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**FIRST CROSSGRID YEARLY REPORT**

**WP5.1**

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Abstract: This is the first yearly report of the CrossGrid Project, to be submitted to the EU Brussels office. It details the progress achieved within CrossGrid during its first year of operation.



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## 1. EXECUTIVE SUMMARY

This document summarizes the work done within the CrossGrid project in its first year of operation. The document starts by explaining the concepts underlying CrossGrid and describing its basic work units (called Work Packages). Afterwards, we present brief summaries of actions undertaken in each of the first year's four quarters (starting from March 2002), followed by a list of first year's deliverables and milestones. Section 6 is devoted to co-operation with other Grid research projects, in Europe and overseas, while Section 7 details dissemination activities undertaken by Project partners. The document also contains confidential information regarding the allocation and utilization of resources and a list of issues which have arisen during the first year. In conclusion, the authors present an overview of the Project's short- and long-term future.

This document partially overlaps with quarterly reports delivered after each three months of the Project's operation. Where appropriate, references have been provided to external documents and deliverables.

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## 2. LIST OF ABBREVIATIONS

5FP	5th Framework Programme
6FP	6th Framework Programme
AT	Architecture Team
CERN	Centre Européenne pour la Recherche Nucléaire
CG	CrossGrid
CVS	Concurrent Versioning System
EDG	European DataGrid
EGEE	Enabling Grids for E-Science and industry in Europe
G-PM	Grid-enabled Performance Monitoring
GAT	Grid Application Toolkit
GGF	Global Grid Forum
GLUE	Grid Laboratory Unified Environment
GPDK	Grid Portal Development Toolkit
HEP	High-Energy Physics
IRB	Internal Review Board
IST	Information Society Technologies
M1, M2, (...)	Month 1, Month 2 (and so on)
MPI	Message Passing Interface
OGSA	Open Grid Services Architecture
PM	Person-Month
PPB	Publication Policy Board
QA	Quality Assurance
QoS	Quality of Service
SRS	Software Requirement Specification
TAT	Technical Architecture Team
UML	Unified Modelling Language
VO	Virtual Organization
WP	Work Package

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### 3. BIBLIOGRAPHY

- [ANNEX] CrossGrid Technical Annex; [http://www.eu-crossgrid.org/CrossGridAnnex1\\_v31.pdf](http://www.eu-crossgrid.org/CrossGridAnnex1_v31.pdf)
- [FRAME] The CrossGrid - DataGrid Collaboration Framework; [http://www.eu-crossgrid.org/cooperation\\_dg.htm](http://www.eu-crossgrid.org/cooperation_dg.htm)
- [QR1] CrossGrid Deliverable D5.1.1 (First Quarterly Report); confidential
- [QR2] CrossGrid Deliverable D5.1.2 (Second Quarterly Report); confidential
- [QR3] CrossGrid Deliverable D5.1.3 (Third Quarterly Report); confidential
- [QR4] CrossGrid Deliverable D5.1.4 (Fourth Quarterly Report); confidential

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## 4. INTRODUCTION

This section introduces the main part of the yearly report. We start by detailing some essential information regarding the Project and listing its first years' deliverables and milestones. Written deliverables are appended to the Yearly Report on an accompanying CD.

### 4.1. WHAT IS CROSSGRID

CrossGrid is a three-year research project, funded by the European Union within the 5th Framework Programme, and - more specifically - as part of the IST (Information Society Technologies) Programme, which constitutes part of the 5FP. The Project's aim is to extend the area of Grid computing to cover a new and societally important category of applications, which are characterized by the presence of a person in a computing loop, i.e. a human agent, who - basing on the data supplied by the system - makes informed decisions as to the direction in which the calculations should proceed. These kinds of applications place heavy stress on QoS and real-time responses, which wasn't hitherto a characteristic of early Grid designs. CrossGrid comprises five separate work units, called Work Packages (WPs), which are further subdivided into tasks. These are described in detail in [ANNEX]; below is a short description of each Work Package.

#### 4.1.1. Work Package WP1: CrossGrid Application Development

The main objective of this work package is to design and develop large-scale Grid-enabled applications for simulation and visualization that require real-time responses from the system. The main challenges are the distribution of source data, simulation and visualization tasks, virtual time management, simulation/visualization rollback due to user actions, and platform-independent VR visualization. This work package provides a representative collection of sample applications from various fields that can exploit the specific interactive functionalities developed in the CrossGrid project. Their need for specific services and their performance characteristics provides a driving force for other software development-related work packages. The applications will serve as benchmarks for CrossGrid performance, and crucially, they will demonstrate within their respective fields the added value provided by Grids in general, and technology developed by the CrossGrid project in particular.

#### 4.1.2. Work Package WP2: Application Development Support

For end users and program developers, one of the critical aspects of the Grid is its complexity. The development, debugging and tuning of parallel and distributed applications on the Grid is difficult and tedious due to the fluid and heterogeneous nature of the Grid infrastructure, which incorporates numerous hardware and software components. The aim of this work package is to specify, develop, integrate and test tools that facilitate the development and tuning of parallel distributed, compute- and data-intensive, interactive applications on the Grid. Verifying that user applications comply with the MPI standard will reduce the need for debugging sessions on the inhomogeneous Grid environment. In order to make parallel applications portable and reproducible, this work package develops a debugging and verification tool for MPI programs. Efficiently using the Grid as an environment for large-scale interactive applications requires the end-users to monitor and analyze the performance of their jobs. To this end, tools are being developed that automatically extract high-level performance properties of Grid applications. In addition, online performance monitoring

tools are being developed to analyze performance data for detecting bottlenecks within applications. Custom-tailored benchmarks are being prepared with regard to data transfer, synchronization, I/O delay and CPU utilization. Taken together with the monitoring tools, they will allow analysis of the system at any level of granularity, from the Grid level down to the process level.

The tools developed in this work package will be integrated into the testbed and will be promoted by and tested with the real end-user applications of WP1.

#### **4.1.3. Work Package WP3: New Grid Services and Tools**

As a lot of Grid services and tools are already available and ready to be used, we only focus on those which are necessary for development of interactive compute- and data-intensive applications, and which have not been addressed in other Grid projects, as well as on services necessary for end users.

Among others, this WP addresses user-friendly Grid environments. Portal access to the Grid infrastructure and user applications, independent of the user location, is very important from the practical point of view. According to the questionnaire on Grid user requirements analyzed by the ENACTS project, more users would be interested in Grids as soon as such services become more easily accessible. Portal technologies, such as the Grid Portal Development Toolkit (GSDK), and iPlanet, have already started to address this issue, however, no practical implementations exist so far. One of the portal features that we are implementing is roaming access, i.e. a mobile personalized environment. Secondly, we are addressing the construction of new resource management techniques based on self-adaptive scheduling agents for scheduling particular parallel applications submitted to the Grid. The goal is to achieve a reasonable trade-off between resource usage efficiency and application speedup, according to the user's optimization preferences. As our third objective, we are developing a prototype infrastructure for the needs of monitoring-related activities for automatic extraction of high-level performance properties and for tool support for performance analysis in work package 2.

Deployment of these new Grid tools and services on the CrossGrid testbed will enable us to test them in the final user environment, and will provide feedback to the tool developers.

#### **4.1.4. Work Package WP4: International Testbed Organization**

The role of the international testbed is to assure the integration of all the applications, programming tools and new Grid services developed in this Project. Organizational issues, performance and security aspects, including network support, can only be evaluated with a testbed relying on a high-performance network (which is provided by the Géant project), with participation of an adequate number of computing and data resources distributed around Europe. The main objectives of the testbed organization are to:

- provide distributed computer resources where the Project developments can be tested in a Grid environment,

- integrate national Grids,
- integrate software developed within the Project,
- co-ordinate software releases,
- assure interoperability with other Grids, in particular with DataGrid,
- support the construction of Grid testbed sites across Europe.

Testbed sites are placed in 10 different institutions distributed across 9 different European countries, significantly expanding the Grid community.

#### **4.1.5. Work Package WP5: Project Management**

This work package is devoted entirely to coordination, management and dissemination of project results. It develops no software but instead is aimed at managing other work packages. Within work package 5 there are such entities as the CrossGrid Architecture Team, devoted to developing the overall architecture of CrossGrid and its standard operating procedures, the Internal Review Board, the role of which is to review project documentation, the Dissemination Board, which publicizes information regarding the project and promotes it on an international scale, and finally the Project Steering Group which oversees the organizational issues pertaining to CrossGrid.

### **4.2. LIST OF FIRST YEAR'S CROSSGRID MILESTONES AND DELIVERABLES**

This section lists the CrossGrid milestones and deliverables due in the first year of the Project. Written deliverables are supplied on a CD distributed to project reviewers and selected partners together with this report. For a complete list of deliverables of all three years, please refer to [ANNEX].

#### **4.2.1. Deliverables due**

The following deliverables have been prepared in the first year of the Project.

##### **Work package 1, Task 1.0**

- D1.0.1: Joint requirements definition document (M3)
- D1.0.2: Semi-annual managerial report for WP1 (M6)
- D1.0.3: Extended yearly managerial report for WP1 (M12)

##### **Work package 1, Task 1.1**

- D1.1.1: Application description including use cases for Task 1.1 (M3)
- D1.1.2a: Internal progress report (M12)
- D1.1.2b: First internal software release (M12)

**Work package 1, Task 1.2**

- D1.2.1: Application description including use cases for Task 1.2 (M3)
- D1.2.2a: Internal progress report (M12)
- D1.2.2b: First internal software release (M12)

**Work package 1, Task 1.3**

- D1.3.1: Application description including use cases for Task 1.3 (M3)
- D1.3.2a: Internal progress report (M12)
- D1.3.2b: First internal software release (M12)

**Work package 1, Task 1.4**

- D1.4.1: Application description including use cases for Task 1.4 (M3)
- D1.4.2: Internal progress report on migration of data mining algorithms to Grid structure (M12)

**Work package 2**

- D2.1: General requirements and detailed planning for programming environment (M3)
- D2.2: WP2 internal progress report (M6)
- D2.3: Demonstration and report on WP2 initial prototypes (M12)

**Work package 3**

- D3.1: Detailed planning for all the tools and services including use cases for WP3 (M3)
- D3.2: WP3 internal progress report (M6)
- D3.3: First prototype - initial WP3 software release for health and HEP applications build on local Grid infrastructure (M12)

**Work package 4**

- D4.1: Detailed planning for testbed setup (M3)
- D4.2: First testbed set-up on selected sites (M6)
- D4.3: WP4 internal status report (M9)
- D4.4: First testbed prototype release (M10)

**Work package 5, Task 5.1**

- D5.1.1-D5.1.4: Quarterly reports (M3, M6, M9, M12)
- D5.1.13: Extended yearly managerial report (M12)

**Work package 5, Task 5.2**

- D5.2.1: Quality Assurance Plan (M3)
- D5.2.2: CrossGrid architecture requirements and first definition of architecture (M3)
- D5.2.3: Full description of the CrossGrid Standard Operating Procedures and specification of the structure of deliverables (M6)
- D5.2.4: Report on requirements for integration and interoperability with DataGrid (M12)

**Work package 5, Task 5.3**

- D5.3.1: CrossGrid Web pages (M3)
- D5.3.2: Dissemination and exploitation plan (M6)
- D5.3.3 - D5.3.4: Public (industrial) presentations (M6, M12)
- D5.3.9: Project leaflet/brochure (M11)
- D5.3.12: Dissemination and exploitation report (M11)
- D5.3.15: Yearly collaboration meeting (M11)

**4.2.2. First year's milestones**

This section lists the milestones which have been scheduled for the first year.

**Work package 1**

- M1.1: Application descriptions and use cases for all applications; requirements to other Work Packages, identification of principal common tasks (M3)
- M1.2: First software releases (M12)

**Work package 2**

- M2.1: Definition of requirements (M3)
- M2.2: First prototypes - software tools (M12):
  - For Task 2.2: containing the subset of MPI calls required by end user applications, running in a local environment,
  - For Task 2.3: containing the benchmarks, running in a local environment
  - For Task 2.4: containing the instrumentation software and local monitoring modules, for a homogenous platform with examples of automatic extraction of specialized properties and selected visualizers

**Work package 3**

- M3.1: Definition of requirements (M3)
- M3.2: First prototype (running on a local Grid) for health and HEP applications (M12):

- For Task 3.1: Batch application running
- For Task 3.2: Self-adaptive scheduling agents
- For Task 3.3: Separate components: monitors and managers
- For Task 3.4: Analytical expert system for migration strategies

**Work Package 4**

- M4.1: Testbed setup plan (M3)
- M4.2: First testbed on selected sites (M6)
- M4.3: First CG testbed release (M10)

**Work Package 5**

- M5.1: Successful completion of the first EU review (M12)

## 5. FIRST YEAR'S ACTIVITIES

During its first year, CrossGrid has gone out of its conceptual and design phases and entered the implementation and refinement phase, which will last throughout the remainder of the Project's lifecycle. Specific progress, with regard to each work package and task is presented in the appropriate Quarterly Reports (see [QR1], [QR2], [QR3] and [QR4]); this section details the key achievements of the first year.

### 5.1. FIRST QUARTER

The CrossGrid project started on March 1, 2002, although it was expected to start on January 1, 2002, which was reflected by our original planning. This unexpected delay caused some difficulties in financing the planned operations for January-February (recruitment, travels), however most of the working meetings went as planned, although with limited participation. The first CrossGrid Conference (the so-called "kick-off" meeting) took place in Cracow on March 17-20, 2002, with about 80 participants, most of them from abroad. The meeting was productive, with an impressive set of "software requirement specifications" (SRS) draft documents, based on IEEE standards, being handed out. The overall project architecture was precisely defined, which allowed for fruitful discussions within each of the technical Work Packages. In some cases different views on the planned developments were observed, which called for further discussions. The managerial structures of the project were approved by the CrossGrid Collaboration Board. The workplan for the coming months was defined and the procedure of internal reviews was accepted.

The conference was accompanied by a Globus tutorial presentation, by Lee Liming, a member of Ian Foster's Globus development team at the University of Chicago. Fabrizio Gagliardi and Robert Jones presented the DataGrid project and its architecture, as well as a general overview of EU Grid projects.

A CrossGrid steering group meeting, with the participation of DataGrid leaders (F. Gagliardi and R. Jones) discussed the collaboration framework for both projects, with particular emphasis on the architecture, and on the integration of testbeds along with their interoperability.

The conference is documented in two volumes of proceedings, and all materials can be found at [http://www.cyfronet.krakow.pl/eucgc1/post\\_confer/papers\\_pdf.htm](http://www.cyfronet.krakow.pl/eucgc1/post_confer/papers_pdf.htm). In April, subsequent versions of most of the SRS documents were produced. At the end of April they were reviewed by the CrossGrid Architecture Team (AT), and detailed comments were provided to the authors. Working discussions of developers and the Architecture Team took place, either in person or via tele- or videoconferencing, to clarify critical points and emphasize clarity (explaining how the application is going to work on a Grid), practicality (do not go for academic developments – be pragmatic) and interoperability (learn what is provided by Globus, learn the DataGrid architecture and software). These initial reviews and discussions helped trim and straighten out several ideas and obtain good coherency between applications and software developments. The Architecture Team played an essential role in guiding the elaboration of Software Requirement Specifications with special regard for both existing and envisioned Grid technologies and development tools.

The main achievement of Work Package WP1 was a detailed descriptions of four applications which would run on the Grid. A set of requirements specifications with regard to addressed to both programming tools and new Grid services was developed, along with a description of the functionality of all application components and use cases.

Work Package WP2 defined in a precise fashion the functionality of tools for MPI verification, benchmarking, and performance evaluation which will support development of Grid-enabled applications. The structure of this tool environment was also well established. Work Package WP3 established the functionality and internal structure of portals, roaming access, resource management, Grid monitoring, and optimization of data-access Grid services. These new services built on top of those available from Globus and DataGrid middleware.

The testbed developments were on a parallel track and in close cooperation with DataGrid; aiming for interoperability, making use of their experience or even planning rapid integration tests. A minimal testbed configuration was defined and most of partners involved have purchased the necessary hardware. Certificate Authorities in seven countries: (Slovakia, Germany, Poland, Cyprus, Spain, Greece, Portugal) were established. CrossGrid Virtual Organizations (VOs) were defined following the DataGrid schema: one for the testbed and one for each of the applications (with the HEP task planning to join the EDG VO). Infrastructure support to CrossGrid members has been established: this involves a software SourceForge repository, a help desk (together with EDG) and QoS working groups. Plans for first integration tests with the DataGrid testbeds crystallized, and these tests were scheduled for September-October 2002.

In parallel, the CrossGrid managerial structures have been strengthened. The Internal Review Board (IRB) has been composed of about two dozen specialists, who should review the CrossGrid documents and software. Most of the QA engineers have been identified – we aim for one per Work Package. A Publication Policy Board (PPB) began operation. Monthly reports for every partner concerning technical, managerial and dissemination activities were introduced, providing materials for the Quarterly Report. The IRB started a review process for the deliverables in mid-May – since then, it has played an essential role in improving the content and the quality of these documents.

## 5.2. SECOND QUARTER

In accordance with the Technical Annex, the period spanning June through August 2002 saw focus on the improvement of the software requirements specifications, implementation of CrossGrid architecture by every Work Package and task, and development of detailed software design, together with a first definition of corresponding interfaces for all software modules developed within the Project. A parallel effort was directed toward the deployment of testbeds and their integration with the DataGrid middleware software and infrastructure.

The main effort of Work Package WP1 (Cross Grid Application Development) concerned detailed analysis of potentially available solutions for interactive applications, analysis of currently available application code, design of new software components for all applications within the framework of this WP and acquiring initial experience with the Globus Toolkit. WP1, together with Technical Architecture Team, started research on the development of reusable distributed components for interactive applications, which will be of generic nature for other applications.

Work Package WP2 (Grid Application Programming Environment) concentrated on the detailed design of

- the MPI code debugging and verification tool,
- metrics and benchmarks,
- the performance analysis tool,

together with a detailed definition of interfaces between tools.

This work was done in collaboration with tasks from WP3 working on new Grid services.

Work Package WP3 (New Grid Services and Tools) focused on the reanalysis of the software requirement specifications and detailed design of the following new Grid services

- portals and roaming access,
- Grid resource management,
- Grid monitoring (four systems),
- optimization of data access.

The important achievements of this WP during the second quarter were:

- analysis of security issues and the first proposals of relevant solutions,
- a detailed description of the test and integration procedures.

The design artifacts elaborated in WP2 and WP3 are expressed using UML which became the standard formal language for the Project.

The effort of Work Package WP4 (International Testbed Organisation) concentrated on preparing Certificate Authentication documents for those countries which had not previously possessed them (Cyprus, Greece, Germany, Slovakia, Poland), installing new Globus-DataGrid software, and integrating the first CrossGrid testbeds with the DataGrid. Germany (FZK) and Portugal (LIP) were the first new CrossGrid sites to go online during summer (Spain and Ireland has already been part of DataGrid testbeds before). A CrossGrid Virtual Organisation was set up by LIP, including a Resource Broker, to allow for internal testing.

The Project Management (Work Package WP5) concentrated on the implementation of the common approach to the CrossGrid architecture in all Work Packages of the Project, as well as on analysis of current trends in Grid technology; especially of a web services-based approach (called OGSA) and the developments of other Grid projects (DataGrid in particular). At the beginning of the second quarter WP5 defined the structure of design documents and standard Project operating procedures for software development, verification, deployment and testing.

The cooperation with DataGrid proceeded very well. There were several direct contacts between the managers and architects of both projects: discussions at CERN (M. Bubak, J. Marco, M. Turala), Cetraro-GridStart (M. Bubak), Edinburgh-GGF5 (M. Bubak, M. Dikaiakos, J. Marco, N. Meyer). Closer links to other Grid projects were forged under the auspices of the GridStart projects (Cetraro meeting in June 2002). CrossGrid representatives (M. Kunze, M. Turala, W. Wislicki) took part in the preparation of an Expression of Interest to the EU 6th Framework Program called EGEE (Enabling Grids for E-science and industry in Europe).

Concerning dissemination, several public presentations were conducted (High Performance Computing Workshop in Cetraro, GridStart, Moscow-ACAT2002, Edinburgh-GGF5). A general CrossGrid brochure was published. Preparations for a demo at IST2002, under the umbrella of GridStart, commenced. The initiative of integrating dissemination activities of CrossGrid and DataGrid, in particular regarding the Industry and Research fora, has progressed, and a dedicated

meeting of both teams took place in Rome on 25 July 2002 – a common IR Forum is the goal for 2003.

Contacts with the Globus development team continued, and a short visit of one of the CrossGrid architects to the Globus Team HQ at Argonne National Laboratory was agreed upon.

### 5.3. THIRD QUARTER

In the months September-November 2002, the Project focused on “use case” studies, bearing in mind the global CrossGrid architecture and the software being designed by the corresponding Work Packages. Particular attention was paid to the interfaces between different software tasks, with an objective to define them in sufficient detail to commence the programming process.

The second focal point was the deployment of testbeds and their integration with the DataGrid middleware software and infrastructure.

Work Package WP1 (Cross Grid Application Development) worked on development of all four applications as well as visualization modules according to Software Requirements Specification documents and on elaboration of the generic model for interactive applications. This model should provide functionality offered by the well-known HLA and should be implemented through Grid services. For all application, the use cases for the initial prototype were defined.

Work Package WP2 (Grid Application Programming Environment) commenced software implementation in all tasks according to the design documents prepared in August 2002, taking into account the use cases defined by WP1 for applications. The generic use case for Grid-enabled performance monitoring (G-PM) was developed and presented to WP1 to achieve better understanding. WP2 discussed the dependency of programming tools on underlying services and infrastructure as well as the integration of separate components of G-PM (task 2.4).

Work Package WP3 (New Grid Services and Tools) focused on the implementation of the following middleware: Migrating Desktop, Grid Resource Management, Monitoring (Grid and applications), Optimization of Data Access. At the Linz Workshop, the WP defined rules for the final delivery of the first demo version of WP3 middleware. Middleware development is based on design documents and is modified according to results of direct contacts with tasks responsible for application development. Two CVS repositories were used at this stage: in Poznan and at FZK.

The effort of Work Package WP4 (International Testbed Organisation) concentrated on further deployment of the CrossGrid testbeds and on understanding their interoperability with MPI technology. The testbeds at FZK Karlsruhe, LIP Lisbon and CSIC Valencia were integrated with EU DataGrid, and became part of the “World Wide Grid” demo at the IST2002 event (November 2002). The other twelve sites are operational within the CrossGrid Virtual organization, set-up at LIP Lisbon and running the EDG software version 1.2.3. – the status of these sites can be checked at <http://mapcenter.lip.pt/>. In addition, the deployment of EDG software version 1.3.0, which is supposed to be much more stable and robust, started in November.

Project Management (Work Package WP5) focused on:

- studies of “use cases” (task performed by the Architecture Team),

- organization of the CrossGrid workshop in Linz (in conjunction with the 9th EuroPVM/MPI conference),
- preparation for the CrossGrid Yearly Conference in Santiago (February 2003) and the Yearly Review (March 2003),
- contacts and cooperation with other Grid initiatives,
- presentation of the Project at the IST2002 event in Copenhagen (November 2002).

In relation to the first point, the Architecture Team issued a detailed instruction and an example of how the “use case” analysis should be done, and which documents are expected. The discussions took place at the Linz CrossGrid workshop (28-29 Septemebr 2002) and at the Architecture Team workshop, including participation of some application tasks, in Vienna (25-26 October 2002). More work is expected of the teams working on “Distributed Data Analysis in High Energy Physics” (task 1.3) and “Weather Forecasting and Air Pollution Modeling” (task 1.4).

The CrossGrid semiannual workshop at Linz (28-29 September) was successful – about 50 CrossGrid members participated. Such direct contacts among participants are indispensable for understanding of different aspects of the Projects and they help reach consensus in case of divergent opinions. A number of CrossGrid members participated in the following EuroPVM/MPI conference, at which several CrossGrid papers were presented (and subsequently published in the Lecture Notes in Computer Science; LNCS 2474 by Springer).

The cooperation with the DataGrid project proceeded very well, along the lines of the Cooperation Framework, on every level: managerial, technical and dissemination. Of particular intensity were contacts between architecture teams and testbed teams. Several members of the CrossGrid Project took part in the CERN Computing School, which focused on Grid technology and EU DataGrid software (Italy, September 2002).

Links to other Grid development teams and projects were also active. In September M. Malawski (CrossGrid TAT) visited the Globus team in Chicago – he then gave a summary report on OGSA at the CrossGrid Linz workshop. M. Bubak (CrossGrid) participated in the GridLab workshop in Zakopane and G. Allen (GridLab) presented the GridLab project at the CrossGrid workshop in Linz. M. Bubak and M. Hardt participated in GGF6 in Chicago, and related GridStart events. A number of CrossGrid partners followed the preparation for an Integrated Project Proposal called EGEE (Enabling Grids for E-science and industry in Europe), to be submitted to Brussels within the 6FP, which includes many large European Grid initiatives.

Concerning dissemination, several public presentations were conducted. CrossGrid was present at the EuroPVM/MPI conference (see LNCS 2474 by Springer). It was also one of the GridStart members actively participating in the IST2002 event in Copenhagen (November 02), presenting brochures and posters along with an animated demo, and being part of a large testbed (a “World Wide Grid”), together with the DataGrid, DataTAG and iVDGL projects, covering Europe and USA.

#### **5.4. FOURTH QUARTER**

In December 2002 - February 2002, the Project concentrated on the development of CrossGrid testbeds, prototyping and integration of initial software packages, and demonstrations of selected applications. Work schedule had to be aligned with the yearly CrossGrid conference (10-12 February 2003), and the Project yearly review (12 March 2003).

Work Package WP1 (CrossGrid Application Development) worked on development of all four applications and visualization modules. All application tasks submitted their first internal releases, accompanied by software description documents including software functionality descriptions, installation manuals and user guides. The results of application development were presented and integrated (where possible) with tools from WP2 and WP3 at the integration meeting in Santiago (7 – 9 February 2003).

Work Package WP2 (Grid Application Programming Environment) worked on initial prototypes of its software. The first prototype of the MPI verification tool, Grid metrics and benchmarks as well as the Grid Performance Monitoring tool were documented in software description documents that included software functionality descriptions, installation manuals and user guides. These tools were integrated with available applications and Grid services at the integration meeting (see above) in order to prepare the first prototype demo.

Work Package WP3 (New Grid Services and Tools) focused on preparing the final versions of initial software prototypes for the Migrating Desktop, Portal, Scheduling, Monitoring and Data Access. The effort was principally devoted to software integration, aimed at installation on the testbed infrastructure, packaging and internal testing. All software was accompanied by detailed documentation including design diagrams, functionality descriptions, user and administrator manuals and test scenarios. Prototype demonstrations for the yearly review were prepared.

Work Package 4 WP4 (International Testbed Organization) further enhanced the CrossGrid testbed. 10 sites were registered with the CG Resource Broker using EDG v1.2.2 and v1.2.3 software; two sites also experimented with the EDG v1.4.3 software release. A CG “Gridportal”, integrated with CVS repositories, was successfully deployed by FZK and utilized by CrossGrid software developers. During the integration meeting in Santiago, WP4 members took active part in the process of installation of WP2 and WP3 software on the testbed infrastructure.

The achievements of all WPs were presented at the Cracow Grid Workshop (12 – 14 December 2002), at the 2003 Annual CrossGrid Project Conference (10 – 13 February 2003) and at the 1st European Across Grids Conference (14 – 15 February 2003) in Santiago de Compostela, Spain.

The Technical Architecture Team worked on analysis of possibilities of integrating CrossGrid services with OGSA; it also presented requirements for integration and interoperability with DataGrid middleware, and, finally, integration scenarios for software developed by individual WPs.

The main activities of Project Management (Work Package WP5) concerned:

- preparation for the yearly review of the Project, scheduled for 12 March 2003 in Brussels,
- organization of the CrossGrid conference in Santiago de Compostela and the accompanying Across Grids conference,
- contacts and co-operation with other Grid research projects and new Grid-related initiatives,
- preparation of a large number of M10, M11 and M12 deliverables.

In relation to the first point, Project Management maintained regular contacts with the IST Brussels office; it has also established contacts with reviewers, providing them with access to all existing

deliverables and related documents. In coordination with the Architecture Team, Project Management issued a timetable of preparations, which called for early submittal of deliverables. Summaries on main achievements, cooperation, issues and future plans were collected for the CrossGrid Yearly Report. The Architecture Team prepared templates for oral presentations and technical demonstrations. A CD-ROM, containing all CrossGrid deliverables of the first year, was assembled, to facilitate access to CrossGrid documents.

As stated above, one of the key events of the reporting period was the CrossGrid yearly conference, the aim of which was to summarize the Project's progress. This conference was organized on 10-12 February 2003 by the University of Santiago de Compostela and the Galician Supercomputing Center (CESGA) – see <http://grid.cesga.es/>. The conference was preceded by a workshop of Work Package WP3 and by a general CrossGrid software integration workshop. The reports, along with real-time demonstrations, have shown good technical progress of the Project.

The CrossGrid conference was followed by the First European AcrossGrids Conference, initiated by CrossGrid and supported by the GridStart project. The goal of the Conference was to bring together representatives of European Grid projects, to exchange results and experience, and to promote Grid technology to potential users. Around 100 participants took part in that conference, mainly from the CrossGrid project, but also from Damien, DataGrid and GridLab. There were several invited talks and about 40 technical presentations; the proceedings of the conference will soon be published. A User Forum was organized as a part of the Conference, with about 30 additional participants representing educational institutions, government agencies, research centers and commercial entities. The joint CrossGrid-DataGrid demonstration stand allowed participants to obtain more information on Grid technology and its applications.

In a similar spirit, albeit on a smaller scale, another conference, called the Cracow Grid Workshop was held in December 2002 (<http://www.cyfronet.krakow.pl/cgw02/>). The main objectives of this event were to share information on different Grid projects and to introduce young researchers to Grid technologies. The workshop was oriented mainly towards Polish communities, yet foreign participants were also welcomed. There were four invited lectures, 28 technical presentations and three tutorials on EU DataGrid, Unicore and Cactus software. The proceedings have been published as a local CYFRONET report.

CrossGrid partners continued to express their interest in the 6<sup>th</sup> Framework Programme. In the reporting period there were several working meetings of the EGEE initiative (concerning integrated Grid infrastructure), a HealthGrid meeting in Lyon (17 January 2003) and a Workshop on Grids for Large Scale Problem Solving in Brussels (29-30 January 2003) – all of them attended by several representatives of the CrossGrid community.

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## 6. COOPERATION WITH OTHER GRID PROJECTS

The CrossGrid project is open to collaboration. Its Web pages contain a lot of information about its goals, partners, structure and results.

### 6.1. THE DATAGRID PROJECT

European DataGrid can be characterized as the main external partner of the CrossGrid project. EDG has always been the partner of choice for CG members, because of the three early (“first wave”) large-scale EU Grid undertakings (the other two being EuroGrid and DAMIEN), it has the most in common with CG: both projects are based on Globus middleware, both have similar timescales and their goals are closely aligned. CrossGrid is complementary to DataGrid in expanding the Grid geographically, by installing additional 15 testbed sites in 7 European countries, and by introducing the Grid concept to a new category of applications (interactive ones).

The framework of collaboration between CrossGrid and DataGrid is governed by a special contract signed in mid-2002 [FRAME]. In it, the management teams of both projects agree to co-operate in the following areas:

- reuse of middleware developed within both projects,
- interoperability of testbeds,
- joint design and implementation of new, interactive Grid services,
- establishing joint teams for evaluation of OGSA, participation in the GLUE effort and evaluation of software engineering tools,
- elaboration of common programming and naming conventions,
- elaboration of joint proposals for the GGF,
- participation of the chairmen of the EDG Architecture Board and the CG Architecture Team in common meetings,
- coordination of dissemination - exploitation activities towards a common Industry and Research Forum,
- exchange of managerial information and experience.

Technical details of co-operation between CrossGrid and DataGrid are covered by a special CG deliverable (CG D5.2.4: *Requirements for Collaboration with DataGrid*) and will not be discussed here; however, CrossGrid has received the following contributions from EDG within its first year of operation:

- access to DataGrid software modules (replica manager, replica catalog, job submission service, resource broker, logging and bookkeeping),
- access to DataGrid operating procedures (such as the Consortium Agreement and the licensing policy document), along with deliverable templates,
- testbed collaboration (with several common meetings and successful implementation of EDG procedures and software),
- joint conferences (the first European Across Grids Conference in Santiago de Compostela) and events (testbed demonstration at IST 2002 in Copenhagen and a common stand at the First European Across Grids Conference, Santiago de Compostela)

## 6.2. THE GRIDSTART PROJECT

GridStart is an initiative sponsored by the European Commission with the specific objective of consolidating technical advances in Europe, encouraging interaction amongst similar activities both in Europe and the rest of the world and stimulating the early take-up by industry and research of Grid-enabled applications. The initiative brings together technologists, scientists and industry in multi-disciplinary approach to developing the Grid infrastructure. The clear goal is to develop sustainable, effective and universal solutions addressing the needs of science, industry and the public.

CrossGrid is a partner to the GridStart consortium, along with nine other Grid research projects (AVO, Damien, DataGrid, DataTAG, EGSO, EuroGrid, GRIA, GridLab and GRIP). Co-operation with Gridstart has so far involved the following activities:

- Common technical discussions. CrossGrid Architecture Team leader is a member of the GridStart Technical Committee, which has convened at several venues (Cetraro, Edinburgh, Chicago, Santiago de Compostela), and discussed the ways of improving the coherency of Grid developments, standardisation and visibility,
- Participation of CrossGrid members in GGF meetings, supported by GridStart (Edinburgh, Chicago),
- Attendance and participation of CrossGrid representatives in international events under the umbrella of GridStart (such as the November 2002 IST event in Copenhagen, where CrossGrid was part of the GridStart stand)
- Organization of the First European Across Grids conference in Santiago de Compostela, attended by representatives of CrossGrid, DataTAG, DataGrid, Damien and GridLab projects,
- Regular publications in the GridStart Technical Bulletin and Newsletter.

## 6.3. THE GRIDLAB PROJECT

The GridLab project develops an easy-to-use, flexible, generic and modular Grid Application Toolkit (GAT), enabling modern applications to make innovative use of global computing resources. The project is grounded by two principles: the co-development of infrastructure with real applications and user communities, leading to working scenarios, and dynamic use of Grids, with self-aware simulations adapting to their changing environment.

CrossGrid has co-operated with GridLab (a fellow GridStart partner) for some time, particularly through common presentations (Cracow Grid Workshop, CrossGrid Conference in Santago de Compostela), tutorials (Cactus tutorial in Cracow) and participation in projects' workshops (GridLab in Zakopane) and conferences (CrossGrid in Santiago de Compostela). Plans are underway to foster this co-operation by signing a collaboration framework agreement similar to the one worked out with DataGrid (see section 5.1). This would permit sharing of software modules and allow CrossGrid to influence the GAT with respect to real-time applications and allow both projects to operate a common testbed. It is expected that the agreement will be concluded in the coming months.

## 6.4. THE GLOBUS PROJECT

CrossGrid maintains active links to the Globus team at Argonne (USA). Mr. L. Liming gave a tutorial on Globus at the Cracow CrossGrid kick-off conference in March 2002. Co-operation is centered on the OGSA technology currently advanced by Globus and incorporated in version 3.0 of the Globus Toolkit. One CrossGrid Technical Architecture Team representative (Maciej Malawski of UMM Cracow) has been specifically assigned to this task. CG representatives have scheduled meetings with

Ian Foster of the Globus team and the CG TAT has drafted a proposal for the incorporation of OGSA elements in the software being developed by Work Packages 1, 2 and 3. Work is also underway to redesign the overall CrossGrid architecture around the Grid Services concept.

## 7. DISSEMINATION AND OUTREACH

### 7.1. WORKSHOPS AND CONFERENCES

CrossGrid Project representatives have both organized and attended numerous Grid-related events in the first year of the Project. Table 6.1 lists major events, which have seen CG participation. Please note that the table only lists official conferences, where participation was funded by CrossGrid. Many more informal meetings have taken place between Project partners since the commencement of the Project (especially at CERN) and there were introductory meetings for individual Work Packages preceding the official start date (for instance in Geneva in July 2001 and in Amsterdam in January 2002). Additional information can be found on the CrossGrid Project Web pages at <http://www.eu-crossgrid.org/>.

Name	Where	Start	End
1st European Across Grids Conference	Santiago de Compostela (Spain)	13-FEB-03	14-FEB-03
2003 Annual Crossgrid Project Workshop	Santiago de Compostela (Spain)	10-FEB-03	12-FEB-03
1st European HealthGrid Conference	Lyon (France)	16-JAN-03	17-JAN-03
Euoweb 2002 Conference - The Web and the GRID: from e-science to e-business	Oxford (UK)	17-DEC-02	18-DEC-02
2nd Cracow Grid Workshop	Cracow (Poland)	11-DEC-02	14-DEC-02
FP6 Warsaw Conference - Inauguration of the Sixth Framework Programme of the European Union	Warsaw (Poland)	25-NOV-02	26-NOV-02
SC2002 High Performance Networking and Computing Conference	Baltimore (USA)	16-NOV-02	22-NOV-02
European Research 2002 - The European Research Area and the Framework Programme	Brussels (Belgium)	11-NOV-02	13-NOV-02
FORTE2002 - Formal Techniques for Networked and Distributed Systems	Houston (USA)	11-NOV-02	14-NOV-02
Partners in Projects FP6 - European and regional cooperation	Aalborg (Denmark)	07-NOV-02	08-NOV-02
IST2002 - Partnerships for the Future	Copenhagen (Denmark)	04-NOV-02	06-NOV-02
6th Global Grid Forum	Chicago (USA)	15-OCT-02	17-OCT-02
e-Power Networking Conference	Bordeaux (France)	02-OCT-02	02-OCT-02
NPDPA 2002 - Networks, Parallel and Distributed Processing, and Applications	Tsukuba (Japan)	01-OCT-02	04-OCT-02
9 <sup>th</sup> EuroPVM/MPI Conference	Linz (Austria)	29-SEP-02	02-OCT-02
iGrid 2002 - The International Virtual Laboratory	Amsterdam (The Netherlands)	23-SEP-02	26-SEP-02
13 <sup>th</sup> Summer School on Computing	Trest (The Czech)	16-SEP-02	21-SEP-02

Techniques in Physics	Republic)		
The CERN School of Computing 2002	Vico Equense (Italy)	15-SEP-02	28-SEP-02
5 <sup>th</sup> EDG Conference	Budapest (Hungary)	01-SEP-02	06-SEP-02
Euro-Par Conference Series	Padeborn (Germany)	27-AUG-02	30-AUG-02
The Eleventh IEEE International Symposium on High Performance Distributed Computing	Edinburgh (UK)	24-JUL-02	26-JUL-02
5th Global Grid Forum	Edinburgh (UK)	21-JUL-02	24-JUL-02
NeSC Workshop on Applications and Testbeds on the Grid	Glasgow (UK)	20-JUL-02	20-JUL-02
VIII International Workshop on Advanced Computing and Analysis Techniques in Physics Research	Moscow (Russia)	24-JUN-02	28-JUN-02
ISC2002 - 17 <sup>th</sup> International Supercomputing Conference	Heidelberg (Germany)	20-JUN-02	22-JUN-02
Interactive Analysis Tools Meeting	Berkeley Lab (USA)	18-JUN-02	19-JUN-02
2nd IEEE International Symposium on Cluster Computing and the Grid	Berlin (Germany)	21-MAY-02	24-MAY-02
Cray Users Group Conference	Manchester (UK)	20-MAY-02	24-MAY-02
The 2002 International Conference on Computational Science	Amsterdam (The Netherlands)	23-APR-02	24-APR-02
The Polish Optical Internet: Technologies, Services and Applications	Poznan (Poland)	23-APR-02	24-APR-02
CrossGrid Kick-Off Conference	Cracow (Poland)	17-MAR-02	20-MAR-02
4 <sup>th</sup> EDG Conference	Paris (France)	04-MAR-02	08-MAR-02

**Table 6.1: Conferences and events organized or attended by CrossGrid partners in March 2002 - February 2003**

## 7.2. WEBSITES

CrossGrid operates one of the most extensive and up-to-date Web portals of all EU-funded Grid projects. The main website of the Project is located at <http://www.eu-crossgrid.org/>. This site lists all partners, participants and events related to the Project. It also contains a document section, where all CrossGrid deliverables can be downloaded (confidential materials and deliverables require password validation). There is also a separate dissemination site at <http://www.crossgrid.org/>, maintained by Algosystems and devoted to dissemination and exploitation issues.

Most CrossGrid partners have their own websites devoted to Project affairs. Details can be found on the main Project portal.

CrossGrid also runs a software repository and Web portal out of the FZK center in Karlsruhe (Germany). The address is <http://gridportal.fzk.de>. A backup repository has been set up in Valencia.

### **7.3. PARTICIPATION IN THE GLOBAL GRID COMMUNITY**

CrossGrid continues to play an active part in the global Grid community. This is exemplified by the numerous presentations and conferences both organized and attended by CG representatives, as described above; by co-operation with other Grid projects, as detailed in Section 5 of this document and by drafting plans for future engagements (see section 9). Our participation in shaping the Grid community is not limited in scope to EU (or even European) countries. Several CrossGrid testbed sites have joined the “World Wide Grid” testbed and took part in the IST2002 demo in Copenhagen. CrossGrid has taken keen interest in the OGSA/OGSI standard currently being developed by the Globus team (a CrossGrid representative has visited the Argonne National Laboratory in the US for that purpose); CG also participates in the GLUE and GGF fora.

## 8. RESOURCE ALLOCATION

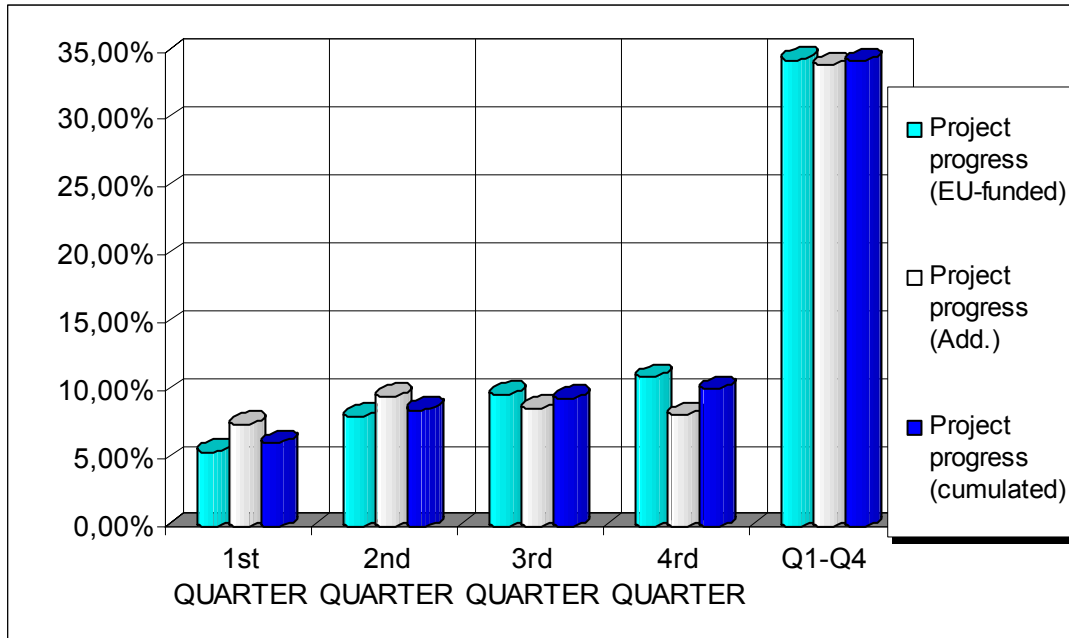
Table 8.1 shows how much manpower was directed at each task since the commencement of the Project. The manpower is listed in person-months (PMs).

**Table 8.1: Manpower consumption by task**

Task	WPI		WP2		WP3		WP4		WPS		Total for each partner (add, PM in blue)	Assigned PM (EU-funded)	Assigned PM (add)	Progress in funded PM	Progress in % (add, PM)	
1 CO1	0,00	0,79	2,07	5,07	16,49	21,90	5,07	3,59	25,72	23,99	49,4	168	152	29,4%	36,4%	135,0
2 ICM(AC2)	10,26	9,55			4,71	2,71	3,94	2,74			18,9	60	60	31,5%	25,0%	140,0
3 INP(AC3)	7,70	3,30									7,7	23	23	33,5%	14,3%	131,3
4 INS(AC4)	4,46	3,09					3,43	2,31			7,9	23	23	34,3%	23,5%	140,0
5 CR5(UVA)	43,02	27,22					0,29	0,50			43,3	78	62	55,5%	44,7%	123,3
6 AC6(II SAS)	25,83						3,58	0,00			29,4	88	0	33,4%	n/a	140,0
7 UNI.LINZ(AC7)	5,55	26,30									5,6	23	23	24,1%	63,1%	133,3
8 FZK(CR8)	0,17	0,00	4,04	0,00			21,95	0,34			26,2	92	0	28,4%	n/a	131,3
9 USTUTT(AC9)			12,15	1,15							12,2	31	0	39,2%	n/a	131,3
10 TUM(AC10)			10,01	3,50							10,0	34	34	29,4%	5,8%	140,7
11 PSNC(CR11)	0,00	0,00			31,26	17,66	1,59	4,89			32,9	85	83	38,7%	13,6%	140,0
12 UCY(AC12)			4,76	1,35	1,84	0,14	6,12	0,87			12,7	44	36	28,9%	2,3%	147,3
13 DATAMAT(AC13)					11,12	0,00			1,12	0,00	12,2	37	0	33,1%	n/a	136,7
14 TOD(AC14)					17,00	4,29	1,00	3,45			18,0	28	28	64,3%	13,9%	140,0
15 CSIG(CR15)	28,90	1,84	4,99	0,64	9,44	0,00	39,36	0,00			82,7	182	0	45,4%	n/a	125,0
16 UAB(AC16)	1,35				8,93	0,00	6,35	0,00			16,6	74	0	22,5%	n/a	131,3
17 USC(AC17)	4,38	5,87	6,93	4,65			7,73	15,09			19,0	60	36	31,7%	44,9%	131,3
18 DEMO(AC18)							11,25	6,62			11,2	40	19	28,1%	11,7%	125,0
19 AUTH(AC19)							18,60	15,16			18,6	43	31	43,3%	25,6%	125,0
20 LP(AC20)							13,75	8,18			13,7	49	0	28,1%	n/a	146,0
21 ALGO (AC21)					11,66	0,00			15,84	0,00	27,5	54	0	50,9%	n/a	140,0
<b>TOTAL funded/add. (blue)</b>	<b>131,61</b>	<b>77,95</b>	<b>44,96</b>	<b>16,36</b>	<b>112,46</b>	<b>46,69</b>	<b>144,03</b>	<b>63,75</b>	<b>42,68</b>	<b>23,99</b>						
PM assigned	365	172	156	77	258	163	435	132	102	66						
Progress in %	36,1%	45,3%	28,8%	21,3%	43,6%	28,6%	33,1%	48,3%	41,8%	36,3%						

Table 8.2 and 8.3 show the overall progress of the Project by quarter. As can be seen, resource allocation has been on schedule and after its first year, the Project has exhausted around 1/3 of its allotted manpower.

**Table 8.2: Overall manpower consumption per quarter**



**Table 8.3: Overall manpower consumption per quarter (progress chart)**

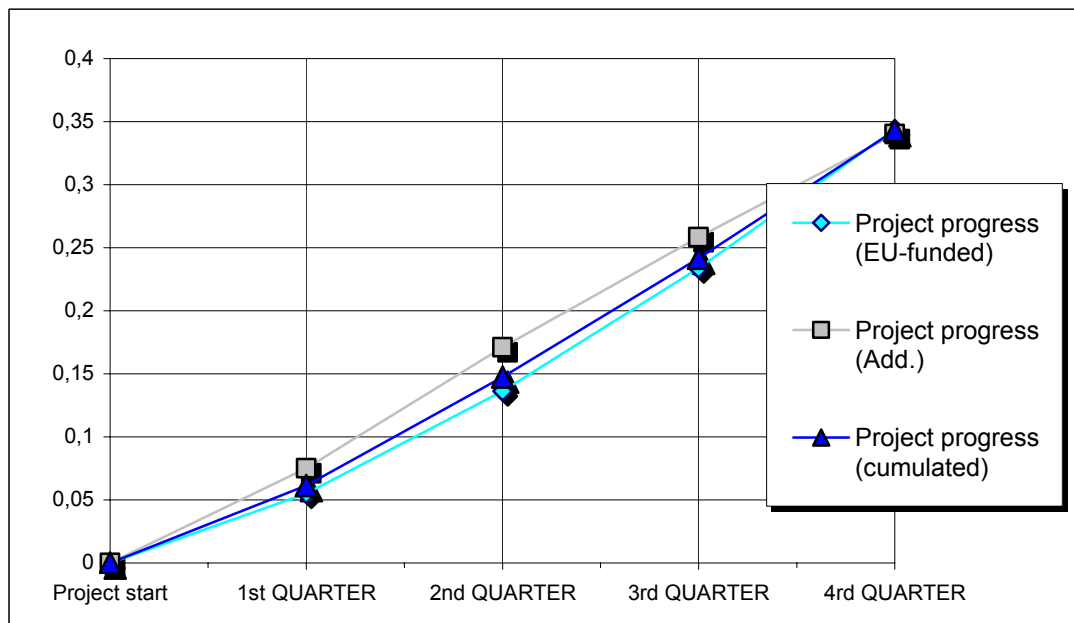
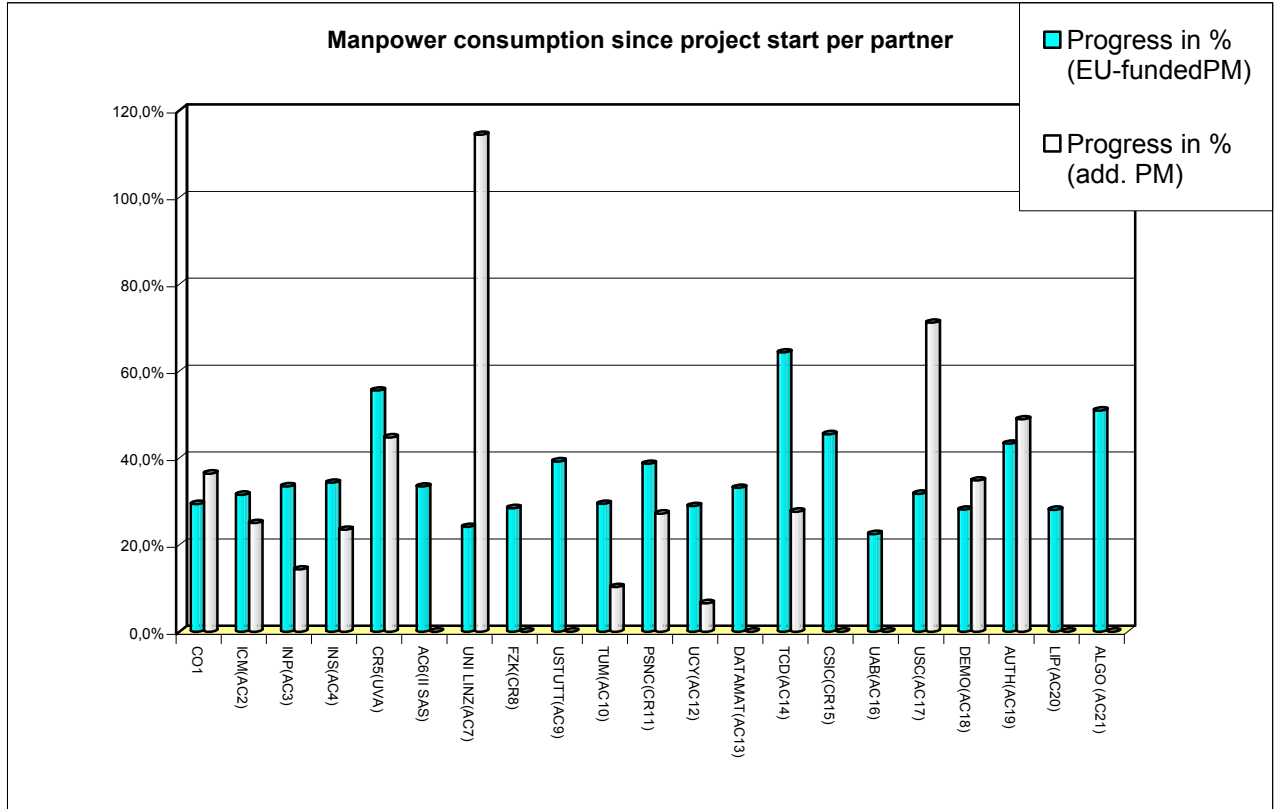
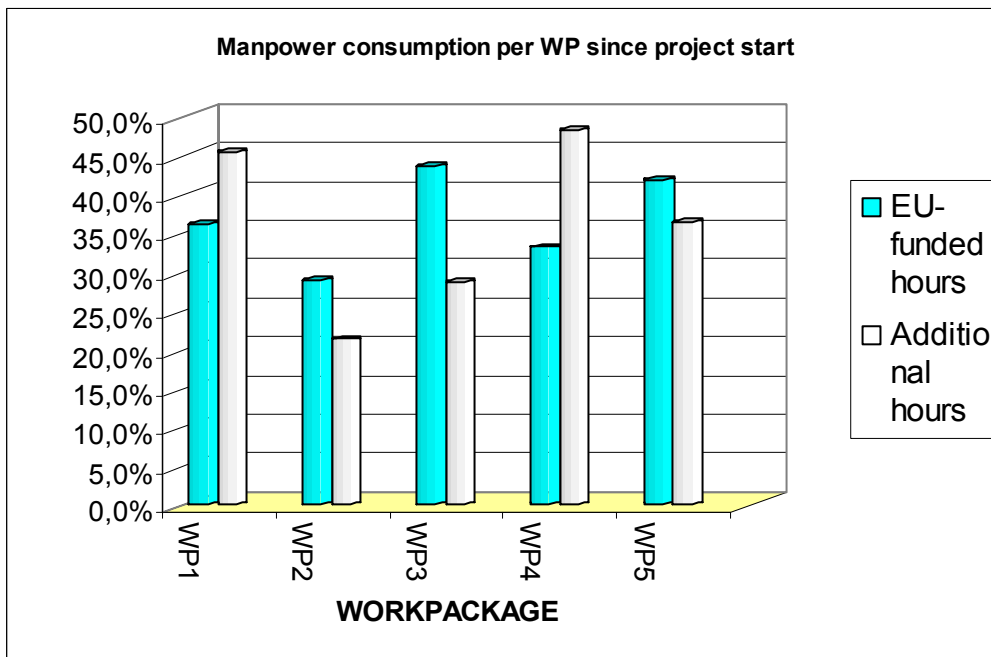


Table 8.4 is a per-partner summary of the allocated manpower, while Table 8-5 sorts the same data by Work Package.

**Table 8.4: Overall manpower consumption per partner**



**Table 8-5: Manpower consumption per Work Package**



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## 9. ISSUES

The overall progress of the Project in the reporting period has been good and there are currently no critical problems that could threaten the future progress of work. Nevertheless, based on the experience of the first twelve months, one could point to several areas, which need improvement. The following issues have been reported:

- The Project is large and heavy on the managerial side; i.e. significant effort is required on the part of coordinators of technical work packages, the Project Coordinator and the Project Office to coordinate Project activities, and to collect the necessary reports. This is somewhat understandable, taking into account the fact, that CrossGrid unites 21 separate institutions from 11 European countries.
- Interactions between the application tasks and other technical work packages (WP2, WP3, WP4) need intensification, so that direct feedback can be provided to developers, who can then promptly verify whether their software satisfies the needs of other Project members (it should be noted, however, that functional application prototypes are not due until August 2003).
- The function of QA officers is not sufficiently understood and the central guidelines for the QA process are implemented with limited success only. This affects certain technical aspects of the Project, such as proofreading documents, following naming conventions set out in CG D5.2.3 (*Standard Operating Procedures*) or assuring uniformity of templates and software modules.
- The Internal Review Board is hard pressed to deliver reviews on time. This is mostly due to the large number of required deliverables, but the problem is compounded by individual tasks drafting up the deliverables shortly before their respective deadlines. Such procrastination leaves little time for review and causes a saturation effect within the IRB, where reviewers have to cope with a large volume of documents on a tight schedule - in addition to preparing their own deliverables.
- The dissemination and exploitation effort calls for more initiative and better coordination. A coordinated dissemination/exploitation effort would result in better visibility of the Project and its results.
- CrossGrid suffers from limited travel resources. The budgetary shortfall limits direct contacts between Project members (which are essential for such large undertakings, with highly factorized activities - see issue 1), makes it difficult for CG representatives to attend general interest events and impacts dissemination activities.

## 10. THE FUTURE OF THE PROJECT

### 10.1. PLANS FOR NEXT YEAR

Work during the next year is expected to follow the detailed workplan set out in [ANNEX]. Following a successful release of initial prototypes from Work Packages 2 and 3 (augmented by the internal release of software from Work Package 1), the Project will enter a phase of incremental releases, culminating in the final software release, which is still two years away. Detailed plans of release procedures can be found in CG D5.2.3 (*Standard Operating Procedures*). All these developments will have a solid infrastructural base, due to the successful deployment of testbeds and EDG software (releases 1.2.3 and 1.2.4) at 15 CrossGrid sites, which is the result of work done by Work Package 4.

Experience garnered from the integration workshop which preceded the yearly CrossGrid conference in Santiago de Compostela (7-9 February 2003), speaks for a necessity to organize another, similar workshop, to verify and integrate all the software produced and help prepare all application demonstrations, due by month 18 (August 2003). Project Management is also planning to organize another CrossGrid yearly conference at the beginning of 2004, to review the progress of the second year – the venue for that event will be chosen soon.

In addition to the technical developments, the achievements of the Project will be demonstrated on international fora, through active participation in the world Grid community and Grid-related events, such as the PIONEER conference in Poznan (April 2003), the EU DataGrid Barcelona conference (May 2003), the next IST general event in Milan (October 2003) and/or the GGF conferences. Detailed schedules and plans for CrossGrid presentations during such international events have yet to be drawn up, as they are influenced by technical issues and budgetary considerations. In general, it is our aim to present applications and “live” software demonstrations as soon as they become technically feasible.

As the software development process progresses, special CrossGrid tutorials (modelled on analogous DataGrid efforts) are foreseen. These will familiarize prospective users with CrossGrid software, its modes of operation and any issues which may arise during work.

As far as testbed expansion and hardware acquisition is concerned, CrossGrid partners are advancing national initiatives aimed at establishing Grid infrastructure in their respective countries. CrossGrid can be expected to draw resources from these national Grids.

### 10.2. LONG-TERM FUTURE

As Grid technology gains recognition and is forged into a paradigm of future computing, it is very essential that the CrossGrid results and experience are not lost, and that there is continuity to the development and use of the CrossGrid software products – this goal is part of our exploitation plan. The long-term future of the CrossGrid project is largely bound to the EU 6th Framework Programme and the initiatives advanced therein.

Many CrossGrid partners have expressed their interest in the EGEE (Enabling Grids for E-science and industry in Europe) initiative, the aim of which is to develop production Grid infrastructure, integrated with the GEANT network, based on the experience gained by the initial Grid projects. The proposal is being prepared within the framework of the Integrated Infrastructure Initiative call of the 6 FP. CrossGrid representatives are present in the EGEE governing bodies (both policymaking and technical) and involvement of a number of CG partners in this initiative is assured.

Active consultations are also being held in Brussels regarding the area of “Grids for Large Problem Solving”, in which CrossGrid achievements can be utilized and further advanced. CrossGrid partners participate in corresponding meetings organized by the IST office and by the communities concerned (such as HealthGrid). Plans for large-scale systems based on the CG concepts of flood prediction, weather forecasting, biomedical support and particle physics are being prepared.

## 11. CONCLUDING REMARKS

In general, the Project is progressing well. The results of prototype software integration along with first software demonstrations (as presented at the Santiago event in February 2003), allow us to be confident that the objectives of the second year (in particular the initial prototypes of all applications running on the distributed testbed), will be achieved as scheduled. CrossGrid deliverables are being produced on time and partners are living up to their contractual obligations. There are currently no significant delays in any area of the Project and no significant budget overruns (although the limited travel budget has constrained international co-operation in recent months - see section 9, *Issues*).