

EGI_DS

EGI BLUEPRINT PROPOSAL

EU DELIVERABLE: D4.4

Document identifier: EGI_DS_D4-4

Date: **12/09/2008**

Workpackages: **WP3 EGI Functions definition**
WP4 Design Study of the EGI legal and organisational options
WP5 Establishment of EGI

Lead Partner: **CERN and CNRS**

Document status: **V2.2**

Document link:

Abstract:

In this European Grid Initiative (EGI) Blueprint we describe the proposal developed by the EGI Design Study (EGI_DS) to establish a sustainable grid infrastructure in Europe in place by the end of EGEE-III in spring 2010. The basis of EGI will be National Grid Initiatives (NGIs) expected to be established in each participating European country. The EGI will be composed of the NGIs and a central (mostly coordinating) part, called EGI-Organisation (EGI.org).

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EGI_DS (“European Grid Initiative Design Study”) is a project co-funded by the European Commission as a Coordination and Support Action within the 7th Framework Programme. EGI_DS began in September 2007 and will run for 27 months.

For more information on EGI_DS, its partners and contributors please see www.eu-egi.org

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1. INTRODUCTION

1.1. PURPOSE

Research does not stop at national borders. While national infrastructures are fundamental in providing local connectivity and resources to researchers, they need to be linked seamlessly at a world-wide level to enable global scientific collaboration. This is in particular required inside Europe itself where the construction of a European Research Area (ERA) overcoming the current limits of Member States' research, has been recognized as one of the top European priorities. The ERA will provide a unified framework for the selection and realization of the best scientific projects, will avoid the multiplication of similar parallel efforts in all member states, providing in this way large synergies, economies of scale and a dimension for the European research more adequate to remain ahead in a world-wide competition. A general pan European e-infrastructure is required to support the research projects of ERA in many research disciplines enabling them to easily share of a range of national resources: compute, storage, data, instruments, and easing their effort to reach a global dimension

Over the last few years the pan-European distributed grid infrastructure has been developed and operated through a series of short term projects such as EGEE and DEISA. It has demonstrated to be very successful and to be able to satisfy the needs of thousands of users from a large variety of scientific disciplines. The EGI Design Study was partially funded by the EC as a project over 27 months from September 2007 with the aim of bringing about the creation of a new European Organizational model, which will be capable of fulfilling this vision of a sustainable European grid infrastructure for e-Science. The foundation for e-Infrastructure sustainability has been identified since the beginning in establishing National Grid Initiatives (NGI), as legal organizations, in general supported by governments, - providing a unique representation at European and international level of all the national communities related to national grid infrastructures: from resources providers to scientific users. Over the last nine months the study has collected and consolidated the requirements of a wide range of research disciplines within a large number of NGIs, and designed the required functionality & modelled the organization that could consolidate, operate, manage and continue to develop a sustainable European e-Infrastructure. The study has developed this draft EGI Blueprint as a description of what that sustainable infrastructure could look like.

The purpose of this blueprint is for NGI and other stakeholders to assess whether it meets their requirements. The design project will modify this draft blueprint on the basis of feedback provided, and produce a convention of the new organization that can be agreed.

1.2. EDITORIAL RESPONSIBILITIES

This document has been drafted with the aim to support the discussions in the EGI Geneva Workshop (30 June 2008). Following the feedback from the participants of the workshop and in particular the representatives of the NGIs we present now a major revision of the document. The individual sections have been developed by different groups of people, with many contributions especially from EGI Task Forces, including members not only from the organisations carrying the EU Project EGI_DS; the actual work has been performed under the guidance of the EGI_DS Management Board and the respective EGI_DS Work packages, with the editorial responsibility remaining with several authors. The following table lists the individual responsibilities:

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5	Na	L. Matyska	Work Package 5
6	Na	J. Knobloch	Work Package 5

1.3. DOCUMENT ORGANISATION

Following this introduction, the executive summary, Chapter 3 introduces the major actors – the user community and the grid service providers as well as the legal requirements.

Chapter 4 contains the functionality of the EGI across operations, user support and management. The requirements for middleware development – though not part of the EGI funding – are also described. It is important for NGIs to consider whether the proposed functionality meets their requirements.

Chapter 5 outlines the funding model proposed to support the EGI, and the relationship between the EGI.org, the NGIs, the resource centres and the national funding bodies. The EGI proposed in this document is dependent on particular funding becoming available. NGIs should consider whether the relationships described are appropriate for them, and whether the funding model proposed is appropriate.

Chapter 6 considers the transition from the current project based approach towards a sustainable infrastructure from the start of EGEE III in 2008 until the EGI is operating normally.

1.4. DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the authors.

1.5. TERMINOLOGY

This subsection provides the definitions of terms, acronyms, and abbreviations required to properly interpret this document.

Glossary

AAA	Authorisation, Authentication, Accounting
API	Application Programming Interface
ARC	Advanced Resource Connector
CA	Certification Authority
CAO	Chief Administrative Officer
CERN	European Organization for Nuclear Research
COO	Chief Operational Officer
CPU	Central Processing Unit
CSIRT	Computer Security Incident Response Team
CTO	Chief Technical Officer
DANTE	Delivery of Advanced Network Technology to Europe
DEISA	Distributed European Infrastructure for Supercomputing Applications
DESY	Deutsches Elektronen-Synchrotron
EC	European Commission
EDG	European Data Grid
EGEE	Enabling Grids for E-science
EGI	European Grid Initiative
EGI_DS	European Grid Initiative Design Study
eIRG	e-Infrastructure Reflection Group
ENOC	EGEE Network Operation Centre
ERA	European Research Area
ERI	European Research Infrastructure
EU	European Union
EUGridPMA	European Policy Management Authority for Grid Authentication
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GGUS	Global Grid User Support
GNI	Gross National Income
gNOC	National Grid Operating Centre

GNP	Gross National Product
IGTF	International Grid Trust Federation
JRU	Joint Research Unit
JSPG	Joint Security Policy Group
LHC	Large Hadron Collider
M	Million
MoU	Memorandum of Understanding
NGI	National Grid Initiative
NREN	National Research and Education Network
OCC	Operation Coordination Centre
OGF	Open Grid Forum
OMII	Open Middleware Infrastructure Institute for Europe
PB	Policy Board
QA	Quality Assurance
ROC	Regional Operating Centre
SDC	Strategic Discipline Cluster
SLA	Service Level Agreement
UMD	Universal Middleware Distribution
UNICORE	Uniform Interface to Computing Resources
US	United States of America
VDT	Virtual Data Toolkit
VO	Virtual Organisation
W3C	The World Wide Web Consortium
WLCG	Worldwide LHC computing Grid Project
WP	Work package
WS	Workshop

2. EXECUTIVE SUMMARY

The Grid infrastructure now operational over many European countries was established through projects starting early 2001 with the European DataGrid (EDG) under the fifth Framework Programme. After this proof of principle demonstrating the potential impact of Grid technologies on European science, a first large scale production Grid infrastructure was deployed by the Enabling Grids for E-Science project (EGEE), and its second and third phase (EGEE-II and EGEE-III) [1] which have provided now a large-scale production quality grid for scientists in Europe. In parallel to this major effort, many regional or scientific grid activities and projects contributed to the Grid infrastructure ecosystem available in Europe today. Though the initial driving force behind EGEE was High Energy Physics with the enormous computing requirements of the Large Hadron Collider (LHC), many other disciplines contribute to and exploit now the European Grid infrastructure.

EGEE and similar European Grid infrastructure projects rest on three pillars for financial support:

1. Co-funding by the European Commission
2. Matched national funding
3. Funding of computing infrastructures, their operation and maintenance by national/institutional sources

In this European Grid Initiative (EGI) Blueprint we describe the proposal developed by the EGI Design Study (EGI_DS) to establish a sustainable grid infrastructure in Europe in place by the end of EGEE-III in spring 2010.

Driven by the needs and requirements of the research community, it is expected to enable the next leap in research infrastructures. The Blueprint is based on the vision of a large pan-European distributed computing and data grid infrastructure providing such services as described in the EGI Vision Document (available at <http://www.eu-egi.eu/vision.pdf>) [1].

The EGI Blueprint is a proposal how to realise such a vision, with the necessary implications for the implementation, operation, user interaction and management of the corresponding infrastructure thereby supporting collaborative scientific discoveries in the European Research Area (ERA).

The main foundations of the EGI are the National Grid Initiatives (NGIs), which operate the grid infrastructures in each country. The EGI will be composed of the NGIs and a central (mostly coordinating) part, called EGI-Organisation (EGI.org).

EGI.org will not directly own any grid infrastructure.

Although all effort must be made to ensure continuity for the current users of European infrastructure projects, especially but not limiting to EGEE, **the EGI is not a simple continuation of EGEE**. Most existing infrastructure projects have made direct agreements with resource providers, in contrast, the EGI concept is built on each member state's establishment of its own NGI which can represent the resources in its country and which can interface to the EGI.

It is important to note that EGI is composed of NGIs and EGI.org and the relation between EGI.org and the NGIs is not a hierarchical one. EGI.org is rather seen as the "glue" enabling coherence between the NGIs for the benefit of their user communities.

EGI.org will link existing NGIs and will actively support the setup and initiation of new NGIs where none exists. The relation between EGI.org and the NGIs is governed by the "subsidiarity principle" meaning that tasks that are more effectively performed at the national or regional level should be left there. The EGI.org will ensure pan-European Grid coordination - aiming at standardization wherever reasonable.

EGI.org will provide central functions to address the operation of the infrastructure, user support and application development, middleware interfaces and final certification, and management. Table 1

summarizes the number of FTEs required for each of these functions. More details of the functions are described in Chapter 4.

Costs for	EGI.org Costs (in FTE/a)
Operations	17
Middleware interfaces and final certification	8
Application Support and training	12
External functions	4
EGI.org Management and Administration	10
Total	51

Table 1: Resources for EGI.org

It should be noted that these resources represent only a small fraction, equivalent to a few percent, of the total effort spent on Grids in Europe today.

To run an NGI within the EGI, between 5 and 30 FTEs are necessary to cover the basic tasks as described in Chapter 4– the precise requirement depends on the size of the NGI and on the demands of the local user communities. In countries with an operating grid infrastructure, most these resources already exist.

It is necessary that the underlying middleware for the European grid be further developed. This development will continue to take place in the “middleware consortia” and is not part of the EGI funding model. EGI will foster middleware commonality and interoperability wherever possible. A common European middleware distribution (UMD) is strongly supported.

For the successful launch of EGI initial co-funding by the European Commission will be necessary. The major purpose of this co-funding is to bring all the players—NGIs—together, not to substitute for national funding, that is the base of EGI financial stability and sustainability. National funding will have to play an increasing role in EGI while effort to operate the grid can be gradually decreased thanks to streamlining and automation. In the highly dynamic environment of distributed computing for science, funding for innovation has to continue – most logically on a project basis.

3. THE EUROPEAN GRID INITIATIVE AND ITS MAJOR ACTORS

The European Grid Initiative (EGI) aims to establish a sustainable and operational grid infrastructure in Europe. Driven by the needs and requirements of the research communities, EGI is expected to enable the next leap in research infrastructures, thereby supporting collaborative scientific discoveries in the European Research Area (ERA). The term EGI describes the overall efforts to achieve this goal and is, in this sense, a voluntary activity by institutions and people to develop the ideas outlined in this document.

The main foundations of the EGI are the National Grid Initiatives (NGIs), which operate the grid infrastructures in each country (see Figure 1). The EGI will be composed of the NGIs and a central (mostly coordinating) part, called EGI-Organisation (EGI.org).

The NGIs have been contributing to the work of EGI Design Study (EGI_DS) via the EGI Policy Board (**EGI PB** - previously called Advisory Board) where each NGI is a voting member. Each of the current 38 NGIs declared their support for the EU Project EGI_DS and for the **EGI Vision** [1].

Upon installing the EGI model and instantiating EGI.org, the EGI Policy Board is expected to transfer into the EGI Council, which will be the sole governing and decision making body for EGI.

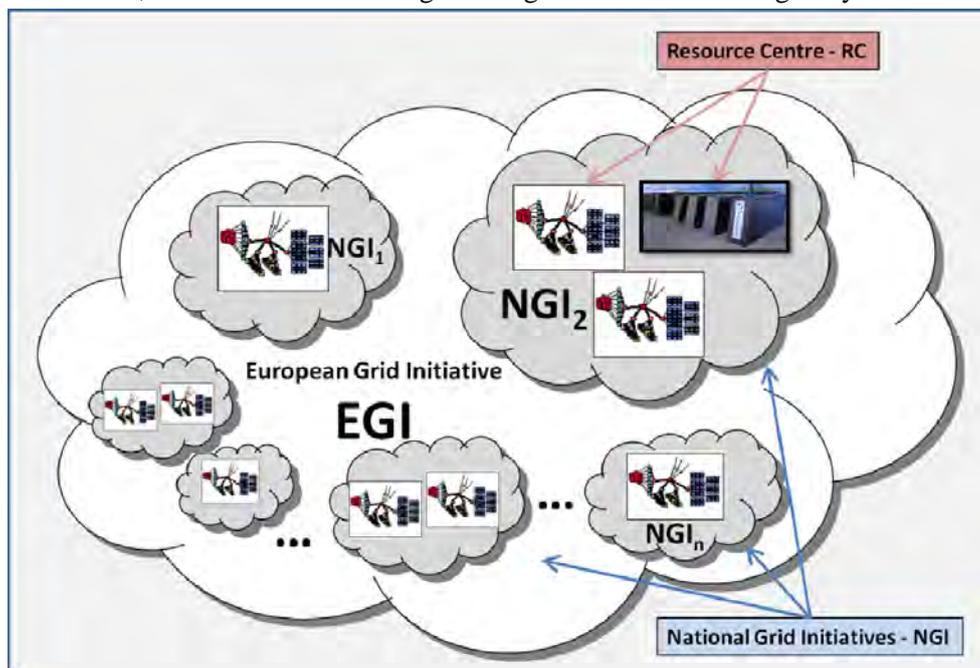


Figure 1: The EGI and the NGIs

Fundamental for the functioning of the EGI, but outside the proposed scope of the EGI are the developers of the middleware (“Middleware Consortia”) and the providers of computing resources (Resource Centres –RCs).

The *raison d’être* for the EGI are its users in the various scientific disciplines (Applications). For the use of the Grid there are one or more Virtual Organizations (VOs) for each Application. A scientist is affiliated to a Research Institution (RI) and may be member of one or more VOs (see Figure 2).

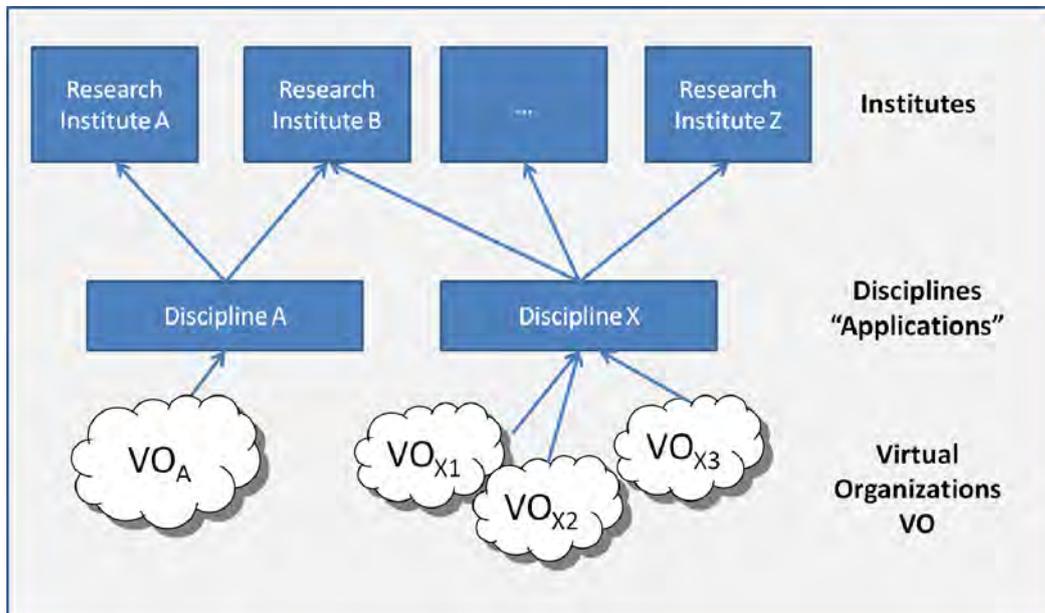


Figure 2: The User Community

3.1. THE NEED FOR A EUROPEAN E-INFRASTRUCTURE FOR RESEARCH

In 2000 in Lisbon, the EU member states adopted the ten year Lisbon Strategy to make the EU "the most dynamic and competitive knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment by 2010". This declaration acknowledges that the aspect of the European economy which will make it competitive in the globally competitive market is its knowledge-based component.

In order to maintain the competitiveness of the European knowledge-based economy it is essential to educate its workforce, and ensure a steady stream of scientific and technological breakthroughs from research which will provide the innovations that can be exploited to drive the economy.

Most research strategists argue that the major research breakthroughs in the future will be in interdisciplinary areas. To create interdisciplinary teams to develop these often requires picking experts from across Europe since the sets of expertise are not always available in any single country. Therefore international research projects are required to provide the innovations needed to drive the knowledge economy, and maintain European competitiveness in the global market.

Current research in many disciplines now includes not only theory and experimentation, but the computational modelling of theories to derive experimentally testable predictions as the third essential element of research.

Many research advances bring together interdisciplinary scholarship with data from large facilities, such as those addressed in the ESFRI roadmap, and vast amounts of computational modelling.

The principle of subsidiarity is applied by most nations, resulting in a common policy that resources should be supported at the national level, and shared with other countries in return for use of their resources when required. This principle applies to large facilities such as synchrotrons, lasers and neutron sources as well as computational resources. Only in a few exceptional cases, where the investment required for a facility is immense, an international organisation has been established (e.g. CERN, ESA, ITER).

The PRACE consortium is proposing a plan which will link the top few supercomputers in Europe and synchronise their procurement times so that the specialist European users will always have access to a recent machine in this supercomputer category.

However, large supercomputers are not a realistic solution to most European research computing needs, even in the peta-computing era. Firstly, models in only a small number of disciplines are amenable to this form of parallelisation. Secondly, high-end systems cost about 70 million Euros, while the rate of advance in such machines is such that the 200th machine in the world in January 2008 would have been 500th six months later, so even such massive investment does not yield a top facility for long. Thirdly, of the top 500 supercomputers in the world in June 2008 Europe has 175 which cannot not provide enough computing resources for all commercial and research large scale computation demands.

There remains the need to share data and processing power among international research projects using the computing resources available to teams in their departments, universities, research laboratories and national facilities. This e-infrastructure needs to build upon the European networking infrastructure to provide the sharing of resources, where the control of those resources, the procurement and planning of those resources remains under local control.

3.2. THE NEED FOR A EUROPEAN GRID INITIATIVE

Research funding is usually provided by national governments through research funding agencies (or councils) to individual researchers, universities or research laboratories. Research funding from national funding agencies or the European Commission is usually project based. Where funding is provided for computing resources, these are also hosted by individual academic departments, or universities.

For international and interdisciplinary research projects to flourish, researchers need to share their local computing resources during each project. They need to share data, and they often need to share processing capacity in order to provide access to resources when and where they are needed.

Researchers can establish links between the computing resources of each individual site involved in each collaborative project, however, this entails a considerable overhead, especially where there are many sites involved in a project where the number (N) of sites and the $N * N$ interaction results in a very large product.

The role of the EGI is to provide a common infrastructure to which international projects can go, and which will link together their computing resources with minimal overhead to each project.

Without an EGI, then each project or each discipline would develop its own solution to computational interoperability. This would spread the cost of the infrastructure between all the projects, but it would also replicate the same work being done many times by different groups who have to learn how to do it each time, again adding to the overall cost. For governments and national funding bodies who fund research projects across a broad range of disciplines, the additional cost of a piecemeal solution would be considerable.

The EGI is not proposed as a vast central European facility, but is designed as a small central clearing house (called the EGI.org) which relies upon each member state establishing a national grid initiative (NGI).

For the EGI to operate it needs to support:

1. The authentication of individual users as the people that they claim to be.
2. The allocation of project members to virtual organizations (VO) where resources are shared within an international research project.

3. The allocation of computing resources to those VO, which VO members will be authorized to use.
4. The authorization of VOs to run computing jobs, store and retrieve data on individual computing resources (machines, data centres, facilities etc...).
5. The distribution and scheduling of computing jobs, workflows, data retrieval and access requests to authorized computing resources.
6. The monitoring of the jobs submitted, processed, and the data stored by individuals.
7. The accounting of users and VO in their allocations and usage of computing resources.
8. The reporting to the NGI of their allocation of resources to VO, and the use of those resources by individual users to enable the NGI, and the national funding bodies to account for the use of funds in terms of the research results produced by VOs.
9. Centrally coordinated, management, user support, application porting, and training functions.

In turn, the NGI in each member state needs to support these functions so that it can interact with the EGI. The technology and organization to support these functions have been developed over the last eight years in the series of EGEE and related projects. Countries which participate in EGEE have local resources which support these functions in the same way that the EGI will require. In order for the EGI to operate, each country needs to centralize its research computing co-ordination using these established interfaces in order to share resources on international projects through the EGI.

The reason to base the EGI on EGEE is that it has already established a pan-European infrastructure with connections to other parts of the world. EGEE in its current form is not the complete solution, and the EGI will not just be EGEE renamed. EGEE has made direct agreements with resource providers, in contrast, it is necessary for each member state to ensure that it establishes its own NGI which can represent the resources in its country and which can interface to the EGI. Such a change should not be underestimated, but it is necessary in order to support research international projects while also maintaining national independence of computing resources.

Following the principle of subsidiarity, most of the activity of the overall EGI will be undertaken within each member state by its NGI. Similarly, all computing resources will be hosted within the member states, or other international facilities. Consequently, the vast majority of the expenditure will be within the NGI of each member state, which must expect to obtain funding for it. The small central EGI.org will perform a co-ordination role and only undertake those functions which need to be operated centrally.

Once the small central EGI.org and the NGI in each member state support these functions through common interoperable interfaces, then each new international collaboration will easily be able to create a VO, allocate resources to it from the contributing NGI, and interoperate its computing resources across the participating countries.

3.3. THE GRID RESOURCE AND SERVICE PROVIDERS

3.3.1. National Grid Initiatives

The main actors of EGI are the National Grid Initiatives (NGI), which ensure the operations of the grid infrastructures in each country and a transparent representation of the requirements of all their scientific communities together with resource provider and all e-Infrastructure related Institutions. The goal of EGI is to link existing NGIs together and to actively support the setup and initiation of new

NGIs in those countries, where corresponding efforts do not yet exist. The characteristics of the NGIs can be identified as follows¹:

Each NGI should

- be the **only** recognized national body in a country with a single point-of-contact representing all institutions and research communities related to a national grid infrastructure
- have the **capacity to sign** the Statutes of EGI.org – either directly or through a legal entity representing it.
- have a **sustainable structure** or be represented by a legal structure which has a sustainable structure in order to commit to EGI.org in the long term.
- mobilize **national funding** and resources and be able to commit to EGI.org financially i.e. to pay EGI.org membership fee and – if there is a demand for such services in the NGI – order EGI.org services and pay for these services.
- ensure the **operation of a national e-Infrastructure** to an agreed level of service and its integration in EGI
- **support user communities** (application independent, and open to new user communities and resource providers)
- contribute and adhere to **international standards and EGI policies** and quality criteria.

At this point in time, all NGIs in Europe are at different stages of their implementation, ranging from individuals claiming to represent an NGI to early implementations of NGIs with a preliminary legal status. During the development of EGI, these early forms of NGIs are expected to transform into legal entities, which are able to collaborate on formal grounds in the European landscape. The EGI effort intends to support this development in order to achieve a mature level for all NGIs in Europe.

NGI's are fully autonomous in their choices, within the boundary condition of the EGI model and the established EGI policies and rules. The autonomy of the NGI's is not limited to the tasks each NGI performs for supporting the national grid infrastructure and the national users and application communities (NGI's National Tasks), but naturally extends also to the tasks that are specifically aimed at allowing the sharing of the national IT resources at pan-European and international level in a uniform, robust and seamless way and at supporting the international application communities (NGI's International Tasks). The EGI model and the EGI.org coordination intend to promote such autonomy and related responsibilities, proposing only the specifications, operational rules and policies needed for the good working of the infrastructure and for the benefit of users, applications and resource providers. (For more details, consult EGI_DS deliverable D4.3) [2].

NGIs fulfilling these requirements should ideally exist by spring 2009.

3.3.2. The EGI Organization – EGI.org

To facilitate the interaction and collaboration between NGIs and to provide a common managerial framework of the pan-European grid infrastructure, EGI intends to setup and implement the so-called EGI Organization (**EGI.org**), which is expected to start its operation in 2010. This deadline must be met to ensure a smooth transition without interruption from today's EGEE-based infrastructure into the future **EGI model**. (Over the course of time, other European grid infrastructures are expected to employ the EGI model as well or at least benefit from the EGI services). The EGI model itself captures the relations between EGI.org and the NGIs, as well as the procedures needed during their life-time. It is clear that EGI.org will evolve over time corresponding to the requirements of the user communities and the evolution of the NGIs.

¹ These characteristics are further developed in an EGI_DS Document "Guidelines for NGIs", which also reflects the different stages of evolution of the NGIs.

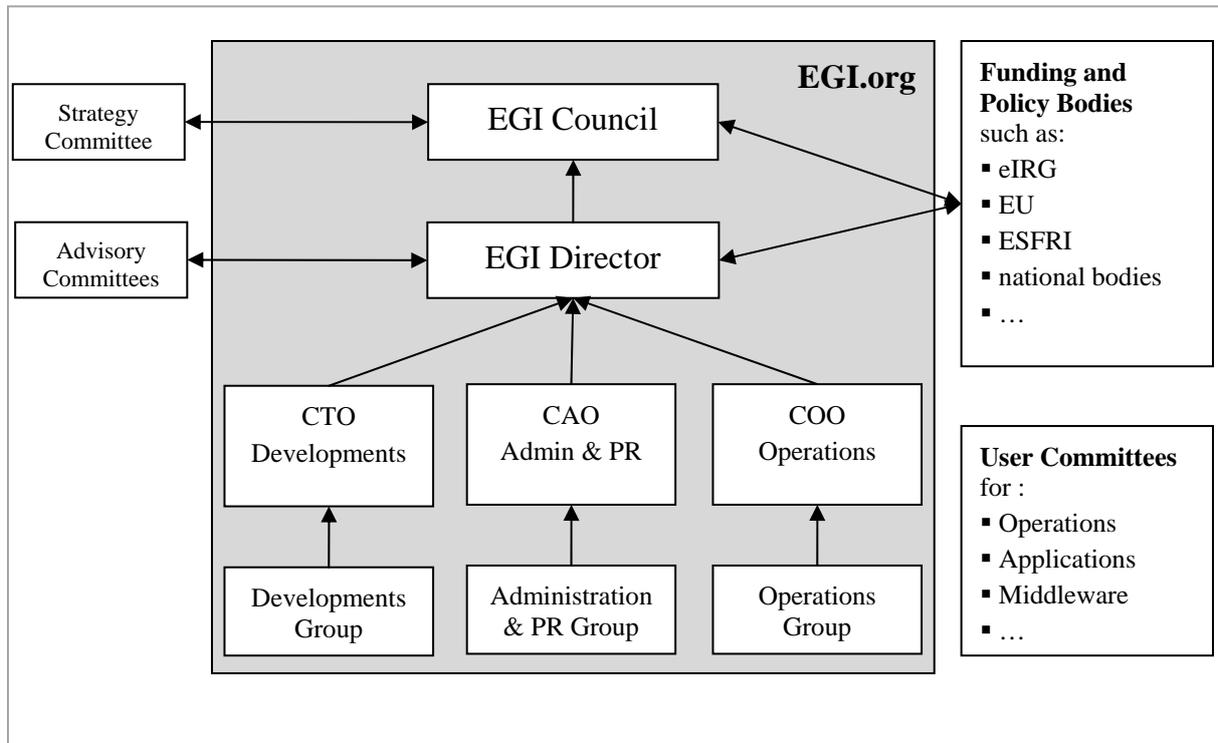


Figure 3: The EGI.org Management Structure

One of the obviously necessary functions for EGI is the management of EGI.org. Figure 3 shows the outline of the proposed organizational structure. The following description contains a rough sketch of the management levels and (within text-boxes) assumptions how the functions should be funded.

3.3.2.1. EGI Council

The top level management layer in EGI.org is the EGI Council. The NGIs own EGI.org and voice their views on all EGI matters through the EGI Council. The EGI Council may install committees, which elaborate recommendations to the EGI Council for specific topics. It may furthermore elect an Executive; details will be determined later.

3.3.2.2. EGI.org Director and Heads of Units

The EGI.org Director, who works full time, provides the organizational interface to the EGI Council, to funding and policy bodies (EU etc.) and to several EGI committees on one side and manages the Heads of the EGI.org Units on the other side. The EGI Director has to direct the group of unit heads. For all internal and external activities the EGI.org Director has one person who will assist him with handling his work. Within the unit heads the functions of a Central Technical Officer (CTO), a Central Operational Officer (COO) and a Central Administration Officer (CAO) are implemented. The administration also covers efforts for the public relations and contains positions in the administrative and legal services. The EGI.org Director needs a secretariat and must have some staff which prepares policy developments, the representation on European level and the support function for the EGI Council.

EGI.org should be positioned in a flexible way as far as EGI.org units are concerned. It seems that only three units should have a permanent basis: the Operational Unit, the Development Unit and the Administration Unit with the COO, the CTO and the CAO as head of the respective unit.

Projects may, based on EGI.org's findings, be embedded in these units or they may be organized as a separate project oriented unit within EGI.org, but always embedded in the organization's structure.

3.3.2.3. Assumptions about EGI.org's Financing Structure

The EGI.org funding is based on three income streams:

- (a) membership fees from NGIs according to an EGI-Key, which is decided by the EGI Council,
- (b) income from project grants
- (c) service charges to be paid by those NGIs who get specific services from EGI

During the initial phase of the EGI, we expect that only the first two streams will be actually available for the EGI.org funding.

The funds available to EGI.org are expected to be split into three cost centres:

- (a) Central management,
- (b) Projects,
- (c) Service provisioning

Cost centres are an efficient way of presenting activities of EGI.org in a transparent way to the EGI Council. In order to keep the transparency, we propose that only the EGI Council is able to transfer resources from one cost centre into another one

3.3.2.4. EGI.org Legal Aspects

We have analysed a range of legal structures and their characteristics, and coupling them with EGI.org specific needs. Details can be found in [3] and [4]. Based on this analysis below is a list of requirements a legal entity should fulfil in order to be adapted to EGI.org:

- autonomous legal entity
- legal structure which allows both public and private entities to be member
- legal form which allows for membership of entities established in non-EU member States
- not-for-profit status
- limited liability of its members
- fast to create
- location in a EU member State

National laws in Europe offer solutions that fulfil these requirements (for example: French Société Civile, the English Company Limited by Guarantee, the Foundation or the Association).

A potential solution would be the legal framework currently being defined by the Commission for European Research Infrastructure (ERI). The use of the ERI framework for EGI.org would enhance its political status and credibility in Europe and with regard to the rest of the world. It would also offer advantages in terms of tax exemptions and other facilities which will probably be granted to an ERI. However, the suitability of the ERI legal framework for EGI.org will finally depend on the time by which the regulation will be in force as well as any constraints it may impose and their compatibility with EGI.org's needs.

3.3.2.5. Location of the EGI Organisation and creation calendar

According to the EGI_DS Description of Work, we should start obtaining the agreements of the NGIs on the EGI.org Statutes in October 2008 [5]. However, the Statutes cannot be completed as long as the legal structure is not defined, which cannot be done until the location is known.

Therefore, a call for tender shall be launched for the location of the EGI.org central office. Bidders will also be required to describe one or several types of legal entities existing within their national legal framework and satisfying the EGI.org requirements. This bidding process will be launched by the EGI_DS Policy Board, which will determine the best procedure to select a location.

It is our plan that the call be launched in autumn 2008, so as to receive the expressions of interest by the beginning of 2009. The process might then take 4 to 6 months to be completed. Afterwards the EGI.org Statutes will be finalised and agreed by their future members and the creation process will be launched so that we meet the goal to have the EGI.org established by January 2010.

3.3.3. Resource Providers

The Resource Providers and the Funding Agencies, which collectively fund, procure, host and operate the IT resources for the Applications in specific Resource Centers.

EGI is not normally intended to act as a direct resource provider; thus no changes should be in general expected in the relationship between Applications and Funding Agencies. The NGI's services however include global monitoring and accounting tools that are supposed to be quite useful for a Funding Agency in order to verify and tune the resource allocation to the Applications it supports and the overall resource usage balance. In the same way EGI should not be expected to change the present funding models for the Resource Centers

EGI is intended to strongly interact with the Resource Centers, acting as their entry point into the global Grid, and playing a facilitator role for Centers of different sizes, serving different Applications, with different requirements, without imposing any unnecessary hierarchy. The Resource Centers hardware is not included in the EGI infrastructure, as defined above, but a Resource Center (with its hardware and the usual system level support for it and for the Applications using it) joins the EGI grid via its reference NGI, which, being part of the EGI takes care of making its resources part of the global grid. The resource owners will of course still be free to decide who has the right to use their resources.

The Resource Centers are included in the EGI organization only through their reference NGI, but are the final destination of much of the activity included in the Operation and Security function of EGI. As the Resource Centers are responsible for the good working and the security of the IT resources and Grid services they host, they have to grant the tempestive application of the needed corrective actions when EGI detects any kind of Grid malfunctioning connected to the Center.

3.3.4. Middleware Consortia

The maintenance, support, interoperability and development of the middleware will not be a direct responsibility of the EGI. However, a tight relation with middleware expert teams will be established and maintained by EGI.org.

There will be two main tasks:

1. to guarantee the maintenance and the interoperability of the middleware currently deployed on the e-Infrastructure – this is a task similar to any software maintenance, with its rules and costs provided as general service offered to all European grid users
2. to provide the further development required by the Research Communities VOs and operational teams.

Even if these tasks are strongly related they are conceptually different and should be treated separately in terms of financial responsibility. To guarantee the continuity of the grid infrastructures in Europe, the natural partners for EGI are the Middleware Consortia around the most largely used European middleware stacks: gLite, ARC, and UNICORE. EGI sees further evolution in the form of an EGI Unified Middleware Distribution (UMD), which does not constitute the development of a new middleware stack but implements a unified distribution of certified components of the current stacks which are currently deployed in the European e-Infrastructure – see Chapter 4.2.

The EGI.org will include only a small team for the final certification of the accepted components. The work programme in the context of the UMD will be defined in a Middleware Coordination Board (MCB) composed of representatives of the user communities and the developers.

The funding of the independent middleware activities related to the maintenance, support and increased interoperability of the deployed components will be guaranteed by EGI, while the new developments agreed in the MCB should be funded by the VOs or operational teams who require them. In case that the MCB has identified wide-spread need for new developments, EGI could provide consultancy to the EC for co-funding via calls connected specifically to EGI, ensuring the generality and coherence of the new components and avoiding duplication of effort.

3.4. THE USERS OF THE GRID

The Applications or more specifically the Research Teams part of different Research Institutions (RI), which will organize themselves together to work on the Grid Infrastructure as Virtual Organizations (VOs). Note that the term Application is here, as usual, the shorthand for “Users belonging to the same Scientific Discipline and using similar applicative software”. In a similar sense, VO is usually a concrete collection of individuals working on a common problem and as such is part of the Application. In the initial phase of EGI the support for commercial or industrial applications is expected to be small, consistent with the non-profit nature chosen for the EGI, hence the virtual identification between Application and Research Team, belonging to academic or scientific not-for-profit institutions.

The ultimate purpose of EGI and of its Grid Infrastructure is to provide value for the benefit of the research communities (present as well as future ones) enabling them to get better results

The specific value EGI offers to the Applications is the infrastructure (set of services) that enables them to share, in a secure and transparent way, IT resources and data provided by distributed Resource Centers, where each Application is allocated a given resource share. A secondary value is the possibility for an Application to have lower priority access to a larger pool of resources, primary allocated to different VOs in the same or even extended set of resource centers. Such access to additional resources is possible because the Resource centers use the same Grid infrastructure for satisfying the sharing needs of the different VOs

The Grid Infrastructure may be defined as the set of tools and services needed for the secure sharing mentioned above. From the point of view of the Applications EGI is the organization that maintains and operates this set.. While the required development of the tools is also included in the responsibility of such an organization, the provision and operation of the computing hardware is not. This falls under the responsibility of the Resource Centers represented at pan-European level by the NGI's

Feedback from the users is vital to drive the evolution of EGI.

4. FUNCTIONS OF THE EGI

The main goal of EGI is to realize a large-scale, production Grid infrastructure for the sharing of IT resources and data – built on National Grids that interoperate seamlessly at many levels, offering reliable services to a wide range of applications, ranging from “mission critical” to prototyping and research.

This chapter describes the functions needed for accomplishing the above goal. Within each function the bulk of the activities will be performed by the NGI’s, some specific tasks with international scope will be taken up by EGI.org, and some others by other actors. Manpower estimates are given based on the assumption that each NGI is a fully independent organization that provides Grid Infrastructure at the country level. The estimates are split between functions for which EGI.org is directly responsible and between tasks necessary for EGI to fulfill its role but being part of the NGI responsibilities. Overall estimates for NGI’s are also provided, but these are more a description of the effort expected at the national level to operate National Grid Infrastructure and the actual numbers will vary depending on the structure each NGI adopts (for example, several NGI’s can decide to federate to share efforts).

4.1. 5.1 OPERATIONS & SECURITY

The operations and security function includes those EGI services needed to ensure optimal functionality of the pan-European infrastructure and the overall seamless effective interoperation of national and regional Grids. These goals depend critically on the NGI’s work; the task of EGI.org is to support, coordinate and integrate them. Individual countries can federate in order to share the effort, thus saving manpower. In this section, the term NGI is used to refer to both a national Grid infrastructure and a federation of national infrastructures, where applicable. In addition, we define as *global/international VO* those user communities that are supported by two or more NGI’s, whereas *national/regional VOs* are those supported by a single NGI.

4.1.1. Distributed Operations Model

The operations model needs to satisfy various requirements:

1. *scalability and interoperability*: we expect the level of complexity of the EGI Grid infrastructure to gradually increase due the growing number of NGI sites involved, of user communities supported and, in the transition phase, to an increasing complexity of the middleware to be deployed and supported. Scalability and interoperability of operations need to be guaranteed under such conditions.
2. *availability and reliability*: operations need to be structured in a way which eases the delivery to the customers of a production-quality e-Infrastructure.
3. *sustainability*: responsibility of daily operations and of ensuring high availability of services needs to be distributed to NGI’s and to the resource centers themselves. This is also achieved through increasing automation, the improvement of Grid operational tools and the establishment of bilateral SLAs.
4. *autonomy of NGI’s*: the operational model needs to be sufficiently flexible to allow the NGI to fully conform to EGI policies and procedure and to satisfy specific requirements and activities in the country.

Distribution is one possible approach to both ensure smooth transition and to address the above-mentioned requirements. For example, reporting of usage will need to be collated and trouble tickets² may well also traverse several helpdesks.

Interworking relies on common standards and/or specifications for interoperation between NGI's. For example, exchange of information between Grid domains is necessary to support functionalities such as resource discovery and accounting; protocols for this need to follow common guidelines. To this end, collaboration from the NGIs is important to jointly define specifications, policies, best practices, and in general, to share operational responsibilities.

In this model the main operational functions of EGI are the coordination of NGI activities, definition of procedures, policies, specifications and standards for interoperation, and the operation of central data aggregation services and user-support services such as the helpdesk. The added value of the EGI.org tasks is to grant the seamless and efficient integration of the National Grids, providing coordination, procedures, repositories etc. Note that the current EGEE III model is already distributing various operational and security responsibilities to regions, and is currently reviewing the existing operation tools and processes to see where additional distribution can increase efficiency.

In the next Section we list the International Tasks that each NGI (or federation of NGI's) is expected to take care of. These task are mandatory in the sense that they are needed for the good working of the Grid Infrastructure, but not in the sense that each NGI has to execute them. In fact, an NGI can share effort by federating with other NGI's, or by outsourcing them to EGI.org (where catch all services are foreseen to this effect) or to some other NGI, via specific agreements between them. The NGI is completely free to adopt the most suitable approach.

4.1.2. EGI Tasks and Resources

Many of the EGI operations and security tasks are jointly delivered by EGI.org and the NGI's, i.e. the EGI.org tasks (namely central support, coordination, and operation of central services for interoperability) complement those carried out by NGI's themselves in the regions, as illustrated in Figure 4.

For example, it is requested that the NGI gathers and publishes accounting information in the region, while EGI.org has the responsibility of making the relevant aggregated usage records from one country/region available to other member NGI's. These tasks are indicated as "EGI.ORG + NGI" in Table 2. The manpower estimate in the table only refers to the EGI.org part of the task.

² User support relies on a central helpdesk, which is a regional support system with central coordination. It gives access to user documentation and support, and to a problem ticketing system. A trouble ticket system (also called issue tracking system or incident ticket system) is a computer software package that manages and maintains lists of problem issues, as needed by an organization.

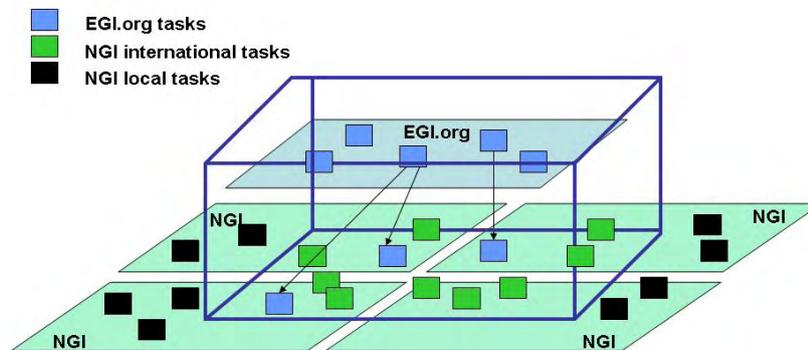


Figure 4: EGI operations and security tasks (blue rectangle) as a sum of NGI international tasks and EGI.org tasks

Tasks are described in general and abstract terms, however they have a correspondence with the operational model developed in the framework of the current and past EGEE projects.

Security

A common authentication trust domain is required to persistently identify all Grid participants. The International Grid Trust Federation [IGTF], and the EUGridPMA [EUGridPMA] in particular, operated in line with the relevant e-IRG recommendations, exist to ensure interoperability at the European as well as the global scale. This must continue in EGI and must also adapt to take advantage of the work currently underway in TERENA and the National Research and Education Networks on developments of large-scale Authentication/Authorisation federations and infrastructures, as well as from the work of the Joint (EGEE/WLCG) Security Policy Group, that has successfully developed common interoperable security policies now in use across a number of international Grids

In a European e-infrastructure some central coordination will be required on policies, vulnerability handling, and operational security; to support and coordinate the work of teams drawn from the NGI's, will be the task of EGI.org

Development and maintenance of operation tools

While the tools for Grid accounting are included in the Middleware, other tools are needed to support operations. Examples are: tools for SLA-compliance monitoring, dashboards and alarm systems, ticketing systems, portals, etc. and new tools to improve automation..

The maintenance of the set of the tools presently in use on the Europe production Grids and the upgrades that will be necessary for keeping in step with the quantitative and qualitative evolution of the Grid, are included in the responsibility of the Operation function of EGI. This includes monitoring tools to measure and report on the quality of networks used by Grid project to ensure the underlying network infrastructure is working properly and is efficiently used, and that SLA constraints with network providers are met.

It is foreseen that EGI.org will only take coordination responsibility while a set of willing NGI's will take care of the development work, to be co-funded by the EC.

4.1.2.1. EGI.org Resources

Support and coordination task	FTE EGI.o rg
Operation of tools and services: 5.5 FTE	
Operation of the Grid configuration repositories, providing information on service nodes, contact details, certification status and downtime status (EGI.ORG + NGI) – EGI.org task: gathering and making publicly available configuration information (as applicable) for each NGI (for example, via a central repository, or through the definition and implementation of an exchange protocol between peer NGIs, or via other implementation techniques)	1
Operation of the Grid accounting repositories, needed for Global VO's in order to make information available to VO managers about the amount of IT resources consumed by the VO across different domains of the e-Infrastructure (EGI.ORG + NGI) – EGI.org task: gathering and making publicly available accounting information (as applicable and according to local laws) for each NGIs.	1
Operation of the Grid repositories for SLA compliance ³ and performance monitoring (EGI.ORG + NGI) – EGI.org tasks: publication of SLA-compliance statistics, central repository, maintenance of schema for central publishing of site and service status information, preparation of reports on performance of NGIs.	2
Operation of the Grid Operations Portal (EGI.ORG + NGI) – EGI.org: support and central instance	0.5
Oversight of the NGI Grid (monitoring of status of services operated by sites, opening of tickets and their follow up for problem resolution), 1 st line support for operations problems: this task includes all the work related to operation support including managing and responding to problems reported by the grid operator, running the required grid services at each site as well as services provided by the NGI, and services required by virtual organizations, such as file catalogues, and other VO-specific services (EGI.ORG + NGI) – EGI.org: support and active overall control of status of Grid services and sites, opening of tickets for requesting problem fixing. Residual problems not successfully distributed to NGI's	1
User Support: 4.5 FTE	
Maintenance and Operation of a a central ticket handling system for Grid and network end-to-end problems. User support relies on a central helpdesk, which is a regional support system with central coordination [GGUS]. It gives access to user documentation and support, and to a problem ticketing system. 1 st line local/regional support by NGIs	2
Triage: assignment of tickets to the 2 nd line support units, ticket escalation end ticket follow-up to ensure they get closed	2
Gathering of requirements for user support tools and process taking input from NGI's and VOs, interoperations of ticketing systems (EGI.ORG + NGI): to take into account additional requirements which may arise with the evolution of the middleware stacks in use, and with the support of new user communities EGI.org coordination and support	0.5

³ Note that Service Level Agreements (SLAs) can be established at different levels involving various EGI actors, with the purpose of formally defining the service profile requested by a customer and delivered by a provider. For example, SLAs can be established between the NGI and resource centres in the country to define the level of support in case of troubles, and the minimum overall availability guaranteed by the centre; or between a VO and the resource centre itself to define the minimum availability of a set of services operated by the centre, and minimum amount of IT resources allocated to it.

Security: 2 FTE	
Security policy development and maintenance to define agreement on best practice and security policies, CA policies (EUgridPMA) etc. (EGI.ORG + NGI). A team of security people in NGI's will take care of ensuring the definition and application of standard security policies – EGI.org support and coordination	0.5
Coordination of security and incident response (EGI.ORG + NGI): in the region for NGI and overall for EGI.org to ensure that common policies are followed for coordinated incident response by Grid participants– EGI.org coordination and support	1
A team of experts will deal with security vulnerabilities in middleware and its deployment (EGI.ORG + NGI) – EGI.org support and coordination	0.5
Other international tasks: 4 FTE	
Middleware deployment and support (roll out of updates), operation of pilot and certification testbeds: to ensure that resource sites and NGI's in general, deploy whenever new critical updates of supported middleware stacks are released, and to provide testing facilities for testing and certification of middleware (EGI.ORG + NGI) – EGI.org support and coordination	1
Resource allocation and brokering support for VOs from NGI's - resources and membership services (EGI.ORG + NGI)	0.5
Interoperations between NGI's and with other Grids, with Asia-Pacific regional Grids, OSG, Naregi, etc, and related infrastructure projects: this role owns the definition of the middleware and the models allowing the NGI's to interoperate. EGI aims at continuing the collaboration established with operations centers outside Europe in order to preserve the current integration of non-European sites into the production infrastructure. The goals of this collaboration will also include the promotion of the EGI middleware outside the EU. An international body will need to be defined (EGI.ORG + NGI)	0.5
Network support: network operation design, trouble handling, network assessment and improvement, application network requirement assessment, ensure the projects know the state of the network used and that problems raised by the Grid are managed, link between Grid operations and network operations.	0.5
Definition of best practices, operations procedures, operations requirements (EGI.ORG + NGI)	0.5
EGI.org Operation of catch-all production Grid core services, catch-all services for global VOs, catch-all CA: running the required Grid services provided by the NGI, and services required by global VOs	1
Development and tool maintenance: 1 FTE	
Coordination of development and maintenance of the operation tools	1
Overall Sum	17

Table 2: Resources in EGI.org for the operations and security

4.1.2.2. NGI Resources

The estimation for the total manpower needed from the NGI's depends of course on the size of the NGI and on its model of working, including if it will outsource mandatory tasks or take care of extra tasks on behalf of other NGI's or EGI.org, etc.

Here tentative estimations are provided separately for three rough categories of NGI's, namely "small", "medium" and "large". These are based on the present EGEE experience, assuming that increasing automation and expertise will at least partly make up for the increase of Application variety and Middleware complexity.

- Small NGI 3-6 FTE

- Medium NGI 7-10 FTE
- Large NGI 16-18 FTE

Note that we estimate that in the countries presently involved in EGEE a similar number of people are already working on the grid working on tasks similar to the ones envisaged here for the NGI's.

In the long term, we envisage that when all the NGI's that have expressed interest in EGI will have been properly constituted and will have joined EGI, in EGI will count 6-7 large NGI's, 12-15 medium NGI's and 16-20 small NGI's. Nevertheless, for the very first year the number of NGI's will be somewhat smaller. More details are provided in D3.1

4.2. MIDDLEWARE

4.2.1. Need for an EGI Middleware Function

Production grids in Europe depend critically upon specialised software to manage data distribution and access as well as job submission, monitoring and user authentication and authorization, known as the grid middleware. The principal middleware distributions used in European production grids are gLite, ARC, and UNICORE. Some of these middleware solutions have reached a world-wide reputation and became a reference in many countries outside Europe (Asia-Pacific, Africa, India, China, South America etc.) thanks to the efforts of international projects of the European Commission. They have shown to be able to support the production activity of a large number of user communities with complementary requirements and dimensions, ranging from teams of few individuals to very large international collaborations with thousands of researchers and ten to hundred thousand jobs daily.

The middleware will continue to develop following new user requirements and the evolution of technology. Experience has shown that the operational stability of grids depend critically on the quality of the middleware. Though the quality of the middleware was continuously improved, further improvements of functionality and robustness are required by the users and the service providers. The latter are also urging for the simplification and automation in the installation and operational procedures. With grids spanning Europe and beyond, standardization and interoperability are absolutely essential for global communities.

Middleware development is a long term process, requiring a careful balance between stability and high quality for existing user communities one hand and the need for new functions and services often required by changes in the infrastructure on the other.

The EGI itself, being a collaboration of NGIs to run Grid infrastructure and provide accompanying services, is not, as a whole, directly responsible for the middleware development. However, the success of the EGI is critically dependent on robust middleware components from well organized sources. Also, EGI is the proper place to provide the necessary feedback from Operations and Applications to middleware developers.

We propose therefore that EGI.org will include and fund directly only the limited person-power needed to steer the process of providing the necessary requirements and feedback to the middleware developers, to certify the selected components and to promote the interaction with standardization bodies. While the middleware development process will be largely carried out by organizations outside of the EGI funding, the small middleware-related group within EGI will ensure continuity and the proper channelling of the requirements of users and grid service providers.

4.2.2. Universal Middleware Distribution

The middleware consortia gLite, ARC and UNICORE propose to foster the convergence of the current solutions into a Unified Middleware Distribution (UMD), similar to what the Virtual Data Toolkit (VDT) in the US is for the Open Science Grid (OSG). The UMD will contain only the necessary high

quality middleware components satisfying the strict policies, interoperability standards and quality criteria established by EGI through a Middleware Coordination Board (MCB).

UMD is a pragmatic way of building up a new coordination at European level, avoiding the current independent parallel developments with the inherent duplication of effort. The set of services included in UMD will expand and evolve in strict accordance to the European research communities' requirements and the operational needs of the resource providers as determined by the MCB.

Initially, avoiding any disruption of the current e-Infrastructure, UMD will make available the best services originated currently in the different EU middleware systems (stacks) and any additional required components requested by the MCB: UMD may include components of the different stacks with similar functionality, adhering to rules, policies, standards of interoperability and other requirements defined by the MCB. Components from sources outside the above mentioned stacks will also be welcome in the UMD provided they are requested by users and NGIs, and follow the same rules agreed by the MCB.

During a transition period, gateways and other means may be developed and deployed if required to guarantee an immediate availability of the EGI grid infrastructure also to communities currently not using any of the current base middleware from the three EU middleware Consortia. In particular a high level of interoperability with Globus and Condor-based grid islands will be provided if required, with the aim to support such scientific communities so that they can use immediately the EGI grid infrastructure without major new investment. This clearly requires a positive attitude from the international providers in going in such a direction.

The Open Source middleware developments and the related maintenance and support services are not immediately self-supporting economically as is now the case for the network bandwidth offering by the Dante/NRENs organization. The middleware Consortia cannot expect to gain economic sustainability through standard fee-for-service contracts because software can be freely downloaded and used by skilled communities in a similar way as Linux is used today. Therefore, specific actions to expand the usage of UMD novice user communities should be undertaken, in order to progressively extend the user base. Sustainability should rely on the generalization of the UMD services to adapt to requirements from a growing user community, including business and government (similarly to the case of Red Hat or the Apache consortium). This process will take time and will require continuity of explicit support of the development efforts leading to general and standard products.

The UMD will allow EGI to continue to be open and promote a close collaboration with the other international development teams such as Globus and Condor and in particular VDT which includes all the components deployed in OSG, NAREGI, etc. to progress in the definition and adoption of global standards, exchange of useful components and agreement about common policies and quality criteria.

Apart from the basic (core) services UMD will also provide the definition of interfaces and other "hooks" that will allow independent development of higher level services; encouraging the faster development of new services which will thus remain compatible with the UMD and be able to run on the EGI Grid. The software ecosystem thus created will provide a further pool for innovation and extension of the UMD without placing unacceptable immediate overload on the developers of the components included in UMD.

4.2.3. Working model and EGI.org role, effort evaluation and funding

The Central technical coordination of the middleware should be provided by an EGI.org unit (middleware unit) led by the Chief Technical Officer (CTO). The main objective of this unit is the coordination of the EGI middleware procurement, its maintenance, support and certification and the establishment of the general common requirements in terms of interoperability and new developments from users and operations. The Unit will not develop the software itself, this will be in an appropriate form outsourced to the development teams. In future, the no-profit Consortia will possibly include

industrial partners who, following the usual Open Source general practices, might offer and charge for maintenance and support services of UMD components. This model could ultimately include a commercial offer of the components, provided they fulfil the requirements.

The EGI middleware unit will also promote the EGI involvement in the relevant standardization bodies as well as of specifying the acceptance criteria and define and execute acceptance tests that the components will have to pass. The manpower needed for the EGI.org middleware unit is estimated to be 8 FTE.

Based on the past experience that only the strong interaction between Operation, Application and Middleware activities (included in the same project) has shown to be able to deliver the best results, it is proposed that the strategic planning of the activities related to the EGI middleware function be made by the already mentioned horizontal EGI.org body (EGI Middleware Coordination Board) which will include representatives from the Middleware Development, Operations (including NGI's) and Applications sectors. This body will decide about priorities and long term planning while it will be up to the middleware unit of the EGI.org to plan and guarantee the detailed execution of the decisions taken.

The UMD as the key component of the European grid infrastructure relies on adequate funding lines agreed with the national and EC funding bodies and, in the more long term future, on service charges. The practical maintenance and support work will be outsourced by EGI to the enlarged EU Middleware Consortia and the other development teams of the currently used middleware.

This strategy addresses continued support by the European funding Agencies of the European middleware development teams as well as collaborative agreements with other international development teams such as Globus and Condor in US. The transatlantic collaboration is already working well by the exchange of components between the different middleware stacks.

As the middleware is fundamental for the proper operation of the EGI, the proposal is to continue the funding through an explicit EU support. The current consortia partners are used to provide a national co-financing at the 50% level. The EU would be asked to finance the remaining 50%, for instance in a call directly connected to EGI or other more direct means, allowing for a communal level of control on the middleware development and maintenance. The EGI control over the middleware has been accepted by the consortia, recognising the important role of active users and operation teams in the delivery of production quality middleware.

A first approximate evaluation of the manpower needed for the middleware activities of maintenance support and the establishment of interoperable standard components not included in EGI.org is about 70 FTE/year. Note that this estimation includes the integration and packaging of the components as well as their full testing except the final acceptance test which is under the responsibility of EGI.org. The functionalities include Security tools (Authentication, Authorization, etc.), Information system, Accounting, Computing (exec) Element/ Services, Data Storage and Management Services, Job management services; the Operation tools and instead not included (they are taken into account in the Operation function). The technical details are provided in the Deliverable 3.1 [6].

4.3. APPLICATION SUPPORT AND TRAINING

The primary customers of the Grid are the Applications, and the goal of EGI is to provide a significant added value for the existing and new applications and user communities. The growing application demands in turn have provided and will continue to provide the necessary push for development and extension of the Grid infrastructure. Therefore the active support for existing and new applications and user communities is a primordial concern for the EGI / NGI community: applications and users are the *raison d'être* of the Grid (middleware, infrastructure, operations and deployment).

Note also that the requirements of the specific VO are very important in determining the way the users and Resources Centres get and offer access in the grid. For the users the conditions needed for belonging to a VO are under the control of the VO, which normally require that the user is authorized by some institution, recognized by the VO.

The EGI.org will provide an overall coordination point for the application support and community building activities, however the Application Support must be directly sustained by the NGI's when the NGI's will have reached the expertise level needed to provide the required support. In the phase of the transition to EGI, including the first EGI years, the establishment of **Specialized Support Centres** (SSC) will ensure that the Applications that currently receive support in EGEE (what are referred to as the Scientific Clusters) and other relevant ongoing efforts will continue to be supported. In other words, an SSC can be formed for a particular scientific area (Biomed, Astro, Archaeology, ...) but it may also be formed for specific user needs. Examples of SSCs can be drawn from the characteristics any number of current projects, and new ones can be envisioned – e.g. there could be a Training SSC or a Baltic SSC, an SSC for interoperation for massively parallel applications (in collaboration with DEISA/PRACE), etc.

SSC's can be seen as evolutionary entities that provide continued support for current and new projects, bringing them to a more stable status as "Science Gateways" within the EGI ecosystem. A more detailed proposal for this evolution will be presented in the EGI_DS deliverable D3.1.

The main characteristics of these centres are currently envisioned as follows:

- The articulation in SSCs will provide flexibility to the EGI ecosystem, minimising the load on the central EGI.org (hence the NGIs' "membership fee"), and allowing the NGIs to support the parts of the system that are closest to their interests and would benefit most from federation of resources.
- An SSC can be hosted by an NGI that has (or can host) the appropriate resources and European-level commitment, under a specific agreement with the other member NGIs and EGI.org.
- There is no obligation for an NGI to be part of any SSC. An SSC can (and should) have a mechanism to allow new members to join at a later date, or – if appropriate – to allow a community within an NGI to make "partial" use of its services, which would be properly acknowledged by the relevant NGI.
- The formation of SSCs will be carried out under assessment by the EGI governing bodies of proposals submitted by federations of NGIs and the relevant VOs. These plans should include timetables for the evolution of the SSC and resource estimates, for which we will give some guidelines in D3.1.

The manpower for the SSC's will be provided by the interested NGI's with EC co-funding

Structures like the SSC may in some cases prove also in the later EGI years to be the best way for a group of willing NGI's to ensure the support for some Applications of interest for the group. EC co-funding is envisaged to be important for allowing the NGI's to act efficiently in their role as primary Application supporters (possibly via the SSC's). The evaluation of the manpower in EGI.org for supporting the SSC's is 2 FTE, which will also act as link with the Operation and Middleware functions; an evaluation of the global NGI's' manpower for Application support is provided at the end of this Section, together with a table summarizing the EGI.org Application Support effort.

Some user support falls under the operations activity, however current experience shows that for a successful new demonstration a pilot user requires special assistance even with the basics (VO registration, certificates, helpdesk etc). In EGI this will continue to be a fundamental role of the support team assigned to the new community, ensuring a fluid collaboration with the operations to avoid these fundamental but "bureaucratic" aspects of the entrance into any secure Grid environment.

4.3.1. The role of the Applications in the EGI.org organisation

The central place of the Applications in the EGI should be reflected in the structure of the EGI organisation. Representation of the Applications is envisaged at the EGI Management level in User Committees and at the level or more technical decision in the EGI Middleware Coordination Board (MCB), together with the Operation and Middleware relevant people (see section 4.2.2).

Given the very wide range of scientific communities EGI is envisaged to serve, there must be a way to ensure an effective and comprehensive representation of the Application world in these bodies, and in others that may be deemed necessary (e.g. Advisory Committees).

It is clear that the VOs making the largest use of the computing resources supported by the EGI infrastructure will need to be represented, together with the ESFRI-like VO's that express interest in the use of the EGI infrastructure; mechanisms will also be devised for granting the representation of the smaller VO's. Specifically with respect to the ETCB, a mechanism will be conceived for the participation of some VOs that are interested in devoting some of their resources for working together with the EGI Operation and middleware experts at the consolidation or upgrade of specific services. These VOs could make an "offer" to EGI.org and if EGI.org considers that the proposed service upgrade or consolidation is also in the general EGI interest of a common plan of work (resource loaded), the VOs in question would get the right to be represented directly until the end of the common work.

It is also clear that some way has to be envisaged for extending the representation to the Applications that do not belong to the above mentioned categories. This issue still needs further discussion involving also explicitly the representatives of the VOs that are now most present on the Grid.

4.3.2. EGI.org Application Support Tasks and effort

Supporting the (existing and new) large international VOs is an issue whose importance cannot be underestimated. The role of the SSC's and NGI's in this issue has been described above. The present Section summarizes the EGI.org tasks which are aimed at central coordination of the SSC's and of the services for the Applications, and specifically also at attracting new communities to the Grid and helping them in their starting phase.

The tasks identified as necessary for this purpose are:

- Event Organization
- Services for new communities
- Coordination of SSC interfacing activities
- Grid planning for the sake of new big Applications (like ESFRI members)

The task are briefly described in the following

Event Organization

- 2 FTEs in EGI.org

EGI must encourage interaction between grid users within areas of interest and between different areas of interest or scientific disciplines, to facilitate the development of technical solutions to specific application needs. The organization of events aimed at these goals will also allow new potentially interested users to get a first contact with the Grid, also specifically interacting with users that are already more experienced

1. User Forums and other international events.
Mandatory. The organisation of events like the present User Forum of EGEE must continue, and EGI.org should take a leading role in coordinating these events.

2. Discipline-specific events

highly recommended. SSC's and related VOs. Application support teams specialized in certain application areas are encouraged to attend general scientific events and be able to present their grid activities to researchers who know little about the grid. It helps in this regard to have transparently accessible community portals (e.g. sites that are accessible to people who don't have a personal certificate) with clear illustrations of what applications are available to the relevant VOs.

These event organization activities should be done in close liaison with Training and Dissemination

Services for new communities

- 2 FTEs in EGI.org not including application porting support

As said above EGI should take care of introducing new communities to the use of the grid. This introduction will be done with

1. talks disseminating "success stories" of communities in the use of the EGI grid, in the different events where best these communities can be reached
2. support offered for running freely example application of the new community on the EGI infrastructure. The procedure in this sense should be totally flexible, allowing this fast immersion by any NGI or support group. The SSC's should be therefore ready to provide a Grid infrastructure at any moment (including certificates, services and support) to port immediately the applications to the Grid. The key of the success of such fast applications is the time. The structure should be ready to demonstrate first promising results in less than a couple of days as previous Grid projects have already widely demonstrated.

This porting is the responsibility of VOs, in collaboration with specialized support teams provided by the SSC's and the NGI's. EGI.org does not provide this service, but could redirect requests for this service within the demonstration activities.

Coordination of SSC interfacing activities

- 2 FTEs in EGI.org

The bulk of activities which can be considered practical interfacing between the VOs on one side and Operations and Middleware on the other should be taken up by an explicit dedicated effort in the SSC's, with central support by EGI.org. These activities include tasks such as help desk requirements, repositories, portals, and requirements towards the middleware developers.

These activities are relevant also for the national VO's for which they will be carried out by NGI personnel dedicated to the national VOs. It is expected that requests directed to the EGI ecosystem be handled by this unit.

Grid Planning

- 2 FTEs in EGI.org

EGI plans to devote a specific effort towards the large scientific communities like the ones presently in ESFRI for giving them the opportunity to become users of its Grid and share the inherent benefits.

To this effect it is of course not sufficient to demonstrate to one of such Application how well the EGI grid works for other communities and how easy is to start to use it. These steps must be done, as for the smaller communities, but need to be complemented with a strategic planning worked out together by some EGI experts and some representatives of the application, showing how, with which advantages and with which use of the resources the Computing Model of the Application could be

fitted for the best use of the EGI grid infrastructure, and how this infrastructure in turn should be adapted for the best use of the new Application.

Within EGI an e-Infrastructure Architectural Planning Group must be established for carrying out this kind of activities, and 2 FTE are estimated to be needed in EGI.org for coordinating such group and ensuring (actively searching) the contact with this kind of Applications. The other EGI members of the group should be Operation and MW experts coming also from the NGI's and Consortia

4.3.3. Training

4.3.3.1. General Principles

The overall goal of the activity is to increase usage of the e-Infrastructures by providing users with the skills needed to access the services.

Training is required by operations centers for system operators, by application developers who are developing programs to use the system and by users to allow them to access the services. Training is also required for trainers and educators regionally to support them in disseminating experience of changes in the system, which they must then pass on to their communities (local and in different user communities / VOs).

Training provision will be largely federated by its nature. Each NGI will be required to provide training both for users and for operations. However there will be a central role in providing coordination of the dissemination of technical changes, support to encourage sharing of teaching materials and experience, coordination of sharing t-Infrastructure resources.

4.3.3.2. Training Tasks

The experience gathered during EGEE and ICEAGE shows that production infrastructures don't fully match needs of education trainers and students, starting from the strict identification procedures that often discourages students and beginners through their learning process, or even the difficulties for trainers on finding suitable resources to effectively run events. Therefore an infrastructure specialized for training (a t-Infrastructure) is required, in order to match requirements of this kind

The current scenario is that the majority of training provision occurs at the NGI level, gradually moving towards education being taken over by universities in their normal duties.

However, the expectation is that, especially initially, coordination and facilitation of sharing of resources and expertise will be required.

Estimates of staff are separated into:

1. National/regional (NGI's)
2. Central (EGI.org)

For 1. Estimates will depend on size, engagement of communities and maturity of local infrastructures. In general, assuming we are purely discussing resources for a NGI, we might see approximately

- 2 FTEs engaged in material creation, live or broadcast training events and provision of web based materials;
- 1 FTE to maintain local repositories and online teaching environments;
- 1 FTE supporting coordination and interoperation of regional t-Infrastructure resources
- 1 FTE for operations in each site part of the regional t-Infrastructure.

For 2 the estimate for EGI.org is 4 FTE for taking care of the tasks enumerated below and for ensuring the liaison with the EGI.org Application Support team

1. Management and coordination of training efforts in the NGI's
2. Technical information gathering, content and material creation
3. Support of central services such as material repository and online resources
4. Support of t-Infrastructure interoperation and management of grid central services

4.3.4. Summary of the manpower estimations for Application Support and Training

Table 3 summarizes the manpower estimation for the Application Support function in EGI.org.

The estimation for the total manpower needed from the NGI's is depending on the number and kind of Applications EGI will support, and thus from the number and size of the SSC's that will be established.. In addition to the manpower an NGI devotes to the SSC's of its interest, there are other Application Support activities an NGI will take care of, including the services for purely national VO's, the organization of the national events, the help to new national communities for getting started on the grid.

ACTIVITIES	FTE
Support to SSC's and link to Operation and MW	2
Event organization	2
Services for new communities	2
Grid Planning	2
Training	4
TOTAL	12

Table 3 :Overall effort for EGI.org Application Support and Training

For a reliable estimation of the manpower needed in the SSC's system more work and more contacts with the Applications are still required. At the moment we can however estimate it will be no smaller than the one presently supporting the Strategic Discipline Clusters in EGEE, also taking into account new Application and redistribution of resources for the current ones.

The estimation of the manpower needed for Application Support and Training in addition to the one devoted to the SSC's system, needs to be done separately for "small", "medium" and "large" NGI's with a model similar to the one used for the Operations (see 5.1.4)

- Small NGI : Application Support 1-3 FTEs ; Training 1-2 FTEs
- Medium NGI: Application Support 2-4FTEs ; Training 2-3 FTEs
- Large NGI: Application Support 3-6 FTEs; Training 3-5 FTE's

The exploitation of the synergies between Application Support and Training and the federation between NGI's may allow some consistent reduction of the manpower estimated above for the NGI's. Note that we estimate that at least in the countries presently involved in EGEE a similar number of people are already working on the grid with task similar to the ones envisaged here for the NGI's.

More details are available in the EGI_DS deliverable D3.1 [6]

4.4. EXTERNAL LAISON FUNCTIONS

4.4.1. Dissemination

A small team within this function will execute the dissemination activities of the EGI.org. The team will focus on content production and coordinating activities. Technical and specific services will preferably be bought from third party.

The dissemination team of the EGI.org will support and coordinate the publication work of the EGI. Press releases and Newsletters of the work and key achievements will be published and widely distributed in order to increase the visibility of the EGI. NGIs have to contribute by providing material to paper and electronic publications. The EGI.org will also be in charge of organisation of annual events and conferences, similar to e.g. EGEE User Forum and DEISA Symposium

The effort estimated is 2 FTEs for EGI.org and 0,5 for each NGI

The following expertise is proposed:

- A dissemination manager – 1 FTE for EGI.org
- A web editor – 1 FTE for EGI.org
- NGI dissemination interface for EGI – 0,5 FTE for each participating NGI. As said above 1-2 of the NGI interfaces can also further staff the EGI dissemination team.

4.4.2. Other External Relations

External relations are defined as relations with organisations and initiatives outside of the EGI and of direct relevance for the EGI in terms of collaboration or interoperation. Examples of such organisations and initiatives are:

1. Grids outside Europe
2. Commercial grids (e.g. cloud computing efforts)
3. Large-scale international research collaborations (e.g. the EIROForum organisations and WLCG)
4. Networking organisations (e.g. NRENs, DANTE, TERENA)
5. Policy and standard shaping bodies (e.g. e-IRG, ESFRI, OGF)
6. Private sectors that could bring extra competences and resources to the EGI

The EGI.org management and specifically the Director should be in charge of External Relations. This responsibility should primarily be focused on

- establishment of formal relations when necessary
- promotion of common understanding on policies in scope of grid interoperation
- influence on policy and Standards shaping activities
- networking and enlargement of the EGI “sphere of influence”

The effort estimated is 2 FTEs for EGI.org.

The following expertise is proposed:

- 1) A policy and external liaison manager – 1 FTE for EGI.org
- 2) A standardisation liaison manager – 1 FTE for EGI.org

4.5. SUMMARY OF THE EGI FUNCTIONS MANPOWER ESTIMATIONS

Table 4 Summarizes the manpower estimations for EGI.org made in this Chapter.

For the manpower estimations for the NGI's and the Middleware Consortia the reader is referred back to the specific sessions in this Chapter.

Note that these estimations are always made for the initial phase of EGI

Nr.	Manpower for	EGI.org FTE
1	Operations	17
2	Middleware	8
3	Application Support and Training	12
4	Exteral Liaison Functions	4
	Total	41

Table 4: Overall effort for the EGI.org functions

5. RESOURCES AND FUNDING

EGI will come up with a new sustainable organisational scheme, based on national grid organizations in each country—the NGIs—and a coordinating body—the EGI.org. NGIs will be the basic blocks of the EGI sustainability—the national grid infrastructures must themselves have a long term funding commitments and organizational setup different from purely project oriented organizations. EGI will be just a natural extension of the principles used at national level.

As the EGI.org is mostly coordinating institution, huge majority of EGI costs is a direct consequence of the existence of grid infrastructure itself, not related to the actual organizational scheme (e.g., regardless of organizational setup, any grid infrastructure will need system administrators, some security staff, user support and helpdesk etc.). Only a tiny fraction of the total EGI costs are related to the EGI.org implementation and personnel. Thus, the financial sustainability of EGI is primary based on financial sustainability of NGIs—their budget guarantees at national level are an axiom for the EGI sustainability. However, as a whole is usually larger than sum of its parts, we expect the EGI to have synergistic effects to NGIs not available otherwise (without the pan-European organization). To initiate these synergies and to fully exploit them, some cohesion funding must be provided, too—this we expect to come from the European Commission.

The EGI will thus be financed from three sources: at the foundation lies the national funding of the national grid infrastructures. The coherence of implementation of these separate efforts is guaranteed through EC funding, providing the necessary glue that will keep the NGIs moving in the same direction, creating thus the truly European (EGI) infrastructure. These two sources are complemented by project oriented funding, that is usually shorter term and more focused to solve particular problem(s) (e.g., including new region, providing specific support for particular community, development of new functionalities and services etc.).

EGI.org will not provide any resources directly, i.e., no specific equipment funding is foreseen at the trans-national level. On the other hand, EGI.org will provide extensive accounting data on users and resources (“who is using what and to which extent”) to allow NGIs (and their funding bodies) to account for the use of national resources by “their” and “foreign” researchers.

The EGI must undergo a review on a 3-5 year cycle of its funding model and required budget, based on the actual usage of the EGI, available commercial technologies, and the innovation required.

5.1. FUNDING OF THE EGI

As EGI is NGIs plus EGI.org, the primary EGI funding is at national level, providing services needed for the national grid infrastructure. The EC funding is expected to cover the cost of coordinating the national efforts and also to promote and support activities that span several NGIs (countries). The NGI funding (without equipment cost) could be split in the following way:

- The budget for operation Grid services. This is the major cost item, however practically independent on the actual EGI organizational scheme.
- The budget for covering the basic EGI.org (i.e., coordination) costs. This will be provided through EGI membership fees.
- The budget to pay specific services—service charges that go to EGI.org (or any other body capable to provide them, including commercial offerings).

The initial EGI budget is based on the first two items, the service fee will be applied gradually at later stages (more mature EGI service offering).

While this funding is sufficient in theory, the EC plays an un-substitutable role to provide a glue to focus the national contributions on the same direction. Covering part of costs associated with coordinating the NGIs and assuring they are on the same track, the EC contribution guarantees that the

potential synergies of the large Europe wide Grid infrastructure will actually happen. The EC contribution will always be just a small fraction of the total EGI budget (budget of NGIs and EGI.org), but it provides international assurance for individual NGIs (and their funding agencies) that they are part of a large and welcomed community.

During the initial phase, the EC funding will be used to help to overcome the difficulties associated with the setup of the large infrastructure and its operations, including in some cases adaptation at the national level to new requirements of the EGI (as we expect that the EGI grid will be much larger than the EGEE and will cover not only Grid infrastructures currently operated by other EU projects based on the EGEE-like (gLite) grid like Baltic Grid, SEE_Grid etc., but also other grid infrastructures based on different approaches). Gradually, the purpose of the EC contribution will change, the operational aspects of the international infrastructure will be better understood and become part of the standard national operations and funding, and EC contribution will be more and more focused to support innovations that will keep the EGI a step ahead of commercial offerings even in a very long term (see Figure 5). Even if the EC contribution will be kept constant, its share on the total EGI costs will go down as we expect the EGI Grid to grow, attracting more resources and also more user communities.

Funding

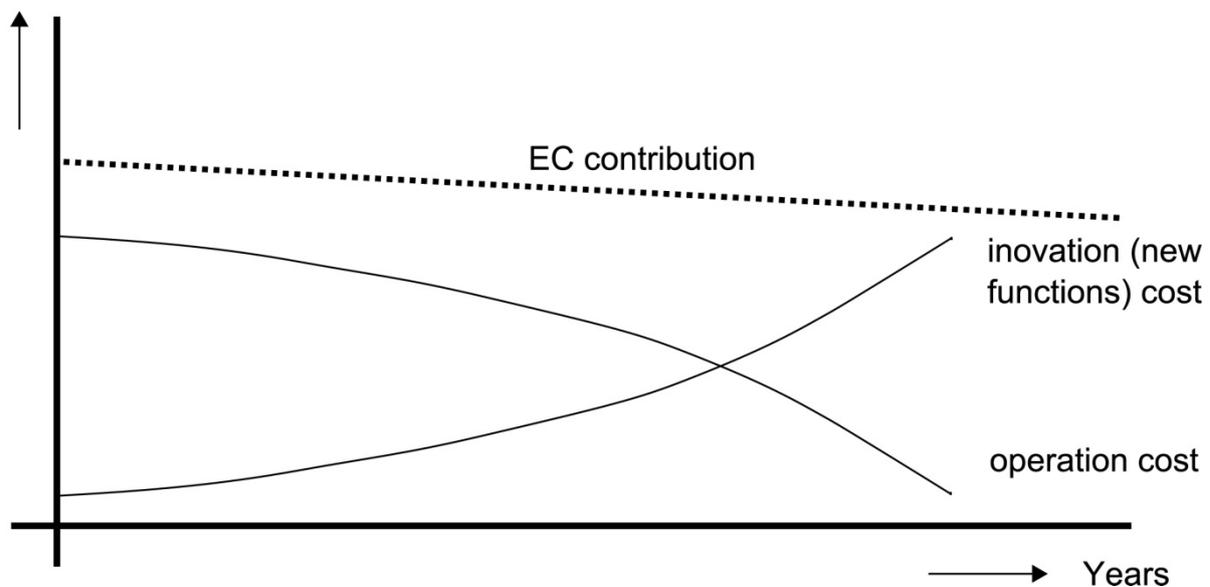


Figure 5: Evolution of EC contribution

5.1.1. Funding Estimates

Each of the previous chapters in this blueprint have outlined the functionality of aspects of the EGI and provided estimates of the required person effort in FTEs. Majority of these FTEs must be put in place regardless of the EGI scheme (or even EGI existence itself), only the EGI.org person efforts estimates are a consequence of the proposed organizational model (EGI.org as a coordinating body). We estimate the total operational budget (without equipment) of EGI to be up to 90 MEuro (for some 900 FTEs in the whole Europe), from which less than 5 MEuro are direct costs of EGI.org. Most of these 90 MEuro are already in place—the yearly EGEE II budget was some 35 MEuro (including the so called unfunded contribution), and EGEE II was just a fraction (although large) of the sum of all the international and national Grid activities in Europe. In fact we estimate that the sum of all the current

Grid infrastructure related projects in all EU countries goes high above these 90 MEuro (none of these numbers include equipment costs which may represent additional 30 MEuro Europe wide).

5.1.2. Funding Sources

Based on the arguments provided above about the un-substitutable role of EC funding and also taking into account the complexity of the EGI Grid creation and initial operations, we propose to set up the EC contribution to these 90 MEuro at the level of 20 MEuro, i.e. between 1/5 and 1/4 of the total cost. These 20 MEuro should be used to support international activities both at EGI.org and especially at the NGI level.

Each NGI is expected to have its own budget to run primary national Grid infrastructure and its international collaboration. This budget stays with the NGI with the only exception of membership fees which are paid to EGI.org. However, as we expect the membership fees to cover a part of EGI.org own costs, staying at the level of 1MEuro in total, the sum to be transferred to EGI.org from the NGI should not be more than just a fraction of the NGI budget. The membership fees will be calculated by a formula based on that currently used by the TERENA⁴ organization. As each NGI will be a part of the EGI international activities (contributing directly to some services), the expected EC contribution will not only cover the EGI.org budget not provided through membership fees, but will go also directly to NGIs to cover part of their costs related to international activities and adaptation to the Europe wide agreed (operation, monitoring, ...) standards. The EC funding, while always only a smaller part of the EGI costs, will thus serve its primary “glue” role for the EGI.

Each NGI is free to select a provider for services the NGI is not providing by its own staff. We expect that EGI will gradually introduce services that will become attractive to NGIs. The cost of providing these services will be charged directly to NGIs that will use them (either per use or through a flat rate fee) and will provide additional income stream for EGI (i.e., either to the EGI.org or some NGI (or several NGIs) that actually provide the service).

5.1.3. EC Contribution

To maximize the potential synergies, we foresee the EGI infrastructure as the one and only European Research Grid. Therefore, at the level of infrastructure funding, we do not expect a truly competitive situation—no other organization should be able offer to provide this kind of “all inclusive” grid infrastructure. Recognizing this, we propose the EC contribution to be provided through a closed call for EGI.org and NGIs, in a similar way to the one used to support European networking infrastructure (GEANT) via call closed to DANTE, TERENA and NRENs. Based on the assumption of wide international support of the EGI concept and scheme, together with the fact that NGIs will represent the national grid infrastructures, we assume the closed call being the most appropriate instrument for this case, giving EU always the right to withdraw any support at all if EGI.org and NGIs will not be able to come with a reasonable proposal or if they will start to behave incoherently.

5.2. RESOURCE PROVISIONING FOR THE EGI

EGI.org will not own directly any resources, NGIs will serve as proxies to actual resource owners (providers). At the national level, NGI may own resources directly but we foresee that every NGI will have also to interact with resource owners to become the national point of contact for EGI resources originating in its country. The resource centres funding is out of scope of EGI, as it should happen at the national level. However, EGI must provide mechanisms for proper accounting of resource usage so each resource owner (and its funding agency) will be able to evaluate the impact of providing

⁴ <http://www.terena.org/>

resources to EGI on the grid availability to their scientists (i.e., to evaluate the efficiency of sharing resources through EGI from their national point of view).

5.3. INTERNATIONAL RELATIONS

While the primary purpose of EGI is to stabilize the Grid infrastructure in Europe (EU), it must be able to interact with Grid infrastructures outside this region, continuing the current successful practice of extending European Grids (especially those based on the EGEE model) to other regions (Asia Pacific, Latin America). We expect these activities will continue through a mix of direct international collaboration between EGI (represented by EGI.org or through some NGI or NGIs) and the target region or through participating in specific projects (support actions) when appropriate. Gradually, some mechanism similar to the membership fee (but with limited membership rights) may be applied to countries/regions that will be successful to setup their own sustainable grid infrastructures and organizations, but further elaboration of this model is out of scope of this document.

5.4. FUNDING STABILITY

The longer term national commitments for NGIs are the basis of the EGI funding stability. They provide the necessary guarantees for the existence and operations of the eInfrastructure. At the EGI.org level, the funding stability comes primary from the combination of member fees and expected EC contribution spanning several years. Any changes in the funding must be know well ahead in time, being it change in membership fee or a withdrawal of any NGI. We expect that changes that influence basic EGI.org funding will be announced with a proper grace period -- proposal is 12 months -- that will give EGI.org enough time to adapt for changed "income"..

5.5. DOCUMENTS REQUIRED TO MANAGE THE EGI

Templates for the following documents required to manage the relationship between EGI.org and both NGIs and VOs, as described above, will be produced by the EGI-DS project:

- Agreement for a VO to use EGI.org – including policies for users to join the VO
- Agreement for an NGI to join EGI.org – including policies on resource providers.
- Agreement for an International Facility to use and provide resources to EGI.org
- Annual agreement for an NGI or International Facility to provide resources and funding to EGI.org
- Annual report from EGI.org to a VO
- Annual report from EGI.org to an NGI
- MoU with non-European countries

6. TRANSITION PERIOD

The transition from the current Grids in Europe to EGI has already started. As described below, the EGEE project [7] will move towards an EGI/NGI structure during its third phase that has started in May 2008. The transition will continue through the initial three years of EGI when it is expected that the number of NGIs contributing to EGI will steadily ramp up. During this period, additional EU funding will be necessary to allow the full functioning of EGI.org from the beginning. After the transition, a steady co-funding by the EC is still required for a certain time.

The main change from the present situation towards the distributed model of the EGI will be organizational: The emphasis moves from individual interested institutions to national initiatives and from central supervision to central coordination of European NGIs. In addition NGIs will represent all national scientific communities and institutions, as the one providing resources to their national grid infrastructures. It is essential that the operating large-scale production Grid continues to serve the scientific communities through the transition period with at least the same quality and level of satisfaction today.

We concentrate in this chapter on EGEE and related Grid projects. Other related projects in the same Ecosystem, such as DEISA and PRACE, which focus on Supercomputer, are establishing collaboration and coordination with EGI, e.g. in the field of standardizing middleware interfaces. Clearly, these projects are not concerned at the same level as EGEE with the transition to EGI.

6.1. EGEE III AS A STARTING POINT

The Grid infrastructure, which is now operational over many European countries, was established through nationally and European co-funded projects starting early 2001 with the European DataGrid (EDG) 2001 under the fifth Framework Programme. After this proof of principle demonstrating the potential impact of Grid technologies on European science, a first large scale production Grid infrastructure was deployed by the Enabling Grids for E-Science project (EGEE), and its second phase (EGEE-II) has provided now a large-scale, production quality grid for scientists in Europe. These Grid projects together with related activities such as DEISA, OMII-Europe, BalticGrid and SEE-Grid, exploiting the pan-European network GÉANT2 and the NRENs carrying the Geant2 activity have established European leadership in the development and exploitation of Grid technology. The latest e-Infrastructure project, EGEE-III, co-funded by the European Commission for two years started on May 1st, 2008.

Although High-Energy Physics and the enormous computing requirements of the Large Hadron Collider (LHC) in particular were a major initiator of scientific computing grids in Europe, other sciences use a growing fraction of the EGEE infrastructure as shown in Figure 6 where this fraction grew from 10% two years ago to more than 30% by mid-2008. Even more impressive is the 12-fold growth of overall CPU usage of non-LHC communities over the same period.

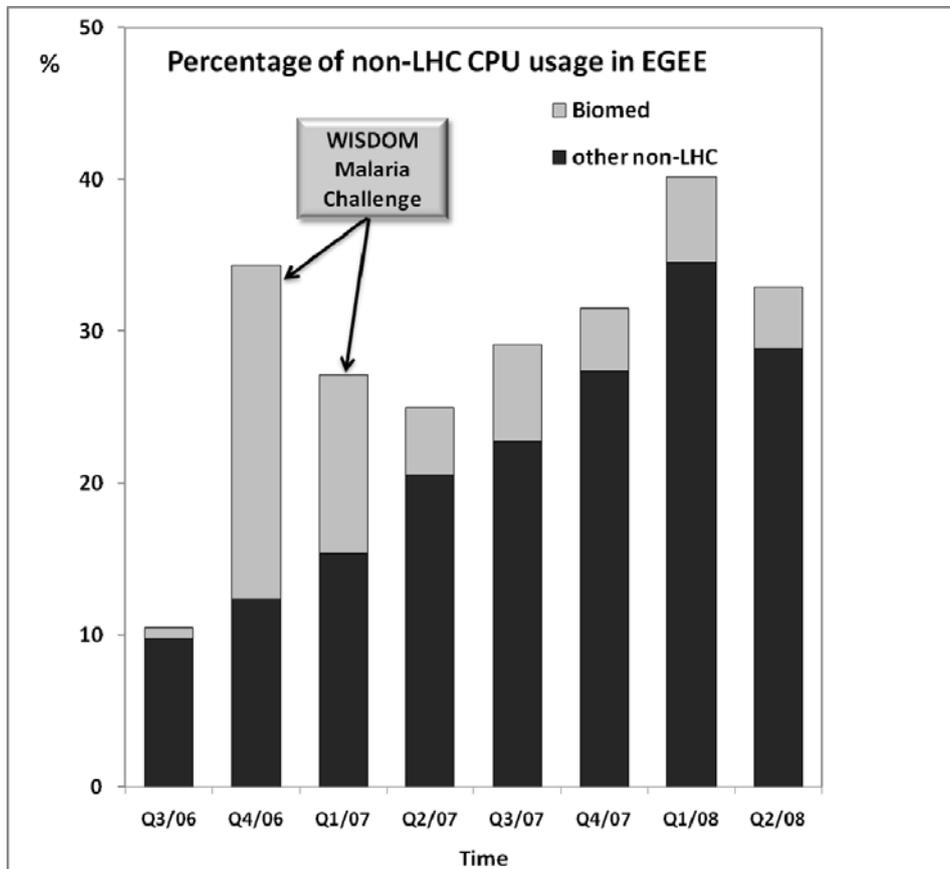


Figure 6: non-LHC CPU usage in EGEE

A growing number of scientific disciplines organized in more than 200 Virtual Organizations (VOs) with more than 7500 users rely now on production quality grids and the underlying infrastructure:

- Archeology
- Astronomy & Astrophysics
- Civil Protection
- Computational Chemistry
- Computational Fluid Dynamics
- Computer Science/Tools
- Condensed Matter Physics
- Earth Sciences
- Finance (through the Industry Task Force)
- Fusion
- Geophysics
- High-Energy Physics
- Life Sciences
- Multimedia
- Material Sciences

It is imperative that these sciences using the current grid operations supported by EGEE and other EU-funded projects can transit without disruption to the envisaged EGI/NGI-based model.

Therefore it is clear that the transition must address the following issues:

- Before the beginning of EGI a sufficient number of NGIs must have been established (or be in the process of being established) to represent a credible European Grid infrastructure.
- The concept of federating several countries to share common tasks was very successful in EGEE building the Regional Operations Centres (ROCs). It is inconceivable that these centres cease to exist from one day to next without appropriate replacement or continuation. In EGEE-III it is planned to move towards National Grid Operating Centers, so-called gNOCs.
- There is a central place providing overall coordination (such as the Operations Coordination Centre – OCC, in EGEE-III located at CERN). These functions will be taken up by EGI.org. The transfer of people from the current locations to a new one chosen by EGI is a concern.
- Strategic Discipline Clusters (SDC) have been established to maximize the penetration of Grid technology into key scientific disciplines ensuring that the requirements of each area can be met and that the scientists get focused support and help for the development of high-level application services. This task will still be required for existing and new communities in EGI.
- The middleware is still under development within the community and this effort is co-funded by the EU. These developments have to continue through the transition phase from the current organization to the EGI/NGI model and new requirements and technology evolution will imply new development throughout thereafter.
- The developments and operational tasks are performed by staff having built up their expertise through the lifetime of the current grid projects. Care must be taken that this expertise is not lost.

These issues require that appropriate funding for EGI.org and the NGIs is ensured in a timely manner. This is particularly critical during the transition and early phase of EGI.

With EGEE-III operating in parallel with EGI_DS, the work plan of EGEE-III contains already the implementation of structural changes required to allow for a seamless transition from the current project based EGEE model to a stable EGI model based on NGIs. To achieve this goal, a close collaboration between EGI_DS and EGEE-III is essential. This is also clearly stated in the Annex I – Description of Work - of the EU Project EGEE-III:

“EGEE-III will take key steps in moving Grids to dependable and sustainable production infrastructure while providing a continuous service to its expanding user base.

The Project Director and Technical Director of the project will interact closely with the EGI_DS project management team to check the progress of the parallel goals and ensure carefully timed milestones are met to ensure the progress of the project towards a sustainable model. These milestones, agreed with the EGI_DS management, are illustrated in the figure below. In a series of joint workshops EGEE will provide input to EGI_DS, such as EGEE-II deliverable DSA1 (WS1), the status of National Grid Operating Centers (gNOC) will be reviewed (WS2), and based on this input the EGI_DS blueprint document will be developed and discussed (WS3). This blueprint document will form the basis of the draft transition plan (DNA1.4) EGEE-III will develop and discuss at its annual conference, EGEE’08. This plan will detail the steps needed to migrate EGEE’s operation to EGI, identify major risks and shortcomings and develop stop gap strategies in case a full transition seems unlikely in the remaining lifetime of EGEE-III. The implementation of this transition plan will start in project year two and the EGEE description of work will be updated accordingly, taking into account any major changes to the programme of work to ensure the objectives are met. The status of the transition will be reviewed at the EGEE’09 conference (MNA1.5) which will probably also see the EGI launch workshop. This interaction is paramount for the overall coherence of plans, both technical and strategic. In addition to the technical work outlined above, EGEE-III’s adoption of JRUs will provide the necessary legal and organisational groundwork for EGI as discussed in Section 3.1. The

project will actively participate in concertation initiatives and meetings related to the e-Infrastructures and other related areas including the participation and contribution in relevant working groups established under the above initiative. The objective of the concertation activity is to optimise synergies between projects and the collective impact and value of the programme.

In order to manage the large number of partners, the EGEE-III consortium will be structured in federations (13 in this project) clustering countries on a regional basis. In addition, the Joint Research Unit (JRU) instrument introduced in EGEE and EGEE-II is being expanded to all countries where recognised National Grid Initiatives do not yet exist, to prepare the ground for long term sustainability by promoting international standards.”

This current draft Blueprint of EGI_DS constitutes an important step to continue the definition of the EGI and to complete the planning of EGEE-III for its second year.

The figure mentioned in the EGEE text above is re-copied here visualizing the tight coupling between the planning of EGEE-III and EGI_DS - see Figure 7.

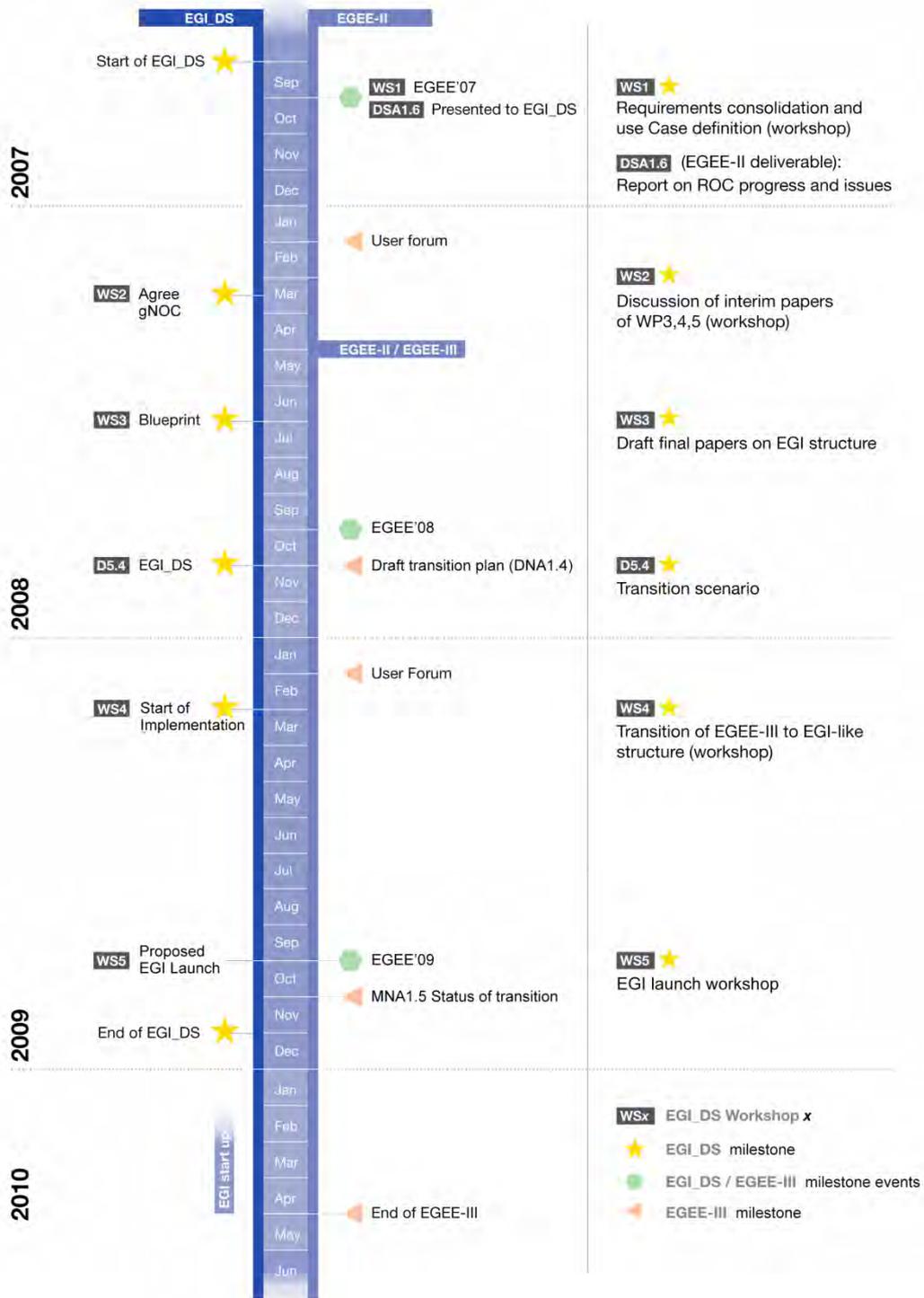


Figure 7: EGEE-III and EGI_DS common workplan

6.2. FROM JOINT RESEARCH UNITS TOWARDS NATIONAL GRID INITIATIVES

The Joint Research Units (JRU) that is an organizational structure introduced in the EC's Framework program was already implemented in the early phases of EGEE has now been established for 21 countries out of the 38 that have expressed interest in joining EGI. The goal in EGEE-III is to establish JRUs in all countries where recognized National Grid Initiatives do not yet exist, preparing the ground for long term sustainability by creating a stable institutional basis and promoting international standards.

The definition of a JRU is as follows:

Joint Research Units (JRU) are research laboratories/infrastructures created and owned by two or more different legal entities in order to carry out research. They do not have a legal personality different from that of its members, but form a single research unit where staff and resources from the different members are put together to the benefit of all. Though lacking legal personality, they exist physically, with premises, equipment, and resources individual to them and distinct from "owner" entities. A member of the JRU is the beneficiary and any other member of the JRU contributing to the project and who is not a beneficiary of the Grant Agreement has to be identified in the clause. The JRU has to meet the following conditions:

- *scientific and economic unity*
- *last a certain length of time*
- *recognised by a public authority*

This covers some but not all of the criteria of NGIs. Nevertheless JRUs may be considered an excellent starting point for the establishment of NGIs. A requirement still to be established is

- An NGI must have a sustainable structure or be represented by a legal structure which has a sustainable structure in order to commit to EGI.org in the long term, being authorized to sign the EGI statutes and to commit financially to EGI.

Some of these conditions for NGIs as described in Section 7.2 are today already fulfilled by the existing JRUs in EGEE. This needs to be improved in the near future.

6.3. EVOLUTION OF HUMAN RESOURCES DURING THE TRANSITION

The evolution of the overall level of human resources will be governed by several factors:

- De-centralization in general requires more effort than centralized solution. In EGEE-III this is expected to be compensated by reducing the effort required for daily operation through automating tools and processes.
- With increasing maturity of software, the emphasis shifts from development to maintenance. In the medium term it is, however, expected that additional effort will be required to implement in existing middleware components the standards agreed in the EGI framework. In addition, new communities using the European Grids are likely to have new requirements that need to be analyzed and implemented.
- During its existence, the EGEE program has seen a constant increase in the number of user communities supported, countries and sites connected to the infrastructure, collaborating projects and partners in the consortium. The usage of the infrastructure (CPU and storage) has increased by an order of magnitude in the last two years. This trend is likely to continue through the transition period and beyond. The observed growth could up to now be handled with constant or even slightly decreasing human resources. Significant cuts in personnel developing, maintaining and operating the Grids in Europe would seriously hamper the growing scientific community relying on the Grid.



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