COMBINATION OF COLLABORATIVE PROJECT AND COORDINATION AND SUPPORT ACTION

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Infrastructures Call 1
FP7-INFRASTRUCTURES-2007-1

Economics and financE in the European GRID

E³GRID

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*   *Please use the same participant numbering as that used in Section A2 of the administrative forms*

Work programme topics addressed
(if more than one, indicate their order of importance to the project. The main (first) objective <u>must</u> be one included in this call)
INFRA-2007-1.2.2: Deployment of e-Infrastructures for scientific communities

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Proposal abstract

The goal of E3GRID is to deploy a grid e-Infrastructure for the pan-European Economics and Finance research community.

The project will bring together key players in this field in both the **private** and **public** sectors, thus attaining an unprecedented synergy in the implementation of grid based tools for a research community that plays a strategic role in promoting a wider adoption of grid technologies.

E3GRID will give rise to a well integrated community of researchers, autonomously using a grid-based e-Infrastructure for research in a secure resource-sharing environment. The E3GRID infrastructure will operate in tight collaboration with EGEE, the largest European research grid infrastructure, which will be the basis for the E3GRID architecture.

The E3GRID project will also benefit the EGEE infrastructure by systematically identifying and addressing issues that are specific to the Economics and Finance Research sector, such as certain limits in data access, security, and licensing which are of key importance to this sector. It will promote, drive, and, where necessary, implement the required changes to the general grid services and will develop a specific E3GRID high level service layer that will ensure that the EGEE e-Infrastructure can be easily used by Economics and Finance researchers. .

E3GRID thus responds to the joint need of Academia and Industry for greater computational power in their research, as well as a more coordinated collaboration for their shared interests and resources.

This consortium is strategically committed to the task of ensuring that Europe's GRID e-Infrastructures will be compatible and productively usable by the overall community. In pursing its objectives, the consortium leverages on the successful pilot experience of the Italian EGRID project in setting up a grid e-infrastructure for academic financial Italian research teams.

E3GRID's main objectives involve:

- o Providing grid services tailored to these specific research community needs;
- o Producing a specific grid software layer on top of the existing European scientific grid;
- o Ensuring a pan European grid-based research community in Economics and Finance with direct involvement of industrial players.

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<u>**Proposal**</u>

Section 1: Scientific and/or technological excellence, relevant to the topics addressed by the call

1.1   Concept and objectives

Motivations for the present proposal

There are important motivations that bring the consortium to formulate this ambitious thirty-six month (36) proposal:

1. **An opportunity to integrate the Economics and Finance research community into the major European GRID e-Infrastructure, as this community is currently not represented in the computing activities based on the major European GRID e-Infrastructure**.

Research infrastructure projects like EGEE (Enabling Grids for E-science) and DEISA are providing academia and research labs with access to major computing and data resources as well as large spectrum of applications belonging to various scientific domains, including high energy physics, life science and computational chemistry just to name a few. It is however evident that at the moment these infrastructures are, for several reasons, not attractive for the research groups involved in Economic and Finance. It must be remarked here that the strategic role of such a key research community in promoting the adoption on a wider market of the European grid infrastructure is fundamental in addressing the objectives of the FP7 call in addressing specific needs of new scientific communities within a pan-European model.

E3GRID will make those parties engaging in Economics an Finance Research fields aware and of the services provided by the Grid infrastructures, and, at the same time, will allow the Grid community to be aware of the specific requirements and service enhancement needs of the Economics and Finance communities.

The project will develop a focused program of activities aimed at building a general leading edge e-Infrastructure including new services specifically tailored for the economic and financial sector which will be finally integrated in the European e-Infrastructure. These achievements may be easily extended to the human and social sector too. E3GRID may then have a seminal role in extending the more advanced computing collaborative practices developed for natural sciences to the human and social sector greatly enhancing European competitiveness in this domain and promoting ERA.

2. **The misalignment between GRID exploitation in financial industry and the European Grid infrastructures**

A GRID like approach is currently widely adopted within industry with many proprietary solutions specifically targeted to Tier-I banks and large financial institutions. In fact, many commercial industrial providers are able to offer state of the art proprietary grid services for smaller institutions and even research centres, but they lack the global research dimension provided by the large e-Infrastructure projects such as EGEE There is a dangerous misalignment among the industrial financial sector and the public e-infrastructure that may limit a future industrial exploitation of the European research results. E3GRID aims to bridge this mindset, and will transmit the financial industry's clear awareness of the GRID technology as a powerful key-enabling factor for cutting-edge research, into the Academic financial research community and to address the related interoperability issues surrounding them.

The diffusion of the collaborative practices of resource sharing, through the Open Source middleware services developed for the natural science by EGEE in the Economics and Finance Research sector coupled with the development of a related common e-Infrastructure will create the foundation for the adoption of common standards, as those of the Open Grid Forum (OGF), to address the interoperability issues between the public Open Source and the commercial proprietary solutions available for this sector.

3. **The significant need for computational resources within the composite research community in Finance and Economics**.

There are many groups in Economics and Finance, from Academia, Industrial quantitative research groups, and mixed Academia-Industry collaborations, with large computational requirements which are not currently operating through grid technology, and are therefore bound to a well defined amount of resources and so limited in the type of research they can do. These groups will be targeted by E3GRID enabling them as active members of the E3GRID infrastructure. Such groups will be referred as "**Target Group**" in the rest of this proposal. There are however some groups (identified as "**Pilot Users**" and/**or "Pilot Groups**") belonging to the target group, as those involved e.g. in the 3 year recently completed Italian Project EGRID, financed by the Ministry of the University and Research, that has already initiated using and/or exploring the use of grid technology and infrastructures for their own research. Many of these groups are part of the present consortium and will drive the effort of this proposal to deploy the E3GRID e-infrastructure and make it available for the Economics and Finance research applications within a trans-European context.

E3GRID main Objectives:

All the above considerations lead to the E3GRID project that will be aimed at achieving the following measurable objectives:

- *Objective 1:* **Deploy and support an interoperable Grid infrastructure for the E3GRID Economics and Finance Research Community to be integrated with EGEE**

E3GRID will provide the next generation GRID infrastructure for its research community which poses challenging requirements in terms of security, data management and interoperability among pre-existing grid solutions. It will be therefore fundamental to take care of those requirements and make the underlying GRID middleware satisfy them through the adaptation/generalization of the common general services adopted in the European e-Infrastructure provided and operated by EGEE and successor.

In this context the first step will be to setup, integrate into a common e-Infrastructure and support the core computing resources collected among partners, using a set of baseline grid services from the EGEE gLite middleware and leveraging on the previous successful experience of core partners of the consortium in installing and managing the EGRID Italian infrastructure. Some of the requirements of the Economics and Financial Research sector have already been taken into account and satisfied within the EGRID infrastructure and this latter will be the stepping stone of the new E3GRID infrastructure. Further steps will be then performed in order to identify and develop an advanced set of enhancements in the baseline grid services , tailored to the specific community requirements.. The Consortium partners have pluri-annual experience in handling the gLite services. INFN is currently leading the middleware development efforts in the EGEE II project and together

with ICTP and SISSA, in strict collaboration with INFN, have already made a significant headway with the Italian EGRID project in addressing some of the Economics and Finance specific requirements. The enhancements will be developed in the course of the project. The final objective will be therefore reached in an incremental way. The measurable output of this objective will be in term of active services made available to the community.

- *Objective 2:* **Develop a specific high level grid service layer for the E3GRID Economics and Finance Research Community allowing a transparent access to the e-Infrastructure**

The development and the place in production of the specific grid software layer on top of the existing European grid infrastructure is necessary to ensure that this community can easily and transparently use it for its research needs. Indeed the single and most pressing issue is precisely the addition of the missing software layer tailored to the Econimics and Finance Reseach sector given the general purpose nature of the European grid Infrastructure. This objective is at the core of this project and an absolute pre-requisite for the successful creation of the E3GRID community. This effort is fully organised and motivated around peculiar characteristics of the target group. This objective will produce the following tangible results:

1. a computing utility model

2. advanced tools for data management

3. interoperability layer among gLite/EGEE middleware and AGA Grid Solutions

4. integration of data cache solutions on the European e-Infrastructure

- *Objective 3:* **Create a Pilot community and networking within it to ensure effective transfer of knowledge and technology among the pilot groups**

Pilot Groups are members of this consortium and will act as early adopters of the grid technology, thanks to the experiences and knowledge they can add to the project. Collectively they constitute the **Pilot Community**, thus the term **Community** will be used here with the meaning to identify the set of teams originally belonging to the target group, that will be early networked together by means of grid technologies .Specifically, they will use the facility from the onset for their research activity thereby highlighting issues, contributing to their solution together with the other members expert on grid middleware and evaluating the progress towards tailoring the EGEE gLite public scientific grid services for the needs of Economics and Finance Research sector. They are committed to studying the feasibility and test the implementations required for sharing their resources and data and hence, are prepared to share them. They will drive the alignment of the consortium on initiatives of strategic importance to the wider target group, such as the standardization efforts, participation in events and interest groups, and the specific activities of the consortium's research fields

- *Objective 4:* **Expand the Economics and Finance Research Community, to ensure other researchers become actively involved in the project and/or become users**:

Pilot groups will be the initial core of the community that will be expanded and make self sustainable by the end of the E3GRID project. In order to comply with this objective the project will envisage the creation of the research Academic-Industrial Forum **(A.I. Forum)** for the Economics and Finance Research sector, **A.I. Forum**. This is the formal means for expanding the community

beyond the pilot users, outreaching towards the target group, and allowing the community guide to have a say in strategic interests. Members of the A.I. Forum study the feasibility of sharing their resources and are prepared to do it, thereby receiving resources from the other community members. They obtain access to the general high quality support for porting applications to the grid, and for integrating their resources in the grid.. They benefit from the general services, and therefore, provide valuable feedback on self-sustainability. The A.I. Forum will also be a means to network and will include other grid technology providers into the community.

- *Objective 5* **Bridge the gap between the public EGEE e-Infrastructure solutions and the private commercial solutions within the financial industry by evaluating and addressing interoperability issues, thus enabling the technological transfer between Academia and Industry and establishing joint, standardised state of the art services in this field.**

E3GRID consortium involves important commercial private organisations that are grid technology suppliers to the financial sector. They are eager to collaborate and complete the e-Infrastructure supplying the skills needed to support the emerging activities of the forming community from the industrial research point of view as well .

The industry's research interest is equally concerned with engineering issues which go beyond those related to the technical challenge of the computations involved and that are already shared with academia. Industry is also concerned with the issues involved in integrating the Open Source research solutions within their production infrastructure or in establishing ways to interoperate with them, which is an aspect usually neglected in pure academic research e-Infrastructure. Hence the need for aligning and interoperating the research and production grid environments.

This need for alignment and interoperation is also a reflection of the structural characteristics of the E3GRID Target group which include a significant presence of Industrial research teams. This brings in the consortium an intrinsic and internal need for seamless and smooth integration between the research and the commercial grid environments. In turn, the common efforts between public an industrial teams required for the alignment and interoperation of the two environments will act as a powerful and essential building force for the overall community.

The common experience and knowledge gathered in this process together with the technology transfer in both directions required to establish the interoperation between the two grid environments will provide a strong foundation for a continuous fruitfully expansion of the Target group e-Infrastructure to new scientific communities of this sector.

E3GRID Team

The E3GRID proposal is made up of a balanced mix of eleven research institutions and Grid enterprise experts comprising of:

- *"Coordinating partner & technology developer" (*Scuola Internazionale Superiore di Studi Avanzati(SISSA), IT)
- *"Consortium grid technology suppliers & scientific experts in the domain-field"* (SISSA, City University, UK Athens University of Economics and Business, GR Christian-Albrechts-University of Kiel, DE, Consiglio Nazionale delle Ricerche, - Istituto Nazionale per la Fisica della Materia, IT, The Abdus Salam International Centre for Theoretical Physics, Int. Org.);
- *Infrastructure providers (*INFN, IT*)*
- *Enterprise experts in the domain* (EXCELIAN, UK, AVANADE, NL);

- *Networking experts on finding user communities for early Grid adopters (*Consorzio Pisa Ricerche, IT)
- *International Outreach partner* (CDAC, India)

These organisations have the necessary expertise to implement the:

E3GRID overall structure:

In order to reach all the above listed objectives the project is organised in one service activity, two networking activities and a joint research activity composed of four working packages that will operate in strict coordination and alignment with each other:

- The service activity will operate to reach Objective 1.
- Joint Research Activities that will represent the core activities of the E3GRID project will take care of Objective 2 and will also contribute toward Objective 1.
- Network Activities will take care of complete Objectives 3 and 4
- Objectives 5 will pursed jointly by all the activities of the projects. There are many different actions that concur in its realizations, ranging from software development (JRA) to strong Networking activities and including as well Services activity with the provision of enhanced services.

The project's overall activity to meet the above objectives consist in promoting, driving, guiding and implementing the required changes, in the existing EGEE e-Infrastructure; and to create the E3GRID service layer that ensures the EGEE e-Infrastructure can be used by Economics and Finance researchers.

Elaboration of main objectives

The principal objectives of this project can therefore be structured into a Networking activity (NA), a Service activity (SA) and an elaborate Joint Research activity (JRA).

NA: dedicated to allow strategic project direction from the Pilot Users; and expansion towards the target group.

The Networking activity has two central objectives:

- To effectively allow the Pilot Users to drive the needed strong adaptation effort of the generic European scientific grid, in order to make it a usable tool for its community's research needs.

- To expand the community beyond the Pilot Users and make it a thriving and important presence in its fields of research.

Pilot Users drive

Pilot Users are the essential building block of this project. They will be in the position to effectively drive the adaptation effort of the general scientific grid, in the following three networking approaches:

(1) Creation of *power user role* within each pilot research group; and assignment to a consortium *consultant.*

Each research group has software applications that they use for their research activity. It consists of routines that they developed for their interests, which they keep developing for any new research need. This software is not ready for the grid as is, and needs to be adapted; this operation is called porting. Once the software has been ported, researchers must learn how to use the grid to run the ported applications. They must be autonomous in managing error situations and problems that usually happen when using software, and that also occur when using the grid. Finally, when they are ready to share resources, they need to know how to set up and manage their grid site within the community.

To address the porting effort and the user support for grid usage, each research team will identify one of their own members who will become a *power user*. This person will be knowledgeable in the research field, but also eager to use grid technology. This person will be committed to make the grid productive, since the initial impact will be rough: the current state of the general European scientific grid is still not tailored to the needs of the researchers. The power user will be especially concerned with the porting effort and with the internal user support to the team.
Each team will then be assigned to a skilled individual from the consortium knowledgeable in grid, who will act as a dedicated *consultant*. The consultant will work closely with the power user in the porting effort. Through this activity, the consultant will identify not only technical issues but also, and very importantly, the usability issues, that prevents a seamless usage of the grid infrastructures by the researchers.

By virtue of the role, the *power user* will then also become the first line of support for the rest of the

team, helping in trouble-shooting in running the applications in the grid and also in transmitting grid knowledge to the rest of the team. They carry out a continuous and implicit training activity for the research team as this latter evolves its research activity with the grid; and since they are knowledgeable in the field, they are on the same wavelength of the researchers and share the same needs and interests.

The actual porting effort of the research teams will be part of the JRA; the consulting services will be part of the SA. The NA is the crucial, initial bootstrap of this process, which will occur within the first four months: each team will identify the power user; all power users will then undergo an intense training activity; during the training activity the power users will be assigned to a consultant team that will personally follow them throughout the whole project duration.

This internal networking activity connects all parties, sets the stage for the subsequent strong adaptation effort of the generic scientific grid and provides focused support both within each research team and to each research team.

Lastly, for sharing the computing resources there will be focused approaches, which include similar personalised training and support, as in the porting effort. However, the situation is more complex, as it may involve the specific research team computing resources that will get shared, it may also involve the research institute. Given this complexity, it is not possible from the onset to set general dates for training events for all members sharing the resources: some will be able to do so at an early stage while others will need more time for organisational reasons. As these dates become defined, focused training will be delivered to the team administering the computing resources. This team will then liaise with the Service activity for administering the grid site.

Similar to application porting, it is the NA that supplies the bootstrap for sharing resources; it is therefore an internal networking activity that connects all parties.

(2) Collaboration tools for general high quality user support and request: web portal.

Pilot users will also have other means to direct and guide the adaptation effort. Tools will be put in place to allow for collaboration with the other consortium members; they are geared towards the day-to-day handling of issues. Essentially, there will be an E3GRID portal which will collect all the information regarding the project, supply the tools to file issues and receive answers, setting mailing lists, and more.

These tools complement the more focused attention dedicated to Pilot Users, through the power users and the consultant. This portal will also include sections more strictly focused with the SA. The portal, as collector of all information and tools, is introduced here under the NA, because its function is to network the community both internally and in its expansion phase.

It is the consortium members in charge of dissemination and outreach that will set up the initial core web site and collaboration tools. This core will then be further expanded and be greatly augmented by the Service activity that has the technical know-how to best identify and put in place the tools for supporting porting efforts and administration of shared resources.

(3) Annual Strategic Plan and progress assessment of previous plans.

During the first three months of each project year, a **Strategic Monitoring** meeting will be organised between all consortium members especially dedicated to the Pilot users. In this occasion, Pilot users will set the guiding direction of the scientific and technical project efforts. They will:

1. Assess requirements and evaluate progress on previously set strategic goals. It includes decisions on resource sharing and setting of strategic goals for grid adaptation efforts.

2. Decide on the dissemination of significant research results enabled by the e-Infrastructure. These decisions regard scientific publication objectives and participation in international scientific conferences. Decisions will be taken on the participation in at least two international conferences where scientific results achieved with the help of the infrastructure will be presented.

3. Draw the attention to and decide on dissemination towards stakeholders in the private industrial sector, through participation in events organised by industry, such as CityGrid and Grid Computing for Financial Services. Participation will be in at least two such events (Please peruse table of events taking place in 2007-2008 indicated below).

4. Decide on consortium participation to specific working groups within international standardisation efforts and interest groups.

5. Network within Europe's other e-Infrastructures and initiatives of interest to the community. For example if some research problems can benefit from High Performance Computing, possible interactions with Europe's EU project DEISA may be studied. Likewise for interactions with other fields such as statistics, machine learning, pattern recognition, and social sciences, which share with Economics and Finance a common set of computational tools.

6. Highlight and raise awareness to yet unaddressed needs by the rest of the consortium.

7. Consider and evaluate the A.I. Forum report.

All these decisions will result in drawing a Strategic Plan for the consortium, which must be implemented during the course of the same year. It is therefore, a very important moment in the life of the consortium; and given the evaluation of the A.I. Forum Report, This strategic meeting is key in the decision-making progress for the community of E3GRID in general.

The ultimate aim is to create a solid and active community. The previous activities focused on internal Pilot Users networking, as a pre-requisite to the intense grid adaptation effort. These activities focus instead on outreach towards the target group, for the expansion of the community which by the end of the project is expected to attract a solid, specific group of grid researchers as well as financial researchers from a wide range of institutes within Europe and eventually worldwide. The formal mechanism for achieving the community expansion is through the creation of the *Academic-Industrial Forum, A.I. Forum*, strongly supported by focused dissemination and outreach activities.

The Academic-Industrial Forum acts as the gathering place where new members of the community can express their interest in the E3GRID e-Infrastructure and decide the level of involvement best suited to their interests. The level of involvement can range from being an informed but passive interested party, to a full member of the community whereby the A.I. Forum allows to:
- contract with the consortium on resource sharing;
- receive support for grid enabling applications and for setting up grid sites;
- have a say on important standardisation efforts and on initiatives that may be of interest to the Community;
- decide on directions and needs that may not be addressed.

A.I. Forum members benefit from high quality demand-driven user support, from the services offered, and from the ability of having their opinions heard in the evolution of the community. It is therefore an important test for verifying the self-sustainability of the community after project completion. Moreover, at the end of each project year there will be a meeting of the A.I. Forum, which will result in a Forum Report. The Forum Report will contain requests, issues and observations made by the community, and will then be considered and evaluated by the Pilot User meeting during the development of the Strategic Plan for the coming year. The Pilot users will maintain the final say on any request from the A.I. Forum.

This expansion effort will be supported by two kinds of focused and specific dissemination and outreach activities, and by a broader advertising:

- Organised, targeted workshops;

- Networking connections of the consortium members;

- Web presence and generalised promotion.

(1) Organised workshops

Two types of workshops will be organised. **The New User Workshop (NUW)** will be organised to present the project and its aims, and then present case studies and best practices highlighting the benefits, and what can be achieved. This aim to attract new users to the community and ensuing discussions could lead to part of the target group collaborating on the E3GRID infrastructure. Since the adaptation effort will only be in the beginning stages, one workshop will be organised every six months starting from the second year of the project. There will also be a second type of workshop, **Community Networking Workshop (CNW),** to allow networking between current community members and where discussions take place on new targets to bring into the community, which will be organised every 12 months.

Grid related events

In addition to the above, the consortium will consider showcasing E3GRID results at targeted events already organised within EU27. The following list provides targeted events related to Grid technologies in the field of Finance organised in Europe over the coming months. Presence at these types of events will ensure that E3GRID, its objectives and future results will reach its targeted market. Dates listed cover events organised in 2007, but as several of those events are recurrent, we can presume that they will take place in 2008 as well. Events like CityGrid, which was successfully organised in December 2006 and December 2007 as well as EGEE & OGF - the Open Grid Forum events have been listed.

Date	Event description (related to Grid)	Place	Target Audience	Vertical Market analysed
April 2007	Grid Computing for Financial Services 2007	London, UK	Enterprise & Research	Finance
May 2007	Market Data Training	London, UK	Enterprise & Research	Finance
May 2007	OGF User Forum	Manchester, UK	Enterprise & Research	Grid also in Finance
August 2007	The 4th International Workshop on Grid Economics and Business Models	Rennes, France	Enterprise & Research	Economics and Finance
September 2007	9th Annual Chief Financial Officer Summit 2007	London, UK	Enterprise & Research	Finance
September 2007	Trust & Privacy in GRID Systems (SecurCOMM 2007)	Nice, France	Enterprise & Research	Finance
October 2007	European Financial Information Summit 2007	London, UK	Enterprise & Research	Finance
December 2007	CITY#GRID	Hilton Canary Wharf, London	Enterprise & Research	Finance

Table of Grid & Finance related events organised around EU27

(2) <u>Networking connections of the consortium members</u>
Another important outreach mechanism that must not be underestimated is the introduction of E3GRID to others in the target group by the pilot users, Community members or A.I. Forum members – through *word-of-mouth* and informal dissemination activities that can be carried out in the course of the project. The word-of-mouth approach is very important in the community because *trust relations* are usually already in place. Financial institutions trust their consultants; financial institutions trust specific academic scientists with whom they have already set up mixed collaborations for common research interests.

During the first year it is expected to achieve a number of AI Forum representatives, even though the e-Infrastructure adaptation effort will have only just begun, and no focused workshop will have been organized yet. Indeed, the effect is already at work as the letters of intent and support collected in Appendix I witness. It is thanks to the trust relations between some of the partners of this consortium and their research contacts that financial institutions and academic research group are ready to collaborate with the project.

(3) <u>Web presence and generalised advertisement</u>
To complete the outreach activity, the web portal already developed for the Pilot users will also serve the same purpose for the rest of the community, apart from any section on the site that reflects Pilot User specific activities that therefore are not accessible to the Community at large. Moreover, there will also be the preparation of promotional material to support project visibility and the

different marketing phases, and liaison with press, media and potential sponsors acquired.

SA: Setting up, integrating and supporting core resources of our community

This service activity collects the European grid know-how and will deliver this as two well structured services:

1. A service to aggregate the efforts and resources of the community, integrating them within Europe's EGEE grid e-Infrastructure
2. A service to support the grid enabling of the community's tools and applications, and their subsequent place in production within the infrastructure

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This activity applies both to Pilot Users and members of the A.I. Forum, at different levels of service as explained below.

Aggregation of community resources

This activity supplies consulting services from a system administration point of view, as far as installing grid sites go. It also covers monitoring the infrastructure and ensuring its proper working so the community can carry out its research activity.

This activity results in the actual E3GRID infrastructure being physically in place, which consists of two actions: adding community resources, and integration into the EGEE e-Infrastructure.

- It will receive requests from the Networking activity to incorporate new partner sites into the infrastructure. It will therefore install the necessary middleware at partners' sites, including support in setting up the necessary security infrastructure such as Registration Authorities recognised by the National Certification Authorities involved. Consultants of this activity will also be involved in training of the local grid site administrators at partner sites, through the Networking activity.

- It will have the important task of integrating the infrastructure into Europe's EGEE e-Infrastructure, which collects Europe's grid based scientific communities. Through the sharing of E3GRID resources, the community will benefit from the other communities' resources, greatly expanding the availability of computational power. The expansion of the computational power through the sharing of resources between partners and with EGEE, will allow the community to further its research possibilities as explained in *Section 1.2 provision of services and coordination of high quality research.*

This activity also results in the Grid Operation Center (GOC), which takes care of the infrastructure. Through the GOC, the community signals malfunctions and makes the administrators accountable for any loss of productivity that follows an interruption of service.

- The GOC is essentially present as a web site with a collection of tools such as a wiki, documentation, knowledge base, trouble ticketing system, mailing lists, SVN repository, middleware repository, bug tracking system, links to the monitoring tools, etc. These are all collaboration tools needed to allow interaction between the community and the administrators. This web site is integrated into the project portal core, already developed in the Networking activity.

- The ticketing system will be eventually interfaced with the Global Grid User Support (GGUS), the official support system used by EGEE and OSG grid infrastructures.

Other verifiable outputs include:
1. the number of community sites formed;
2. Tangible results of Registration Authorities set up,
3. quantifiable Digital Certificates issued,
4. number of Europe's sites that grant access to the community,
5. the number of issues raised & closed as tracked by the issue tracking system, the monitoring records of the infrastructure.
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The difference between Pilot Users and A.I. Forum members is in the level of service each receives. A.I. Forum members benefit from the general high-level support received through the GOC site for day-to-day management and issues. They receive training during the Networking activity expansion task. Pilot Users benefit more, from personal consultant and personal and intense training for system administration and site installation.

Grid porting support

This activity supplies consulting services as far as the porting of applications to the grid goes. It also integrates all of the grid software layer produced in the infrastructure and deliver them as new services to the community.

The consulting service is given to the research teams during their grid porting development effort. It is given to the Pilot Users during their JRA activities, and also to the Community as represented in the A.I. Forum.

- For the Pilot Users during their JRA, the consulting service is personal. All Pilot Users will be assigned to specific consultants during an initial intense and focused training activity. Through out the lifetime of the project, the consultant will work closely with the Pilot Users, and especially with the power user within each research team. The consultant will help the porting development effort that the power user and the team will undertake: some development will be done by the consultant but most will reside in the hands of the team. A report on the consulting will also be produced to track progress.

- Consulting to A.I. Forum members will not include a personal service. They will not be assigned to specific consultants. During the community expansion networking activity, they will receive some training. They will benefit from the general web based collaboration tools that will be in place also for the Pilot Users to address the day-to-day needs and help requests. The report summarizing the outcomes of these general collaboration tools will allow the monitoring of this activity.

This activity also results in the physical integration of the grid software layer developed during the JRA, through a request for integration. The A.I. Forum may also ask for an integration request of software that has been developed independently.

- The installed software is the main outcome, together with the new services that the new software delivers. The new services range from grid enabled applications that can be seen as tools by the researchers in their daily activities, to new general grid services specifically tailored to the needs of the community. The JRA goes on to develop, new general grid services in this project.

- It is not only installed software in production, the tangible outcome of integration requests. Software repositories of varying forms will be used to collect all the efforts. The JRAs will certainly have a CVS/SVN for source code; and for suitable applications developed by the researchers, also a web based graphical front end. For the binaries, the situation will be more delicate; several options will be considered, including proper packaging and feeding to the EGEE/gLite development teams for inclusion in official distribution of the gLite middleware. The web presence of these repositories will be achieved though a grid portal, which will also allow access to the grid computing resources and be integrated into the general project portal already developed during the Networking activity.

The verifiable outputs of this activity include as well: user support requests and bugs opened and closed as tracked by bug tracking system.

JRA: Additions of missing grid software layer functionalities.

This activity is central to the entire project: it is responsible for adapting the generic European grid infrastructure and middleware to the specific needs of Economics and Finance research. It will improve the quality of the existing generic service offered, and specifically supply innovative software solutions for making this new user community benefit from computing services. This activity is carried out by all Pilot groups and all consortium grid technology suppliers.

The effort is designed around three main considerations, deriving from consortium members' involvement in private and public grid initiatives, and resulting in knowledge of:

* currently missing or incomplete functionality;
* existence of different approaches to research in Economics and Finance;
* crucial importance of financial data for the adaptation effort.

The development effort takes place in the context of aligning the research environments with the production environments, already present in top tier banks and financial institutions. This is needed to allow transfer of knowledge and technology among them, given that both environments demand big computational power and duplication of effort would be wasteful.

* **Knowledge of currently missing or incomplete functionality**

* **Criteria for selection of Consortium partners**

The presence in the consortium of members that work in the private financial sector specifically with grid technology, and of members that have worked in the EGRID Italian project for a national pilot facility for research in computational finance, allows for significant missing or incomplete functionality to be addressed from the onset. This is why specific work packages and tasks have been identified as following including descriptions of the partners involved:
 (1) Integration of a data cache solution in the public grid
Data cache solutions are a fundamental service in top tier production environments; they are needed to address the bottle neck that results when computing solution to models, and data supply to the models becomes the limiting factor; memory needs of the models to get addressed, as typically, tens of Gigabytes are needed thereby exceeding usual computing nodes technical specifications. Enterprise consortium member, Excelian is experienced in bank production environments, is expert in the heavy use carried out in such environments, and has identified this as an important functionality needed in a financial grid environment.
Excelian
It was decided, therefore, to integrate an industrial solution into the European research gLite grid middleware of the EGEE project. In particular, there are agreements with Gemstone to integrate its Gemfire data cache solution into gLite (view letter of support from Gemstone in appendix I) This will at once bring an industrial strength product with a proven track record of withstanding the demanding production environments of banks, into the research world of e-Science. This results in the research community at large to benefit. Addressing licensing issues will be explained later on.

SISSA & ICTP(2) Development of a full utility model for Finance research
Currently resource sharing in terms of compute in the public grid is done through sharing of unused resource time. Top tier banks are currently less concerned as they own private internal departmental grids; yet they are approaching limits where they cannot own all the computing power needed. Both

private and public grids will benefit from more advanced models for resource access, not only in terms of compute, but also in terms of algorithm and data sharing. Excelian has identified this need, which is shared also by SISSA and ICTP that worked in the Italian EGRID pilot facility for research in Economics, and are aware of the situation of the public grid.

Avanade
(3) <u>Addition of a compatibility layer to MS Windows .Net based enterprise grid solution AGA.</u>
There are enterprise grid solutions in the Finance sector, which are based on MS Windows platform. MS Windows is a commonly used platform for banks. Linux is almost absent, but is the main technology for the public grid. Therefore, it is important to address compatibility issues in order to guarantee some degree of transparency and usability. Avanade, which comprises a joint venture between Microsoft and Accenture, is involved in the Enterprise financial sector. It has developed the AGA grid, which is MS Windows based. Through this effort, it will be possible for AGA to accept jobs submitted from the Linux based grid. Hence, the public grid is not altered, which is important given its wide adoption, and unfeasibility of changing an already common grid solution. The public scientific grid community will benefit from the potential sharing of computing resources from MS Windows based solutions.

INFN & ICTP
(4) <u>Evolution of the SRM-standard based EGRID data management solution and alignment to the scheduled advances of the standard</u>
Controlling access to financial data files in grid storage through ACLs for members of the same public grid virtual organization is currently possible only through the StoRM server (as far as we know), and through the ELFI clients which also provide a simplified public grid paradigm for managing files. Consortium members ICTP and SISSA involvement in the Italian EGRID project produced such tools, in a joint collaboration with consortium member INFN for the StoRM server. Both tools are based on the SRM protocol for accessing files in public grid storage, that is now the standard adopted in the EGEE infrastructure. It is therefore fundamental to keep these tools updated and further developed for having them as reliable and fundamental services to the whole community. It is also important to keep them aligned with the evolution of the SRM protocol; in fact SRM is going through a period of rapid evolution towards very sophisticated models for managing space, incompatible with previous versions. It is therefore crucial to remain aligned with the rest of the SRM grid community and make present the needs of our community within the SRM working group in this critical period.

All these software additions result in services, detailed in section 1.2 on the provision for integrated services and high quality research. In this section, a case was made to the need for such technology, and the previous knowledge that motivates its missing or incomplete status.

- **Knowledge of the research approach**

A central objective is to integrate and develop the necessary generic grid tools, crucially keeping in mind the research approach the community has. It is important to understand its particular composition: there are pure academic groups, mixed industry-academia groups and pure industry quantitative groups. Their approach to research is very different:

- on the one hand it encompasses an important share of research that is less structured and more exploratory and free-drifting in nature;
- on the other hand there is a more structured approach that levies existing procedures and stable generic application frameworks that are referred to as analytics.

Less structured approach

This approach to research is very focused on specific interests of the group and yet it is sufficiently different from that of other research communities. It warrants specific tailoring of the European scientific grid in other ways as well. It is this characteristic very common in the academic research community, which is one of the principal drivers for the organisation of the project.

In order to efficiently capture and port the typical tools and procedures of this segment of the community, it is unrealistic to have detailed requirement specification sessions. It is not feasible to gather expert researchers in Finance and Economics, together with experts in grid and software analysts, during detailed and focused work sessions to produce the necessary software requirements. This capturing approach is at odds with the usual way of carrying out this segment of research. It can only work well if there are standard and clear procedures in place, which is not the case here. So the capturing approach is very unlikely to be efficient.

To address this problem, capturing the typical tools and procedures of academic researchers will occur while the researchers carry out their daily activities. As already mentioned in the Networking activity, a specific team member will be given the role of the power user: not only will this researcher be an expert in its subject matter, but will also be trained to be knowledgeable in grid as well. Every software tool developed by the team for the daily research activity will be ported to the grid by the power user possibly with the help of the rest of the team. The power user will also be the first line of support and dissemination towards the rest of the team. The power user will therefore share the same needs, worries and interests of the rest of the team.

Each team will also have a group consultant from the consortium members' experts in grid that are present in the Service Activity that will help the team in the application porting effort throughout the whole lifetime of the project. This consultant is crucial not only because of the help it gives to the teams, but also because of the constant presence. It is this constancy that will allow for the capturing in all those tools and procedures that will be ported to the grid, of the abstractions common to all research teams. Once these commonalities have been captured, the grid experts will be in a much better position to further elaborate the ported applications and possibly spot general patterns.

These general patterns can then be made explicit in specific software routines or other. They can be collected in repositories together with the researchers' ported applications and tools. The patterns may also highlight general needs still not addressed, which can then be discussed with all the Pilot Users and suitable actions be taken. Indeed, every year there will be a meeting in person between all

consultants and power users possibly extended to the whole Pilot research teams. This meeting will occur halfway through the year. Its aim is precisely to allow sharing of the on-going porting experience, evaluating any common need and solution necessary to all Pilot users.

Although use of an initial and detailed software requirement session is unworkable as argued, a minimum amount of broad direction is still useful and required. To this end, the Pilot User meeting for drawing the yearly Strategic Plan supplies the right occasion for also setting strategic goals for the JRA, that may already be known or become better focused during the lifetime of the project. This is a reasonable compromise: one initial moment that sets strategic requirements and checks on-going progress, while all tactical decisions and requirements are left to the JRA activity proper. In this way, the nature of the academic research approach is respected, and capturing of requirements as well as their satisfaction is favoured.

A structured approach

On the other hand, the more structured approach that levies well-known procedures and software routines is frequent in industrial quantitative research groups. The consortium participation of an important top-tier bank consulting company, allows to directly port the typical tools and procedures in use in such environments.

An important advantage of the whole project is that through the long consulting experience the abstractions have already been captured; this project will therefore benefit from not having to repeat the analysis process. The consortium will be in the position of immediately beginning the production of the grid software layer needed by researchers used to this approach. Moreover, as the tools will be available to all the community also all other researchers will benefit from being able to use such tools as starting point for further research.

Both approaches result, therefore, in the production of missing grid software layer, a physical half-year meeting between all consultants and power users, as well as the output of a meeting report.

- **Knowledge of the importance of financial data to drive the adaptation effort**

Economics and Finance research makes use of financial data bought from several sources such as stock exchanges or other data suppliers. In order to develop some of these necessary services the consortium requires a certain amount of financial data, which must be shared among the consortium members through the grid infrastructure that we are building. This service development effort cannot be done through the sharing of existing data each partner has: there are strict non-disclosure policies attached with the existing contracts.

The service developed is precisely the supply of such financial data: at the end of the project lifetime the infrastructure will be in place to allow also a working utility model for data. Not only will the cost model be in place, but also the services to make it possible. Moreover, since real research use cases from the Pilot Users are the drivers for the adaptation effort, this data will also be used by the Pilot groups in conjunction with any other data they already own and of which they have exclusive rights.

A task has been dedicated to:

- Understanding together with the pilot users the best-suited sources of data, result in a report.

- Signing of Financial data contracts.

Indeed, a conservative amount of the budget, in the order of 5% of total, has been reserved to ICTP to buy the necessary data. ICTP has been chosen, due to its previous experience within EGRID project. Clearly all Pilot Users during their first meeting will decide the best sources and data needed, compatible within the allotted budget.

1.2   Provision of integrated services and co-ordination of high quality research

The provision for integrated services that will be delivered stems from the NA that will enable the sharing of pooled resources through grid technology, with the full support of the SA and from the articulate JRA activity that will greatly augment these core pooled resources. All of this will result in the enabling of high quality research as discussed in the final part of this section.

Integrated service resulting from pooling of resources, during NA with the full support of SA

The research activity that is currently being carried out in Finance and Economics employs computing resources that are owned by the respective teams. Such resources are usually limited, apart from a few groups that can benefit from exceptional funding. The limited computing resources results in limiting the research, in that the analytic potential of developed models cannot be fine-grained or else the time taken for processing becomes prohibitive. This limit also hinders the amount of data that can be realistically analysed, because large amounts demand more processing power. Advanced analysis techniques which are unfeasible with limited resources, become a viable option as more processing power becomes available.

Research Potential
For the reasons mentioned above, the pooling of resources among our community and with the rest of the scientific community, is the first step towards augmenting the research potential. From the pooling and managing of shared resources through grid technology, the ensuing service will allow each researcher to get access on best effort basis to the resources of the other community members. By best effort it is meant that the owner research group gets priority access to its resources, and shares its idle time with the rest of the community. So all groups share and receive each other's idle processing time. This is a very simple sharing model that will be used as starting point for more elaborate sharing models as described later on.

In summary, the current state-of-the-art for the community is that each research group owns its computing resources. Through this service, the resources will be pooled with grid technology, resulting in more computational power available on a simple best effort basis. The know-how of grid technology will therefore be disseminated to the community, thereby becoming part of the community's common body of knowledge. The community will therefore autonomously use the grid for its research needs. This will be laid out in the Consortium Agreement signed before beginning of the project.

Integrated services resulting from JRA

This project is centred around a strong core development effort in the JRA, guided by the pilot community that carries out high quality research, and that will result in the addition of an important grid software layer. This development effort is also carried out by industrial financial grid technology and know-how suppliers. The net result will be the integration of new services into the infrastructure, from which the research community at large will benefit. The software and hence the services consist of:

- An advanced utility model for Finance research, which is currently absent.
- Data caching grid service currently absent in the public grid, but heavily used in internal grids of top tier financial institutions.
- AGA Enterprise MS Windows Financial grid solution, able to execute scientific gLite public grid jobs which are Linux based.
- Enhanced EGRID data management solution aligned with the most recent SRM protocol standardisation efforts.
- Application portal and repository that will collect APIs, samples, tools, and be the graphical interface to launching full financial and economics applications in the infrastructure; this service is absent given the absence of the Economics and Finance research community in the European scientific grid.

These services will not be available all at once since a development effort is needed, but as soon as they are ready they will be put in production. Some services will start right from the onset such as the application portal and repository through which grid-porting support will be provided to the pilot community, which therefore can start working right from the beginning. Also the current version of StoRM will be placed in production immediately to handle the Financial data acquired securely. Other services will need more time, such as the utility model for Finance research.

It is important to understand that currently top-tier banking sector has in place very advanced grid solutions with respect to the public scientific grid. Some key technologies are outright missing in the public grid, such as the use of data cache services. Other services such as the utility model is not currently the highest priority for tier-1 banks, because their grids are all internal and not shared even with other departments. So many services will advance the public scientific grid towards the private grids; but it will also be an opportunity for the private sector to advance their understanding of the interactions and use services specifically designed for open grids, through the utility model.

To summarise the overall advance that this project will bring to the grid based research community through the JRA, it is the congruence of the public facility with direction of the industry, plus the accompanying high quality industrial tools inherited from the advanced state of grid technology in banks. This will spread beyond the Economics and Finance community through the common grid base, and hence benefit the whole grid based scientific community.

Utility model

The vision of grid is: "Resource sharing & coordinated problem solving in dynamic, multi-institutional virtual organisations" (Foster). Today we are quite some way towards this but as yet have been slowed by practical considerations, both technical and organisational. In the scientific community, grid resource is shared across virtual organisations, with the "right to use" often granted

based upon a contribution of compute resource. This works well and it works on a best efforts basis. There is no guarantee of service, completion times, or of resource availability in such a sharing model.

The utility compute model extends the sharing model and makes service guarantees possible. It works in a similar way to other utilities, such as electricity and water in that compute is available "on demand", as needed, provided by a central service. Accounting models are based upon a "pay as you use" basis (plus service charge) and commercially are available at around $0.30 per CPU/Hr. We could certainly drive this cost far lower through this project. Research organisations would not necessarily pay in hard cash to use the facility, but the utility-based tools would allow accountable, secure sharing with some degree of guarantee of service level, and this sort of model is essential for future sustainability of any compute resource. In particular industrial research may make use of such a facility and be prepared to pay.

Sharing in a utility grid is facilitated through resource allocation, resource discrimination and prioritisation. These technical capabilities are available in some grid middleware, but have not been tested and stretched across WAN level resource pools. Development of this functionality will enable global utility computing and the provision of accounting and monitoring modules will make capacity planning possible. It is clear that the demand for compute will only increase; the utility model is the only practical way to account for this demand, sustain the facility and ensure that researchers are not waiting weeks for important results.

This utility concept can extend in to data as well as compute; data can be shared, secure and provided on demand (according to policy), across the grid. If required, a pay per use model can be put in place for high quality financial data which will allow the costs to be shared between research organisations making use of this data, based upon how much of the data they use.

In summary the utility compute facility will provide the following benefits:
- High utilisation of the compute facility (better ROI)
- Compute available (nearly)"on-demand" as well as for forward reservation
- Guarantees of service levels
- High quality financial data available on a "fair share" basis (pay for what you use)
- A sustainable, available, resource pool that has the capability of growing in line with the needs of the research community.

Data Caching

As compute requirements increase grid has the capability of making more compute resource available on an "as needed" basis. Grid harvests resources and may do this through a widening of locality. This means that Compute tasks can now be spread across chassis, machine rooms, data centres, organisations and countries. Distribution and aggregation of compute tasks is not particularly constrained by network latencies, however the distribution of associated data can cause network bottlenecks and the I/O tasks will compete with compute tasks leading to low grid utilisation.

Financial calculations require large amounts of data. Typically this data needs to be shared across large numbers of compute nodes in a grid. A good example for this is the Value at Risk calculation that requires market data for all positions held by an institution on every compute node, this can

stretch from 10GB to 100GB. The patterns of data delivery for grid computing, shared file systems, central database or delivering data with compute, do not scale to large numbers of nodes or large datasets due to read/write contention, blocking, disk read latency and network latency. The fundamental problem is getting the required data to the right compute nodes at the right time. This is a standard locality of reference problem and may be addressed by an architecture that uses data caching as an abstraction layer between the data store and the compute nodes.

Data can be cached locally, or in central services and be made available by a simple common interface to all compute nodes, even across the WAN. The data cache takes responsibility for ensuring data consistency and coherence across the compute nodes, essentially acting as a distributed shared memory. Cache size is not limited and the use of "near caching" ensures data and compute affinity. Data caching can also include: security, allowing only some processes or users to have access to some data; partitioning and transaction capability.

Data caching is seen as essential in financial institutions for scaling the grid and decreasing latency. It also makes classes of problems that were initially inappropriate for on boarding to the grid a reality for parallelisation. Particularly problems, which require large scale PDE solvers or Monte Carlo problems that can benefit from data and path caching. In turn, this technology will open up new research questions around the most appropriate and efficient way to on board these application types. Data caching is essential in utility grid as it frees resource, reduces calculation times and increases utilisation.

Given the complexity of such data cache solution, it was decided to use an already developed industrial product. Indeed, through Excelian commercial collaboration with many data cache solution vendors, it was seen that synergies could be possible with Gemstone who created the Gemfire data cache solution for the banking sector. Indeed, Gemstone is eager to explore new technical challenges in other scientific areas beyond Finance, so the European grid based advanced research community proves an excellent place where to try the data cache technology. This service promises to be valuable and usable also by the whole European grid based research community.

Compatibility with AGA MS Windows based financial enterprise environments

The current public scientific grid is completely based on Linux technology and therefore does not allow the execution of MS Windows applications. Yet research environments and especially production ones in Finance and Economics make considerable use of MS Windows technology. It is therefore important to guarantee a degree of usability in key points of the infrastructure; more specifically, important gains can be achieved by the implementation of interoperable Worker Nodes able to execute .Net programs, compatible with the rest of the grid infrastructure that will remain the same (including existing Linux worker nodes). On the other side, Financial institutions having mainly Windows machines can exploit specific libraries or hardware architectures supported by Linux but not available under the MS Windows environment, all as part of the same private grid.

By adding a dedicated EGEE compatibility layer to it, it will be possible for users of AGA MS Windows enterprise grid platform for Finance, to integrate into the public European grid and so access a broader range of computational nodes; eventually specialised ones like clusters or Symmetrical Multi Processors (SMP) computers, and very importantly to let willing enterprises to share their Windows machines. This will help to scale to a larger and heterogeneous Grid. In Finance this will allow for applications where specific parts of the overall computation, can be run on the most fitting type of resources. For example, Montecarlo simulations of complex financial instruments can be split by executing related computations on parallel machines and repetitive

simple computations on a large set of standard CPU nodes. Avanade already carried out a pilot experiment of such an architecture using HPC nodes to simulate path dependent instruments, while executing other calculations on common workstations.

This allows Economics and Finance researchers to use .Net technology for their research and so leverage the software tools present. But this brand new type of compatible Worker Nodes will open up new possibilities to the current grid based European scientific community; they will have at their disposal new potential tools to carry out their research.

EGRID data management solution alignment with SRM standardisation efforts

The coordinators home institutions leading role in the Italian EGRID project, produced the EGRID data management solution for handling of Stock Exchange strict disclosure policies on data sold to individual research groups by the New York Stock Exchange, the London Stock Exchange, Milan Stock Exchange, Tokyo Stock Exchange and others. It consists of the StoRM SRM server developed jointly with Italy's INFN, for the ACL need of the Economics community and for addressing data access performance needs of scientific communities on the EGEE infrastructure. It includes also the ELFI client for accessing data in grid storage, which provides an integrated feel to the end user as far as current public grid use of logical file names, physical file names, and file transfer mechanisms goes.

The EGRID solution based on ELFI and StoRM is presently the only one explicitly designed for handling financial data but stills lacks important features like the sophisticated new SRM space management, and performance improvements. Since SRM is currently undergoing important protocol changes regarding the space model, E3GRID is committed to maintain StoRM and ELFI aligned with these new versions of the protocol as well as arising awareness of the data management needs of the community within the standardization SRM committee.

Application portal and repository

All development effort that will result from the pilot community activity will be collected in repositories. Other researchers will therefore be able to use them as starting points for further research. This service therefore will contribute towards aggregating the knowledge present in the research community. Moreover, for select applications there will be the integration in the grid portal, which will allow the community to access a web based user interface. This will allow for completely masking the grid technology that enables the analysis; and let the researchers only concentrate on their Finance and Economics domain. These web-based applications will therefore become tools at the disposal of the research community for their activity.

Specifically from the project involvement of banking sector consultants, their applications samples will be based upon current and potential use cases taken from industrial practice and research. They will drive the development of the grid and provide reference implementations on the new architecture for researchers to use as they implement their own solutions. There are opportunities for both Financial and Technological research that could benefit. Some examples of possible use cases would be:

- Large scale Monte Carlo exotic option valuation schemes, with path caching. This would make use of the Data Caching architecture for both path caching and possibly random number caching. This could include innovative MC techniques for American options that

benefit from new research in valuation approaches.

- Computational efficiency through data affinity. Improving the efficiency and timeliness of Monte Carlo Value at Risk schemes through data partitioning and locality of reference.
- Data caching solutions for implementing shared memory model PDE solvers on a grid. This is important research as this class of problem (predominantly low dimensional exotic option pricing) is not currently parallisable.
- Parallel portfolio optimisation techniques. Portfolio optimisation in the credit markets can be computationally intensive yet the most common schemes are not immediately parallelisable.
- Back testing and calibration – Model back-testing against historical data. This is essential in the provision of new models.

Coordination of high quality research

The Pilot Users will carry out research leveraging the advanced services created, and the increased computational power derived from pooling of resources. The starting point will be given by the state of the art EGRID e-infrastructure that will provide a common space to engage Pilot users in a close collaboration so as to explore similarities and abstract out common elements with respect to their distinct approach to the EGRID infrastructure usage. This will lead later to the creation of common GRID tools and services that will further enhance coordination and collaboration among different research groups. A relevant role will also be played by the financial data acquisition and usage policies that will require a strong coordination among all research partners.

The high quality research that will drive this effort includes:
- Application of cointegration techniques to identify hedging algorithms for equity and energy markets. Traditional analysis is based on volatility and correlation.
- Agent based simulation of Electricity markets. The issues involved are difficult to treat analytically and this has motivated the use of agent-based simulations.
- Statistical analysis of massive ultra-high frequency financial data sets using computationally intensive statistical procedures.
- Simulation of Large Agent-Based Models.
- Empirical estimation of agent-based models.
- Design and implementation of online trading strategies.
- Portfolio Optimisation.
- Elaboration of robust simulation techniques for asset allocation.
- Diffusion Monte Carlo for Security Pricing
- Investigation of the determinants controlling the dynamics of the order book in a double auction financial market.
- Detection of resulting strategies observed in the action of broker performing transactions and submitting orders in a financial markets
- Distributed computing using message passage algorithms for clustering and risk management of huge-portfolios.
- Design and deployment of effective hybrid emergent computing techniques for financial services sector problems in a grid environment.

City University will carry out the following research plan:

- *Hedging with Cointegration*

  This research activity is carried out by City University. Many analysis as well as instruments for risk management available in the market are still based on the traditional analysis of volatility and correlation. Nonetheless correlations are static, capture only short-term, linear co-dependencies and lack stability. Cointegration, on the other hand, is a statistical technique for detecting common trend in prices. In this project we will apply advanced cointegration techniques to identify hedging algorithms for equity and energy markets. For equity markets we will investigate how to implement nonlinear cointegration methods in a hedging problem where the objective is to minimise the risk of a basket of stocks (our portfolio) by hedging it with a basket of indexes. Traditionally this would be done by the minimum variance method, where the correlations among the basket constituents have to be computed. Our objective will instead be to find a basket of indexes that is nonlinearly cointegrated with our portfolio. In

energy markets we will introduce cointegration methods to investigate arbitrage relations, product spreads (location/quality spreads or cracks), storage models and their relation to other market variables (like economic activity, GDP and freight), and option pricing. This project will involve (informally) team at the Royal bank of Canada and a team at Leheman Brother.

- *Agent based simulation of Electricity markets*

This research activity is carried out by **City University**. Electricity is a non-storable commodity, delivered into a market with low demand elasticity, high requirements for security of supply and wide seasonal variations. For this reason electricity generators often own a portfolio of plants. Other firms are specialists, focusing on only one technology. The aim of this project is to study the relationship between the degree of diversification in the firm's generation portfolios and their market power. These issues are difficult to treat analytically and this has motivated the use of agent-based simulations.

Preliminary results on a duopoly generator suggest that more diversification leads to lower market prices and that the negative influence of diversification on prices grows with the amount of excess market capacity.

E3GRID aims to expand the simulation environment to several electricity-generating companies who have a given productive capacity in high and low marginal cost capacity and compete for the supply of the market. Trading takes place through a compulsory uniform-price auction. Suppliers simultaneously submit single price bids at which they are willing to sell up to the capacity of each plant. An independent auctioneer determines the uniform market price by intersecting the supply function with the demand curve. Full capacity is assigned to the firms that bid below the market price and the rest is shared among the ones who bid at the market price, while none is assigned to the firms who bid above the market price. This setting is known to be characterised by a multiplicity of equilibrium solution for the bidding strategy. The equilibrium selection method proposed here is adaptation. In particular we implement the reinforcement-learning algorithm proposed by Roth and Erev (1995). Reinforcement models are based on the assumptions that actions that result in positive consequences are more likely to be repeated and actions that result in negative consequences are less likely to be repeated, independently on the information about strategies, history of play and payoff structure of the other players. We want to study the property of the equilibrium price when diversification ratios and the demand/supply ratio change.

Athens University of Economics and Business will carry out the following research plan:

- *Statistical analysis of massive ultra-high frequency financial data sets using computationally intensive statistical procedures*

This research activity is carried out by Athens University of economic and business. These research projects have a significant computational component that can be used as drivers in resolving generic obstacles to porting finance & econometrics research to grid infrastructures. Inter alia, these projects involve the statistical analysis of massive ultra-high frequency financial data sets using computationally intensive statistical procedures. It has already been established that such research, while certainly CPU-bound is also I-O and memory bound when implemented with commercially available econometric packages so it is clear that adaptations to the grid hardware and development of appropriate econometric software must

proceed in tandem. More specifically, problems to be handled on the grid include:

- Optimisation of econometric estimators

- Computation of financial decision models

- Regression, model and variable selection methods

- Monte Carlo simulations

Technology that exploits the grid to effectively handle such problems would involve commonalities not only with the Econophysics/finance/econometrics community, but also more with many researchers in statistics, machine learning, pattern recognition, economics and the social sciences more broadly.

Christian-Albrechts-University of Kiel will carry out the following research plan:

The research unit at Christian-Albrechts-University of Kiel has a long history of work in computational intensive work in agent-based modeling and empirical finance. Particular computation-intensive research projects to be pursued as pilot projects within the E3GRID infrastructure include:

1. Simulation of Large Agent-Based Models: As early as 1999, in a study conducted on a Cray-T3E very large markets with up to 500,000 traders (Egenter et al., 1999) have been studied. Results showed that important structural regularities of the artificial market did change with system size while empirical markets seem to be characterised by the same scaling laws irrespective of their size. Despite some progress towards a theoretical understanding of the underlying long-range dependence in the behaviour of market participants, this central feature of empirical markets needs to be addressed more systematically in computational research. In particular one would be interested in investigating large markets with agents using artificial intelligence tools (e.g. classifier systems, genetic programming). To deal with large markets of artificially intelligent agents is beyond the reach of our current computational resources and should become possible within the grid project.

2. Empirical validation of agent-based models: so far, behavioural models of financial markets have hardly been rigorously estimated and tested with empirical data. Currently, an approach is being developed that allows estimation of the parameters of stochastic models of interacting agents via numerical approximations to their Fokker-Planck equation (c.f. Lux, 2007). Recent research also suggests that as an alternative avenue one could exploit advances in Monte Carlo estimation techniques in order to get an econometric handle on models with interacting agents. While a simple model of interacting agents has already been estimated via approximate maximum likelihood (Lux, 2007), the involved discretisation of the Fokker-Planck equation via finite difference or finite element schemes proofed to be extremely time consuming. It seems that it would be hardly possible to go beyond the one-dimensional case with current computational resources. However, the interaction of more than two types of agents and the interplay of group dynamics with the evolution of measurable quantities (like prices) in markets requires pertinent high-dimensional generalisations. Again, given the well-known computational needs of high-dimensional finite difference, finite elements and

Markov-Chain Monte Carlo Methods, this step could only be achieved using the E3GRID infrastructure.

3. Design and implementation of online trading strategies: Yusupov and Lux (2007) have designed an 'artificial technical trader' (ATA). Its performance has been tested with high-frequency data from Tokyo Stock Exchange using records over six months for some hundred stocks, which effectively consumed a few months computational work on a cluster of 10 PCs. We hope to take advantage from the grid architecture enabling us to cope with larger samples and simultaneous applications of the ATA to multivariate data. Since automated trading systems are of immediate relevance to financial institutions, we would expect to carry out part of this research together with partners from industry within the grid project.

SISSA will carry out the following research plan:

There will be two main research lines in SISSA. The first one will be within a longstanding collaboration with researchers of Generali Asset Management, and the topics are:

- Recent developments of financial markets have seen a large increase in complexity of instruments and investment strategies. The aim of this research line is to find optimisation techniques for portfolio management and asset allocation with high non-linear pay-off instruments and fat-tailed probability distributions of asset returns. We foresee a heavy computational load in order to get the results of the optimisation within a time compatible with the industrial needs.

- Elaboration of robust simulation techniques. These will applied specifically for asset allocation tools: robustness requirements will certainly involve a CPU intensive set of analyses which properly fits with the grid environment.

The second one foresees an informal collaboration with people of of Credit Suisse and deals with "Diffusion Monte Carlo for Security Pricing".

- A variety of pricing problems of derivative securities can be formulated in terms of the solution of certain partial differential equations. These equations are very similar to those treated by means of the Diffusion Monte Carlo technique in the study of strongly correlated electrons in condensed matter Physics. This method is a reliable and well-established technique allowing one to determine stochastically the exact solution of the Schrödinger equation for a system with a large number of degrees of freedom (the coordinates of the electrons). The aim of the project is to explore the possibility of generalizing Diffusion Monte Carlo to deal with the partial differential equations that are of interest in Finance. Among other things, this would allow to solve problems of American options depending on a large number of assets, which are difficult or impossible to treat by means of conventional deterministic techniques.

Both these research lines require a joint research activity bridging the development of the algorithms and the optimization of their implementation on the grid.

CNR-INFM will carry out the following research plan:

- The first research topic will deal with the investigation of the determinants controlling the dynamics of the order book in a double auction financial market. The book dynamics will be empirically analysed and modelled down to the scale of a single event (order submission, order cancellation, transaction) occurring in the order book. We will investigate some of the most liquid and active markets of the world such as the London Stock Exchange providing a complete set of data describing the book dynamics (the "Rebuild order book" database). We will investigate the determinants of book dynamics by putting a major emphasis on determinants which are related to the state of the market such as, for example, different proxies of volatility and liquidity and we will build minimal statistical models able to reproduce the largest set of stylised facts about the dynamics of spread, book depth, order imbalance and similar book order indicators..

- The second research topic is related to the detection of resulting strategies observed in the action of broker performing transactions and submitting orders in a financial market. Preliminary studies of our group performed by using high frequency data allowing an anonymised characterisation of brokers, which are sending orders to the market, have strongly indicated that we can detect resulting strategies of those brokers. These "resulting" strategies are the sum of all single strategies followed by all the distinct agents using the considered broker. We aim to improve this characterisation and to perform this analysis on the markets were similar data are available. Our goal is to characterise classes of these resulting strategies and to study the interaction between different classes. After this empirical investigation, we aim to develop an empirically based agent based model computer platform allowing us to simulate different scenarios including heterogeneity of traders in size and used strategies allowing to explain the empirically detected stylised facts observed at the level of "resulting strategies".

ICTP will carry out the following research plan:

- Distributed computing using message passage algorithms for clustering and risk management of huge-portfolios. Risk management techniques, in their simplest form, involve computations (e.g. matrix inversion), which grow with the cubic power of the number of assets in the portfolio. This becomes computationally demanding for a single node when this number grows larger than some tens of thousands. These do not take into account the structure of correlations present in markets, which may allow for a much faster evaluation of risk measures. The bottleneck, however, lies in efficient estimation of the cluster structure. Our idea is to use message passing algorithms, recently proposed to tackle hard problems in computer science, exploiting their nature of distributed systems, in order to investigate the feasibility of GRID oriented clustering approaches. The same technique can be used in order to study other data sets, such as those arising from gene expression profiling.

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CDAC will carry out the following research plan::

Our proposed research activities will be focused on investigating ways in which effective hybrid emergent computing techniques can be designed and deployed for financial services sector problems in a grid environment. Due to the fierce competition for their survival and success, this

sector is most receptive to qualitative, quantitative and computational areas of science and engineering and crosscutting traditional disciplines. Moreover, they continually require innovative and unconventional techniques for improving their performance, which have direct impact on their profitability and risk-reduction. In financial services optimization problems there are multiple objectives to be achieved and these are likely to clash with each other. Also the weightages given to these criteria vary over different time periods, hence real benefits are drawn only with multi-stage, multi-objective optimization approach. The techniques developed are further required to offer powerful exploration capabilities for the identification of high-performance, novel and competitive solutions to these problems, which are complicated by inter-relationship between various types of massive data. All this is achievable through crossbreeding of emergent computing techniques inspired by nature, society, biology and time-tested conventional scientific models from mathematics/statistics/physics. Part of the biological metaphor used to motivate evolutionary search is that it is inherently parallel. Data as well as algorithmic parallelization is most suited for such methods. Also hybridization of conventional methods and evolutionary techniques can exploit best of both the worlds. The new methods can inherit characteristics of emergent computing like problem-domain independence, exploration capabilities of searching large solution space effectively and they can also have specialized knowledge and fast convergence capabilities of conventional methods. Proper balance needs to be maintained to retain flexibility and generic nature of problem techniques without sacrificing the high throughput and performance of the systems. In undertaking this research, our focus will be on high performance communications and computing techniques deployed on a grid platform based on emergent computing concepts. Such applications are both data intensive as well as compute intensive and at the same time they need to have reasonably fast response time.

Research activities will aim at deploying data and compute intensive applications in the econometrics and finance sectors to enable further development/refinement of EGEE grid to address industrial problems. Some representative areas will be:
- Portfolio Design and Optimal Investment Management
- Fundamental, Technical and Quantitative Analysis for Financial Markets
- Data mining based on Statistical/Mathematical/Artificial Intelligence techniques
- Fraud/Anomalies Detection in Financial Markets

1.3   Networking Activities and associated work plan

The overall strategy of the workplan includes two Work Packages. The first one is dedicated to the overall project co-ordination, while the second one is focused towards dissemination and outreach, both within the Pilot Users and towards the target group at large.

A unique Work Package looks after both *Pilot Users networking* and *Target group networking*. These activities cannot be separated, as further explained earlier on: Pilot Users are an integral part of the community, actions to both parties have a degree of symmetry, and Pilot Users will for all practical purposes act as a networking mean towards the target group. There are similarities in handling both, which are such that separating the activities would provoke poor streamlining.

Work package list

Work package No[1]	Work package title	Type of activity[2]	Lead participant No[3]	Lead participant short name	Person-months[4]	Start month[5]	End month
1	Project coordination	MGT	1	SISSA	50.4	M1	M36
2	Dissemination and Outreach	SUPPORT	6	CPR	42	M1	M36
	TOTAL				92.4		

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[1]   Work package number: WP 1 – WP n.
[2]   Please indicate <u>one</u> activity per work package:

   RTD = Research and technological development; COORD = Co-ordination; SUPP = Support;
   MGT = Management of the consortium; SVC = Service activities.

[3]   Number of the participant leading the work in this work package.
[4]   The total number of person-months allocated to each work package.
[5]   Measured in months from the project start date (month 1).

List of Deliverables

Del. no. 23	Deliverable name 24	WP no.	Nature	Dissemination level 25	Delivery date 26 (proj. month)
1.1	Activity reporting	1	R	PU	M12, M24, M36
1.2	Financial and project reporting	1	R	CO	M12, M24, M36
1.3	Self sustainability actions plan	1	R	CO	M33
2.1	Project Marketing Plan	2	R	PU	M5, M24
2.2	A.I Forum Report	2	R	PU	M14, M24, M36
2.3	Strategic Plan	2	R	CO	M3, M17, M27
2.4	Training Reports	2	R	PU	M3, M5
2.5	Project Web portal	2	O	PU	M3, M6

Work package description

Work package number	1		Start date or starting event:				M1		
Work package title	Project coordination								
Activity Type[6]	COORD								
Participant number	1	2	3	4	5	6	7	8	9	10
Participant short name	SISSA	Uniath	Ava nade	Uni Kiel	Unic ity	CP R	Exceli an	IC TP	IN FN	CNR-INFM
Person-months per participant	36	0.5	0.2	0.5	3	3	0.2	6	0.5	0.5

Objectives

- Finalise, if necessary any rules and regulations, define the Consortium Agreement) regarding procedures and working methods with respect to the research, the results, IPR, reporting, and dissemination and exploitation activities.

- Assure that the governing, operative and advisory bodies as described in the management structure are set up and made fully operative and receive full admin support. If necessary specify and clarify tasks of each and requirements for interactions.

- Clarify all management, admin and financial (including audit certificates) procedures to all partners.

- Set up collaborative environment tools to support consortium interactions.

- Plan, monitor and control project progress and outputs, and take corrective actions.

- Support the consortium in management and in financial data acquisitions and legal aspects connected.

- Administer project funds in the interest of the success of the project, in accordance with the consortium, and according to individual partner performance.

- Assure that the EU has a clear and correct vision of project progress.

Description of work (possibly broken down into tasks) and role of partners

In order to accomplish the Work Package objectives, the following tasks have been identified:

T1.1 Overall Project Management *(Task leader SISSA)*
The Overall project Management Board (OPMB) has the task of organizing and scheduling the activities, meetings, inputs and outputs of the governing bodies. The OPMB also provides direct

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[6] Please indicate <u>one</u> activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

support to the project coordinator and the executive committee as well as liaising with the EU on all organisational issues The OPMB will be the reference point for all partners for the transparency of all management issues described in this section.

It will be the OPMB responsibility to assure that the required awareness and knowledge of all management, admin and contractual issues are suitable communicated to all participants. The OPMB will minute such communications and distribute them.

The OPMB will plan, monitor and control project progress in collaboration with the project coordinator and his assistant.

T1.2:Financial Management *(Task leader SISSA)*
In collaboration with the scientific and executive management and the partners, establishes detailed financial plans for activity-linked expenditure periodically. Verifies with the coordinator that financial reports comply with performance and deliverable production, assures partners comply the audit certificate requirements, collects cost statements and certificates for sending to the EU.
Administrates funds according to the indications provided by the consortium agreement and the governing bodies.

T1.3 Financial data risk and Intellectual property management *(Task leader SISSA)*
This task aims at finding support in handling all the legal issues related to financial data acquisition and management within the consortium.
The E3GRID consortium partners have listed some potential risks and how the consortium intends to deal with them. When new, unidentified risks or problems occur, they will be discussed within the management structure and appropriate contingency plans will be decided and activated in accordance with the E3GRID consortium. The risks involved with any type of project of this kind are related to coordination risk, implementation and execution risk and technological risk. Coordination risk is minimised by existing relationships with the E3GRID partners and the strong complementary bonds between the domain knowledge experts.
This will also manage the Intellectual property issues and counselling will be provided to partners to ensure early and correct intellectual property rights protection.

T1.4 Transition to self sustainability *(Task leader SISSA)*
This task aims at studying and bootstrapping the procedures for self-sustainability of the community, close to the end of the project lifetime. A transition plan will be produced at M33.

SISSA will play a major role in this work package. Some management body will include the some contribution from other partner namely: CPR, ICTP and UNIKIEL. All the other partners do not play any significant role apart from taking part in the official meeting of the governing bodies.

Deliverables (brief description) and month of delivery
- D1.1.- D1.3   (M12, M24, M36)   Financial and project reporting
- D1.4   (M33) Self-sustainability plan

Work package number	2		Start date or starting event:			M1	
Work package title	**Dissemination and Outreach**						
Activity Type[7]	SUPP						
Participant number	1	2	4	5	6	8	10
Participant short name	SISSA	UNI ATH	UNI KIEL	UNI CITY	CPR	ICTP	CNR-INFM
Person-months per participant	3	3	3	3	24	3	3

Objectives

The central objective of this activity is to thoroughly plan and deliver all dissemination, logistics, web portal, and community engagement activities associated with the E3GRID technical results. Targeted dissemination will be adopted for the three principal networking activities (as described in section 1.1) of E3GRID, taking advantage of the presence, within the Consortium of partners, of industry and academics and research institutes with high domain knowledge, also from the marketing and communication point of view.

Dissemination will be conducted according to the Dissemination Plan, and will reflect the principal activity addressed, to specific approaches, for instance, to the end-users of E3GRID, to the leading hardware, software and solution vendors and to the stakeholders of E3GRID.

The dissemination approach is lead by CPR, and will assist the impact of the project from month 1 through to month 36 in terms of:

- Creating awareness among potential target groups, community, pilot users and A.I. Forum collaborative business services of the potentials of E3GRID architectures.

- Developing concrete market opportunities for the new knowledge and extended market opportunities developed during project duration.

- To understand the needs of users and the target market and to set and assess strategic goals to ensure that the E3GRID service is demand driven.

- To engage the target groups, community, A.I. Forum and pilot users effectively.

- To organise E3GRID workshops that ensure effective know how within the project and to catalyse Community expansion and networking within it.

- Creation and delivery and maintenance of the project web portal to support all the activities of the project including management.

Description of work (possibly broken down into tasks) and role of partners

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[7] Please indicate one activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

In order to accomplish the Work Package objectives, the following tasks have been identified:

T2.1 Project Marketing & Communication *(Task Leader CPR)*
1. Producing printed visuals to distribute at E3GRID A.I. Forum events; in external events that the project attends; for sending to individual worldwide financial research targets;

2. European targeted Press relations: news releases, managing media contacts; Press and media with European presence will be targeted, which will outreach to current and potential end-users from industry and research; promote the achievements and highlights of E3GRID during the targeted workshops organised, predominantly in & around EU27.

3. Research on new targets - creating sector specific databases, analysis of existing organisations, initiatives and projects which could gain from E3GRID and from whose ideas or know-how the project can benefit;

4. Inviting new targets to events: invites in themselves are an essential aspect of project marketing;

5. Attending events to disseminate E3GRID:

   - Choosing the events: making the strategic choice of the most pertinent events for the project to attend, and which project member to attend it. Events at which E3GRID will be present will all be relevant to the topic of financial/economic research and will be chosen based on i) the community membership whereby the project will target financial sectors within its community; ii) events where there are many participants and an international audience which would guarantee high impact; iii) where there are European e-Infrastructures and initiatives of interest present. *(See current table of events listed in Section 1).*

   - Attending the event: i) presenting the project to the audience via slides or printed material case studies; significant research results and best practices; clear benefits and description of the project will be presented to raise awareness of the project; and attract targets' involvement in the A.I. Forum and thus becoming community members. ii) word of mouth networking at the events.

T2.2 E3GRID Events organisation *(Task Leader CPR)*

This task focuses on the organisation of specific events each with different goals. The following events are planned:

1. **Training activity** within the consortium to form the power user and site administrator to manage grid resources. There will be 2 distinct events within the 4 first months.

2. Delivery of four **New User Workshops (NUW)**, an activity of the **A.I. Forum**

3. Delivery of three **Community Networking Workshops (CNW)**, an activity of the **A.I. Forum**

- **Training activity**
  - *Principal Aim: Create the Power Users*
  - *Output: One power user per pilot community consortium member*
  - *Event Dates: M 2, M4*

Two training events within the first four months of the project will be organised to enable the Power users in their tasks for the project. The logistics will be organised by CPR, which will oversee the participation of relevant members at the event, whereas the substantial training itself will be given and arranged by ICTP as part of the SA. The training event thus will be a physical meeting in ICTP premises whereby the future power users gather to learn the systems that they will need to master in the project and the know-how that they will need in order to impart to their respective organisations within the Pilot Users and the Community. Using the EGRID infrastructure, the trainees will be introduced to the basics of grid computing and will be asked to bring to the event a real life application that they want to be grid enabled, thus ensuring real hands on learning experience.

- **New User Workshops (NUW) (Approx. 20-40 participants)**
  - *Principal Aim: Bring new members into the E3GRID Community*
  - *Output: A group of New Qualified Users and an extensive base of potential users at end of project. The event will be reported upon in the A.I. Forum report*
  - *Dates: M15, M20, M25, M30*

Organisation of four NUWs (two workshops in each of years 2 and 3). The first NUW of the project will be in month 15, then every 5 months hereafter. The first NUW in each year will be immediately followed by the Pilot User Meeting (PUM) on the following day; the second NUW in the year will be followed by the Community Networking Workshop (CNW) on the following day. Considering that some of the participants of the NUW will be from the Consortium and will be interacting with those outside of the community, having these events on consecutive days will a) save on consortium travel costs b) ensure that CNW and PUM participants have a chance to network with potential new members in the evening between the two meetings.

Venue & Location
The workshops will take place in around EU27, perhaps co-located at partner premises, if appropriate to save on budget expenses. In the context of this task, the time, location, specific goals and expected outcomes for these workshops will be planned. In addition, the process of selecting attendees will be determined. E3GRID consortium links and relationships with European and worldwide multiplier associations will be leveraged for dissemination purposes as well as to attract, support and recruit participants.

Anyone accepting to attend a NUW will become a member of the A.I. Forum. The NUW will include participants from the community members (approx. ten) and the individuals from outside the community interested in joining (approx. thirty). It will comprise different sessions as follows:

1. A presentation to introduce the project;

2. Presentations of case studies, best practices, success stories and the status of the project currently

3. Rationale of the advantages of becoming a user and the different levels of

commitment and conditions;

4. Round table dialogue of Q&A whereby potential new members can ask questions and contract levels of commitment within the E3GRID Community.

5. Establish agreements on level of commitment and Closing session

6. Networking post-workshop between E3GRID community and pilot members

Target Audience
- Those who have shown an interest during the year and who requested attendance proactively after hearing about such workshops through project marketing.
- Those who have shown an interest through Community members' word of mouth networking.
- Those from the target market whom the Community deem to benefit from the project but who have not been subject to project communication in any way or involved in the A.I. Forum activities yet.
- The participants will be an equal balance between Industry, Academia and Academia-Industry collaborations.

The follow-up after the events will ensure:
- That those who want to become new users actually sign up to do so and receive the necessary support.
- That those who do not wish to immediately become new users instead receive relevant and regular updates on the project (via web portal and emails and printed material on the project). This group who do not sign up to be new users will nevertheless receive the targeted surveys to input needs and ideas, thus engaging them with a view to either becoming a new user during the project or being an informed interested party that will be potential user once the project and product is finished. The latter group nonetheless remains an informed, passive member of the Community and A.I. Forum during the project.

Thus, on one level, the output of the New User Workshops will be a group of actual, agreed new users. On another level, all participants including those who do not become new users will, as A.I. Forum members, constitute a group who have a clearer understanding of the project and its benefits and that, come project's end, will be either a potential or actual 'client base'

- **Community Networking Workshop (CNW)** *(Approx. 20-40 participants)*
  - *Principal Aim: Exchange knowledge and needs between existing community members*
  - *Outcome: Networking report outlining the main user needs that should be acted upon in the PUM to direct strategy accordingly. This event will be reported upon within in the annual A.I. Forum report*
  - *Dates: M10, 20 and 30*

The Community Networking Workshop (CNW) will serve as a round table where members of the community, from various commitment levels, gather to discuss key needs and issues that have arisen in the year, and to discuss other targets to bring into the community. This meeting serves two functions: i) as an agenda setting event that gathers issues for discussion in the PUM; and ii) a networking event whereby this process of discussing problems and needs catalyses knowledge exchange in the community which is key to effective project

progress.

Both the NUW and the CNW will result in user needs and issues that will be reported upon in the annual AI Report to be issued prior to and for discussion at the PUM. The first PUM will be in the first month that will generate the first strategic plan and will be regarded as a kick off meeting and will repeat within the first three months of each year.

- **E3GRID Product Launch Event** *(Approx. 100 participants)*
  This event will be organised on the final month of the project in order to demonstrate its final product to the target market. This event will serve as the final milestone and ultimate final output of the project.

T2.3 Research community strategic drive *(Task Leader UNIKIEL)*
This task ensures that the needs of the Finance and Economics research community are central to guiding the direction of our scientific and technical project efforts. The following steps are envisioned:

- **The Pilot User meeting (PUM)**
  - *Principal Aim: Analyse needs as highlighted by the pilot users and the A.I. Forum and thus reorient strategic goals as necessary and assess project progress towards previously set goals.*
  - *Outcome: Strategic Plan (M3, M17 and M27)*
  - *Date of PUM: M1, M15, M25*

  The PUM, occurring in the first 3 months of each year, will assess requirements, evaluate progress on previously set strategic goals, and set new ones as necessary. It includes decisions on resource sharing and setting strategic goals for grid adaptation efforts. The PUM will also address opening of RAs, resource sharing, and setting of JRA strategic goals. The input to the meeting is the A.I. Forum report that comprises proceedings and recommendations from: the Community Networking workshops; New User Workshops; the Specifically targeted surveys. The output will be the Strategic plan. The first PUM will *create* the strategic plan and the subsequent meetings will *update* it with the new goals decided during the meeting.

- **Standards compliance activities.**
  Consortium will participate in specific working groups within international standardisation efforts and interest groups. E3GRID will attend standards forums to
  - ensure that the technology and service it provides is standards compliant and
  - to input into the debate on standards to ensure project opinions on best practice be listened to.

  This activity will ensure that the final product is standardised and therefore 'usable' by as many users as possible, and not just in Europe but internationally as well.

- **Specifically targeted surveys (as from M8).**
  Specifically targeted surveys will be developed for the target market in order to gain specific, key information from the market itself that will help drive the E3GRID infrastructure. Each survey, leveraging from the previous, will be adapted and sent out on a bi-annual basis. The survey will be available on-line at all times for those new to the project.

The results from the surveys will be analysed by the A.I. Forum management and make up part of the A.I. Forum report which will be analysed and discussed during the PUM.

T2.4 E3GRID Project portal *(Task Leader CPR)*
The CMS system introduced on the E3GRID portal may support the complete E3GRID organisational, promotional and dissemination activities and it will incorporate the following features:

- Area to download the public E3GRID reports and the related updates, once produced

- Workshop agendas, speaker details and results materials and post event reports

- Access to related initiatives (stand-alone & piggy-backed events)

- Digital rights management – Content Access based on Profile & Identity for Community Member and Academia Industry Forum registration

- Monthly E3GRID announcements on milestones and Press Releases

- Dedicated Grid European and international Press and media partner section

- Specifically targeted surveys will be developed and hosted on the public portal

- User help desk as well as an on-line FAQ "Frequently Asked Questions" section that has been extracted from incoming queries

- EC related information.

The portal will provide a front-end for a repository of documentation relevant to the users and non-users of the infrastructure as well as up to date information relevant to them. For the A.I. Forum, the portal will provide a place where users from financial research and academic research sectors can discuss their experiences, share tips and provide feedback to the project activities. This will be take place in an on-line discussion forum. In addition to providing a useful communication tool and a channel for passing on targeted information, the portal will also allow to monitor the impact of the project's efforts with the Community.

This Work Package will also consistently update the portal to reflect the evolved nature and expanded goals of E3GRID. The website will serve as a tool to reflect the project's objectives and goals as it evolves due to user-driven needs. Used in the day to day running of the project, the portal will remain the responsibility of this Work Package as well as members within the project who will be strongly encouraged to provide content or useful information to better meet its objectives.

Deliverables (brief description) and month of delivery
- D2.1 Marketing Plan (M5, M24, M36)
A plan on how the project will raise awareness and market the project to expand the community, leveraging logo and brand. It will give an overview of what targets will be communicated to, through which channels and on which specified dates. It will outline the messages that should be communicated depending on the target audience, and moment in the project. The report will

give an overview of the printed dissemination material that may include posters, flyers, and 'how to get involved' fact sheets.

- D2.2 Forum Report (M14,M24, M36)

This report will collate the outputs of the NUW, CNW, surveys and online AI discussion board held in the year, reporting the major issues raised. The A.I. Forum Report will be released in time for the PUM where it will be a key input into discussions.

- D2.3 Strategic Plan (M3, M17, M27)

This plan outlines the strategic goals and objectives and will define a roadmap for the project to follow. It will be the output of the PUM kick-off.. It will be updated following each PUM event and create the following two deliverables of this Plan.

- D2.4 Training Reports (M3, M5)

The training reports give a summary of the training material used. All training materials used will be made public, subject to copyright and Intellectual Property Rights issues

- D2.5 Web Portal, (M3, M6)

The web portal will have two deliverables representing two versions of creating the project website. (M3, M6). The first version will be an informative static website with contact details. It will describe the project's objectives and the planned activities. The second version will be fully functional, based on feedback on the first version. Thereafter, will the portal be consistently updated to meet the needs of its audience and the evolutions of the project.

Risk Analysis and contingency plans

The consortium foresees the following risks during the project implementation, from the networking and management perspective and contingency measures are in place in case these risks take place.

Risk	Approach
Delay shift & quality of extensive deliverables may occur/ may not be easy to measure. Especially important to achieve the necessary feasibility, accuracy, scope & usefulness of the deliverables delivered.	o At the beginning of the project, The PTB and the PMB will define an assessment method and criteria approved by the other partners. It will include paying particular attention to the recommendations and feedback from collaboration experts, primarily the A.I.forum members & the Pilot User consultants; o Regular reporting will be ensured through standard planning tools and reviewing of the deliverables by the PMB for non technical reports and the PTB for those of a technical nature. o Counselling and discussing structures will be developed for feedback
Participation in the interactive workshops (in appropriate balance between enterprise & research)	o E3GRID partners are pivots in their respective countries and have a broad background and networking links within the GRID scene globally. All of the partners will participate actively in the promotion and dissemination concerning the organisation of the workshops and of the training activities, taking advantage of their mobilization potentials, o The E3GRID consortium has already earmarked some other important, related events in Grid & Finance taking place in EU27 where E3GRID members may participate and recruit speakers and delegates to its own workshops. o The E3GRID as already built strong links with representatives from public research centres and industry and partners are expert in innovation, dissemination and contacts management.
Poor response to marketing activities	o The consortium will check communication message for comprehension, ease of navigation and understanding next steps – realign message if appropriate. o Verify effective receipt of message through follow up telephone calls.
Financial problems for participants attending the workshops	o Attendance to all events organised will be free of charge. Budget has been set aside to cater for dissemination materials, and restricted consumables (publications produced at the workshops) and catering costs for the workshops.

Summary of staff effort for NA activities

Participant number	Participant short name	WP1	WP2	Total person months
1	SISSA	**36**	3	39
2	UNIATH	0.5	3	3.5
3	AVANADE	0.2	0	0.2
4	UNIKIEL	3	3	6
5	UNICITY	0.5	3	3.5
6	CPR	3	**24**	27
7	EXCELIAN	0.2	0	0.2
8	ICTP	6	3	9
9	INFN	0.5	0	0.5
10	CNR-INFM	0.5	3	3.5
11	CDAC	0	0	0
Total		50.4	42	92.4

List of milestones for NA activities

Milestone number	Milestone name	Work package(s) involved	Expected date	Means of Verification
1.1	Consortium Agreement (together with EU contract)	WP1	M1	Physical presence of document in project portal
1.2	Management structure definition: members, tasks, responsibilities and procedures of each body	WP1	M1	Physical presence of document in project portal
1.3	Collaborative environment	WP1	M1	Physical environment
2.1	Strategic Plan	WP2	M3, M15, M27	The physical presence of a document in the project portal.
2.2	NUW	WP2	M15, M20, M25, M30	Physical meeting
2.3	Training	WP2	M2, M4	Physical meeting
2.4	PUM	WP2	M1 (kick off), M15, M25	Physical meeting
2.5	CNW	WP2	M10, M20, M30	Physical meeting
2.6	Web Portal	WP2	M3, M6	Publicly accessible web site
2.7	Surveys launch	WP2	M8	The presence of a survey on the portal that can bee accessed by target market.
2.8	A.I. Forum Report	WP2	M14, M24, M36	The physical presence of a document in the project portal.
2.9	Product launch	WP2	M36	Physical meeting

1.4   Service Activities, and associated work plan[8]

The overall strategy of the workplan for the Service Activity involves a unique Work package dedicated to the grid infrastructure deployment, support and operations, broken down into appropriate tasks. This is motivated by the fact that all tasks are oriented towards orderly structuring the community, so further fragmentation would be counter productive.

Work package list

Work package No[9]	Work package title	Type of activity[10]	Lead participant No[11]	Lead participant short name	Person-months[12]	Start month[13]	End month
1	**Grid infrastructure deployment, support and operations**	SVC	10	INFN	87	1	36
	TOTAL				87		

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[8] Regarding Trans-national Access, an updated version of this Guide for Applicants will be made available at the time of the next call that will involve these activities and will address this more specifically.

[9] Work package number: WP 1 – WP n.

[10] Please indicate <u>one</u> activity per work package:

   RTD = Research and technological development; COORD = Co-ordination; SUPP = Support;
   MGT = Management of the consortium; SVC = Service activities.

[11] Number of the participant leading the work in this work package.

[12] The total number of person-months allocated to each work package.

[13] Measured in months from the project start date (month 1).

List of Deliverables

Del. no. [14]	Deliverable name	WP no.	Nature[15]	Dissemination level [16]	Delivery date[17] (proj. month)
1.1	E3GRID e-Infrastructure operational	WP1	O	PU	M12
1.2	Assessment of the E3GRID e-infrastructure and GOC report	WP1	R	CO	M18, M30
1.3	New components integration and deployment report	WP1	R	PU	M18, M30
1.4	Final report on E3GRID e-infrastructure usage and integration with EGEE	WP1	R	CO	M34

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[14]   Deliverable numbers in order of delivery dates. Please use the numbering convention <WP number>.<number of deliverable within that WP>. For example, deliverable 4.2 would be the second deliverable from work package 4.

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

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

[17]   Measured in months from the project start date (month 1).

Work package description

Work package number	1	Start date or starting event:		M1
Work package title	Grid infrastructure deployment, support and operations			
Activity Type[18]	SVC			
Participant number	3	6	8	9
Participant short name	Avanade	CPR	ICTP	INFN
Person-months per participant	8	5	24	33

Objectives

This activity focuses in providing a stable E3GRID infrastructure and enhanced it during the lifetime of the project providing the additional services developed with JRA. Its main objectives are:

- Define and agree on the common security and authentication framework.

- Define the basic tools and the grid middleware to be used.

- Promote and support the establishment of a Virtual Organisation (VO) for the identified Economics and Financial community.

- Set up and support a grid infrastructure shared with EGEE and including resources from at least 3 partners' sites in Europe.

- Provide Public grid Know-How consulting to JRA.

- Place in production of JRA software produced.

Description of work (possibly broken down into tasks) and role of partners

In order to accomplish the Work Package objectives, 3 tasks have been identified:

T1: Deployment of the grid infrastructure *(task leader INFN)*

This task aims to coordinate the deployment of a grid infrastructure at the sites, which are partners of the present project. The following steps are required:

1. Agree with the E3GRID community and their sites to adopt Grid Security Infrastructure (GSI) based on PKI mechanism and X509 certificates, as used within EGEE.
2. Provide support to establish Registration Authorities (RAs) trusted by the corresponding national Certification Authorities (CAs) for those sites and research institutes, which are not yet enabled to issue EUGridPMA, trusted digital certificates.
3. Identify the middleware and grid services to be deployed at the E3GRID sites, according to

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[18] Please indicate <u>one</u> activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

the selected E3GRID research pilot groups needs.

4. Establish the E3GRID Virtual Organisation, deploy and keep updated a set of central grid services for it; typically they are:
   - Virtual Organisation Membership Service (VOMS)
   - Workload Management System (WMS)
   - LCG File Catalogue (LFC)

5. Deploy and keep updated the selected grid services at the remote E3GRID sites; typically they are:
   - Computing Element (CE) with ELFI tool enabled
   - Storage Element (SE) using StoRM Server

The first three steps strongly rely on the related tasks of the Network and Joint Research activities. The relationship is the following:

- NAs will survey within the E3GRID community the availability to adopt GSI and the institutions involved in the E3GRID research groups which need to establish RAs trusted by their national CAs, while this SA task will provide guidelines and support to establish these RAs where needed.

- NAs and JRAs after having analysed the state-of-art and selected the E3GRID applications to be grid-enabled, will give requirements on the middleware to be deployed at E3GRID sites

  It is then estimated that the core task activity of steps 4 and 5 could start at M6. It will however continue throughout the whole lifetime of the project, in order to keep the E3GRID e-infrastructure aligned with the most updated middleware releases, to upgrade it with the new tools and components produced by the Joint Research activities, and to possibly include new E3GRID sites willing to join the e-infrastructure.

T2: Grid Operation Centre (GOC) *(task leader INFN)*
This task aims to set up an operations structure for the management, control and support of the E3GRID e-infrastructure. It consists in providing:

1. A set of tools for proactively monitoring the e-infrastructure, checking the status and accounting the use of the central grid services and of the remote computing and storage resources. These tools will be chosen among the ones already in use within EGEE (e.g. GridICE, DGAS, SAM, GStat, RTM), in order to make a smoother integration of the operations infrastructure into the EGEE one. In particular, GridICE and DGAS have been developed by one of the partners of the present project: INFN.

2. A support system for both grid end-users and resource centres administrators. It typically consists of a complete portal with a large number of features like:
   documentation, knowledge base, wiki, trouble ticketing system, mailing lists, SVN repository, middleware repository, bug tracking system, links to the monitoring tools, etc. The ticketing system will be eventually interfaced with the Global Grid User Support (GGUS), the official support system used by EGEE and OSG grid infrastructures.

3. People overseeing the management of operational problems and answering support requests. Part of these people has to be provided by NA resources.

A certain level of coordination activity with the relevant EGEE Services Activities is needed in order to leverage as much as possible the already existing operational procedures and tools, and in view of the full integration of the E3GRID e-infrastructure inside EGEE.

It is estimated that the activity could start after the first phase of the deployment task, at M6.

T3: Integration of JRA components *(task leader ICTP)*
This task aims to provide support for testing and certification of the Joint Research Activities developed components, with respect of their integration with the current tools and middleware deployed on the E3GRID e-infrastructure. It consists in providing:

1. Support to integration requests.
2. Dedicated middleware repository, bug tracking system and grid application portal to be set up at the GOC. This task is strongly linked with JRA; given the support nature it is estimated it will start immediately and continue throughout the project lifetime.

Deliverables (brief description) and month of delivery
The following deliverables are foreseen for this work package:

- 1.1 at M12: E3GRID e-Infrastructure operational (document describing the hardware, the middleware and the grid services deployed at the E3GRID sites, and the GOC supporting the infrastructure).

- 1.2 at M18 (with update at M30): Assessment of the E3GRID e-infrastructure and GOC report (document evaluating the use of the infrastructure in terms of number of users, number of jobs run, CPU time used, storage capacity used, integration level with EGEE, effectiveness of GOC procedures and users' support).

- 1.3 at M18 (with update at M30): New components integration and deployment report (document listing the programming libraries, APIs, tools, applications released by the JR activities and describing the procedure adopted for their integration and deployment on the infrastructure).

- 1.4 at M34: Final report on E3GRID e-infrastructure usage and integration with EGEE.

Risk analysis and contingency plans

Service activity is subject to the following risks during the project implementation and contingency measures are in place in case these risks take place.

Risk	Approach
Hardware Issues at GRID site for Pilot Groups	Due to limited funding for hardware resources in the project plans to seek sponsorship from the Industry. If industrial sponsorships is unavailable (partially or fully) the project will seek alternative funding through engaging requests on a national or regional basis or adapt its requirements accordingly.
Few IT skilled people at Pilot Groups to keep up and runn gird site	The E3GRID approach is to provide teams with the adequate tools and knowledge for training provisioning to an appropriate level for making the installation procedure work on an autonomous level
Issues in stability/ reliability of core component of EGEE/gLite middleware	E3GRID architecture relies heavily on basic services provided by external project like EGEE. Unstable behaviour of some critical component within these services may jeopardize the quality of services to be delivered. In case the risk is present E3GRID plans to adapt the services to the latest stable middleware release suitable and/or evaluate other middleware solutions as alternatives.

Summary of staff effort

Participant number	Participant short name	WP1	Total person months
1	SISSA	0	0
2	UNIATH	0	0
3	AVANADE	8	8
4	UNIKIEL	0	0
5	UNICITY	0	0
6	CPR	5	5
7	EXCELIAN	0	0
8	ICTP	24	24
9	INFN	**33**	33
10	CNR-INFM	0	0
11	C-DAC	0	0
-	**Total**	70	70

List of milestones

Milestone number	Milestone name	Work package(s) involved?	Expected date 28	Means of Verification 29
1	Grid infrastructure operational	WP1	M12	The physical presence of shared grid resources.
2	First integration of JRA developed components	WP1	M18	The physical presence in the infrastructure of new software.

1.5   Joint Research Activities and associated work plan

The overall strategy of the workplan for the Joint Research Activity involves four Workpackages, and takes into consideration the different composition of our community and the different approaches to research:

- WP1 is geared specifically towards the continuous development of grid-enabled tools, applications and APIs, needed by our community. It is driven directly by academia, mixed academia-industry research groups, and by know-how providers to financial institutions.

- WP2 regards the development of a full utility model necessary for the facility to make compute and also data available to research organisations on a utility basis that allows them to carry out research that would otherwise not be possible.

- WP3 regards data management and addresses issues pertaining the integration of important data cache missing functionality, further enhancing of existing grid storage solutions, and collaborating in the development of the full utility model as far as data is concerned.

- WP4 regards the adaptation of AGA MS Windows based financial enterprise grid solution. It will be possible for AGA based enterprise solutions to accept jobs from the public scientific grid, which is Linux based.

The first Workpackage handles the discovery and adaptation effort of as yet unfathomed community needs; the other three Workpackages address well known needed improvements which consortium members are aware of due to their previous experience in grid initiatives related to Finance and Economics, both in the pure academic as well as in the pure industrial research context.

It is especially important to understand the nature of the first Work Package. As already said earlier on, the research community has two approaches to research. One is less structured and depends on the researcher's specific interests, so there are no generally defined tools and procedures; in order to allow such research to be carried out, it is essential to set up a continuous abstraction capturing environment. This is addressed in the first task of the Workpackage.

On the other hand, pure industrial research groups tend to have structured approaches characterised by the use of more defined tools and procedures, which are more straightforward to adapt to the e-Infrastructure. Moreover, industry has already carried out the abstraction effort, which is present in Industry consulting know-how companies that through their experience have captured the use cases and application samples. It is therefore central to leverage such know-how and avoid wasting time in re-capturing and re-abstracting efforts. This is why Excelian's role is essential as representative of the industry's research groups on the whole.

Work package list

Work package No[19]	Work package title	Type of activity[20]	Lead participant No[21]	Lead participant short name	Person-months[22]	Start month[23]	End month
1	Pilot Users driver for e-Infrastructure adaptation	RTD	1	SISSA	216	M1	M36
2	Utility compute model for Finance	RTD	7	EXCEL IAN	32	M1	M36
3	Data Management	RTD	8	ICTP	34	M1	M36
4	Interoperability with AGA MS Windows Financial enterprise grid solution	RTD	3	AVAN ADE	24	M1	M12
	TOTAL				306		

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[19] Work package number: WP 1 – WP n.

[20] Please indicate <u>one</u> activity per work package:

RTD = Research and technological development; COORD = Co-ordination; SUPP = Support;
MGT = Management of the consortium; SVC = Service activities.

[21] Number of the participant leading the work in this work package.

[22] The total number of person-months allocated to each work package.

[23] Measured in months from the project start date (month 1).

List of Deliverables

Del. no23	Deliverable name24	WP no.	Nature	Dissemination level25	Delivery date26 (proj. month)
1.1	Ported applications, APIs, tools	WP1	O	PU	M6 throughout M36
1.2	Report on ported applications, APIs, tools	WP1	R	PU	M12, M24, M36
1.3	Structured use cases	WP1	R	PU	M3
1.4	Validation, base-lining and implementation of structured use cases	WP1	O	PU	M5
1.5	Adaptation of structured use case implementation to evolved infrastructure	WP1	O	PU	M30
1.6	Half-year meeting between all consultants and power users	WP1	O	PU	M6, M18, M30
2.1	Gap analysis	WP2	R	PU	M4
2.2	Implemented security model that allows proper and safe sharing of resources	WP2	O	PU	M24
2.3	Resource allocation/sharing models and tools	WP2	O	PU	M30

	implemented into gLite				
2.4	Monitoring and cost accounting tools implemented into gLite	WP2	O	PU	M31
2.5	Take on process for safe deployment, baseline metrics, growth parameters	WP2	O	PU	M32
3.1	Identification of best suited source of Financial data for Pilot Users	WP3	R	CO	M6
3.2	Financial data contracts	WP3	O	CO	M12
3.3	Updated StoRM and ELFI applications	WP3	O	PU	M1 throughout M36
3.4	Version changes report	WP3	R	PU	M12, M24, M36
3.5	Gemstone/gLite adaptor	WP3	O	PU	M13
3.6	Data Cache best practice document	WP3	R	PU	M16
3.7	Data Cache monitoring tools integrated into gLite	WP3	O	PU	M24
3.8	Data Cache utility compute capability for gLite	WP3	O	PU	M30
3.9	Data collection,	WP3	O	PU	M34

	loading and provisioning tools integrated into gLite				
4.1	Use Cases and Technical Design Document	4	O	PU	M1
4.2	Project source packages	4	O	PU	M1
4.3	Demo environment	4	D	PU	M4
4.4	User Manual and Training Deck	4	O	PU	M5
4.5	Case Study document	4	O	PU	M9

Work package description

Work package number	1		Start date or starting event:			M1	
Work package title	**Pilot User driver for e-Infrastructure adaptation.**						
Activity Type[24]	RTD						
Participant number	1	2	4	5	7	8	10
Participant short name	SISS A	UNIA TH	UNIKI EL	UNICI TY	EXCE LIAN	ICTP	CNR-INFM
Person-months per participant	36	42	36	30	12	20	36

Objectives

This Work Package objectives aim at delivering the necessary software layer and tools to allow researchers in Economics and Finance to carry out their activities within the e-Infrastructure. It is specifically tailored towards finding these tools by fully accommodating the researchers' way of working.

Two main objectives are then present:

- To develop the necessary software layer specific for Economics and Finance research, carried out in less structured contexts.

- To create& install necessary software layer specific for Economics and Finance research carried out in more structured contexts.

Each objective originates its own task

Description of work (possibly broken down into tasks) and role of partners

In order to accomplish the Work Package objectives, two tasks have been identified:

T1: Academic and Academic-Industrial research adaptation driver *(task leader SISSA)*
This task is geared towards adapting the grid to researchers that have a less structured approach. Academic and industrial-academic partnerships tend to use less structured approaches characterised by the ad-hoc development of tools according to specific interests: while their specific applications are ported, special attention will be paid to capture common patterns and abstract them into APIs

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[24] Please indicate <u>one</u> activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

and tools. Each group will assign a power user the specific task of porting the team's applications and helping others do their own porting. Each team will have a specific consultant from Service activity for support. Continuous interaction and a meeting in person every 6 months guarantee common patterns and abstraction capturing.

It includes the following steps:

- Research teams carry out their research activity.
- Specific team member attributed also task of porting applications and help others port theirs

It is estimated that the task activity will start at M1 and will continue throughout the whole lifetime of the project. A strong interaction with NA and SA is expected for support requests and for subsequent integration into the e-Infrastructure. Includes all listed members except Excelian.

T2: Industrial research adaptation driver *(task leader Excelian)*

Pure industrial research groups tend to have structured approaches characterised by the use of more defined tools and procedures, which are more straightforward to adapt to the e-Infrastructure. Industry has already done the abstraction effort and it is present in Industry know-how companies, which through their experience have captured the use cases and application samples.

The purpose of this task is therefore to provide use cases for the evolution of the architecture. We will baseline the existing architecture to identify gaps, which need to be closed in order for the new architecture to be fit for purpose in financial engineering research. Near the end of the process, when evolution is complete, we will run further tests to ensure that the new architecture is indeed fit for purpose. Member Excelian will run this task.

Deliverables (brief description) and month of delivery

- 1.1 Continuous availability of ported applications in source and binary packages

- 1.2 Report on ported applications M12, M24, M36

- 1.3 A set of structured use cases that exemplify the ways in which industrial research will stretch and make use of the infrastructure. M3

- 1.4 Validation, base lining, and implementation on existing infrastructure. Identification of gaps in existing infrastructure. M5

- 1.5 Adaptation of implementation to evolved infrastructure, re-validation, re-base-lining and reporting. M30

- 1.6 Half-year physical meeting between all power users and consultants. M6, M18, M3

Work package number	2	Start date or starting event:	M1
Work package title	**Development of a full utility model for Finance research**		
Activity Type[25]	RTD		
Participant number	7	8	9
Participant short name	EXCELIAN	ICTP	INFN
Person-months per participant	20	10	2

Objectives

- To make available a shared, secure, accountable compute and data resource.
- To put in place processes and tools that ensure that this resource is sustainable in the community beyond the lifetime of the project

Description of work (possibly broken down into tasks) and role of partners

In order to accomplish the Work Package objectives, the following tasks have been identified:

T1: Gap analysis – *(task leader Excelian)*
Understanding the Gaps in the existing architecture that need to be filled in order to create a complete utility compute solution using gLite.

T2: Accounting – *(task leader Excelian)*
The accounting module is central to the success of a sustainable utility compute resource. In some way the current usage, and usage requirements of various research groups must be measured and planned for. It may be a requirement (or a necessity) to charge in money, credits or contributions, for use of the resource and data, and allow pre-booking of resource. This task is designed to ensure that these tools are in place and are available to support the sustainability of the resource.

    Development, implementation of accounting model

    Development of accounting and monitoring tools

    Integration into gLite

T3: Security – *(task leader Excelian)*
Sharing a grid means sharing compute resource and data, but there are clearly issues around the access to private, secure data and services. This is particularly the case where the resource is full utility and is shared amongst a number of virtual organisations, especially if these organisations include industrial and sensitive research. This task is designed to ensure that the gLite infrastructure is secure enough to give confidence to research organisations in deploying secure, sensitive,

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[25] Please indicate <u>one</u> activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

expensive binaries and data on a secure grid.

- Gap analysis - understanding the security requirements for both data and compute utility

- Development, implementation of security model,

- Integration into gLite

T4: Sharing – *(task leaders ICTP)*
Fully sharing a grid is only possible when there are capabilities such as prioritisation, lending and borrowing, resource allocation through discrimination etc. This task is designed to ensure maximum possible utilisation of the grid through the implementation and enhancement of resource sharing modules.

- Gap analysis – understanding enhancements necessary to create a fully sharable resource (including features such as prioritisation and resource allocation mechanisms)

- Development of resource allocation and sharing models and modules

- Integration into gLite.

T5: Process – *(task leader Excelian)*
Once in place the utility grid will need to have processes and procedures around the acceptance of services, and data and the sharing and security rules around this. It is clearly important to ensure that the deployment of a service does not render the grid inoperable. This task is concerned with establishing the process around service acceptance and take-on in a way that minimises the risk and support overheads of taking on a given service to a utility grid.

Development and documentation of take-on processes and procedures to ensure safe deployment.

Deliverables (brief description) and month of delivery
- 2.1 Gap analysis – M4

- 2.2 A take on process that ensures safe deployment, baseline metrics, growth parameters – M32

- 2.3 An implemented security model that allows appropriate and safe sharing of resource - M24

- 2.4 Resource allocation/ sharing models and tools implemented into gLite- M30

- 2.5 Monitoring and cost accounting tools implemented into gLite – M31

Work package number	3	Start date or starting event:	M1
Work package title	Data Management		
Activity Type[26]	RTD		
Participant number	8	7	
Participant short name	ICTP	EXCELIAN	
Person-months per participant	24	10	

Objectives

- To identify and buy appropriate financial data needed for the grid development and adaptation effort of Pilot Groups

- To further enhance current state of the art grid data management solutions.

- To integrate a data cache solution.

- To integrate data management into the full utility compute model.

Description of work (possibly broken down into tasks) and role of partners

In order to accomplish the Work Package objectives, 4 tasks have been identified:

T1: Financial data for grid adaptation and development effort *(task leader ICTP)*

This task aims at finding the most appropriate Financial data, which will be used by Pilot users and consortium members during the grid development and adaptation effort. The following steps are envisioned:

- Identification of most suited Financial data
- Signing of contracts.

It is estimated that this task will start at M1and end at M12

T2: Enhancements to StoRM server and ELFI data management solutions *(task leader ICTP)*

This task aims to carry-on ICTP involvement in current state-of-the-art data management as expressed by the StoRM collaboration and ELFI tool development, which derive from experience in addressing the needs of the Italian Econophysics pilot grid community. It includes the following steps:

- Addition of new functionalities to both software, according to important scheduled SRM standard evolution.
- Bug fixing to both software

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[26] Please indicate <u>one</u> activity per work package:

RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

- Refactoring as needed of both software

It is estimated that the task activity will start at M1 and will continue throughout the whole lifetime of the project. Interaction is expected with SA for place in production.

T3: Integration of Gemstone Gemfire data cache solution into gLite *(task leader Excelian)*
This task is to carry out the integration of Gemstone Gemfire industrial grid data cache solution into the new architecture. Data caching is essential for the provision of financial data across the infrastructure as required by financial researchers. This is particularly important as the infrastructure scales across the WAN and as the requirement for low response times increases. The following steps will be carried out:

- Integration of Gemstone Gemfire to gLite
- Development of application best practice templates to assist in the correct and efficient usage of the technology
- Development of monitoring tools for the sustained support of the data cache solution

T4: Collaboration and integration of data management in the full utility compute model WP
(task leader Excelian)
This task completes the utility compute model and is concerned with ensuring secure, accountable, data availability within a shared grid. This task has a dependency on the previous task T3, specifically in relation to the security model developed in WP2 T3. Following completion of WP2 T3 and WP3 T3 development on this task can start.

- Security model – Confirmation/ enhancements of data security model to fit utility compute requirements
- Data Provision – Establishing a process of collecting and pre-populating the data cache with historic market data from appropriate sources (both free, and charged if required)

Deliverables (brief description) and month of delivery

- 3.1 Report on best suited source of Financial data for Pilot users M3

- 3.2 Pilot users Financial data contracts signed M9

- 3.3 Continuous availability of most recent StoRM and ELFI, source and binary packages

- 3.4 Report on StoRM and ELFI version changes M12, M24, M36

- 3.5 Gemstone/ gLite adaptor M13

- 3.6 Best practice documents M16

- 3.7 Data Cache Monitoring tools, integrated into gLite, M24

- 3.8 Data Cache utility compute capability for gLite M30

- 3.9 Data collection, loading and provisioning tools integrated into gLite M34

Work package number	4	Start date or starting event:	M1
Work package title	**Interoperability with AGA MS Windows based Financial enterprise grid solution.**		
Activity Type[27]	RTD		
Participant number	3		
Participant short name	AVANADE		
Person-months per participant	24		

Objectives

- Provide seamless integration between AGA custom Grid and gLite computation nodes

- Add .Net based computational nodes to the gLite environments

- Leverage existing gLite standards as common interfaces to move current custom implementation from internal/private grid to external/accessible grid

Description of work (possibly broken down into tasks) and role of partners

The work involves the creation of an interoperability layer between Avanade custom grid implementation and the gLite middleware, to enable gLite environment to benefit from Financial Industry related features found in the Avanade implementation. The following tasks have been identified:

1. Requirements gathering and Technical Design of integration between Avanade custom grid and gLite middleware
2. Interoperability layer implementation
3. Documentation of the interoperability layer for Users, Training and Operation
4. Test and Production deployment

Avanade will provide its experience with the Financial Industry needs and expectations from a grid environment and knowledge of its existing implementation for consultancy and technical capabilities.

T1: Requirements gathering and Technical Design of integration *(task leader AVANADE)*
Objective of this task is to define and research the best technical approach to implement the complete interoperability between Avanade custom grid computational nodes and gLite middleware ones, enabling both to interchange Job requests based on common standard interfaces. This will bring existing features found in the custom implementation from Avanade to be available to the whole gLite community. It includes the following steps:

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[27]   Please indicate one activity per work package:
RTD: Research and technological development; COORD: Co-ordination; SUPP: Support; MGT: Management of the consortium; SVC: Service activities.

- Assessment of current gLite architecture
- Definition of technical scope for the integration
- Proof of concept of key technical issues
- Writing of a detailed technical architecture document and use cases definition that the implementation will cover

T2: Implementation in code of a set of objects, interfaces and services that will enable integration *(task leader AVANADE)*
Objective of this task is to implement in code a set of objects, interfaces and services that will connect and enable interaction between gLite middleware central scheduler and Avanade custom computation nodes, and integration between gLite computation nodes and Avanade Job scheduler. It includes the following steps:
- Implementation of the technical architecture found as result of T1
- Creation of shared source distribution packages in both source and binary form
- Provisioning of needed hardware and software
- Deployment of a pilot environment
- Test of the pilot environment

T3: Documentation of the implemented interoperability interfaces and supply of training material and support *(task leader AVANADE)*
Objective of this task is to document the implemented interoperability interfaces and provide training material and support for running demos or simplify the set up of a test bed deployment. It includes the following steps:
- Implementation of a demo environment using Virtual Machines or live CDs
- Creation of User Manuals for IT professionals covering installation, maintenance and operation
- Creation Training Decks, manuals and correlated support material

T4: Move of the implemented set of services in a production environment *(task leader AVANADE)*
Objective of this task is to move the implemented set of services and interfaces in production on at least one of the Avanade client, and to document the success of the initiative as a public reference and case study, available with no restriction. It includes the following steps:
- Installation of the interoperability layer on a production environment
- Test of the system
- Usage of the system to manage interoperability between remote Avanade custom internal grids being accessed using the created gLite interoperability layer
- Creation of a Case Study document

Deliverables (brief description) and month of delivery

- 4.1 Use Cases and Technical Design Document - M4

- 4.2 Project source packages - M9

- 4.3 Pilot Environment - M10

- 4.4 User Manual and Training Deck Documentation – M12

- 4.5 Public reference / case study document - M12

Risk analysis and contingency plans

E3GRID will carry out extensive grid software development effort. This is based on gLite, the European grid middleware. Since it is used by all research infrastructures, which are part of EGEE, the advances that the project will bring will also be shared with the other European research communities. We assume that given the large extra functionality being added to gLite, the infrastructure maintainers in charge of gLite will not resist the changes proposed, and rather will be eager to co-operate in view of the benefits that will derive from the adoption of such additions. Indeed, E3GRID will work closely with the rest of the community; but this is a varied community with many different needs, and also different reaction times.

E3GRID partners do not expect any potential conflict between the additions E3GRID will propose and the needs of the community at large; but they cannot be ruled out although all will be done by E3GRID to resolve any issues. Moreover, having an important industry research component in E3GRID, also means that the perception of reaction times to changes and sorting out of issues is more compressed, than that typical of a pure academic research infrastructure. If the reaction time of the research infrastructures will prove unbearable to the industrial quantitative research groups, there is the concrete possibility that E3GRID will remain mostly Academic based, and hence prove to be a missed opportunity for networking with advanced industrial infrastructures.

Summary of staff effort for JRA activities

Participant number	Participant short name	WP1	WP2	WP3	WP4	Total person months
1	SISSA	**36**	0	0	0	36
2	UNIATH	42	0	0	0	42
3	AVANADE	0	0	0	**24**	24
4	UNIKIEL	30	0	0	0	36
5	UNICITY	36	0	0	0	30
6	CPR	0	0	0	0	0
7	EXCELIAN	12	**20**	10	0	42
8	ICTP	20	10	**20**	0	50
9	INFN	0	2	0	0	2
10	CNR-INFM	36	0	0	0	36
11	CDAC	0	0	0	0	
Total		212	32	30	24	298

List of milestones

Milestone number	Milestone name	Work package(s) involved?	Expected date 28	Means of Verification 29
1.1	Report on ported applications	WP1	M12, M24, M36	Document in project site
1.2	Implementation of a set of structured use cases, validation and gap analysis	WP1	M5	Software procedures collected in repositories, and document in project site.
2.1	Utility model gap analysis	WP2	M4	Document in project site
2.2	Implemented security model for appropriate and safe sharing of resources	WP2	M24	Software present in repository.
3.1	Report on best suited source of Financial data for Pilot users grid adaptation effort	WP3	M3	Document present in project site.
3.2	Report on StoRM and ELFI version changes	WP3	M12, M24, M36	Document present in project site
3.3	Gemstone gLite adaptor	WP3	M13	Software present in repository
3.4	Data Cache utility compute capability for gLite	WP3	M30	Software present in repository
4.1	Scope and Approach approved	WP4	M1	Document approved by WP lead and Q&A lead

4.2	Technical Architecture approved	WP4	M3	Document approved by WP lead and Q&A lead
4.3	Code Complete	WP4	M8	Implemented code satisfy all use cases identified
4.4	Pilot environment running	WP4	M10	A pilot environment is accessible
4.5	Production environment running	WP4	M11	A public reference is granted for a running production system on a client

Diagram 1.1: graphical representation of components and interdependencies

The following diagram clearly shows the relations between all actors involved in the E3GRID project.
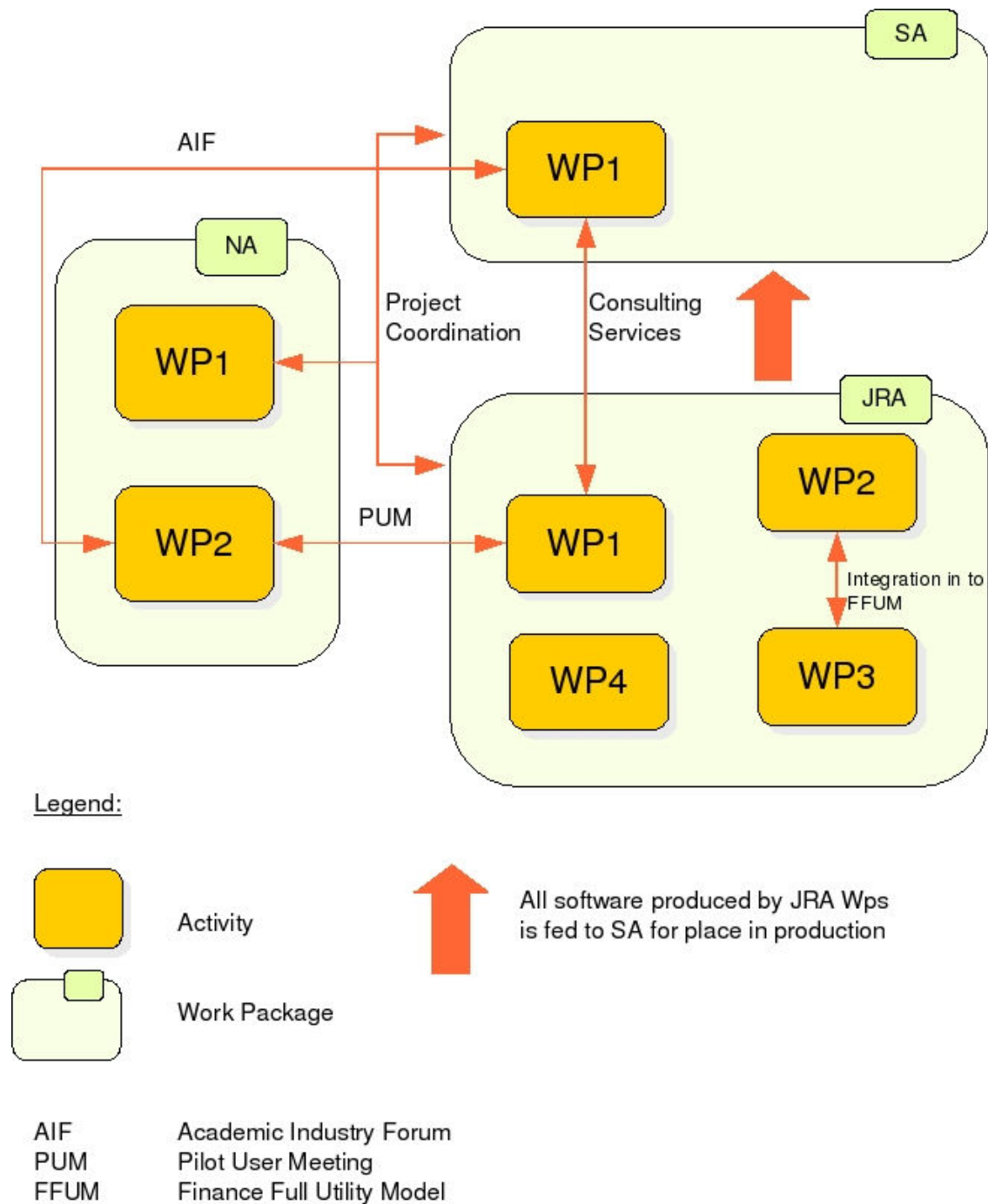
Diagram 1.2: timing of Work Packages and their components

E3GRID WORKPLAN (36 MONTHS)

Project Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Networking Activities (NA)																																				
WP1: Project coordination (SISSA)																																				
T1.1 Overall project coordination																																				
T1.2 Project administration																																				
T1.3 Financial data legal aspect management																																				
T1.4 Transition to self sustainability																																				
D1.1-D1.3 Activity reporting (M12, M24, M36)												X												X												X
D1.4 Self sustainability actions plan (M33)																																	X			
WP2. Dissemination & Outreach (CPR)																																				
T2.1 Project marketing																																				
T2.2 Events organisation																																				
T2.3 Research community strategic drive																																				
T2.4 Project portal development and maintenance																																				
D2.1 Project marketing plan(M5, M24)					X																			X												
D2.2 All Forum Report (M14, M24, M36)														X										X												X
D2.3 Strategic Plan (M3, M17, M27)			X														X										X									
D2.4 Web Portal releases (M3 provisional site, M6 fully functional site)			X			X																														
D2.5 Training Reports (M3, M5)			X		X																															
Service Activity (SA)																																				
WP1. Grid infrastructure deployment, support and operations (INFN)																																				
T1.1 Deployment of the grid infrastructure																																				
T1.2 Grid Operation Center (GOC)																																				
T1.3 Integration of JRA components																																				
D1.1 E3GRID e-infrastructure fully operational												X																								
D1.2 Assessment of the E3GRID e-infrastructure and GOC report																		X						X						X						
D1.3 New components integration and deployment report																		X						X						X						
D1.4 Final report on E3GRID e-infrastructure usage and integration with EGEE																																		X		
Joint Research Activities (JRA)																																				
WP1. Pilot User driver for e-infrastructure adaptation. (SISSA)																																				
T1.1 Academic and Academic-Industrial research adaptation driver																																				
T1.2 Industrial research adaptation driver																																				
D1.1 Continuous availability of ported applications, tools, APIs in source and binary packages, starting from M6 throughout M36.						X																														
D1.2 Report on ported applications,API tools (M12, M24, M36)												X												X												X
D1.3 Set of structured use cases (M3)	X																																			
D1.4 Validation, base-lining, and implementation of structured use cases(M5)					X																															
D1.5 Adaptation of implementation to evolved e-Infrastructure (M30)																													X							
D1.6 Half year meeting between all consultant and power user(M6,M18,M30)			x			x												x						x					x							x

WP2. Development of full utility model for Finance research (Excellan)

- T2.1 Gap analysis
- T2.2 Accounting
- T2.3 Security
- T2.4 Sharing
- T2.5 Process
  - D2.1 Gap analysis (M4)
  - D2.2 Implemented security models (M24)
  - D2.3 Implemented sharing models (M30)
  - D2.4 Implemented accounting models (M31)
  - D2.5 Take-on process document (M32)

WP3. Data management (ICTP)

- T3.1 Financial Data
- T3.2 Enhancement to StoRM server and ELFI data management solution
- T3.3 Integration of Gemstone Gemfire industrial Data Cache solution.
- T3.4 Collaboration and integration of data management in the full utility compute model
  - D3.1 Report on identified data supplier that satisfies Pilot community requirements (M3)
  - D3.2 Pilot community Financial Data contracts (M9)
  - D3.3 Continuous availability of most recent StoRM and ELFI, source and binary packages (Starts at M1 and continues until M36)
  - D3.4 Report on StoRM and ELFI version changes (M12, M24, M36)
  - D3.5 Gemstone/gLite adaptor (M13)
  - D3.6 Best practice documents (M16)
  - D3.7 Data cache monitoring tools, integrated into gLite (M24)
  - D3.8 Data cache utility compute capability for gLite (M30)
  - D3.9 Data collection, loading and provisioning tools integrated into gLite (M34)

WP4. Interoperability with MS Windows based enterprise grid solution. (AVANADE)

- T4.1 Requirements gathering and Technical Design of integration between Avanade custom grid and gLite middleware
- T4.2 Interoperability layer implementation
- T4.3 Test and production deployment
- T4.4 Documentation of the interoperability layer for Users, Training and Operation
  - D4.1 Use Cases and Technical Design Document (M1)
  - D. Project source packages (M9)
  - D. Pilot Environment (M10)
  - D. User Manual and Training Deck Documentation (M12)
  - D. Public reference / case study document (M12)

Section 2.   Implementation

2.1   Management structure and procedures

The project management structure of E3GRID is conceived to create an international collaborative environment dealing with traditional project management problems. The structure has been designed to deal with the project management challenges and problems associated with a diverse collection of scientific and industrial partners. Our major focus is the need to ensure that the management provides the continuous environment to deliver production level services to the community we are addressing. This will be essential for the effective exploitation of the results offered to our scientific and industrial user community. The project will be managed using an overall management structure built on the basis of the experience gained by some of the proponents and by the proposed lead and coordinating partner in previous project experiences.

Roles and responsibilities

The management structure is schematically shown in figure below: It foresees several roles and responsibilities that are described in details in the following.

The lead partner will appoint a dedicated overall **Project Manager (PM)** that will undertake the direction and administrative management of the project, implementing decisions of the **Project Management Board (PMB, see point (e))**, composed by a representative of each partner in the consortium, and taking decisions between board meetings. He/she will also be responsible for communication between the Project and the EU and for coordination with other Grid initiatives.

In this role he will closely interact with a strategic board composed by the following three members:
a) A Technical Manager (TM), proposed by the PM and nominated by the PMB, will be responsible for decision making related to technical issues. He/she will chair the **Project Technical Board** (see point (g)) and work in close collaboration with it, and will be responsible for reporting to the PM.

b) A Scientific Manager (SM), proposed by the research partners and nominated by the PMB, will be responsible for decision making related to scientific and research activities. He/she will monitor the scientific research and report to the Strategic board any needs and requests coming from the scientific partners in order to keep the advance of project well in line with the needs of scientific community.

c) A Networking Manager (NM), proposed by the PM and nominated by the PMB, which will be responsible to drive and monitor the efforts and the activities of the Academic Industrial Forum. This manager that will coordinate the networking activities of the project will propose and implement solutions to actually enlarge and increment the user community. He/She will chair the User-meeting events and will report their outcome within the strategic board.
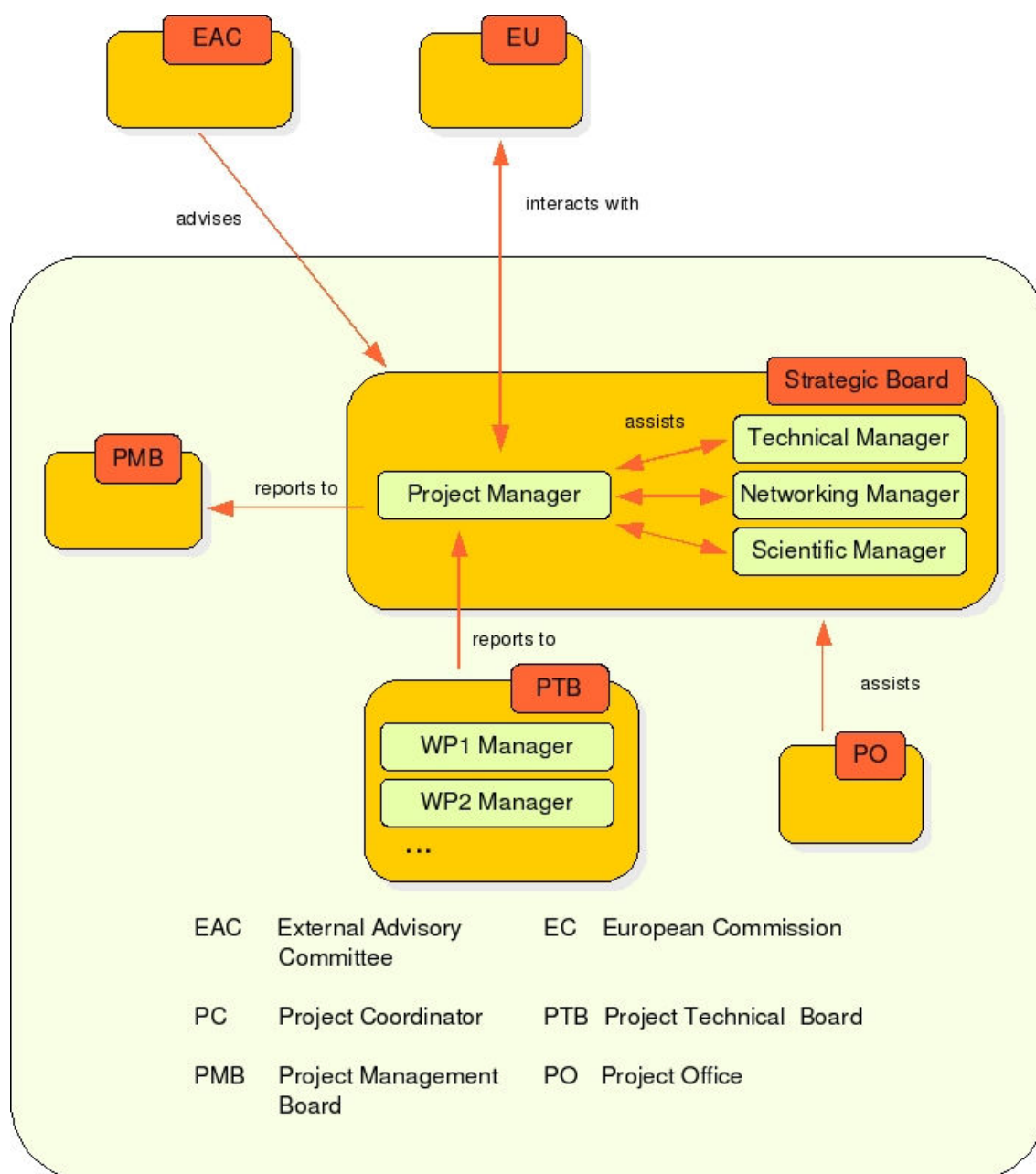
The strategic board will work in a cooperative way in order to follow day-by-day activities and drive the project to success. To minimise travel expenses and travel time, the larger part of the communication among participants will be via electronic mail/conferencing. Therefore the availability of easily accessible and up-to-date information on all relevant issues and activities and a constant monitoring of the effectiveness of the communication will be critical aspects for the success of the initiative.

d) The project coordinator and the strategic board will be assisted by dedicated **Project Office (PO).** The PO staff will be composed of one administrative assistant and a project secretary to form the administrative part of the office and will work in close coordination with the PM providing support to the operational management and the logistics of the project

The E3GRID project office will receive assistance from SISSA legal and financial services during the project negotiation and execution. If necessary a dedicated budget line will be allocated for specific legal consulting especially for financial data acquisition and usage purpose.

e) The Project Management Board (PMB) will be composed of one management representative from each partner and the PM, will specifically deal with items that affect the contractual terms of the project and strategic decisions. The PMB is formally entitled for the decision making related to the budget, the strategic objectives, possible changes and amendments, exploitation agreements. It will as well be responsible for taking remedial action in the event of missed milestones, taking in consideration advices from the technical board.
The PMB will also be responsible for conflict resolution in accordance with the contract and all the specific provisions envisaged within the Consortium Agreement.

The PM (who will be an ex-officio member with voting rights) will act as secretary. Only partners will have right of vote within the PMB, while possible Third Parties will be however provided with the full documentation.

The project management board will normally communicate via email and via phone/video-conference. It is expected that no more than two or three meetings per year will be needed; exceptional meetings could however be called by the PM on request by more than one of the partners for serious motivations.

f) The Project Technical Board (PTB), constituted of the WP Managers (see point (f)), chaired by the TM, and reporting to the PMB, will take decisions on technical issues and will be responsible for the production of deliverables.
Under the direction of the PM, the technical board will be responsible for the overall technical management of the project, i.e. the implementation strategy, the choice of techniques, the monitoring of results and quality. When necessary, the PTB will consult experts for advice and will propose corrective actions (to the management board) in the event that partners fail to meet their commitments or in case of missed milestones.
g) A leader for each work package (WP manager), appointed by the partner responsible for the WP, will coordinate the work of the tasks of the work package itself and will be responsible for the related milestones and the deliverable.

The work package managers, in coordination with the project administration, will be responsible for generating quarterly progress reports, which will report the progress made in each task and the consumption of resources. Whenever possible, in order to maximise the efficiency in the project management and to reduce travel costs, the WP manager will coincide with one of the members of the PMB (according to the needs of the activity and the profile of the person in charge)

h) A leader for each task (Task manager), designated by the partner who leads that activity in agreement with the WP manager concerned and the Technical Manager, will coordinate the work within the specific tasks assigned to him/her, answering to the work package leader.

i) Finally the project will benefit from an **External Advisor Committee**, whose members are appointed by the PMB. Members have to be chosen among senior and experienced people in the field of the project with the aim to advice and judge the work performed within the project and keep it at high quality standards. The EAC members are invited to participate in any official event of the project buy they should also contribute via electronic tools (email /

videoconferencing etc). The PM will send them documents and reports on relevant issues he wants to be advised on.

Information flow

All the information flow, which will be an important part of the day-by-day activity of the project, will be organised by means of electronic tools, to maintain a strong cohesion of the project consortium. A Project Management Database, Facsimile, Postal Service, e-Mail, Mailing lists, Templates for Meetings Agendas, Meeting Minutes, Reports and Costs statements will be the basic tools to be put in place for information bookkeeping and flow. Besides, a project website will be set up, providing authentication and authorisation mechanisms, to encourage participants to use the project information resources by making them accessible through standard browsers. A mailing list will be activated to facilitate the exchange of information within the project community. Other specific functional mailing lists and other collaborative tools will be set-up with the beginning of the project activities to facilitate communication and collaboration among Partners. All the mailing list will be archived with on the project website.

Meetings

Project meetings, supported by means of the electronic tools described above, will be one of the key tools for the running of the project. They will be held either face-to-face, by phone conference or by videoconference, focusing on tools such as VRVS and Skype (to reduce, when possible, loss of time and travel expenses). Meeting in person is however considered one of the most effective ways of strengthening the collaboration and this will be done by taking advantage of the workshops organised to minimise travel expenses.

The following face-to-face meetings are planned to manage the project:

- Kick-off Project meeting

- At least half of the Quarterly PM board meetings (whenever possible, in conjunction with other project workshops/activities and/or EU reviews).

- At least half of the Bi/tri-monthly Technical Board Meetings.

A calendar with the dates of ordinary meetings will be agreed yearly at the kick-off meeting and at the last meeting of the first year.

Documents

Regarding *documentation*, the Work Package Leader is responsible to see that the deliverable is drafted according to the technical and formal requirements. For all the documents a standard naming scheme will be activated[28]. An archive of template documents will be available on the project partner website to facilitate the production of all the relevant documents and deliverables. The PO will be in charge of keeping the archive up to date.

Conflict management

Normally it is expected that conflicts among project partners will be resolved amicably, or simply asking for advice to the PM, TM and their deputies. In case a conflict arises which cannot be settled in this way, the PMB will have the responsibility of its resolution, taking in

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[28] Tentatively in the form in the form E3GRID[Type]-[WPn/PM/GEN]-[Number] [Date], where Type ….

consideration the policies stated in the Consortium Agreement, to be signed by all Partners prior to the commencement of the project.

PMB members will hear the parties and will decide about the conflict by voting on a simple majority. As a general rule, such process will take place during normal PMB meetings (held both face-to-face or via phone-conference or videoconference) but, in case of urgent businesses, it can be carried out via email as well, provided that all voting members are timely informed about reasons and circumstances of the conflict. In case of plain seriousness, a special PMB can be called to discuss the matter.

If, for some reason, a dispute cannot be solved in this way either, parties can decide to resort to arbitration, which shall finally settle the matter and be binding upon the parties. An arbitration committee will be appointed in accordance with the procedure described in the Consortium Agreement, which shall set out in the award the detailed grounds for its decision and shall faithfully apply the terms of the Contract and of the Consortium Agreement itself.

2.2   Individual participants

- **2.2.1 Scuola Superiore di Studi Avanzati (SISSA)**

Profile:
SISSA was the first Italian institute that promoted postgraduate courses aimed at obtaining a PhD degree. SISSA was founded in 1978, in Trieste, as a school for advanced training and theoretical research in mathematics and physics. In the Nineties, it extended its interests to include new advanced themes, such as cognitive science and neurobiology. Today, its courses offer a very original postgraduate option, a case study comparable with few other scientific institutions. The presence of foreign lecturers and students and scientific collaborations with renowned institutions all over the world makes SISSA an international environment. More than 30% of enrolled students are foreigners and come from as many as 37 different countries. All the teaching activities are held in English. SISSA has a long standing tradition in computational science and it always updated with all the IT infrastructure that allow its researchers to compute on state of the art computational platforms(in the last few years HPC Linux Cluster and Grid computing resources). Recently this effort was framed into the newborn department called eLab (SISSA laboratory for e-Science). SISSA has in the last few years established a strong activity in computational finance with excellent results: as matter o fact more than 20 former SISSA students are now active in quantitative finance working for several banks and financial institutions and many of them keep collaborating with SISSA.

Role in the project: SISSA eLab will coordinate the project while research groups dealing with quantitative and computational finance ,in collaboration with industrial partners will act as Pilot User driver for the grid adaptation effort.

Key Personnel:
(1) Stefano Cozzini: *Education*: PhD in Physics, University of Padova, Italy (1995); "Laurea" in Physics, University of Trento, Italy (1991) Professional Experience: CNR/INFM Development scientist at the Democritos National Simulation Center (1999-current). Member of the HPC group at CINECA (1997-1998). Post-doc researcher at Physics department of the University of Seville (Spain) (1995-1996). *Selected Professional and Synergistic Activities*: Leader of the Information Technology Research Activity of Democritos National Simulation Center. Technical director of the SISSA/eLab laboratory. . Technical Manager of the EUIndiaGrid EU project. Consultant for Grid Computing at ICTP. Co- Project leader of ICTP E-GRID project. Co-Project leader for the Grid@Ts project. Organiser and director of more than 10 ICTP training activities in the last five years on High Performance and GRID Computing.Organiser and Co-chair on the international workshop "Grid in finance 2006". Member of the Program Committee of the "Linux Cluster Revolution" meeting (2002/2003/2004/2005/2006/2007 editions).

(2) Cesare Reina: born in Milano (Italy) June the 6th, 1948. Since 1987, full professor of "Relativistic Theories" at the Mathematical Physics Sector of the International School for Advanced Studies (ISAS-SISSA, Trieste).

Previous research activity in General Relativity, Gauge Theories, String Theory, Integrable Systems, Algebraic Geometrical Methods in Mathematical Physics, C*-algebras and non-commutative Geometry.

Professor Cesare Reina has been interested in Mathematical Finance during the last ten years, at the beginning motivated by personal interests, and later in collaboration with Generali Asset Management. This collaboration is dealt within the Sector of Mathematical Finance of the Interdisciplinary Laboratory of SISSA, of which (sector) is currently appointed as director.

(3) Sandro Sorella: born in Pescara, 14 January 1960, he is currently full professor in the Condensed matter sector of SISSA Trieste, and responsible of the activity "Many body systems in presence of strong correlations and/or disorder" INFM-CNR Trieste.

He received his PhD in physics at SISSA Trieste on 1989. He has been a postdoc at ETH Zurich on 1990-1991, assistant professor on 1992-1997 at SISSA, and associate professor on 1998-2005 at SISSA. The scientific activity has been mainly devoted to the study of strongly correlated electron systems. Relevant results have been obtained for the so-called "Mott insulators" where some important properties of the excitation spectrum have been clearly established. Moreover the scientific career has clearly benefit from numerous collaborations with the best theoretical and computational physicists (T. M. Rice, E. Tosatti, M. Parrinello e R. Car), with the active participation to the development of novel numerical techniques, based on the so-called Quantum Monte Carlo method.

The scientific activity is reported in about 100 papers in international peer reviewed journals, and several invited talks in important international conferences. These contributions had a considerable impact on the scientific community with more than 2000 citations (ISI March-2007).

- **2.2.2 Athens University of Economics and Business, department of International and European Economic Studies**

The **Athens University of Economics and Business** (AUEB) was originally founded in 1920. It is the third oldest Higher Education Institution in Greece and the oldest in the general fields of Economics and Business. The **Department of International and European Economic Studies** was established in 1989 with the purpose of training specialists in European Integration issues and, generally, in International Economics and International Relations. Moreover, Athens University of Economics and Business' Research Centre was established in 1983 in order to coordinate and facilitate research by members of the University's faculty. In this capacity, the Centre is collaborating with other university institutions, public entities and organisations, private enterprises, international organisations and selected qualified individuals. The Centre is devoted to the promotion of theoretical, applied and policy research in the general fields of economics and management as well as in the fields of informatics and applied information systems. In this context, the Centre has completed a large number of studies, most of which have been financed by the European Union. Emphasis is given to the analysis of problems and problem-oriented research. The preliminary processing of raw data is arranged in cooperation with other research institutions and statistical services.

Role in the project:
Pilot User driver for grid adaptation effort.

Prof. Skouras is a finance and econometrics researcher currently engaged in a number of projects with a significant computational component that can be used as drivers in resolving generic obstacles to porting finance & econometrics research to grid infrastructures. Technology that exploits the grid to effectively handle such problems would involve commonalities not only with the econophysics/finance/econometrics community, but also more with many researchers in statistics, machine learning, pattern recognition, economics and the social sciences more broadly.

Key Personnel:
(1) Professor Skouras conducts computationally intensive research in finance and econometrics. This research has appeared in leading academic journals such as the Journal of Econometrics and the Journal of Economic Dynamics and Control and has been awarded prizes by the Society for Computational Economics and Panagora Asset Management. It has also attracted the interest of industry and Professor Skouras has held consulting positions with the European Investment Bank, Prediction Company and the Man Group. Professor Skouras is currently Assistant Professor at Athens University of Economics & Business (Department of International and European Economic Studies); previously he has held teaching and research positions at the University of Cambridge (Lecturer, Department of Economics), Imperial College (Research Associate, Department of Mathematics) and the Santa Fe Institute (Research Associate).

Professor Skouras has around ten collaborators with whom he already has computationally intensive research projects in progress and who are enthusiastic about working on these projects within the E3GRID infrastructure. These researchers range from Professor Skouras' PhD students to senior international scientists and have backgrounds in Economics, Statistics, Econometrics, Physics and Engineering.

- **2.2.3 Avanade**

Profile:
Avanade is a global IT consultancy dedicated to using the Microsoft platform to help enterprises achieve profitable growth. Through proven solutions that extend Microsoft products, Avanade helps enterprises increase revenue, reduce costs, and reinvest in innovation to gain competitive advantage. Avanade Inc. was founded in April 2000 as a joint venture between Microsoft Corp. and Accenture. Our unique connections with Accenture and Microsoft enhance our ability to deliver effective mission-critical solutions for organisations in all industries. As a global provider of Microsoft-based technology consulting services, Avanade is committed to providing world-class solutions to its customers around the world. In our efforts to fulfil this mission, our team has grown to include more than 5,000 people serving more than 2,200 companies worldwide.

Role in the project:
The main task attributed to Avanade consists in providing seamless integration between Industry custom AGA Grid and gLite computation nodes, by the addition of .Net based computational nodes to the gLite environments, through leverage of existing gLite standards as common interfaces to move current Industrial custom implementation from internal/private grid to external/accessible grid.

Avanade will provide consultancy on the required feature set and issues the Industry needs to have solved by a Grid infrastructure, leveraging experiences driven by running projects based on a custom Grid implementation that Avanade implemented on the past 2 years, and will implement a software connector to let its Grid implementation to be able to integrate seamlessly with the gLite middleware by the adoption of common standards.

Key Personnel:
(1) Edwin Jongsma is Capability Directory Solution Development with Avanade Netherlands. After 8 years IT career in the roles of software developer, architect and team lead Edwin joined Accenture to build a Microsoft practice. This department became the basis of what is now Avanade Netherlands with around 100 people. In his current role as Capability Director Edwin motivates his team to be the best solution development team to solve business problems in the Enterprise with Microsoft technology. He has published over 10 articles and is a frequent speaker on Microsoft DevDays, a hardcore technology event with over 2000 visitors. Besides running his Capability Group Edwin Jongsma is involved in the development of global assets, his current focus is on Software Factories and Model Driven Software Development.

(2) Roberto Cappuccio is Capability Director with Avanade Italy, Florence Office. Coming from academic research activity in Physics, he started his IT career in Microsoft in 1997. He joined Avanade Italy in September 2000 covering the roles of Account Manager and .Net Practice Director. He successfully contributed in developing Italian Mid Area business and recently started the new Avanade office in Florence. He is currently leading more than 50 people and keeps his focus on customer accounting and business development. In his previous role as .Net Practice Director he sponsored and was one of the lead architects of Avanade Grid Architecture, today an asset widely adopted in Avanade enterprise customers. In his current role he still leads grid initiatives in Avanade.

- **2.2.4 Christian-Albrechts-University of Kiel**

Profile:

Christian-Albrechts-University of Kiel (CAU) is the only university in the German federal state of Schleswig-Holstein with some 20,000 students. The Department of Economics at CAU has a strong orientation towards research and has routinely been ranked as one of the leading departments in this field in Germany. A major asset is the link between the Department of Economics and the Kiel Institute for the World Economy (IfW), the leading institute in applied and policy-oriented economic research in Germany. In collaboration with the IfW the Department of Economics runs a structured International Doctoral Program in "Quantitative Economics" with a focus on international economics, financial economics, and empirical research. Interdisciplinary research is emphasized through joint projects with faculty members from the Departments of Mathematics and Theoretical Physics and their participation in the graduate program.

The major focus of the research of the group led by Thomas Lux has been on behavioral, agent-based models of financial markets. Their ongoing research includes theoretical analyses of financial market models with heterogeneous agents, learning of economic agents via artificial intelligence methods as well as research on more mundane topics in empirical finance (such as forecasting of volatility and risk management). These research interests have stimulated a number of interdisciplinary collaborations with computer scientists and physicists in the emerging fields of 'econophysics' and computational economics.

Role in the project:

Pilot User driver for grid adaptation effort.

Key Personnel:

(1) Thomas Lux, born August, 4th, 1962 in Weidhausen/Germany. Education: Diploma in Economics, University of Wuerzburg, 1987; Dr. rer.pol., University of Wuerzburg, 1990
Academic positions: Research Assistant and Assistant Professor, Department of Economics, University of Wuerzburg (1988 – 1993), Assistant Professor, Department of Economics, University of Bamberg (1993 – 1997), Full Professor, Department of Economics, University of Bonn (1998 – 2000), Full Professor and Head of the Chair for Monetary Economics and International Finance, CAU Kiel (since 2000), visiting academic positions (one month or longer) at University of Frankfurt/M. (Germany), International Christian University Tokyo (Japan), University of Technology Sydney (Australia), Université Aix-en-Provence (France). He is the founding director of the Doctoral Program in "Quantitative Economics" at CAU, and has been ranked as the second most often quoted German economist within the decade 1994 – 2004 (cf. *Handelsblatt* of 18 May 2005); Thomas Lux serves as an (associate) editor or member of the editorial board of five international journals.

(2) Simone Alfarano (born June 21st, 1975 in Cagliari, Laurea in Physics, 2001, University of Cagliari; Ph.D. University of Kiel, 2006) is Assistant Professor for Numerical Simulations of Economic Models, Department of Economics, University of Kiel. His research interests focus on agent-based models in finance and computational finance.

(3) Mishael Milakovic (born April 23rd, 1973 in Frankfurt/M., PhD (2003) New School for Social Research, New York) is Lecturer, Department of Economics, University of Kiel. His research interests include empirical regularities in economics and finance, statistical equilibrium economic modeling, and the influence of network topology on markets.

- **2.2.5 City University**

Profile:

The University is a medium-sized (11,500 students). It has one of the highest proportion of postgraduate students amongst higher education institutions in the UK. As the University of Business and the Professions City University has a clear focus on research and teaching relevant to professional and business activity. The location of the University, in Clerkenwell, close to the heart of London, makes it attractive for students from around the world (153 countries at the last count). The Economics Department at City University has an expanding programme of research and teaching in the main areas of economics. It has grown considerably over the last twelve years and it currently has 14 permanent full-time staff members engaged in research and teaching, one full-time senior teacher and several visiting professors and research fellows.

Role in the project:

Pilot User driver for grid adaptation effort.

The Economics Department has a wide-ranging but focused research programme, with an emphasis on rigorous economic and econometric modelling, but also a concern for practical applications in both private and public sectors. Much of the research in Economics involves collaboration, not simply within the department, but also elsewhere in the University and with outside bodies, for example Nera and the King's Fund. Postgraduate programmes of study in the Department of Economics include MSc courses in financial economics, international business economics, economic regulation and competition, and economic evaluation of health care. The expertise of the team at City University involved in this proposal is mainly in the areas of quantitative finance, theoretical economics, econometrics and financial competition and regulation.

Key Personnel:

(1) Prof. Giulia Iori holds a BSc (1989) and a PhD (1993) degree in Physics from the University of Rome. Between 1993 and 1998 she was a research fellow in theoretical Physics at the University of California Santa Cruz, the CEA-Saclay in Paris (EU Marie Curie fellowship) and the University of Barcelona (EU TMR fellowship). Before joining City University as a Professor of Economics, she worked at the University of Essex and at King's College London where she has taught courses in Financial Engineering, Corporate Finance, Investment, Financial Mathematics and Exotic Options.

Her research work has covered different areas in physics, applied mathematics, biology, finance and economics. Current research interests include: market microstructure, credit risk, systemic risk and operational risk, economic networks, high-frequency financial time series analysis, derivatives pricing. She has authored about 35 papers in peer-reviewed leading journals in Physics and Finance. She has co-organised the 13th Annual Symposium of the Society for Non-linear Dynamics and Econometrics (City University, London, March 31-April 1, 2005) and the 3rd Conference on Complex Behaviour in Economics: Modelling, Computing, and Mastering Complexity (Aix en Provence, 17-21 May 2006). She has served as expert evaluator for the British Council, the Engineering and Physical Science Research Council, the and the European Commission.

(2) Dr Albert Banal Estanol holds an MSc in Mathematics (1998) and a PhD in Economics (2003) from the Universitat Autònoma de Barcelona. Before joining City University in 2005 as Lecturer in Economics he was Assistant Professor at the University of Western Ontario. He

has taught courses in Corporate Finance, Microeconomics, Game Theory, Industrial Organisation, and Quantitative Methods. His research interests are Corporate Finance, Industrial Organisation and Economics of Organisations. He has published several articles on the causes and consequences of horizontal and vertical mergers. Some of his papers focus on particular industries, such as energy and banking. In the area of corporate finance, he has for example studied the role of bankruptcy costs on pure financial synergies.

(3) Dr Jose Olmo obtained a BSc in Mathematics from Universitat de Zaragoza in 1998 and a PhD in Economics from Universidad Carlos III de Madrid in 2005. He joined City University, as Lecturer in Economics, in June 2005. His current research interests include: Financial Econometrics, Financial Economics and International Finance, Extreme Value Theory, Copula functions, Outlier detection techniques and Bootstrap. In particular he has introduced appropriate utility functions to assess the downside risk in portfolio management strategies when extreme co-movements are present between financial assets and has employed the extremal index to test the existence of clustering in extreme values.

(4) Vanessa Mattiussi holds Bsc in Statistics from University of Padova and a Msc in Financial Mathematics (2003) from King's College London. She is currently a PhD students in Financial Economics at City University. Her research interests are high frequency financial time series analysis and in particular the implementation of the Fourier method for the estimation of volatility and correlations in non-homogeneously spaced high frequency financial data.

(5) Dr Mauro Talevi has Bsc (1992) and PhD in theoretical computational Physics from the University of Rome (1996). Mauro is experienced in the architecture, design and development of distributed and network-based applications, involving both server-side and client-side components. He has designed and developed component-based Java Enterprise applications (both desktop and web-based), in areas such as e-commerce, econometrics and statistical data analysis, real-time messaging, rule-based categorisation and search engine systems. Over the past two years, he has designed and implemented an econometrics platform for the statistical analysis of financial data.

- **2.2.6 Consorzio Pisa Ricerche**

Profile:

Consorzio Pisa Ricerche was set up in 1987 with the main aim of promoting and co-ordinating the transfer of innovative technology and expertise from the university and research environment to industry. CPR is a non-profit organisation with both public enterprise and private companies among its members.

Its organisational structure involves a number of centres of excellence, such as the *DITEL - Department of Computer Science and Telecommunications* that is directly involved in the project. DITEL was set up in 1996. Together with its research staff of Information Technologists and Telecommunication Engineers, the DITEL division offers a wide range of technical expertise in the sector of multimedia networking, digital libraries, networking protocols, network management, electronic commerce, home banking, digital right and IPR management, secure communication, and expertise in GMPLS (design and development), QoS, 3D graphics, MPEG-based compression, multi-tiers architectures, software autonomous agents, collaborative environments, secure / authenticated communication, object-oriented languages repository and Internet technologies.

From an organisational & EU framework perspective, CPR, has regularly organised a series of IST Information Days for its Italian constituency on the collaboration process of EU IST funded projects. CPR collaborates with the Ministry of Technology & Science it carries out national IST support activities in the following areas:

- Organises National and International Information Days & National Workshop on IST and thematic priorities;

- Coordinates training sessions with external experts for Italian organisations on Proposal writing under the FP6 Programme;

- Provides assistance & support on framework programme topics to Italian industry, academics, research institutes, SMEs.

The following profiles collaborate within the Communication and marketing division in CPR - DITEL, who will be working on E3GRID specifically, the division focuses on high-level coordination and strategic, communication developments for new technologies, specifically in the software & services, grid and eInfrastructure domains. The division, run by a female, provides innovative, communication platforms for hi-end multicultural audiences, both from the industrial research and academia communities. The division maintains an active interest in finding new user communities (scientific & enterprise) for potential Grid adoption through engaging new users to attend regularly organised workshops.

Role in the project:

CPR with a well balanced international staff of information technologists, software engineers and project managers and by means of a variety of advanced tools and methodologies, representatives in the team are able to develop communication packages, supports promotion and dissemination activities, performs branding and marketing studies, designs and executes training programmes, organises & manages events, and raises awareness on promoting Research, Technology Development achievements internationally. who have acquired over eleven years experience within EU programme initiatives focusing on promotional and dissemination activities. The hands-on experience, of a comprehensive understanding of the international ICT context and the evolving new user needs of innovative technology gives

good stead to contribute specifically in the Networking activities related to dissemination and to the Service activities proposed in E3GRID.

CPR pursues technology transfer activities and training activities in the field of ICT which aims to transfer the research results to industry. Over the years, it has made up a vast network database of research, enterprise, academic and SME contacts which are clearly able to exploit the research results developed.

Key Personnel:
(1) Gianluca Savini is a graphic, web designer and communication expert at Consorzio Pisa Ricerche(CPR), Dipartimento di Informatica e Telecomunicazioni" (DITEL). Since 1999, he has covered a significant part of the design needs of the department, ranging from graphic design, desktop publishing, multimedia design, video editing, web graphics and development. He has worked on over 35 European projects, and has over fifteen years of hands-on experience on developing communication and dissemination strategies, together with the Communication and marketing division at CPR. He has incorporated graphic assets and created logos, brochures, web sites, animations and press materials. He specialised in W3C-compliant highly accessible web templates to be implemented in several high-profile Content Management Systems. He currently acts as the technical manager in two European and international projects INTERREG III MEDOCC.

(2) Alessandro Martucci is a researcher at Consorzio Pisa Ricerche(CPR), where he heads the Voice over IP division of the "Dipartimento di Informatica e Telecomunicazioni" (DITEL). His research interests concern mainly protocols and architectures of the control plane and management of traffic control plane in the field of next generation IP packet networks (NGN). Since year 2000, he participates to a number of European research projects (i.e. BASS, MOICANE, WEIRD) and leads different Italian research project financed by the Italian Ministry of Technology (i.e. Parnaso - Archimede). He has good experience in a number of industrial projects in the field of VoIP and NGN technologies. Alessandro will provide support in the SA activity of E3GRID.

- **2.2.7 Excelian**

Profile:
Excelian was established in 2001 to deliver global, scalable Murex Consultancy across a variety of versions, modules, instruments and business areas. Since then our proven track record of delivering successful, flexible and tailored projects has led to us becoming widely recognised as the leading provider of Cross-Asset, STP Murex solutions to clients across Europe, North America and Asia Pacific. This success allowed us to grow our practice and expertise during 2004 into non Murex-related strategic and technical consulting. Our inherent belief in partnership, transfer of knowledge, team integration, and client ownership have become hallmarks of our unique service and ensured our status as a preferred consulting partner for many of the worlds leading Financial Institutions. Excelian has been involved with the grid since 2004, including the enablement of a number of models and applications. We have built a specialist team who have been trained on and have implemented major 3rd party grid applications. While Excelian continues to develop relationships with key grid vendors, we pride ourselves in being able to bring an agnostic approach to the table. Our aim is to bring value to our clients by understanding their needs and helping them select the most appropriate technology. We can, and will, make recommendations based upon specific architectures but are not tied to a particular product set.

Role in the project:
Industrial research driver for grid adaptation effort, data cache integration, utility model development.

Key Personnel:
(1) Dr Adam Vile. Adam is the Head of Grid, HPC and Technical Computing at excelian. Adam has many years experience in investment banking in various roles ranging from development to project and programme management. Before joining excelian he was responsible for Grid and HPC architecture, strategy and implementation at a premier investment bank. Key achievements: large Datasynapse rollout replacing an internal Grid system across all asset classes; as part of Excelian Adam was responsible for a large Platform Grid rollout at a tier one investment bank; Front, Back and Middle Office experience; management of a centralized reference data project; management of a Fixed Income analytics system; Programme Manager of a large cross-bank decommissioning programme; Grid and HPC Evaluations; responsible for HPC strategy at a major investment bank and its replacement of the in house grid at and its replacement with a DataSynapse Grid; chartered mathematician active in the institute of mathematics and chair of the IMA computational finance conference; DataSynapse certified architect; Industry member of the European Grid Forum (EGEE)

(2) Constantino Ribiero. Constantino has worked in the implementation of Brazilian National Grid part of National System of Hyper Performance Computing, installing and configuring Globus and SGE middleware. He has worked with parallel and distributed computing developing programs in C with MIP for distributed debugging as my Master Thesis Working with compilers optimisations in SUIF compiler framework developing programs in C++ as my PhD thesis. While at Excelian Constantino has received training in Gigaspaces grid and data caching.

(3) Paul Tapper. Paul has worked for Excelian as a consultant for grid based projects in the city including a project at a tier one bank in collaboration with Platform for new global grid implementation based on Symphony 2. This involved assisting in all technical aspects of

global grid implementation at a tier one bank including grid setup and configuration, development of new tools to help manage the grid, integration of Platfom's software with the bank's infrastructure, troubleshooting and advising and assisting developement groups in grid-enabling their applications. Previously Paul has worked on trading platform integration projects on the murex system.

(4) Carlos Rueda. Carlos has worked as Technical Director at a joint financial/academic owned company on research and development on distributed technologies, Grid Computing and Super computing. This has involved project management, proof of value of commercials solutions, design, management and deployment of Grid systems to solve compute intensive applications for the banking and financial sector at the Santander Group. (Group SCH entities include, Banesto, Abbey National and Santander Central Hispano). Carlos developed the first Grid System at Banesto, it's being used by the treasury department for Murex pricing and risk simulations.

- **2.2.8 ICTP**

Profile:

The Abdus Salam International Centre for Theoretical Physics (ICTP) (http://www.ictp.it/) founded in 1964 by the late Nobel Laureate Professor Abdus Salam, is an international institute of research and high-level training in pure and applied physics and mathematics offered mainly to developing countries scientists. In recent years, about 5,000 scientists per year from almost all nations have visited ICTP to participate in the Centre's research and training activities more than fifty per year - and to conduct their own research in various fields. \ ICTP has an excellent network of contacts in Developing Countries and former Soviet Union Countries, and a long-standing tradition of formation and dissemination in IT themes, like networks, wireless networks, cluster computing and HPC and quite recently Grid computing. ICTP is also involved in the GRID@Trieste project that aims to build a metropolitan grid infrastructure to network together the scientific institutions of Trieste. ICTP involvement in grid training activities includes events organised in: Venezuela (2004), Ghana (2005) and in Trieste (2004), with attendees from 15 countries. Also, a special training activity, Porting Scientific Applications on Computational Grids, was held in Trieste in 2006.In addition to these GRID oriented training activities, ICTP has well-established scientific reputation in the field of statistical physics methodologies applied to financial problems

Role in the project:

Pilot User driver for grid adaptation effort, grid data management development effort, utility model for finance, grid porting of research applications. ICTP is currently implementing a national grid infrastructure for financial and economic research in the framework of the "EGRID project", funded by the Italian Ministry for research (http://www.egrid.it). The EGRID project and its results are now also part of EGEE as "generic application"..

Key Personnel:

(1) Matteo Marsili: born in Rome, 4th of January 1966. He is currently research scientist at the Abdus Salam International Centre for Theoretical Physics (ICTP) since 2002. He received his Ph.D. in Physics at SISSA Trieste (27th Oct. 1994) and graduated in Physics at University of Rome "La Sapienza" (22 Feb. 1990). He has been a researcher of INFM at SISSA, Trieste (1999-2002), assistant professor in Statistical Physics at SISSA (1997-1999), assistant docteur at the Institut de Physique Theorique, Universite' de Fribourg (1995-1997) and post doctoral research fellow at the University of Manchester (1994-1995). He has organised several interdisciplinary activities, such as the Thematic Institute on "Networks, dynamics and socio-economics" of the EC Network of Excellence EXYSTENCE (Trieste, 6 May - 1 June, 2002) the 7th Workshop on Economics with Heterogeneous Interacting Agents - WEHIA 2002 and the NATO advanced research workshop "Application of Physics to Economic Modelling" (Prague, 8--10 Feb. 2001), the School and Conference on Fundamental Aspects of Complexity (6-10 Sept. 2004, Trieste), the School and Workshop on Structure and Function of Complex Networks (16 - 28 May 2005), the School/Conference on Statistical Physics and Interdisciplinary Applications (11-22 Sept. 2006, Beijing, China) and the Workshop on Statistical Physics and Financial Markets (20 - 21 Apr. Trieste). Has authored over 100 papers in international peer reviewed journals.

(2) Alvise Nobile: born in Trieste in 1950. He graduated in physics in 1973 at the University of Trieste. He has been responsible of the scientific computing services of the International School for Advanced Studies (SISSA) of Trieste from 1975 to 1989, and of the International Centre for Theoretical Physics (ICTP) from 1989 to 2005. During his service at ICTP, he organised most of the ICTP training activities in the areas of Computing and Internet technologies, both in Italy and in developing countries (Latin America, Africa).

(3) Ezio Corso: born in Trieste in 1975. Graduated at the University of Trieste in Computer Engineering. Since 2004 has worked in the EGRID Project for building an Italian pilot grid facility for research in Economics and Finance. Member of the SRM standardisation group for grid data management. Designer and developer of the asynchronous data movement functionalities in the StoRM SRM server, with ACL capabilities for supporting Stock Exchange disclosure policies on Financial Data in grid storage.

- **2.2.9 INFN**

Profile:

INFN (http://www.infn.it/), is a public governmental research organization, which promotes, co-ordinates and funds nuclear and high-energy physics related researches. It is organized in 4 National Laboratories, 19 Departments (called Sections located in major Universities) and 11 Local Groups (see http://www.infn.it/mappa.php). INFN staff research personnel amounts to more than 1500 peoples with an equivalent number of associates from University and other Scientific National Institutes. INFN has a considerable experience on high performance distributed computing. Already in 1998 INFN deployed a Wide Area CONDOR Pool distributed all over Italy (see http://www.infn.it/condor); at the end of 1999 INFN launched the INFN-GRID project (http://www.infn.it/grid), to evaluate/develop the use of GRID technologies in facing the stringent computing requirements of the High Energy incoming LHC experiments at CERN. Since 2001 INFN has played a major role in the EU DataGrid and DataTAG projects, the CERN based LCG and WLCG projects, the National Grid Projects GRID.IT (http://server11.infn.it/firb-grid) and LIBI, and more recently the EGEE and EGEE II and the grid infrastructure extension projects like EUmedGRID, EUChinaGRID, EU-IndiaGrid and EELA, GridCC and BioinfoGRID The INFN contribution to these projects comprises the setup of the INFN Production GRID, with more then 3000 CPU's deployed in more than 20 sites, the development and reengineering of the grid Middleware, in particular of the Workload Management service, the Virtual Organization Membership Service (VOMS), the Glue Schema, the new Web Service CE implementation with CREAM and CEMON, the Grid Accounting service DGAS, the GRID Monitoring service GridICE, some new components related to grid policies GPBOX and the SRM interface to parallel file systems (StoRM, in collaboration with ICTP) together with the dissemination ad training activities.

Role in the project:

INFN main task in E3GRID will be the participation and coordination of the SA activities that consists in supporting the deployment and the operations of the grid infrastructure for the Economics and Finance community shared with EGEE. INFN will also take part to the NA and JRA activities. Experience to carry out this task comes from the role played in the various worldwide Grid projects quoted above and from the role that INFN has in the EGEE projects. Moreover the experience coming from the coordination of the INFN Production Grid (the INFNGRID) will be of utmost importance in running and coordinating the infrastructure needed by E3GRID. Furthermore INFN has an important role in the development of Grid software and has extensive knowledge of the problems related to testing and certification activities.

Key Personnel:

(1) Prof. Mirco Mazzucato

Present position: INFN Director of Research. CNAF (INFN Advanced Computing Centre) Director, since 2004. INFN Grid Project Project Manager since 2000. INFN delegate and member of the Management Board in the (W)LCG, World Computing Grid for LHC Computing Grid Project at CERN since 2002 (~ 6000 physics in Europe, USA and Asia) Member of the Project Management Board and coordinator of the Italian Federation in the FP6 European project EGEE (and its successor EGEE II) MIUR Italian delegate in the e-Infrastructure Reflection Group.

- **2.2.10 Consiglio Nazionale Delle Ricerche - Istituto Nazionale Per La Fisica Della Materia**

Profile:

INFM carries out interdisciplinary research activities in the field of physical sciences of matter and their technological applications. The Institute is now part of the National Research Council (CNR) and operates in close connection with Universities, and within international collaborations. The Observatory of Complex Systems (OCS) is a research group of CNR-INFM located in Palermo, Italy. The research activity of OCS mainly deals with empirical characterisation and theoretical modelling of stylised facts in financial markets (Econophysics). The OCS is involved in two European projects: DYSONET and GIACS. In the FP6, OCS has been awarded a Marie Curie Development Host fellowship. OCS is also leading unit in the Italian MIUR project High-frequency dynamics in financial markets that heavily used the EGRID infrastructure. Within this project and in collaboration with EGRID in February 2006 Palermo hosted the workshop "Grid in Finance 2006".

Role in the project:

Pilot User driver for grid adaptation effort on the following topics: (i) investigation of the determinants controlling the dynamics of the order book in a double auction financial market, and (ii) detection of resulting strategies observed in the action of broker performing transactions and submitting orders in a financial markets.

Key Personnel:

Prof. Rosario N. Mantegna –Degree in Physics (1984) and PhD in Physics at Palermo University (1989). From 30/12/2004 full professor of Applied Physics at Palermo University. Chairman of the PhD school in Applied Physics. Member of the International Advisory Board of the European School of Advanced Study on Methods for Management of Complex Systems, Pavia University, Italy. The research activity is focused on the application of methods of statistical physics to physical, biological and economic complex systems. Member of editorial board of the International Journal of Theoretical & Applied Finance and of Quantitative Finance. Publications: One book (R.N. Mantegna and H.E. Stanley, An Introduction to Econophysics, CUP, 2000. Translated in Japanese, Polish, Indonesian and Chinese). Author of 84 articles published in international journals inserted into the Science Citation Index and 26 contributions published in proceedings.

Prof. Fabrizio Lillo - Degree in Physics at the Palermo University where he obtained a PhD in Physics in 1999. From 1999 to 2003 he has been INFM post-doc. In 2003 he obtained a post-doc fellowship at the Santa Fe Institute (New Mexico, USA) where he has performed research on socio-economic and biological complex systems. From January 2004 he is Assistant Professor at Palermo University. Starting from July 2005 he is also member of the External Faculty of the SFI. The research activity of Dr. Lillo concerns the application of Statistical Mechanics to complex systems of physical, biological and economic nature. He has worked in the characterisation and modelling of financial market on different scales, going from set of equities to the microstructure of order driven markets and to the investigation of the trading strategies of brokerage firms. Dr. Lillo has also investigated new statistical tools for data clustering and multivariate analysis.

Prof. Salvatore Micciché – Salvatore Micciché graduated in Physics at the University of Pisa in 1995. He got his PhD from Loughborough University (UK) in 1999. From 2000 to 2001 he was an INFM post-doc. From 2002 to March 2003 he hold a post-doc position at the University of Palermo working on a project on the characterisation of stochastic processes with multiple time-scales. From 2003 to 2004 he was an INFM research assistant. Since January 2005 he is Assistant Professor at the University of Palermo. His main research interests include (i) theoretical modelling and empirical characterisation of complex systems, such as the volatility of stocks traded in a financial market and (ii) the study of the network

properties in gene-expression data obtained from microarray experiment.

- **2.2.11 Centre for Development of Advanced Computing (C-DAC)**

Profile:

Established in March 1988, as a Scientific Society of the Department of Information Technology (formerly, Dept. of Electronics), Ministry of Communications and Information Technology (formerly, Ministry of Information Technology), Government of India, **C-DAC**, is primarily an R & D institution involved in the design, development and deployment of advanced Information Technology (IT) based solutions. In a little over a decade since inception, C-DAC has developed and supplied a range of high performance parallel computers, known as the **PARAM** series of supercomputers. C-DAC's development activities in this area have been mission oriented and driven by its mission objectives, both in technology and application developments.

Role in the project:

Pilot User driver for grid adaptation effort

Over the years, C-DAC has diversified its activities to address requirements in various areas, consequently, our expertise also extends to other advanced areas of Information Technology, enabling IT based solutions in areas like **Financial and Capital market simulation and modelling**, Network and Internet Software, Healthcare, Real Time Systems, eGovernance, Data Warehousing, Digital library, Artificial Intelligence etc. C-DAC's National PARAM Supercomputing Facility is being used by C-DAC's own scientific and business applications development team and researchers and institutions not only from India but also from abroad. In a decade and a half since its inception, C-DAC has established its brand image as a premier R & D institution of national and international repute working in advanced areas of electronics and information technology and developing and deploying IT products and solutions for diverse economic sectors.

Key Personnel:

(1) Dr. Medha Dhurandhar, Chief Investigator has Ph.D. in Mathematics (Graph Theory & Combinatorial Analysis). Have more than 15 years of experience in Scientific & Engineering computing as well as business computing. Have developed and delivered projects/products in the interdisciplinary areas of Mathematics, Operations Research, Computer Science, Computational Finance deploying Software Engineering quality systems. Major contribution is in developing business intelligence software tools addressing real-world problems through multidisciplinary approach. Have designed and developed computational engines with optimised performance delivering optimal business solutions. Achieved better business through R&D exploiting interdisciplinary background. Principal industries served include Financial Services, Transport, Logistics, Health Care and Telecom. Areas of specialisation are Optimisation techniques, Business Intelligence, Design and development of algorithms, Parallel Processing, Business/Requirement analysis, Customer interfacing, Handling of multiple teams/projects.

2.3   Consortium as a whole

• **The participants collectively constitute a consortium.**

The E3GRID e-Infrastructure is an activity that requires many competencies in several fields, which are not found in a single entity. It is precisely around these needs that the participants have been involved from the beginning, with a clear definition of objectives. It is the clear definition of objectives that also allows for a clear definition of roles, with academic institutes and private companies committed to the tasks assigned. Indeed, the partition of work activities has been done in order to maximise each member's strength and core competencies:

Project Coordination

The central task of co-ordinating the whole E3GRID project effort, and the main organising force behind the idea of this project, is given to **SISSA**. Its involvement in many European projects in the last few years guarantees the needed experience to manage and run a project of this size. Sissa has also the Grid knowledge and the experience necessary to manage this specific infrastructure research project. The coordinator actually is involved as technical coordinator of the EUIndiaGrid and as project leader on in the Italian EGRID project for the construction of a national pilot facility for research in Economics and Finance. This provides SISSA with the necessary background in this field to generalise the experience to the European level, as well as to greatly move beyond the objectives the Italian project. It is therefore an opportunity for a more ambitious project that can address the limits of the grid as experienced during the lifetime of EGRID, to turn it into a truly central tool for doing modern Economics and Finance research.

Networking Activity

Consorzio Pisa Ricerche has an outstanding experience in dissemination and outreach in grid related projects. This is why it is in charge of the logistics of all events, as well as the general marketing strategy for E3GRID. It knows how to work closely with the other consortium members that are knowledgeable in the Economics and Finance research fields, both industrial and academic, to learn about the peculiarities of this research field and so fine-tune its marketing strategy. Indeed, they have already worked closely with the people involved in drawing this project proposal, to prepare a focused plan that addresses the various peculiarities.

Service Activity

The main task of building the physical E3GRID e-Infrastructure as well as its daily management has been attributed to **INFN**. It built the Italian High Energy Physics grid infrastructure, and takes care of its daily management. It contributed greatly to the development of the public grid gLite middleware. It is in the best position to help setting up grid sites for E3GRID, and knows well all the procedures and issues in integrating sites and it has a large experience in running operational centers for the EGEE/INFN grid infrastructure.

The second role of the Service activity is to help in porting financial research applications to the grid. For this task, **ICTP** is involved because of its role in the Italian EGRID project. All the research groups were aided by ICTP staff experts to port their applications, which were

not originally grid based. It has therefore developed a broad range of expertise in this area that best positions it for this task.

CPR and Avanade will contribute as well to this activity with a minor involvement.

Joint Research Activity

This is the most elaborate activity of the whole project. It stems from the recognition of the proponents of this project by virtue of their previous experience in the Italian EGRID project, of the missing functionality and of how research is done in this field.

The task of driving the adaptation effort of the general public grid, has been given to a representative sample of the research community, who are called Pilot Users.

- The academic adaptation drive has been given to the **Athens University of Economics and Business**, **Christian-Albrechts-University of Kiel**, **City University**, **CNR-INFM**, **C-DAC**, as well as SISSA and ICTP. These research groups are important contributors to the field as exemplified by their CVs. They are aware of the computational and financial data problems involved, and so know the benefits that can be attained by having a powerful tool such as the grid, that is most importantly also usable. Almost all of them have collaborations (some of them just informal) with research department of important player in the financial industry.

- The industrial research adaptation driver has been given to **Excelian**. It is a consulting company for top tier banks. It has extensive knowledge of industry as well as quantitative research groups. It is in the best possible position to know exactly what private research is doing; and more importantly they have already made the requirement capturing effort, by virtue of their work activity. The project will therefore benefit from not having to waste time in the abstraction effort and proceed directly to what is most needed by industrial research.

The missing functionality present in the grid has been given to groups that are knowledgeable in grid for Finance and Economics research, both industrial and academic.

  The public scientific grid based on gLite lacks a data cache solution. Finance and Economics research of industrial type make heavy use of it; the technology is heavily used in top-tier production environments. It is important to have such a solution present in the public grid as well. The task for integrating the industrial Gemstone Gemfire data cache solution into gLite has been given to **Excelian**, with whom Gemstone has agreements on this integration effort.

  The public scientific grid is Linux based. Industry is more heavily based on MS Windows. It has therefore been decided to make an integration effort between a MS Windows based AGA grid solution developed by Avanade, into gLite. This integration task has been given to **Avanade** that is a joint venture between Microsoft and Accenture. Through this effort, AGA nodes will be able to accept jobs from the public gLite based grid, and vice versa, allowing the public grid from benefiting of access to MS Windows based nodes.

  Financial Data handling in the grid is a very delicate issue. Data comes with legally binding non-disclosure policies, which must be enforced. This task has been assigned to **ICTP** given its previous experience in the Italian EGRID project in the

development effort of the StoRM SRM server and ELFI data access client, which allowed the addition of ACLs on files in grid storage for members of the same grid Virtual Organisation.

The most ambitious part of the adaptation effort is the realisation of a full utility model for financial research. This task has been given primarily to **Excelian** and **ICTP**, with the help of **INFN** for low-level middleware interventions. Excelian knows very well the needs of industry and ICTP knows very well the public scientific grid; INFN developed some of the middleware components that may require modifications.

All these partners therefore work to achieve non-overlapping specific goals. All these goals work toward the final aim that is the E3GRID e-Infrastructure for the grid based community of research in Economics and Finance. The three main activities of Networking, Service and Joint Research, provide for division in major lines of action that are the framework within which SISSA co-ordinates the various partners. Each partner contribution and efforts feeds into the others, so this process is a consortium whose final output is E3GRID.

- **Complementarity between participants.**

The roles are very complementary. Each partner, however, does have some partial knowledge and competence also in the tasks assigned to other members: this is why some person month have been distributed also to members that expressed an interest in other member activities. But this is minimal and the main tasks are wholly in the hands of, and under the direct responsibility of, the most natural and best-suited partner.

- The service activity and hence setting up of E3GRID infrastructure is fully in the hands of the best suited partner from Academia, **INFN**, given that this infrastructure is based on the public grid gLite middleware.

- The networking and outreach activity is logistically fully in the hands of the strongest organisational partner, **CPR**, who co-ordinates the events and the other partners in order to achieve the best possible outcome.

- The academic adaptation driver is fully in the hands of important European academic institutes; similarly the industrial research adaptation driver is fully in the hands of important industry **Excelian**.

- The AGA MS Windows based integration effort is in the hands of industry that developed the product, **Avanade**; their previous knowledge of the public gLite grid will also be further augmented by the help of the other consortium members, such as ICTP and INFN, that are knowledgeable in gLite.

- The integration of Gemstone Gemfire data cache solution is done by industry consortium member that has collaborations with Gemstone, **Excelian**.

- Finally, the development of the full utility model for Finance research, is equally in the hands of industry members knowledgeable in the finance sector needs **Excelian**, and in the hands of academic partners knowledgeable in the needs of academic research and in the gLite middleware, **ICTP** and **INFN**.

So there is no overlapping of responsibilities, and more importantly the activities each partner carries out complements those of the others. Hence the complementarity between partners.

• **Well balanced composition of the consortium**

E3GRID consortium comprises 11 organisations, 9 EU based representing 5 EU countries (Member States or Associated States). There is one international organization and one developing countries participant from India. The composition of the consortium is therefore well balanced from the geographical point of view.

The consortium is well balanced among academic and industrial involvement: even if the number of industrial organizations is just two, their roles within the most articulated activity of the project is prominent and of fundamental importance for the success of the core task of the whole project: the production of the missing software grid layer, that will allow the creation of new integrated finance services.

Most of the consortium members are indeed concentrated in the Joint Research activity.They are knowledgeable and specialised in different software aspects, as well as in Economics and Finance research. Although the Service activity as well as the Networking activity are fundamental in the creation for the community, they do not need an articulate and varied presence of different competencies. Hence the concentration of such activities in single, dedicated and high-achieving organisations with a minimal contribution from other partners.So the well-balanced composition of the consortium is with respect to both geographical and the industrial/academic composition.

• **Role of industrial partners**

Important industrial partners, Avanade and Excelian, are involved in the consortium. Their role is in the Joint Research activity, where they will greatly contribute to the addition of the missing grid software layer to the public scientific grid, in order to allow Finance research to be carried out.

It is important to note again that even this project is about deploying a European e-Infrastructure for Finance research this effort must be aligned with the direction of industry. This is because an important share of Finance research is done by industry. The presence of important industrial partners will help to fulfil the above requirement and may as well favour a future use of the software results in the industrial financial sector

In this context Excelian has no precise plan; however it sees there are a significant opportunities presented by the project:

- Making use of the technology to provide a commercially viable shared utility grid that is made available on a pay-per-use basis to small banks and hedge funds that cannot (or do not want to) afford to expand resource internally.
- This would include the adaptation of some of the ISV software (Murex for example), and the creation of adapters for Platform and Datasynapse to allow offloading to the "utility" grid at peak times.

On the other hand Avanade current plans are multiple:

- One is to use the interoperability layer with gLite as a mean to connect remote Grids implemented with their current implementation and let them became discoverable and interoperable with the possibility to request Task execution on both of them from a central location.
- A second one is to use the future availability of remote accessible computing elements to further scale and extend a proprietary financial simulation software that uses the Grid to compute demanding calculations, increasing performance.

Finally

- The only subcontracting activities foreseen are the audit certificate cost for each partner and some logistic services for dissemination activities.
- C-DAC is an internationally renowned research centre based in India. Its participation in the consortium is important: its previous and long-standing experience in HPC and GRID activities within the economical and financial research will help the project to network with economics and finance research groups and companies in the Indian emerging economic realities. This will serve as a launching base for spreading E3GRID beyond Europe into Asia. We finally note the consortium will collaborate with a very active and emerging centre in grid technology, already present in another European grid initiative EUIndiaGrid.

2.4   Resources to be committed

E3GRID project will require a considerable amount of resources in term of either commodities (like e.g. storage space and CPU cycles) or specialised ones for the needs of the community. All the partners are therefore committed in providing them to the project along the lines described here:

Computational resources (CPU and Storage space):
The resources needed to start the project are mainly the above commodities and will be made available through the existing Virtual Organisation EGRID within the EGEE infrastructure. Partners of the present proposal already involved in the EGEE project (INFN and ICTP) are committed to make available them from the beginning of the proposal and for the full length of projects. It has to be noted that in the case of INFN the large amount of CPUs (around 700) will be shared among different Virtual Organisations. However INFN expansion plans should increase from 700 to 1000 cpus in the course of the project. ICTP's resources available right now (30 CPUS plus storage) in the EGEE infrastructure are made available to the project.
Other partners strongly involved in the JRA and SA activities are ready to share some computational resources from the very beginning of the project. SISSA is committed to double the number of CPU available at the end of the first year and increase this number of about another 50% by the end of the second one.
The following table reports the commitments for each partner:

Consortium member	M1		M12		M24	
	CPU	**Storage(TB)**	**CPU**	**Storage(TB)**	**CPU**	**Storage(TB)**
SISSA	50	2	100	2	150	2
UNIATH	-	-	20	0.5	20	0.5
AVANADE	10	1	10	1	10	1
UNIKIEL	-	-	8	1	8	1
UNICITY	-	-	See text	-	See text	-
CPR	-	-	-	-	-	-
EXCELIAN	20	1	20	1	20	1
ICTP	30	1	30	1	30	1
INFN	700	2	1000	5	1000	5
CNR-INFM	-	-	16	1	16	1
CDAC	-	-	-	-	-	-

It has to be noted that for pilot groups (UNIATH,UNIKIEL,UNICITY,CNR-INFM) the mobilisation and the inclusion of their commodity resources within the E3GRID infrastructure will happen during the first year. This is a strategic choice in order not to force partners at the beginning of the project with the complexity of a site installation. This is indeed not a trivial task and high level IT skills and competences are needed to install and then to maintain such a site. The project will rather prefer to count on less computational resources at the beginning and spend more time in increasing IT skills and competences in the pilot groups. Just after having prepared an fertilised soil a site can be installed and shared on the infrastructure in an efficient way.
City University and University of Kiel are willing to explore the involvement of their computer centres in order to share some of their computational resources during the first year

of the project. There then are chances to include in the project not only local resources fo single research group but also departmental/ university ones.

It's worth to mention the active role from the beginning of the industrial partners of the project, ready to contribute toward the infrastructure. There is as well a commitment from Generali Assicurazioni that is ready to consider sharing its own computational resources with the rest of the community in case of satisfactory results of the ongoing collaboration with SISSA.

Other resources: financial data

As already mentioned in many points the level and the quality of services E3GRID plans to offer on the top of the infrastructure requires other kind of resources to be shared. In particular it has to be stressed once again the fundamental role of financial data and the availability of them for high quality research. Unfortunately these kinds of data are subjected to many legal bindings and even if one group owns and wants to share them still this is not generally possible.

For this reason a certain amount of the budget (150.000 Euro, around 5% of budget) is allocated to ICTP to buy financial data available for all the partner of the project.

Other resources: availability of industrial data management tools

As described in JRA one of the aims of the project is to setup a data-caching system on the top of the available gLite middleware. In this context there will be strong commitment from external party Gemstone interested in the project (see attached letter of support) through consortium member Excelian to provide the project with 200 server and 1000 client cost free licenses of their own product. This should allow the project members to port, test, validate it on the top of the E3GRID infrastructure and make it available to the community for the project duration. This contribution has a commercial value of over 3M Euros. In order to ensure the sustainability of the project, they will be happy to enter into a pay per use model following project completion. Details and model to be established as part of the project.

It is important to note that the Gemfire product, once integrated into the E3GRID infrastructure can also be shared by other communities at a very convenient cost: EGEE member Academic institutions are infact entitled to purchase licenses from Gemstone during the project for a 75% discount off standard list piece of US$10,000 per dual core cache server and US$1,000 per dual core client processor.

Financial Plan of the project:

The overall budget of the project is in the order of 3.7 million Euro, of which less than three million is expected to come from EC contribution. The budget is distributed among partners with respect to their involvement in the project. Partners acting as Pilot Groups will receive enough money to hire a FTE person to act as power user. Partners involved in setting up and maintaining the E3GRID infrastructure will receive an adequate amount of money to run these tasks efficiently. ICTP is over the average just because it is charged with the full allocated budget for financial data acquisition. We have however to note that the acquisition will be done as consortium and not as single partner. External costs are allocated for organising the E3GRID workshops and training activities throughout the 36 month period. Finally the CDAC India the only extra-European institute is allocated with a minimum budget that should help it travel and participate in person to some of the project meetings.

Section 3.   Impact
(Recommended length for the whole of Section 3 – ten pages)

3.1   Collaborative arrangements and perspectives for their long-term sustainability

- **Arrangements**

This project will begin with collaborative arrangements set up between consortium members well represented in Europe, and will seek through networking activities to extend them to more researchers, in order to expand the E3GRID community of grid based researchers in Economics and Finance. The collaborative arrangements already agreed include principally the sharing of computational resources by at least three members of the consortium, the extension of this sharing to EGEE, and license agreements.

- Computational resources

  Italian partners INFN and SISSA, as well as Dutch industrial partner Avanade, English industrial partner Excelian, and academic International Organisation partner ICTP have all agreed to share some of their resources through out the project lifetime. Likewise there is a commitment to study the feasibility of sharing resources by the remaining Academic partners in Palermo, Athens, London and Kiel. All these resources are owned by the respective partners, and are therefore self-sustainable in that they are not being funded through this project.

  The community expansion through the networking activity will result in members inclusion in the research A.I Forum. Participation in the research A.I Forum allows for the choice of the best-suited level of involvement in the community, which includes resource sharing. Again, these resources are owned by the member, and do not receive funding from the project. So these resources live of their own, once project funding ends.

  Resources obtained from EGEE are again self sustainable. Indeed, EGEE is transiting towards a GEANT based model of self-sustainability where national grid initiatives maintain the resources in place without further funding from the EU. So long as E3GRID will have computational resources of its own, it will also have access to EGEE's resources.

- License agreements

  The most important licensing agreement of this project regards the Gemstone Gemfire data cache solution, which will be integrated into gLite. Gemstone is donating 200 server cache licenses and 1000 client cache licenses for the duration of the project. This has a value of EUR 3M. In order to ensure the sustainability of the project, they will be happy to enter into a pay per use model following project completion. Details and model to be established as part of the project. EGEE member Academic institutions can purchase licenses from Gemstone during the project for a 75% discount.

Steps needed to bring about the collaborative arrangements, include a networking activity

dedicated to promote E3GRID and so expand the community and those willing to share resources, as well as the development of the utility model, which will allow for the pay-per-use model for data caching.

Trans-European Approach

A European approach is needed for these collaboration agreements. The research efforts of the Economics and Finance research community are carried out by industrial and academic centres that are spread through out Europe. One single country does not represent the whole community. Since this project is improving the use of existing resources, it must set collaborative arrangements with those that have the resources, who as explained are present through out Europe.
Account is as well taken of the research activities and communities working on the top of the European E-infrastructure Indeed the collaboration arrangements will involve primarily EGEE, which collects many well established research communities. Liaisons with new grid enabled communities will also be explored.

The E3GRID important assumption is that the industrial research partners and members of the A.I Forum will find the sharing models reasonable. Indeed, the utility model being developed will allow for more elaborate collaboration agreements to be set up, which should better reflect industrial research needs, while the simple sharing model can satisfy the needs of Academic institutes.

3.2   Expected impacts from Access and/or Service activities

- **Contribution towards access-to/use-of the pool of research infrastructures, and new opportunities for researchers across Europe**

E3GRID is a **grid** based research infrastructure for academia and industry: each member shares owned resources with other members. E3GRID is then integrated into EGEE, which collects grid based research communities all over Europe. E3GRID therefore will be part of a pool of European research infrastructures, so its researchers will benefit from such access and use.

E3GRID contributes to the use of the pool of research infrastructures in the following ways:

- E3GRID pools its own industrial and academic research resources together, through grid technology. Clearly the researchers will need to learn how to use this technology as users. They will also need to learn how to network their resources with grid technology. This knowledge is pre-requisite to the use of the pool of resources, and this project supplies it by two means: knowledgeable consulting service for porting research applications to the grid as well as for grid site installation; and generic support web based tools such as mailing lists, user support forums, documentation, etc.

  Moreover, there is a dedicated team of people monitoring the E3GRID infrastructure, which makes sure that any service interruption is promptly addressed. This allows for accountable use of the pooled resources, since users will know that in case of any problem it will get promptly addressed. It's this assurance that will allow them to be confident on using the pooled resources as a tool for their research needs.

- E3GRID will be fully integrated into EGEE. Since EGEE pools together many research infrastructures, this project will allow its community to use and also share its own resources with many other research infrastructures.

- E3GRID will add a missing grid layer that will favour the use of pools of research infrastructures. It will be possible to access and use MS Windows based AGA research grids. The addition of data cache solution currently missing in the public gLite based grids, will allow the use of pooled resources for tackling new research problems as explained in previous sections. The utility-based tools would allow accountable, secure sharing with some degree of guarantee of service level, and this sort of model is essential for future sustainability of any pooled compute resource. Finally, by porting applications to the grid, which works on pooled resources by definition, these will become research tools needed in the daily activities of scientists; hence by extension use of pools of research infrastructures will be facilitated.

The new opportunities for researchers across Europe to use pooled resources will come from the fact that E3GRID is geographically distributed over Europe, so the European Finance and Economics research community will be able to use this facility. Then there is also integration with EGEE, which will allow reaching a much larger research community spanning many fields ranging from High Energy Physics to the Biomedical community and several others. So these other communities which are already well distributed over Europe, will have the opportunity to access the E3GRID infrastructure.

To bring about this use of pooled research infrastructures, the following steps are envisioned:

- A training activity geared towards the specific characteristics and needs of the Finance research community, in order to make it knowledgeable in grid technology.
- A support system for the community.
- Co-ordination with EGEE, which will also facilitate outreaching towards the other grid based scientific communities.
- A strong development effort by E3GRID, to add the missing grid layer functionality needed by Finance and Economics research, both industrial and academic.

This contribution to the use of pooled resources requires a European approach. First, the E3GRID researchers are spread over Europe; it is their resources that are being pooled. Second, the other research communities that will benefit from access to E3GRID resources, are already well distributed over Europe and organised in pan European initiatives. Third, the new functionality layer can only be completed by grouping together competencies that are found at the European level, that is where the researchers and hence the precise knowledge of the community's needs are found. One country does not represent well all these needs, and hence cannot satisfactorily contribute to the use of pooled resources alone.

Account is taken of other national or international research activities. Indeed since statistics, machine learning, pattern recognition, and social sciences share a large set of common computing tools, this project effort will consider networking with such communities to open pathways for research by people in all these subfields. Moreover by virtue of E3GRID integration into EGEE, it would truly be an enormous contribution to bring the EGEE infrastructure close to such a broad group of researchers.

E3GRID assumption about the use of the pooled resources is mainly concerned with the industrial research component. The Finance sector is articulate. There are Tier-1 multinational banks with very large economic resources that can afford internal departmental grids with thousands of computing nodes for production environments. They are realistically little interested in the advantages of pooling resources with the rest of the research community. Yet there are also Tier-2 banks and small hedge funds that may not afford or may not want to buy all the computing power in house. These are more realistic targets but in any case it will need some selling, and the utility model will have to be in place since the simple sharing of unused CPU time is too simplistic for industrial research.

3.3   Expected impacts from Joint Research Activities

- ### Contribution towards an optimum development of research infrastructures at the European level, and steps needed to bring about these impacts.

E3GRID will be a European infrastructure that networks together through **grid technology** European researchers in Economics and Finance. Grid technology will allow for the sharing of computational resources, whereby the unused processor time can be used by other researchers who in that moment need computing power. The infrastructure being built, therefore, makes more efficient use of computing resources, by reducing unused and thus wasted processing time. By itself the use of grid technology for a European Economics and Finance research infrastructure, is a contribution to optimal development of research infrastructures at the European level.

Moreover E3GRID will also be fully integrated into the European EGEE e-Infrastructure, which collects major grid based scientific communities such as that of CERN's High Energy Physics, the Biomedical community and many others. It will use EGEE grid middleware gLite, for networking and sharing its resources among its members as well as with EGEE. It will therefore contribute to and receive computing resources from EGEE and hence from the European research community at large. This is again a contribution towards optimal development of research infrastructures at the European level, since E3GRID is integrating with all other research communities.

However, our research community needs an extra grid software layer, which will be developed during the Joint Research Activities; since this extra grid software layer is built on top of gLite, not only will it be used by our E3GRID infrastructure but also by the EGEE infrastructure at large. So in general all our community's development efforts will be usable also by European infrastructures based on gLite. E3GRID development effort will add new functionality currently absent in gLite. It is a tangible contribution towards the further development of European research infrastructures, as currently present in the EGEE community. In particular E3GRID infrastructure developments consist of:

- Utility compute model

  The utility-based tools would allow accountable, secure sharing with some degree of guarantee of service level, and this sort of model is essential for future sustainability of any compute infrastructure. In particular industrial research may make use of such a facility and be prepared to pay. This utility concept can extend in to data as well as compute; data can be shared, secure and provided on demand (according to policy), across the grid. In particular for Finance a pay per use model can be put in place for high quality financial data, which will allow the costs to be shared between research, organisations making use of this data, based upon how much of the data they use. Other infrastructures could benefit from this model of usage, and tailor it to their specific needs.

- Data cache

Currently distribution and aggregation of compute tasks is not particularly constrained by network latencies; however the distribution of associated data can cause network bottlenecks and the I/O tasks will compete with compute tasks leading to low grid utilisation. This is a known issues especially when large amounts of data are involved, such as in Finance but also in High Energy Physics LHC experiments.

An infrastructure that is capable of data caching allows for scaling the grid and decreasing latency. It also makes classes of problems that were initially inappropriate for on boarding to the grid a reality for parallelisation. For example problems, which require large scale PDE solvers or Monte Carlo problems that can benefit from data and path caching. These technical improvements that are essential for a Finance and Economics research infrastructure and specifically to E3GRID, will also benefit all of the research infrastructures based on gLite. So European research infrastructures will benefit.

- MS Windows AGA compatibility layer.

By adding a dedicated gLite compatibility layer to AGA MS Windows enterprise grid platform for Finance, it will be possible for AGA to be integrated into Linux based gLite grids. This will help to scale to a larger and heterogeneous grid, of mixed MS Windows and Linux processing nodes, where each class of nodes has its own strengths.

It will let willing enterprises share their MS Windows machines, currently not possible in gLite based research infrastructures. The mixed environments will also allow for applications where specific parts of the overall computation can be run on the most fitting type of resources. Montecarlo simulations can be split by executing related computations on Linux parallel machines, and repetitive simple computations on a large set of standard MS Windows nodes.

This is not the final solution to allow full grid compatibility between MS Windows based grids and Linux ones. Yet it does open up important technical possibilities between the two worlds. Indeed it is a contribution towards the optimal development of European research infrastructures, because it broadens their potential access to MS Windows based resources, making for a richer infrastructure and a richer potential set of new research tools.

- Evolution of StoRM + ELFI tools and alignment to most current SRM version.

These software represent the Italian EGRID data management solution for handling of Stock Exchange strict disclosure policies, on data sold to individual research groups. It consists of the StoRM SRM server that introduced ACLs for the needs of the Economics community for members of the same virtual organisation. It includes also the ELFI client for accessing data in grid storage, which provides an integrated model to the end user as far as current public grid use of logical file names, physical file names, and file transfer mechanisms go. So the functionality supplied represents the current state-of-the-art as far as Economic data in grid storage goes.

There is an important commitment to evolve and enhance StoRM and ELFI and keep them aligned with new versions of the protocol. Our research infrastructure needs these

tools to be aligned, or else risk loosing important functionality.

This alignment of the current state-of-the-art for Economic public data grid management, with the more sophisticated SRM standard being produced, is an important contribution towards the optimum evolution of European research infrastructures. SRM is an international standard recognised by the OGF. SRM is the standard in gLite-based infrastructures for data access. The standard alignment and the fact that E3GRID is integrated into the much larger EGEE infrastructure, will allow also the other communities to benefit from the functionality present in this technical solution. Indeed, since commitments on using StoRM are already made by part of the High Energy Physics community, which is already based on EGEE, this community will benefit from its European research infrastructure using the most sophisticated version of the SRM protocol.

In order to allow these contributions to the optimal development of the infrastructure, two steps are needed:

- The software layer produced by the Joint Research Activity, will have to be integrated into the official distribution of gLite.

  Indeed, for its widespread deployment in the infrastructure, the software must be part of the official repositories of the middleware. It will then be up to each site administrator to decide for its installation. This will also be an opportunity to allow other infrastructure sites to experiment with it, before placing it in production.

- Awareness raising.

  This activity is important to advertise to the infrastructure administrators, as well as to the users, of the new functionality. Towards the administrators the awareness activity is needed to allow them to know about the technical characteristics of the tools. For the users who may then request the deployment to their infrastructure administrators, the awareness is needed to showcase results and the new opportunities offered.

- **Trans-European dimension:**

This contribution to the optimal development of the research infrastructure requires a European approach.

Finance and Economics research is not confined to a single country, but goes on at academic institutes through out Europe, as well as in industry quantitative research groups that again are not concentrated in a single country. Finance and Economics have big computational needs, as well as special data needs; the resources to be shared through grid technology are more readily found at the European level, where the research community is present.

Similarly, the creation of the missing grid software layer for our research community cannot be done by a single organisation since it requires many competencies. These

competencies are found in different partners, which do not reside in the same country; again because research is widespread around Europe, and is done by industry and academia alike. So the people that can fuel such software development are naturally found around Europe.

3.4   Dissemination and/or exploitation of project results, and management of intellectual property

- **Dissemination**

E3GRID has planned an intense dissemination activity that runs throughout the 36 month project duration including::

1. ***Project Marketing and Communicating*** the objectives and goals of the project through a variety of ways. This includes producing printed material for E3GRID events and external events, press relations, surveys, research on new targets, inviting those targets to E3GRID events as well as attending and presenting E3GRID at specifically targeted events.

2. ***New User Workshops*** organised during each year will not only allow outreaching academic and industrial researchers not yet part of E3GRID, but also aim to target them to become new users. Alternating Community Networking Workshops and Pilot User Workshops in conjunction with New User Workshops will provide participants a chance to network with potential new members as well as streamline travel costs for Pilot Users. This all leads toward the ultimate goal of the E3GRID's Product Launch Event.

3. ***Training within the E3GRID community*** focused towards users, specifically using the grid in general and for porting applications will focus towards forming power users, for sharing each partner resources with grid technology and providing the platform to learn the systems and the know-how to impart to their respective organisations within the Pilot Users and the Community.

4. ***Participation in international conferences*** to disseminate research results to foster the increase of awareness in terms of results achievable through E3GRID as well as participation in specific financial sector events and standardisation events.

5. ***Project web portal*** containing documentation, forums, mailing lists, etc. These will support the E3GRID community and serve as one of the main sources of information to users, operators and interested parties of other academic and industrial institutes or organisations.

6. E3GRID will harness each of the ***partners' databases*** of international contacts to whom the project can target its messages.

- **Management of knowledge**

E3GRID will produce a considerable extra grid software layer on top of EGEE's gLite. This effort will be done by academic partners as well as by industrial partners. Generally, the licenses will be academic friendly:

- Software tools/libraries/programmes produced by the academic partners will be open source and freely available to the community. Authors will be clearly identified. The exact license type will be decided by the partners.
- Software developed by the industrial partners will have proper academic licenses.

Avanade is committed to give its AGA adaptation layer for free to the community. Excelian's development of quantitative research use cases will also be given to the community for use as starting point for further research. The utility compute model developed jointly by Excelian and ICTP will be free as in free lunch for every one, not only academics.

- The adaptation of Gemstone Gemfire data cache solution will be free to the community. The main issue is Gemstone Gemfire data cache itself. Gemstone is donating 200 server cache licenses and 1000 client licenses for the duration of the project. This has a value of EUR 3M. In order to ensure the sustainability of the project, they will be happy to enter into a pay per use model following project completion. Details and model to be established as part of the project. EGEE member Academic institutions can purchase licenses from Gemstone during the project for a 75% discount.

Lastly, this research community has important involvement from industry. Banks and Financial institutions in general may find value in the results of each researcher's activity. This project creation of the A.I Forum acts as meeting place where scientists from academic and industrial sector can meet. Exchanges of ideas and possible cross interests are certainly favoured: it is up to each single party to understand how to best proceed for exploitation of the results. This project's A.I Forum supplies the place where such networking can take place.

- **Management of Intellectual Property.**

As E3GRID integrates industrial partners within the project and aims at future, industrial utilization of the proper results, IPR management is an issue which has to be taken into consideration.

The IPR strategy under FP7, follows very much in the same vein as the FP6 requirements, where the encouragement of the adoption of detailed Consortium Agreement (CA) at the beginning of the activities is standards practice and as outlined in the E3GRID management section. The CA will include any sensitive issues of IPR, and the structure and organisation of the project, including:

     –   The specific management of IPR regarding knowledge held by Universities or other academic/public participant;

     –   The exclusion of background and the rights of the other parties to know of such limitation;

     –   The possibility of agreeing upon an economic access rights regime regarding access to background;

     –   Other rules for knowledge transfer.

     –   The internal organisation of the consortium, reporting mechanisms, controls, penalties and management arrangements;

     –   Outline of the distribution of the Community contribution between participants and among activities;

     –   Provisions for the resolution of internal consortium disputes

Section 4.   Ethical Issues

E3GRID will collect information on scientific organisations and industries as well as individuals in relation to the dissemination events organised, and the membership of the E3GRID Community Portal. All partners will abide to national data protection laws. Online forms will comply with EU law with respect to the proposed uses of any personal information provided. Information will be primarily used to help identify industries and scientific communities with an interest in research cooperation or exploitation of ICT related research results based on their profile, skills and experience.

In accordance with the Data Protection Directive, 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, the consortium will not disclose personal details to third parties without prior consent from the individuals concerned. Such personal information will be stored in a secure, encrypted database. In general, registered members of the E3GRID Community Portal will be responsible for keeping their organisational and personal data up to date, and as part of the self-service publishing functionality of the portal, can choose what information to publish and what is to remain private.

Other than Data Protection, there are no ethical issues associated with E3GRID.

ETHICAL ISSUES TABLE

	YES	PAGE
Informed Consent		
• Does the proposal involve children?		
• Does the proposal involve patients or persons not able to give consent?		
• Does the proposal involve adult healthy volunteers?		
• Does the proposal involve Human Genetic Material?		
• Does the proposal involve Human biological samples?		
• Does the proposal involve Human data collection?		
Research on Human embryo/foetus		
• Does the proposal involve Human Embryos?		
• Does the proposal involve Human Foetal Tissue / Cells?		
• Does the proposal involve Human Embryonic Stem Cells?		
Privacy		
• Does the proposal involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)		
• Does the proposal involve tracking the location or observation of people?		
Research on Animals		
• Does the proposal involve research on animals?		
• Are those animals transgenic small laboratory animals?		
• Are those animals transgenic farm animals?		
• Are those animals cloned farm animals?		
• Are those animals non-human primates?		
Research Involving Developing Countries		
• Use of local resources (genetic, animal, plant etc)		
• Benefit to local community (capacity building i.e. access to healthcare, education etc)		
Dual Use		
• Research having direct military application		
• Research having the potential for terrorist abuse		
ICT Implants		
• Does the proposal involve clinical trials of ICT implants?		
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	YES	

Section 5.   Consideration of gender aspects

As established in Articles 2 and 3 of the Treaty of Rome the equality between women and men is a specific task of the European Community, as well as a horizontal objective affecting all Community tasks. The Treaty seeks not only to eliminate inequalities, but also to promote equality.

E3GRID will raise awareness, in Research, Industry & Education fields that the different perspectives of males and females can be of particular benefit and importance to Research Infrastructure activities, as well as gender dimensions to be considered in the development of the knowledge based society.

All organisations involved in E3GRID project are equal opportunity employers or actively safeguard gender equality. That means that all employees should have equal opportunity for employment and advancement on the basis of their ability, qualifications and suitability for the work. No job applicant or employee receives less favourable treatment in any aspect of employment on gender, or furthermore, on the grounds of racial, religion, disability, marital status, age or sexual orientation and caring responsibilities or be disadvantaged by conditions or requirements which cannot be shown to be justifiable.

In particular, within the E3GRID consortium the following considerations of gender aspect have been made:

- Two Consortium members in academic research are lead by women: Professor Giulia Iori of City University in London, and Dr. Medha Dhurandhar, Chief Investigator of C-DAC
- There is excellent gender balance within the E3GRID consortium. Several partners will utilize female key personnel during project development. Finally, all partners plan to employ a well-balanced mix of genders in their E3GRID teams.

These women occupy top positions within their home organisations. Within the consortium, they occupy relevant and important positions, both as far as the research community is concerned but also in the successful creation of the E3GRID community. Indeed, the crucial grid adaptation effort is also guided by them.

As part of the E3GRID workshop and training events which will take place in the different countries, the partners will ensure that there is adequate discussion on challenges women in Industries face in participation in RTD or access to and use of the Grid e-Infrastructure in their daily working lives, and to suggest ways in which these challenges can be overcome to help women fully gain more opportunities for social and economic empowerment which Grid e-Infrastructure enables.

Therefore gender is not an issue, as the whole project is focused on achieving the end results by employing the best fitted people for the job, regardless of gender.

APPENDIX I: Letters of support

(1) Letter of interest from Monte dei Paschi di Siena MPS

Page 1 of FAX from MPS:

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09.APR.2022 08:16 0577295030          SEG.AMM.DELEGATO          #0266 P.001 /002
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CONSORZIO OPERATIVO GRUPPO MPS

MESSAGGIO TELEFAX

da: Consorzio Operativo Gruppo M.P.S.

Sede sociale in Siena - Via Ricasoli, 60
Fondo Consortile Euro 129.870.859,50
Codice fiscale, Partita IVA e
Iscrizione nel registro delle Imprese 00970710521
Gruppo Bancario Monte dei Paschi di Siena - Codice Gruppo 1030.6

SEGRETERIA AMMINISTRATORE DELEGATO

FAX 0577/295030

In caso di ricezione incompleta
o illeggibile riferirsi ai numeri: **(TEL. 0577/299968)**
                                                      (Rif. ...pb/.....)

destinatario: Dott. STEFANO COZZINI
                  E3GRID PROPOSAL COORDINATOR
TELEFAX   SISSA ELAB

                  040 - 2240 7335

oggetto:

E3GRID PROJECT MEMBERSHIP FORUM PARTECIPATION

....

....

(il messaggio è di n. 2 pagine, incluso questo foglio)

GRUPPO MPS

Page 2 of FAX from MPS:

CONSORZIO
OPERATIVO
GRUPPO MPS

Siena, 24/04/2007

Funzione Osservatorio Tecnologico

dott. Stefano Cozzini
E3GRID proposal coordinator
SISSA eLab
via Beirut 2/4
34014 Trieste

OGGETTO: E3GRID Project.

Dear Stefano Cozzini,

Consorzio Operativo Gruppo MPS is interested in the E3GRID project and would like
to be part of the Academia-Industry forum, which is the formal mechanism to be part
of this grid based research community in Economics and Finance that's being
created. Through this membership full interaction with the consortium is possible.

By being a member of the forum, Consorzio Operativo Gruppo MPS can decide the level
of involvement that best suits its interests. It ranges from being an informed but
passive interested party, right to full involvement which includes:
sharing of computing resources and receiving the community's, receiving general
support for application porting and installation of a grid site, have a saying in
the strategic direction of the community, pointing out initiatives of interest, and
generally contributing to the further development of the community.

Yours sincerely, Piero Poccianti

Funzione Osservatorio Tecnologico
Il Responsabile

(2) Letter of support from Universita degli Studi di Firenze – Department of Statistics:

23- 4-07;10:53   ;   ;0554223560   # 1/ 1

Università degli Studi di Firenze
Dipartimento di Statistica
Giuseppe Parenti

Il Direttore
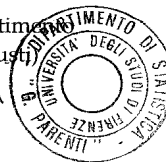
Firenze, 23 April 2007
Protocollo n. 442 pos. III 13

Dear Stefano Cozzini,

The Department of Statistics "G. Parenti" of the University of Florence is interested in the E3GRID project and would like to be part of the Academia-Industry Forum, which is the formal mechanism to be part of this grid based research community in Economics and Finance that's being created. Through this membership full interaction with the consortium is possible.

By being a member of the forum, the Department of Statistics "G. Parenti" can decide the level of involvement that best suits its interests. It ranges from being an informed but passive interested party, right to full involvement which includes: sharing of computing resources and receiving the community's, receiving general support for application porting and installation of a grid site, have a saying in the strategic direction of the community, pointing out initiatives of interest, and generally contributing to the further development of the community.

Il Direttore del Dipartimento
(Prof. Antonio Giusti)

✉ Viale Morgagni, 59 - 50134 Firenze (Italy)   💻 dipstat@ds.unifi.it   ☎ 0554237211   🖷 0554223560

(3) Letter of support from King's College – Financial Mathematics Group:

Department of   Strand
Mathematics   London WC2R 2LS
                      Tel 020 7848 2217/2216/2107
                      Fax 020 7848 2017

KING'S
College
LONDON

University of London

Tuesday, 24 April 2007

Dear Stefano Cozzini,

The Financial Mathematics Group of King's College London is interested in the E3GRID project and would like to be part of the Academia-Industry forum, which is the formal mechanism to be part of this grid based research community in Economics and Finance that's being created. Through this membership full interaction with the consortium is possible.
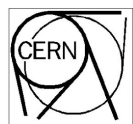
By being a member of the forum, the Financial Mathematics Group of King's College can decide the level of involvement that best suits its interests. It ranges from being an informed but passive interested party, right to full involvement which includes: sharing of computing resources and receiving the community's, receiving general support for application porting and installation of a grid site, have a saying in the strategic direction of the community, pointing out initiatives of interest, and generally contributing to the further development of the community.

Yours sincerely,

Ian Buckley
Lecturer in financial mathematics
Financial mathematics group

(4) Letter of support from EGEE:

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

GENEVE, SUISSE
GENEVA, SWITZERLAND

eGee
Enabling Grids
for E-sciencE

Mail address:
Bob Jones
CERN, IT Department / EGE group
CH-1211 GENEVE 23
Switzerland

E-mail : bob.jones@cern.ch

Votre référence/Your reference:
Notre référence/Our reference:LoS E3Grid

Stefano Cozzini
E3GRID Proposal coordinator
SISSA eLab
via Beirut 2-4
34014 Trieste Italy

Geneva, April 20, 2007

Dear Dr Cozzini,

This is a letter to show my support for the E3Grid project proposal. On behalf of the EGEE consortium, I wish to confirm our willingness to work with the E3Grid project which aims at deploying a grid infrastructure to address the increasing computational needs of the Economics and Finance research community, currently under represented in the scientific communities working on the top of the major European e-Infrastructures.

The challenge of this project is to bring the financial industry's clear awareness of the GRID as key-enabling technology for cutting-edge production environments, into the academic financial research community. From EGEE's side, we can offer access to use our gLite middleware services and the E3Grid project will specifically supply innovative software solutions for making this new user community benefit from computing services. We will use our EGEE funds to offer training services and hope that you will ensure your partner(s) have sufficient funds to visit EGEE experts and attend EGEE events.

EGEE is integrating national, regional and thematic computing and data Grids to create a global Grid-empowered infrastructure for the support of several scientific applications. The E3Grid proposal will give EGEE an excellent opportunity to work with a very interesting user community, and thus give us useful input on our infrastructure.

The EGEE consortium involves more than 90 leading institutions in 36 countries, federated in regional Grids, with a current combined capacity of over 20'000 CPUs, the largest international Grid infrastructure ever assembled.

My colleagues and I look forward to the opportunity of a fruitful collaboration and wish you and your project the best of luck.

Yours sincerely,

Bob Jones
EGEE-II Project Director

(5) Letter of support from Gemstone

Page 1 of FAX from Gemstone:

04/25/2007 10:39   5035333230   GEMSTONE   PAGE 01

GEMSTONE

GemStone Systems, Inc.
1260 N.W. Waterhouse Ave., Suite 200
Beaverton, Oregon 97006

facsimile transmittal

To:	Stefano Cozzini	**Fax:**	+39-040-22407549
From:	Donovan Snyder	**Date:**	4/25/2007
Ph:	503/533-3443	**Fax:**	503/533-3230
Re:	E3GRID	**Pages:**	(Including cover) 2

☐ Urgent   ☐ For Review   ☐ Please Comment   ☐ Please Reply   ☐ Please Recycle

Notes
Here is a letter from Richard Lamb concerning the E3GRID. Thank you.

This facsimile may contain confidential and/or attorney-client privileged materials. Please deliver to the intended
recipient immediately. If received by someone other than the intended recipient, please call the sender at the number
above and destroy all pages of this transmission.

Page 2 of FAX from Gemstone:

GEMSTONE

GemStone Systems, Inc.
1260 N.W. Waterhouse Ave., Suite 200
Beaverton, Oregon 97006
Tel:(503) 533-3000 Fax:(503) 533-3230

April 25, 2007

Stefano Cozzini
SISSA
via Beirut 2/4
34014 Trieste
ITALY

Dear Stefano:

GemStone Systems, Inc. is interested in supporting the E3GRID project and would like to be part of the research Academia-Industry forum, which is the formal mechanism to be part of the newly created grid based research community in Economics and Finance. Through this membership we look forward to greater involvement with the consortium.

By being a member of the forum, GemStone will engage at various levels that best suit our interests and those of the consortium. This will range from being an informed but passive interested party to full participation which includes sharing computing resources, receiving general support for application porting and installation of a grid site, providing advice regarding the strategic direction of the community, pointing out initiatives of interest within the finance sector and other sectors, and generally contributing to the further development of the community.

It will be our pleasure to donate 200 cache server processor licenses and 1,000 client processor licenses for the duration of the project according to the terms of our Standard Software License Agreement. This has a value including support and maintenance of circa €3m. Following project completion and in order to ensure the sustainability of the project, GemStone will be happy to enter into a pay per use model. Pricing details and model will be established as part of the project. EGEE member Academic institutions can purchase licenses from GemStone during the project for a 75% discount off our standard list prices of US$10,000 per dual core cache server processor and US$1,000 per dual core client processor licenses.

We look forward to working with you and supporting you and your colleagues in their endeavors.

Yours sincerely,

Richard Lamb
President
GemStone Systems Inc.

(6) Letter of support from Generali Assicurazioni

GENERALI
Assicurazioni Generali S.p.A.

Direzione Centrale

Trieste, 26th April 2007

Dear Stefano Cozzini,
E3GRID proposal coordinator

Assicurazioni Generali, having a longstanding co-operation with SISSA on the subject of computational finance applied to portfolio optimization, asset allocation and risk management, looks with interest to the E3GRID project. Indeed, the future problems of this joint research program will surely need heavily computational resources that could fit with E3GRID infrastructure.

Said that, Assicurazioni Generali is interested to attend to the works of the Academia-Industry forum, which is a prerequisite to take part this grid based research community in Economics and Finance being created. Through this involvement full interaction with the consortium is possible.

By attending the works of the Academia-Industry forum Assicurazioni Generali can decide from time to time the level of involvement that best suits its interests. It ranges from being an informed but passive interested party, right to full involvement which includes: sharing of computing resources and receiving the community's, receiving general support for application porting and installation of a grid site, have a saying in the strategic direction of the community, pointing out initiatives of interest, and generally contributing to the further development of the community.

Assicurazioni Generali is already committed to consider sharing with the rest of the E3GRID community a certain amount of computational resources, within the first year of the project, depending on computational load associated with the ongoing research program.

Yours sincerely,

Assicurazioni Generali