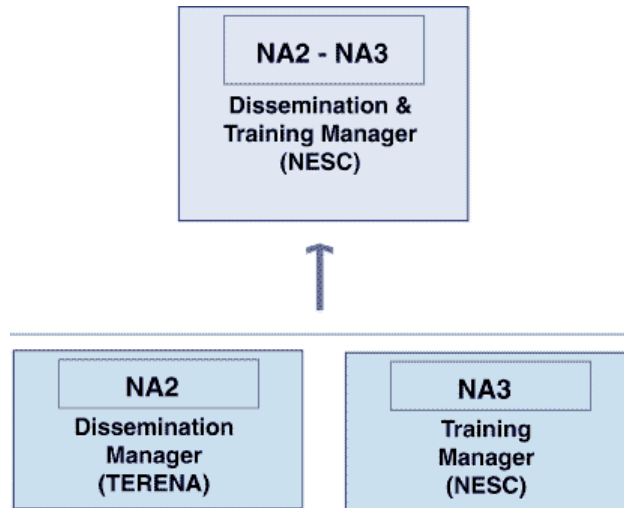
### 5.A.6.1 Relevance to the Objectives of the Networking Activities

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

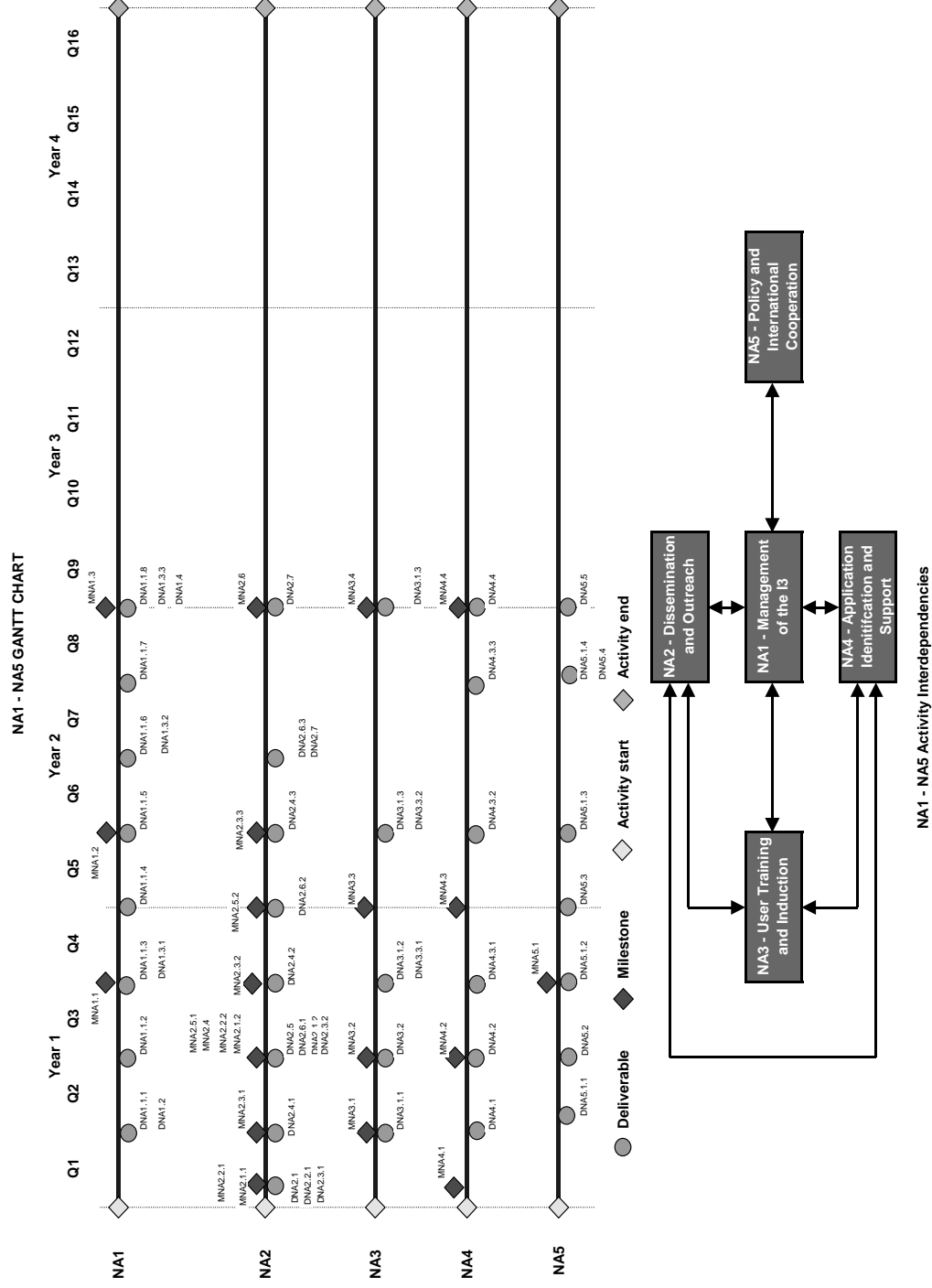
**Figure 11**, on the following page, shows a Gantt chart and Activity Interdependencies diagram for NA1 to NA5. Although funding in this proposal is only sought for the first 24 months of the EGEE I3 we expect its final duration to extend to 48 months. Our detailed planning at this stage only extends 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	M6	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 CI 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)
	<b>(CERN)</b>	<b>N/A</b>	<b>N/A</b>	<b>900</b>	<b>140.0</b>	<b>800.0</b>	<b>1250.0</b>	<b>10000.0</b>
	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
<b>Central-East Total</b>		<b>36.9</b>	<b>105.8</b>	<b>871</b>	<b>21.5</b>	<b>17.5</b>	<b>136.1</b>	<b>590.5</b>
	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
<b>Northern Total</b>		<b>N/A</b>	<b>1099.6</b>	<b>2036</b>	<b>174.2</b>	<b>626.0</b>	<b>642.9</b>	<b>2314.3</b>
	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



<b>Southeast Total</b>		<b>N/A</b>	<b>8.5</b>	<b>322</b>	<b>14</b>	<b>5.0</b>	<b>292</b>	<b>522.28</b>
	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
<b>Southwest Total</b>		<b>N/A</b>	<b>N/A</b>	<b>258</b>	<b>10.5</b>	<b>115.7</b>	<b>533.3</b>	<b>146.2</b>
	Russia	N/A	2.8	152	36.1	59.6	296.7	71.8
<b>Other Total</b>		<b>N/A</b>	<b>2.8</b>	<b>152</b>	<b>36.1</b>	<b>59.6</b>	<b>296.7</b>	<b>71.8</b>
<b>Grand Total</b>		<b>137</b>	<b>1313</b>	<b>7691</b>	<b>757</b>	<b>2388</b>	<b>657</b>	<b>1095</b>

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
		<b>CERN</b>	<b>www.cern.ch</b>	<b>280</b>	<b>43</b>	<b>1800</b>	<b>50</b>
	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
<b>France Total</b>				<b>79</b>	<b>62</b>	<b>1770</b>	<b>32</b>
	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
<b>Germany Total</b>				<b>69</b>	<b>25</b>	<b>961</b>	<b>42</b>
	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
<b>Italy Total</b>				<b>69</b>	<b>50</b>	<b>1160</b>	<b>62</b>
	<b>UK and Ireland</b>	<b>PPARC, University of Edinburgh, CLRC, UCL, Dublin</b>	<b>www.research-councils.ac.uk/escience</b>	<b>235</b>	<b>15</b>	<b>6400</b>	<b>34</b>
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
<b>Central-Europe Total</b>				<b>109</b>	<b>40</b>	<b>2189</b>	<b>48</b>
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
<b>Northern Total</b>				<b>79</b>	<b>28</b>	<b>4118</b>	<b>54</b>
SouthEast	Bulgaria	CLPP, INRNE	www.bas.bg	14	37	36	33
	Cyprus	UCY	gris.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
<b>Southeast Total</b>				<b>106</b>	<b>29</b>	<b>1312</b>	<b>25</b>
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
<b>Southwest Total</b>				<b>52</b>	<b>23</b>	<b>794</b>	<b>30</b>
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	27	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
<b>Other Total</b>				<b>82</b>	<b>61</b>	<b>344</b>	<b>37</b>
<b>Grand Total</b>				<b>1238</b>	<b>37</b>	<b>17654</b>	<b>43</b>

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

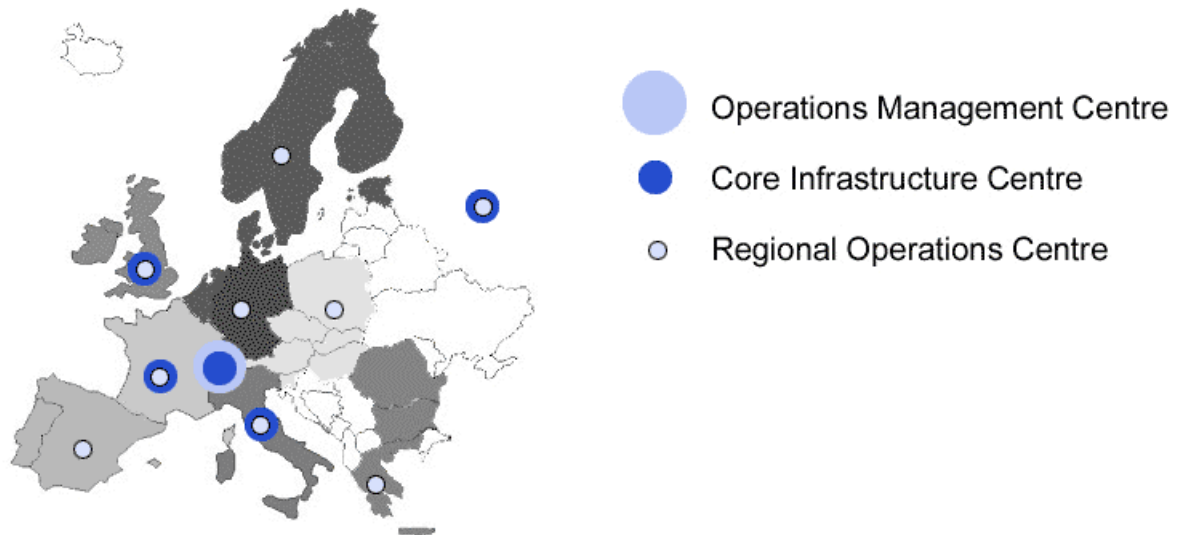
Specific user services including specific user support are developed as part of NA4.

### 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.

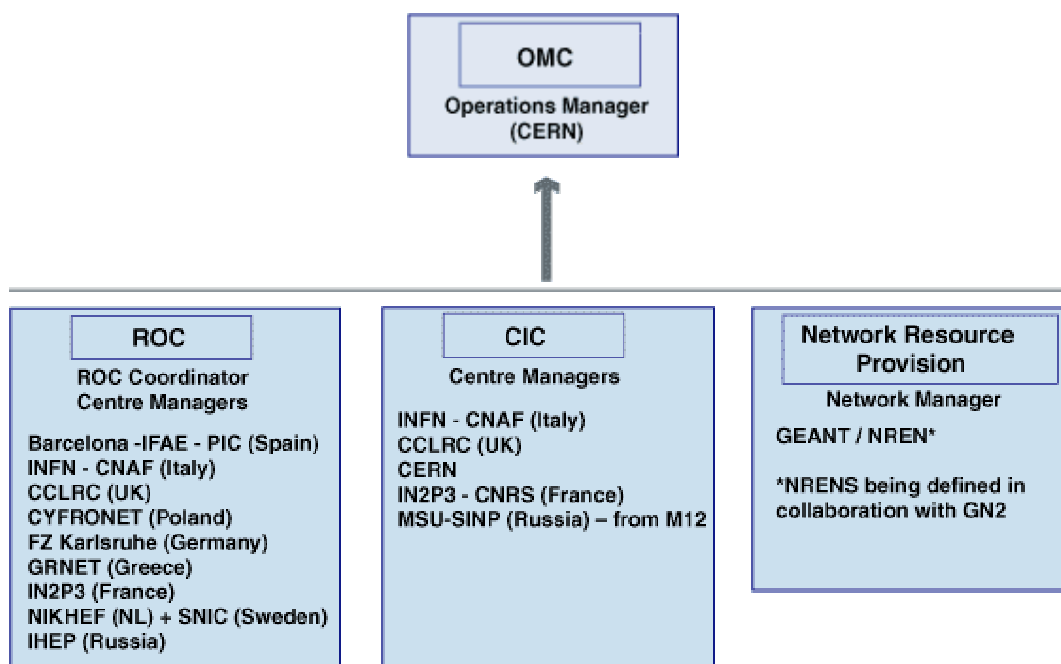
- Layer I Regional Operations Centres (ROC) which deploy Grid middleware at Resource Centres to connect resources to the EGEE Grid and provide geographically local front line support to both users and Resources Centres on a 24x7 basis. There will be an ROC in each of the eight partner regions participating 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.
- 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.
- 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.

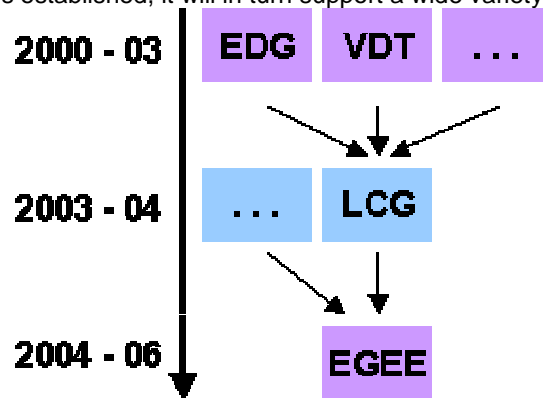
The EGEE and LCG projects will therefore pool resources to provide the core infrastructure of the EGEE Grid, based on the LCG infrastructure that will be available at the very start of EGEE. The advantages for EGEE in having the core infrastructure strongly coupled to the LCG project are:

- 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:

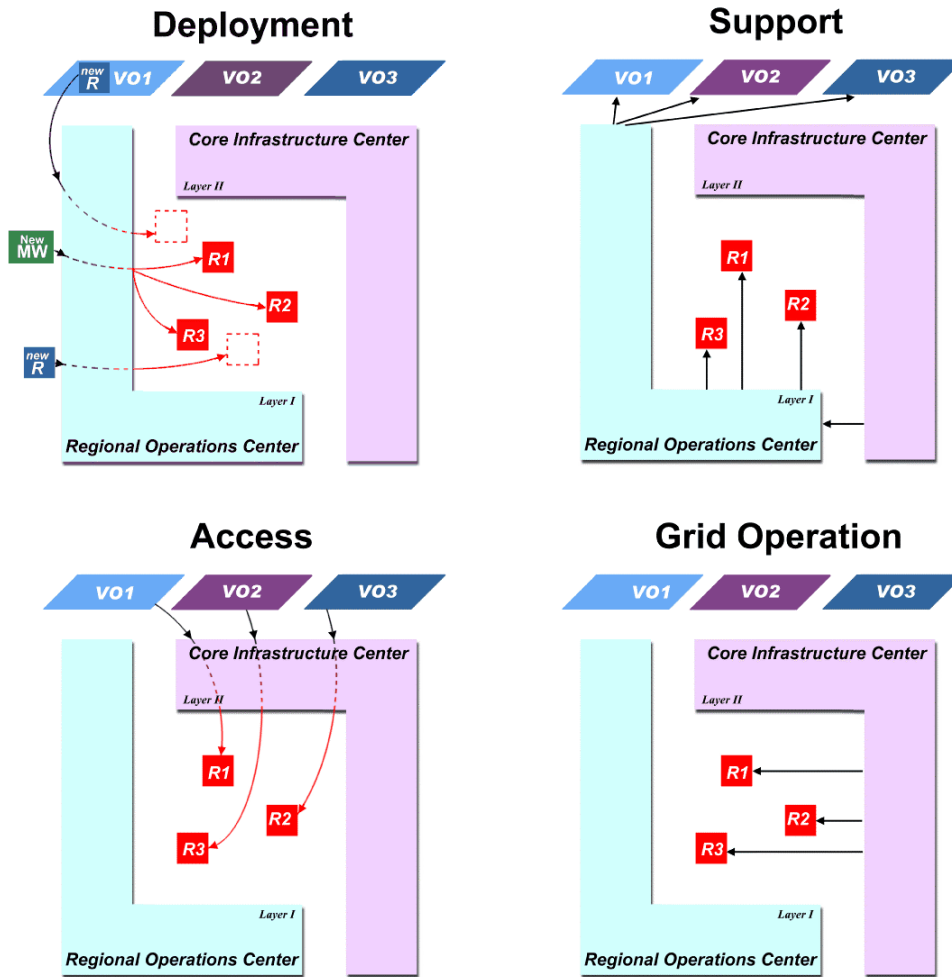
- Access to the resources of the Grid.
- Operation of the Grid as a reliable service.
- Deployment of new middleware and services on the Grid.
- Support of resource providers and users.
- Introduction of new Virtual Organisations and Resource Centres.

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 EGEE 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 solvable 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 shown 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 Infrastructure 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-CNAF, INFN-LNL, INFN- Milano, INFN- Torino, UniCal, UniLe, UniNa	INFN-CNAF, INFN- LNL, INFN-Milano, INFN-Torino, 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
<b>Totals</b>	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 6 months	Initial pilot production Grid operational Based on best existing middleware
	4 Core Infrastructure Centres
	9 Regional Operations Centres
	10 Resource Centres
MSA1.2 9 months	First review
MSA1.3 14 months	Full production Grid operational Using integrated middleware release 1
	5 Core Infrastructure Centres
	9 Regional Operations Centres
	20 Resource Centres
MSA1.4 18 months	Second review
MSA1.5 24 months	Third review and Expanded production Grid operational 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<sup>13</sup>. 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
<b>CERN</b>				
CERN	Operations Management Centre Central Infrastructure Centre	9 + 9	CERN Computer Centre	Overall coordination and HEP coordination
<b>UK and Ireland</b>				
CCLRC	Regional Operations Centre Core Infrastructure Centre	19	National grid infrastructure  1 Gbps access to Network	Support Centre Technology Group National Grid Services VO-specific Grid services Large-scale CPU and Storage provision
TCD	Regional Operations Centre	1 + 1	Dedicated national grid infrastructure  1 Gbps access to Network	Resource Centre National Grid Services VO-specific Grid services
<b>France</b>				
CNRS+CEA	Regional Operations Centre Core Infrastructure Centre	17	National grid infrastructure and Large computing centre in Lyon	Support Centre Technology Group National Grid Services VO-specific Grid services Large-scale CPU and Storage provision Large scale CPU and Storage provision
CGG	Regional Operation Centre	1.8	1 Gbps access to Network Monitoring tools	
CSSI	Regional Call Centre	1.75		Local User support
<b>Germany and Switzerland</b>				
DESY	Resource Centre, Support Centre	3.75	National grid infrastructure	User and Administrator support CPU and Storage provision
FhG	Resource Centre, Support Centre	5.75	National grid infrastructure	User and Administrator support Grid Monitoring and management

<sup>13</sup> 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
				Middleware and service deployment CPU and Storage provision
FZK	Resource Centre, Regional Operations Centre, Grid User Support Centre	3.75	National grid infrastructure	User and Administrator support Middleware and service deployment Call centre German CA Large-scale CPU and Storage provision
GSI	Resource Centre, Support Centre	1.75	National grid infrastructure	User and Administrator support CPU and Storage provision
<b>Italy</b>				
INFN	Regional Operations Centre ROC Coordination Core Infrastructure Centre	8.5 + 8.5	National grid infrastructure  1 Gbps access to Network	Support Centre Technology Group with expertise on Globus, Condor and EDG middleware services National Grid Services VO-specific Grid services Large-scale CPU and Storage provision
ENEA	Resource Centre	1	Distributed clusters	Support Centre CPU and Storage provision
Universita' della Calabria	Resource Centre	0.5 + 0.5	Computing Centre	Support Centre CPU and Storage provision
Universita' di Lecce	Resource Centre	0.5 + 0.5	Computing Centre	Support Centre CPU and Storage provision
Universita' di Napoli	Resource Centre	0.5 + 0.5	Computing Centre	Support Centre CPU and Storage provision
<b>Northern Europe</b>				
SARA & NIKHEF (FOM)	Level-2 Support Centre	6	National VL and grid infrastructure One of the world largest internet exchange points Several thousands of CPUs Mass Storage	Support Centre Technology Group National VL and Grid Services VO-specific Grid services CA service
SNIC/SweGrid HPC2N/Umea University LUNARC/Lund University NSC/Linkoping University PDC/Royal Institute of Technology UNICC/Chalmers University of Technology UPPMAX/Uppsala University	Level-2 Support Centre	3 + 3	National Grid with six primary sites 2.5 Gbps local loops, 10 Gbps national backbone, Geant PoP, Baltic state direct connection 800 cpu's Terascale Storage facilities	Operations, User, and Applications Support Centre Technology Expertise: Security, File systems/Storage management, Performance tools and engineering, scientific software engineering. National and International Grid Services VO-specific Grid services
<b>South East Europe</b>				
GRNET	Regional Operations Centre, Resource Centre, Local Support Centre	4	National grid infrastructure  1 Gbps access to Network	Large-scale CPU and Storage provision Regional Support Centre Technology Group National Grid Services
CLPP-BAS	Regional Operations Centre Interface- Resource Centre, Local Support Centre	1 + 1	National grid infrastructure  34 Mbps access to Network	CPU provision National Support Centre Technology Group National Grid Services
ICI	Regional Operations Centre Interface, Resource Centre, Local Support Centre	2	National grid infrastructure  2x 155 Mbps access to Network	Large-scale CPU and Storage provision National Support Centre Technology Group National Grid Services

Participant	Centre Role	Professional FTE (EU funded +unfunded)	Resources	Services
TAU	Regional Operations Centre Interface, Resource Centre, Local Support Centre	1 + 1	National grid infrastructure  2x 155 Mbps access to Network	Large-scale CPU and Storage provision National Support Centre Technology Group National Grid Services
UCY	Regional Operations Centre Interface, Resource Centre, Local Support Centre	1 + 1	National grid infrastructure  34 Mbps access to Network	Large-scale CPU and Storage provision National Support Centre Technology Group National Grid Services
<b>SOUTH-WEST EUROPE</b>				
IFAE (PIC Division)	Regional Operations Centre	2.3 + 2.3	Data center with Petabyte-level Storage with Disk Caching  1 Gbps access to Network	Southwest Region Coordination  Primary Operations Management Team  Support Centre  National Grid Services  Data handling
LIP	Regional Operations Centre	4	Quality Assurance expertise  Hosting of clusters with direct access to GEANT backbone	Auxiliary Operations Management Team  Quality Assurance of Operational Procedures  Support Centre  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  Support Centre  National Grid Services  Large-scale CPU provision
CSIC (IFCA and IFIC Centers)	Regional Operations Centre	4.4	Computer cluster  Experience with Certification and Authentication	Interoperability and Operations of Certificate Authentication  Virtual Organization Management  Support Centre  National Grid Services  Large-scale CPU provision
INTA (CAB Center)	Regional Operations Centre	2.2	Computer cluster  Experience in middleware development  Molecular Biology data	Deployment and root-cause problem analysis of middleware  Support Centre  National Grid Services  Large-scale CPU provision
<b>CENTRAL EUROPE</b>				
UNIINNSBRUCK	Local support centre	0.4 + 0.4	HPC centre Network connectivity	National Grid services User Support
GUP	Local support centre	0.48 + 0.48	HPC centre Network connectivity	National Grid Services User Support
CESNET	Support centre	1.76	HPC centre (Linux cluster, parallel machines) 622 Mbps access to	National Grid Services CPU and Storage provision User Support



Participant	Centre Role	Professional FTE (EU funded +unfunded)	Resources	Services
			network	
KFKI-RMKI	Local Support Centre	0.96	HPC centre	National Grid Services CPU and Storage provision User Support
MTA SZTAKI	Local Support Centre	0.09 + 0.09	HPC centre	National Grid Services User Support
NIIF	Local Support Centre	0.64	HPC centre GEANT network access	National Grid services User Support
CYFRONET	Regional Operations Centre	0.85 + 0.85	HPC centre (Linux cluster, parallel machines) 622 Mbps access to network	National Grid Services Regional coordination CPU and Storage provision and User Support
ICM	Regional Operations Centre	0.74 + 0.74	HPC centre (Linux cluster, parallel machines) 622 Mbps access to network	National Grid Services Regional coordination CPU and Storage provision Support Centre
PSNC	Regional Operations Centre	0.74 + 0.74	HPC centre (Linux cluster, parallel machines) 622 Mbps access to network GEANT network access	National Grid Services Regional coordination Network connectivity CPU and Storage provision User Support
JSI	Local support centre	0.88	HPC centre 622 Mbit network links GEANT network connectivity	National Grid services User Support
II SAS	Local support centre	1.2	HPC centre Network connectivity	National Grid services User Support
<b>Russia</b>				
IHEP	Regional Operations Centre	5.25	National Atomic Energy GRID infrastructure, PC clusters, Mass Storage, 100 Mbps access	Moscow Regional Operations and Co-ordination; User Support and Training; grid deployment; VO management; CPU and storage provision
IMPB RAS	Application Operations Centre	0.25 + 1	National Computational Biology and Bioinformatics network, PC cluster, 32 Mbps access	Operations and Support Center for Biology; VO management; CPU provision
ITEP	Local Support Centre, functions of CIC and ROC	5.25	National Atomic Energy GRID infrastructure, PC clusters, Mass Storage, 155 Mbps access	Remote backup for Russia CIC and ROC; ROC technology and integration functions; VO management; CPU and storage provision
JINR	Local Support Center, functions of CIC and ROC	5.25	HPC center (PC clusters, Mass Storage), 155 Mbps access	CIC and ROC monitoring functions; ROC technology group; Grid deployment; RC staff training; CPU and mass storage provision
KIAM RAS	Local Support centre	3	PC cluster, network access	MW validation, adaptation and documentation, GRID consultations; CPU and storage provision
PNPI	Local Support centre	2	PC cluster, 100 Mbps access	ROC functions in St-Petersburg region, CPU and storage provision
RRC KI	Local Support Centre, Russian NREN Operation Center	1.9	Russian backbone network operation infrastructure; National	Russia CA and Security services ; Operational monitoring; RC staff training; Regional and international

Participant	Centre Role	Professional FTE (EU funded +unfunded)	Resources	Services
			Atomic Energy GRID infrastructure; PC cluster, 155 Mbps access	(GEANT) connectivity provision, VO management; CPU and storage provision
SINP-MSU	Core Infrastructure Centre, Local Support centre	6	PC cluster and Mass Storage, 155 Mbps access	National core Grid services; RDIG administration support; VO-specific Grid services and management; CIC technology group; RC staff training; 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%.

<u>Federation</u>	<u>Services provided</u>	<u>FTE Requested</u>	<u>FTE Unfunded</u>	<u>Financing Requested</u>
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	11	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	8.74	3.3	1152.5
South West Europe	distributed ROC, 5 Resource Centres	14.15	3.55	1155
Russia	CIC, distributed ROC, 8 Resource Centres	28.9	1	551.5
<b>Totals</b>		<b>145.34</b>	<b>33.85</b>	<b>13963.5 k€</b>

**Table V Total personnel resources required for EGEE Grid infrastructure<sup>14</sup>.**

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

<sup>14</sup> The effort estimations have been rounded for simplicity. See the activity summary table for exact figures.

of the effort required to staff the operations centres on all three layers will be provided by the EGEE partners funded from existing programmes.

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 UNII NNS BRU CK	4 CES NET	7 KFKI - RMK I	8 MTA- SZT AKI	9 NIIF	10 CYF RO NET	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 PSN C	13 II- SAS	14 JSI	15 TCD	16 CCL RC	20 CEA/ DSM	21 CGG	22 CNR S	23 CSS I	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 SAR A	40 VR	41 IHEP	42 IMP B 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 KIA M RAS	46 PNPI	47 RRC KI	48 SINP - MSU	49 CLP P- BAS	50 UCY	51 GRN ET	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 CES GA	56 CSIC	57 IFAE	58 INTA	64 ENE A	65 UniC al	66 UniL e	67 Uni Na		
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-ordinating 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 negotiations 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	<b>Milestone</b> MSA2.1	First meeting of EGEE-GEANT/NRENs Liaison Board
M6	<b>Deliverable</b> DSA2.1	Survey of pilot application requirements on networks, initial SLRs and service classes.
M9	<b>Milestone</b> MSA2.2	Initial requirements aggregation model, specification of services as SLSs on the networks.
M12	<b>Milestone</b> MSA2.3	Operational interface between EGEE and GEANT/NRENs.
M12	<b>Deliverable</b> DSA2.2	Institution of SLAs and appropriate policies.
M24	<b>Deliverable</b> 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. RCC 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. Network resource provision requirements SLR/SLS/SLA definitions Operational model	2 + 0
RCC KI	Network resource provision requirements SLR/SLS/SLA definitions Operational interface between RDIG, Russian network providers and EGEE.	2 + 0
GRNET	SLR/SLS/SLA definitions	0+0.5
<b>Total (FTEs)</b>		<b>4+0.5</b>

**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.

SA1-SA2 GANTT CHART

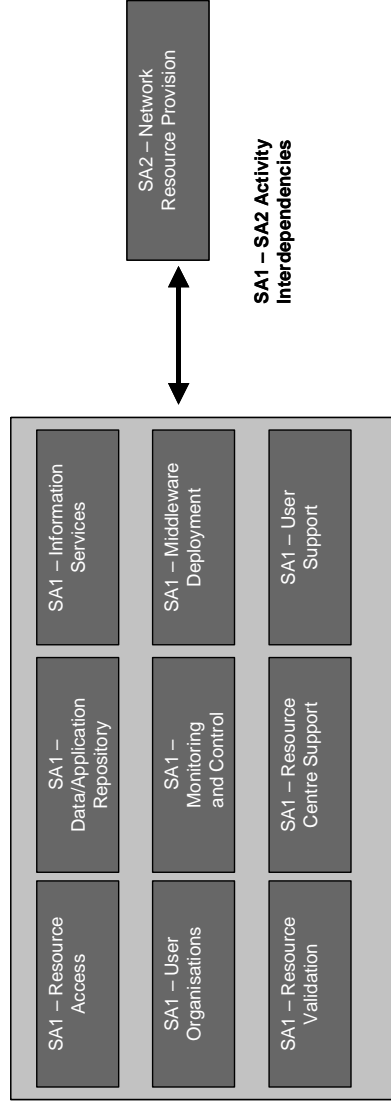
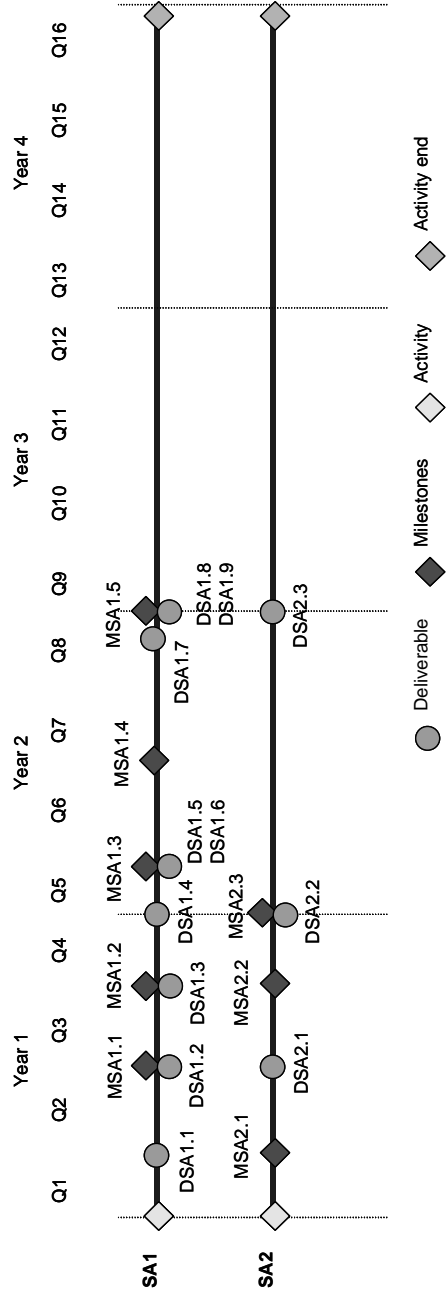


Figure 16 SA1-SA2 Gantt chart and activity interdependencies

**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 SLAs 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 SLAs 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<sup>15</sup>) 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.

<sup>15</sup> 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**

	<b>Service</b>	<b>Description</b>	<b>State-of-the-Art</b>
1	<b>Resource Access Service</b>	<p>This service provides an access channel to a given resource for properly authorized work requests. We split resources into computing resources, data storage resources and network resources.</p> <ul style="list-style-type: none"> <li>• Computing: The service needs to be interfaced to well-known fabric schedulers like PBS, LSF, Maui</li> <li>• Storage: The service needs to interface to mass storage systems, databases, file systems, etc.</li> <li>• Networking: Network resources need to be scheduled, monitored, and accessed.</li> </ul> <p>Possible advanced features to improve on include advance reservation/schedule publishing, pre-emption capabilities, etc</p>	<p>Computing: Condor-G, Globus-GRAM, Unicore            Storage: SRM, SRB, file systems like /Grid, OGSA-DAI, Spiffire, NeST, GridFTP            Networking: GÉANT and NRENS, DataTAG</p>
2	<b>Data/Application Repository and Access/Deploy Service</b>	<p>This group of services deals with issues of Grid data management:</p> <ul style="list-style-type: none"> <li>• Data Catalogs and Movement services. Interface to the storage resource of the previous service.</li> <li>• Application Catalogs and application deployment service.</li> <li>• Virtual data Catalog and instantiation service.</li> </ul>	<p>SRB, SRM, EDG Replica Manager.            EDG LCFGng            EDG/Globus RLS,            Griphyn Chimera            AliEn</p>
3	<b>Information Collection Service</b>	<p>Service to gather data on Grid service locations, accessibility in order to find proper services and resources for usage.</p>	<p>Globus-MDS            EDG R-GMA</p>
4	<b>User ID and Authentication Service</b>	<p>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. Further details of this service will be defined as part of the JRA3 activity of EGEE.</p>	<p>EDG VOMS            Globus CAS            LibertyAlliance            Unicore</p>
5	<b>Resource Matchmaking and Brokering Service</b>	<p>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. 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. 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</p>	<p>CondorG            EDG Resource Broker            Eurogrid-Unicore            Resource Broker            GridLab Broker and            Resource Discovery            Modules</p>

	<b>Service</b>	<b>Description</b>	<b>State-of-the-Art</b>
6	<b>Monitoring and Accounting</b>	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 <i>Simulation</i> , <i>Accounting</i> , <i>Security</i> , and <i>Problem Tracking</i> .	NIMROD-G, EDG RMS, EDG DGAS, MonaLisa

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

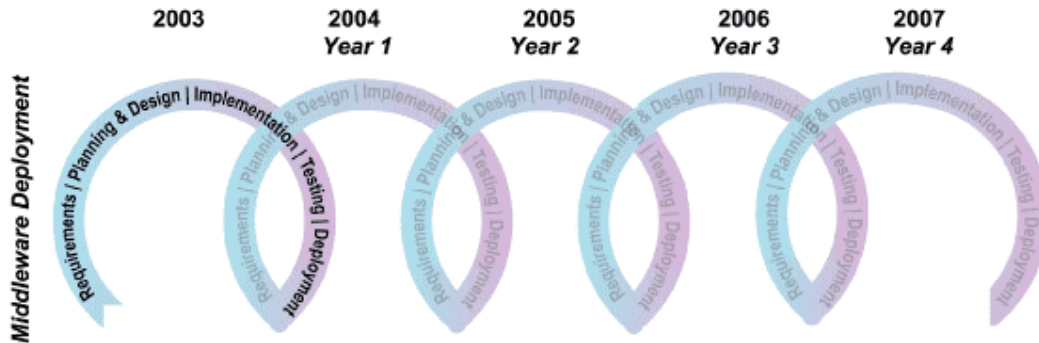
To achieve the objectives of this activity, the execution plan is centred on three main tasks: implementing production-quality Core Grid Services, integrating selected components and testing and validation.

#### 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 team will 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<sup>16</sup>**

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 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.

<sup>16</sup> 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	<p>Tools for middleware engineering and integration deployed</p> <p>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.</p> <p>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.</p> <p>It is important that there is uniformity in the tools and standards at all levels of the software development in all EGEE activities.</p>
3	Implementation group	Milestone MJRA1.2	Software cluster development and testing infrastructure available.
5	Integration and Testing group	Milestone MJRA1.3	<p>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.</p> <p>Test plan for core Grid components and overall Integration (Release 1)</p> <p>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.</p>
5	Implementation group	Deliverable DJRA1.2	<p>Design document for the core Grid services (Release 1)</p> <p>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.</p>
9	Implementation group	Milestone MJRA1.4	<p>Consistent software corresponding to the first release candidate of the EGEE software</p> <p>This includes the following components:</p> <ul style="list-style-type: none"> <li>Software in the official repository (integrated with a release-building system);</li> <li>The software passes all unit tests (these tests are included in the official repository) and test report describes results of these tests;</li> <li>Release documentation, comprising installation guide for each SW component as well as release notes.</li> </ul> <p>Remaining integration issues with the release candidate will be tackled by the integration team.</p> <p>The integration test suite must be ready in time for the delivery of the software components.</p>
10	Integration group	Milestone MJRA1.5	<p>Integrated Release Candidate 1 enters the "bug fix only" final verification and validation period.</p> <p>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.</p>

PM	Responsible Group	Deliverable or Milestone	Item
12	Middleware and Engineering Integration	Deliverable DJRA1.3	Release 1, first major release of EGEE project software delivered to the Operations activity (SA1) for deployment. The deliverable consists of the following components: Software in the official repository (integrated with an automatic release-building system); Certification that the software passes all unit and integration tests (these tests are included in the official repository); 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). 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). 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 that 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)
<b>CERN</b>		
CERN	Data Management, testing and integration, overall coordination	16+16
<b>Italy/Czech Republic</b>		
INFN	Resource Access Resource Brokering Accounting	6+6
Datamat S.p.A.	Resource Brokering Accounting	6+0
CESNET	Logging and Bookkeeping	4+0
<b>UK-Ireland</b>		
CCLRC	Information Collection & Retrieval	8+0
<b>France</b>		
CNRS	Test tools support group	0+2
<b>USA</b>		
UChicago	UChicago	N/A
USC	USC	N/A
UW-Madison	UW-Madison	N/A
<b>JRA3</b>		
<b>Northern</b>		
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 the Architecture 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.

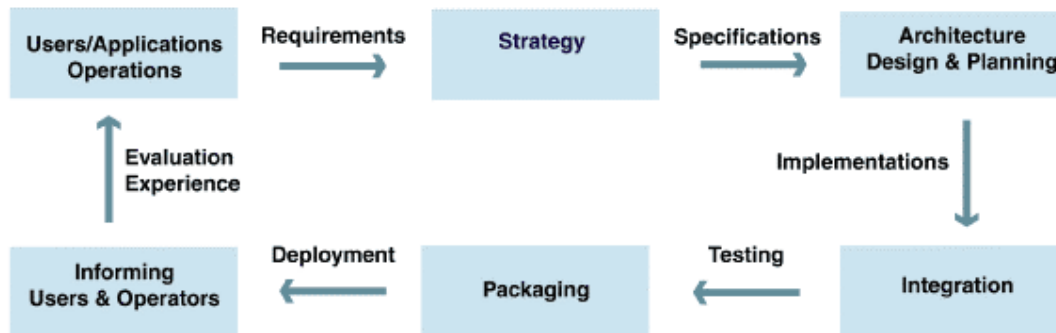
The Integration and Testing team is also responsible for testing integrated software for scalability, platform independence and stress resilience.

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 team and 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.

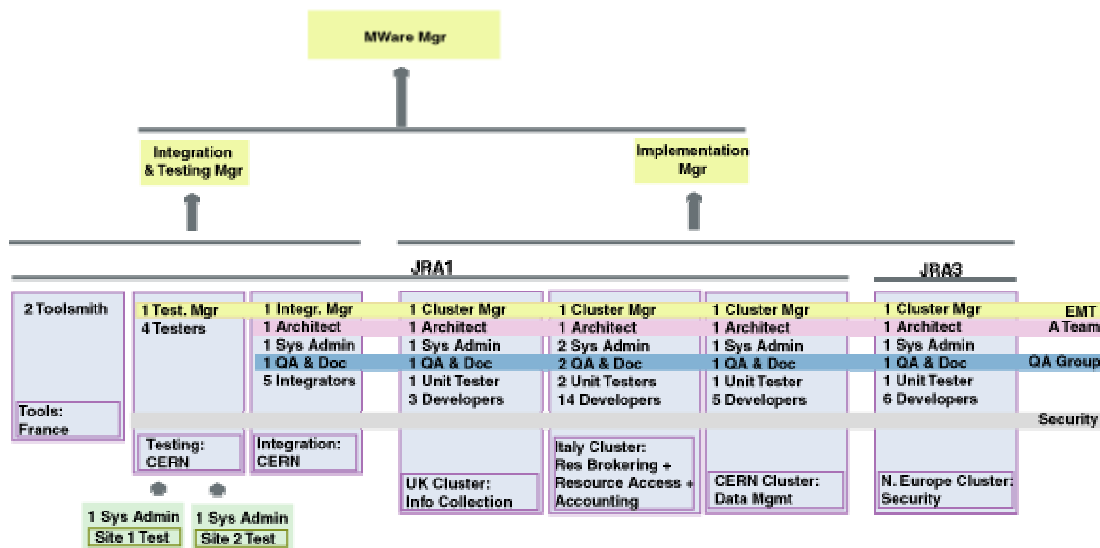


Figure 20: Management Structure for the Middleware Implementation, Integration and Testing activities

#### 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	22
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
<b>Total</b>	<b>73</b>

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

Summarising we have an estimated total effort of 75 (53 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 has 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		
<b>Participant:</b>	1 CERN	4 CES NET	16 CCLR C	30 DATA MAT	31 INFN				
<b>Expected Budget per Participant:</b>	3119	300	1138	1176	1450				
<b>Requested Contribution per Participant:</b>	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<sup>17</sup> 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)

<sup>17</sup> 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 enquires with the metrics will provide a more complete view of the Grid facility operational issues. The enquires 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.

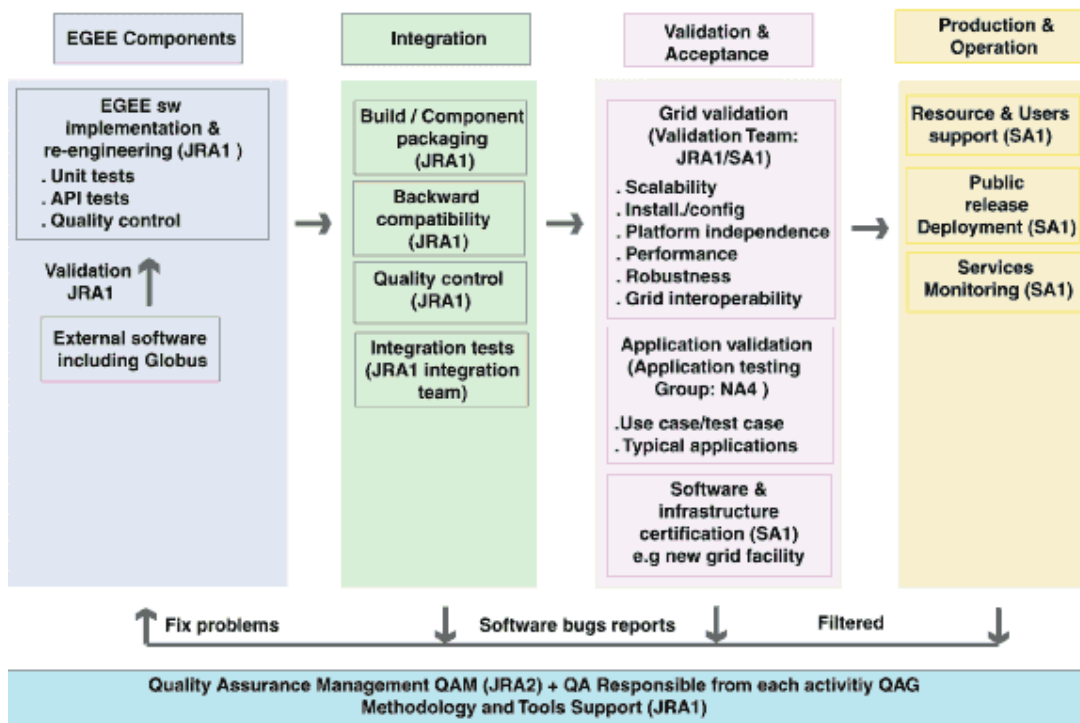
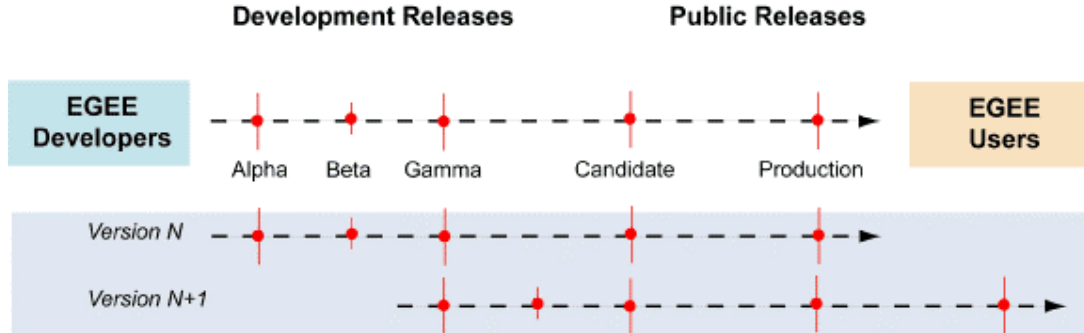


Figure 21 EGEE Tests and Validation process

### 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	Internal QA website
Task 1.2 Provide internal QA website - (PM 3 to 5)	
Task 1.3 Prepare and provide the initial training (QA principles, standards, tools, methodologies, etc.) – (PM 5 to 7)	PM7: Provide Training
<b>Recurrent tasks</b>	
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) 2 <sup>nd</sup> 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:

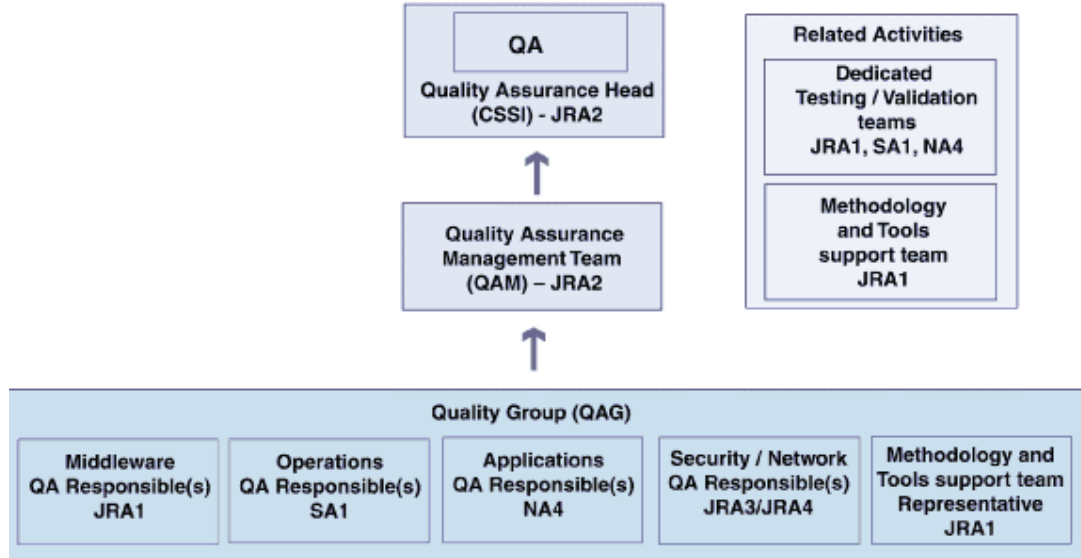
- A Quality Assurance Management team (QAM): QAM is composed of the QA head and two quality engineers. The role of QAM is to define with the activities overall standards, procedures and metrics; to ensure they are applied; to evaluate metrics; to report and to propose progress factors. QAM coordinates 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 Representatives** (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.

**Table GG Effort (Funded and unfunded) for the Quality Assurance JRA2 activity<sup>18</sup>**

JRA2		
Participant	Quality Assurance activity (Quality Assurance Management team)	Professional FTE (EU funded + unfunded)
<b>France</b>		
CSSI	Quality management and coordination. Quality Assurance Head in the Project Executive Board.	1 + 0
CNRS	Quality standards, procedures and verifications	2 + 0

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.

<sup>18</sup> 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

<b>Activity number:</b>	JRA2	<b>Start date or starting event:</b>	Project start		
<b>Participant:</b>	22 CNRS	23 CSSI			
<b>Expected Budget per Participant:</b>	400 K	400 K			
<b>Requested Contribution per Participant:</b>	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) 2<sup>nd</sup> Annual report on EGEE Quality Status, including software and Grid operations

#### Milestones<sup>19</sup> 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.

<sup>19</sup> 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;
- on-line 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	<b>Deliverable</b> DJRA3.1	<b>Global security architecture</b> (document)
6	Milestone MJRA3.4	Security operational procedures and incident handling, definition of a common Grid incident format (document)
9	<b>Deliverable</b> DJRA3.2	<b>Site access control architecture</b> (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	<b>Deliverable</b> DJRA3.3	<b>Global security architecture</b> (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	<b>Deliverable</b> DJRA3.4	<b>Assessment of security infrastructure (report)</b>

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**

<b>Security Head</b>	Fredrik Hedman, Stockholm	
<b>Software Development Cycle Team</b>	4 software engineers: Cluster Manager and Architecture Sys Admin QA and doc Unit Tester	1 person, Stockholm 1 person, Bergen 1 person, Amsterdam 1 person, UH-HIP
<b>Security Architecture and Design Team</b>	7 software engineers: 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.	1 person, Amsterdam 2 persons, Amsterdam 2 persons, Stockholm and UH-HIP 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 countries 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<sup>20</sup> 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.

<sup>20</sup> 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 5.C.4.1 Scientific and Technological excellence

#### 5.C.4.1.1 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	<b>Deliverable</b> DJRA4.1	Specification of interfaces i) to network control plane, ii) to global resource reservation middleware for bandwidth allocation and reservation.
M15	<b>Milestone</b> MJRA4.4	Prototype Implementation of bandwidth allocation and reservation service at specific network ingress points using static network configuration.
M15	<b>Milestone</b> MJRA4.5	Specification of end-to-end bandwidth reservation system.
M18	<b>Milestone</b> MJRA4.7	Dynamic re-configuration of key ingress points in response to reservations.
M21	<b>Deliverable</b> DJRA4.4	Implementation of pilot single-domain bandwidth allocation and reservation service in the network core (GEANT and NRENs).
M24	<b>Deliverable</b> 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	<b>Milestone</b> MJRA4.1	Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations.
M6	<b>Milestone</b> MJRA4.2	Definition of initial network performance metrics and composite measurements required.
M9	<b>Deliverable</b> DJRA4.2	Definition of standardised network measurement query/response interfaces, with adequate authorization.
M12	<b>Milestone</b> MJRA4.3	Prototype tool to access network performance metrics from a limited set of measurement points.
M18	<b>Milestone</b> MJRA4.6	Specification high-level monitoring and diagnostics tools. Revision of network performance metrics.
M21	<b>Deliverable</b> DJRA4.5	Service to supply network performance information to resource brokering middleware.
M24	<b>Deliverable</b> 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	<b>Deliverable</b> 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 is University College London (UCL, participant number 19), which has an established network research group and close relationships with DANTE and a number of NRENs. UCL is a participant in 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; 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 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	Management of the activity Bandwidth Allocation and Reservation task 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 Network performance monitoring and diagnostic tools	1 + 0
DFN	Network performance monitoring and diagnostic tools	0+0.5 <sup>21</sup>
GARR	Bandwidth Allocation and Reservation task Network performance monitoring and diagnostic tools	1 + 0
<b>Total (FTEs)</b>		<b>5.5+2.0</b>

**Table MM Manpower requirements for the Network Services Development activity.**

<sup>21</sup> 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						
Expected Budget per Participant	291	400	186	100	215						
Requested Contribution per Participant	291	200	93	0	107.5						

#### 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 (UCL) Definition of standardised network measurement query/response interfaces
- DJRA4.3 M18 (UCL) Report on implications of IPv6 usage for the EGEE Grid
- DJRA4.4 M21 (UCL) Implementation of single-domain bandwidth reservation pilot service
- DJRA4.5 M21 (UCL) Service to supply network performance information to resource brokering middleware
- DJRA4.6 M24 (UCL) Report on bandwidth allocation and reservation
- DJRA4.7 M24 (UCL) Report on network monitoring

**Milestones and expected result**

M3	MJRA4.1	M3	Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations.
M6	MJRA4.2	M6	Definition of initial network performance metrics and composite measurements required.
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, of which 3.5 are funded by EGEE and the remainder provided by 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 Team will develop an overall architecture encompassing the Grid services deemed necessary for the project. These services will be provided 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 as 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's activities will be intense at an early stage of the annual cycle with all members working essentially full-time for a period several weeks to produce the architecture deliverable. Throughout the rest of the annual cycle, it will meet regularly (at least once per month) to consider additions and address issues discovered during development by the engineering teams and operation groups. This activity may result in revisions to the architecture document.

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. To ensure the architecture is consistent, appropriate simulation tools will be used to execute/simulate critical aspects of the models.

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 Quality Assurance Group (JRA2) will take interface specifications provided by Architecture Team and produce a test-suite to ensure implementations comply to interface definitions.

The Architecture Team will continue to produce an architecture model deliverable each year until the end of the project.

### 5.C.5.1.2 Architecture Team Composition

The Architecture Team (see Figure 24) is animated by a Chief Architect working full-time on architecture issues who is a senior member of the project with extensive experience and high technical as well as communication skills. The Architecture Team, via the Chief Architect, reports to the Technical Director. It is staffed with technically competent representatives from the user communities (NA4 – one representative per major user community – initially one from HEP and one from bioinformatics), middleware engineering (JRA1 – one representative per cluster and one from the integration group), operations group (SA1), network-related (JRA4) and quality assurance (JRA2). The security activity (JRA3) is represented via the security cluster of JRA1. It is important that the Architecture Team is stable with members that participate on a regular basis. Its membership will be reviewed on an annual basis. Participants must be full-time members of the project that can spend 50% of their time on work driven by the Architecture Team. Participants will be proposed by the relevant manager and nominated by the Project Management in consultation with the Chief Architect.

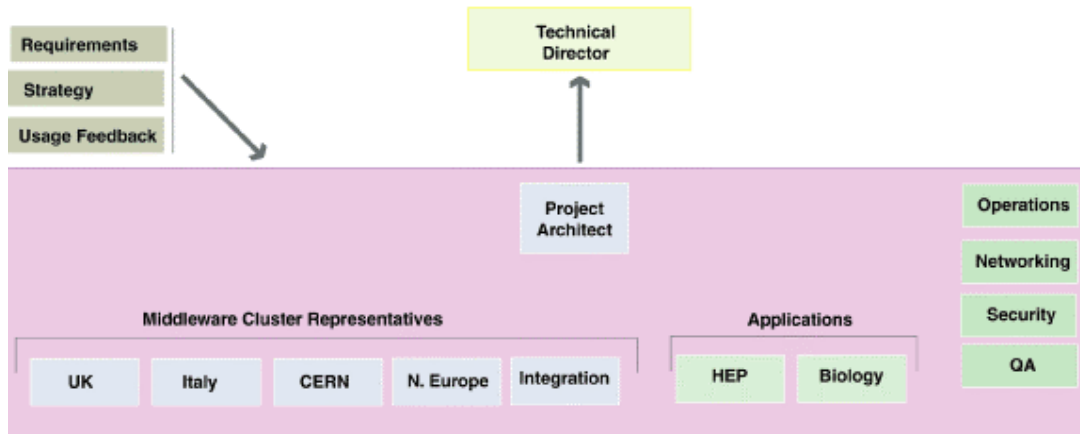


Figure 24: Architecture Team composition



### 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.

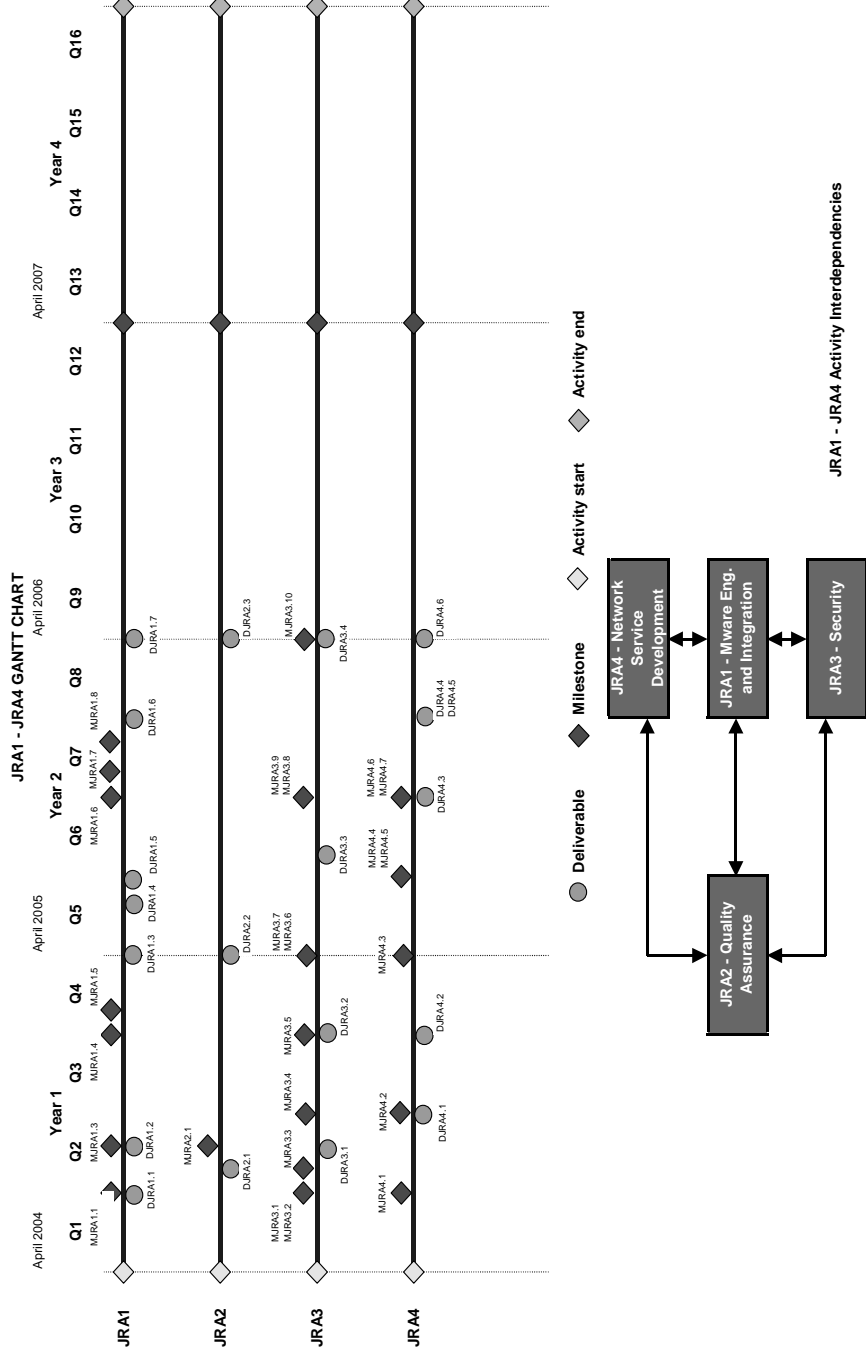


Figure 25 JRA1-4 Gantt chart and activity interdependency diagram

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	Requirements and use cases for monitoring and diagnostics tools for users, middleware and operations.
MJRA4.2	M06	Definition of initial network performance metrics and composite measurements required
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). External 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

< include here a copy of the A3.1 and A3.2 forms from the CPFs – whole duration of the project >

### 6.B Budget for the first reporting period plus 6 months

< include here a copy of the A3.3 forms from the CPFs – first reporting period plus 6 months >

### 6.C I3 management level description of resources and budget

Below is a table summarising the effort foreseen for each activity<sup>22</sup>. 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 per year 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	0,5	0,5
	Germany/Switzerland	28. FZK	1	
	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	0,45	1,2
		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	
	<b>Total</b>		<b>17,93</b>	<b>4,43</b>
NA3	UK / Ireland	17. UEDIN (NeSC)	6	6
	Central Europe	2. GUP	0,4	0,4
		3. UNIINNSBRUCK	0,2	0,2
		4. CESNET	1,7	
		5. BUTE	0,31	0,31
		6. ELUB	0,33	0,33

<sup>22</sup> The figures shown are rounded for simplicity.

		8. MTA-SZTAKI	1	1
		11. ICM	0,53	0,53
		12. PSNC	0,53	0,53
		13. II-SAS	2,24	
	Germany/Switzerland	28. FZK	2	
	Italy	31. INFN	1	1
	Northern Europe	34. KU-NATFAK	1,33	1,33
	Russia	41. IHEP	0,7	2
		42. IMPB RAS	0,2	0,6
		43. ITEP	1,34	
		44. JINR	1,3	
		46. PNPI	1,06	
		47. RRC KI	1,06	
	South East Europe	51. GRNET	2,5	
		52. TAU	0,73	0,73
		53. ICI	2,9	
	<b>Total</b>		<b>29,36</b>	<b>14,96</b>
<b>NA4</b>		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	2	2
	North Europe	36. FOM	2	
	Russia	41. IHEP	1,6	
		42. IMPB RAS	0,3	1
		43. ITEP	2	
		44. JINR	1,6	
		46. PNPI	1,6	
		47. RRC KI	2	
		48. SINP-MSU	2	
	South East Europe	56. CSIC	2	
		59. UPV	2	
	<b>Total</b>		<b>41,4</b>	<b>7,7</b>
<b>NA5</b>		1. CERN	1	1
	South East Europe	51. GRNET	1	
	Italy	31. INFN	0,5	0,5
	Germany/Switzerland	28. FZK		0,5
	France	22. CNRS	0	0,2
		70. GARR		0,5
	South East Europe	56. CSIC	1	
	UK / Ireland	18. PPARC	0,2	
	Germany/Switzerland	69. DFN	0,5	
	<b>Total</b>		<b>3,2</b>	<b>1,7</b>
<b>SA1</b>		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	8,5	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	0,48	0,48
		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	1,2	
	Russia			
		41. IHEP	5,25	
		42. IMPB RAS	0,25	1
		43. ITEP	5,25	
		44. JINR	5,25	
		45. KIAM RAS	3	
		46. PNPI	2	
		47. RRC KI	1,9	
		48. SINP-MSU	6	



	Total		145,34	33,85
<b>SA2</b>				
	France	22. CNRS/UREC	2	
	South East Europe	51. GRNET	0	0,5
	Russia	47. RCC KI	2	
	<b>Total</b>		<b>4</b>	<b>0,5</b>
<b>JRA1</b>				
		1. CERN	16	16
	Italy/Czech Republic			
		31. INFN	6	6
		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
	<b>Total</b>		<b>40</b>	<b>24</b>
<b>JRA2</b>	France	23. CSSI	1	0
		22. CNRS	2	0
	<b>Total</b>		<b>3</b>	<b>0</b>
<b>JRA3</b>	Northern	63. KTH/PDC	1	2
		38. UvA	2	2
		35. UH.HIP	1	1
		39. UiB Parallab	1	1
	<b>Total</b>		<b>5</b>	<b>6</b>
<b>JRA4</b>	UK / Ireland	19. UCL	1,5	1,5
		68. DANTE	1	
	Italy	70. GARR	1	
	France	22. CNRS/UREC	2	
	Germany/Switzerland	69. DFN		0,5
	<b>Total</b>		<b>5,5</b>	<b>2</b>
	<b>Grand Total</b>		<b>300,73</b>	<b>95,14</b>

## 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.

<b>Does your proposed research raise sensitive ethical questions related to:</b>	<b>YES</b>	<b>NO</b>
Human beings		<b>X</b>
Human biological samples		<b>X</b>
Personal data		<b>X</b>
Genetic information		<b>X</b>
Animals		<b>X</b>

## 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

< please refer to the EGEE Consortium Agreement >