



## DELIVERABLE D4.1

# DETAILED PLANNING FOR TESTBED SETUP

### WORKPACKAGE 4

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Abstract: This document describes the detailed planning to build the first testbed, assuring interoperability with the EU DataGrid production testbed.



### Delivery Slip

	Name	Partner	Date	Signature
<b>From</b>	Rafael Marco	CSIC	31-May-2002	
<b>Verified by</b>				
<b>Approved by</b>	Jesus Marco	CSIC	31-May-2002	

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## 1. INTRODUCTION

### 1.1. PURPOSE

This document details the planning for testbed setup in the CrossGrid project.

It is focused on the work taking place in the first six months, with the objective to have a first testbed setup ready as soon as possible in selected sites, joining the EDG testbed 1.2 by June 2002, and in all testbed sites by September 2002 in order to show the interoperability synergy.

It also defines for each task the mechanisms to assure an adequate operation of the testbed, from releases management to support and validation.

The intended audience is the workpackage itself, and WP1, 2, and 3 regarding testbed support requirements and possibilities.

### 1.2. DESCRIPTION OF WORK FOR DETAILED TESTBED PLANNING PHASE

For all partners: Review the infrastructure (hardware and software), manpower and network resources (including contact with national Geant partners) available at each site. Define site expertise and special hardware infrastructure available. Prepare detailed planning for testbed installation.

For Task 4.0 (Testbed coordination and management): Coordinate report elaboration. Define the Integration Team. Propose collaborative tools. Confirm selected sites for first testbed setup.

For Task 4.1 (Testbed set-up and incremental evolution): Receive the requirements defined by the Architecture Team and by WP1/2/3. Define Security and Administrative policy. Prepare the basic infrastructures for testbed installation (Grid Security Infrastructure, Grid Information Service). Elaborate the testbed incremental project release procedure.

For Task 4.2 (Integration with DataGrid): Review DataGrid testbed situation. Establish participation in DataGrid WP1/WP5 meetings.

For Task 4.3 (Infrastructure Support) Provide expertise on hardware and network configurations. Define User support and Helpdesk requirements.

For Task 4.4: (Verification and Quality Control) Define verification and quality control procedures aiming to establish a validation process.

The product is Deliverable D4.1: Public Report

### 1.3. DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

CrossGrid/X# The EU CrossGrid Project IST-2001-32243

DataGrid/EDG The EU DataGrid Project IST-2000-25182

GRID Grid framework for sharing of distributed resources.

DBMS Database Management System.

SQL Structured Query Language.

MPI Message Passing Interface.

MPICH-G2 Grid-enabled implementation of MPI.

HTTP Hypertext Transport Protocol.

XML Extended Markup Language.

WP Work Package

VO Virtual Organization

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CE	Computing Element (EDG).
SE	Storage Element (EDG).
NN	Neural Network.
IIS	Internet Information Server
API	Application Programming Interface
CRM	Customer Relationship Management
MySQL	An Open Source Database following SQL92
RPM	Red Hat Package Manager
VACM	VA Linux Cluster Manager
LCFG	Local Configuration Tool
OGSA	Open Grid Service Architecture
GVK	Grid Visualization Kernel
OGLA	Open Grid License Agreement

#### **1.4. REFERENCES**

- [1] CrossGrid WP1 Task 1.1 Deliverables CG-1.1-SRS
- [2] CrossGrid WP1 Task 1.2 Deliverables CG-1.2-SRS
- [3] CrossGrid WP1 Task 1.3 Deliverables CG-1.3-SRS
- [4] CrossGrid WP1 Task 1.4 Deliverables CG-1.4-SRS
- [5] CrossGrid WP3 Task 3.1 Deliverables CG-3.1-SRS
- [6] CrossGrid WP3 Task 3.2 Deliverables CG-3.2-SRS
- [7] CrossGrid WP3 Task 3.3 Deliverables CG-3.3-SRS
- [8] CrossGrid WP3 Task 3.4 Deliverables CG-3.4-SRS
- [9] CrossGrid WP5 Task 5.2 Deliverable CG-5.2.2
- [10] CrossGrid Annex I v3.1

#### **1.5. OVERVIEW**

Section 2, and in particular 2.1, provides the overall description with some detail, including the relation to existing and future software, and sets the basis for the schedule and corresponding actions, detailed in Section 3.

Section 2.2 describes the coordination task, and is followed by the description of the testbed setup in Section 2.3. The integration with EU DataGrid is covered by section 2.4. Infrastructure support, including Help Desk and Installation Kit, is described in Section 2.5, and section 2.6 introduces the verification and quality control procedures. These sections are complemented by appendixes A-D, where additional information or a more complete description is provided.

Section 3 follows the same scheme, including a first project version.

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## 2. OVERALL DESCRIPTION

### 2.1. TESTBED PERSPECTIVE

Testbeds are a key element in Grid Projects. They provide the framework to test and run the applications and corresponding middleware in a realistic distributed environment. Organizational issues, performance and security aspects can only be evaluated with the help of a testbed. The organization itself of an international distributed testbed sharing resources across fifteen european sites, to run interactive applications, is one of the challenging points of the CrossGrid project.

The sites list ranges from relatively small computing facilities in universities, to large computing centers, so offering an ideal mixture to test the possibilities of the Grid framework. National academic network providers and the high-performance european network, Geant, will assure the interconnectivity of all sites.

The CrossGrid testbed will largely benefit from the DataGrid experience on testbed setup. Initial testbeds follow the EDG scheme, running on the IA32 platform with Linux (RH6.2), assuring interoperability and an adequate framework for first checks of the infrastructure and organizational issues.

In a second phase, testbeds will improve the support for interactive distributed applications, and the corresponding middleware developed inside the project.

Although we talk about a generic CrossGrid testbed, in fact several “testbeds” will co-exist to support different efforts, from pure development, to production after validation:

**Development testbed:** new middleware or application software development will require a dedicated small but well maintained testbed, to allow its test in a Grid aware framework. The testbed setup will include a dedicated minimal configuration, and the flexibility to adapt to the required changes in the external software packages (like for example migrating from Globus 2.0 to Globus 3, or from RH6.2 to RH7.2, etc). Several sites will be in charge for these dedicated testbed, in close contact with the developers: UvA, II SAS and CSIC(IFCA) will provide for WP1, FZK for WP2, PSNC, IFIC and UAB for WP3, and CSIC(IFCA), TCD, AUTH and CYFRONET for WP4 (covering basically the work on a new well integrated release preparation).

**Test and Validation testbed:** each new software release will require a complete test process. The dedicated testbed will support this effort, and will be offered by LIP, CSIC(IFIC), USC(CESGA) and DEMO.

Finally the **Production testbed** will be used to run the applications, showing the Grid potential. It will be extended over all testbed sites: CYFRONET, ICM, INS, UvA, IISAS, FZK, PSNC, UCY, TCD, CSIC, UAB, USC, DEMO, AUTH, and LIP.

The general description of the whole testbed, including the geographical distribution and a detailed presentation for each site including hardware, network and personnel resources, can be found in the main WP4 web page: <http://grid.ifca.unican.es/crossgrid/wp4/>

#### **CrossGrid testbed challenges**

The CrossGrid project addresses, for their final user applications, technical challenges like interactive response, real distributed processing in parallel across different sites, access and data-mining on distributed databases, etc.

Most of these requirements will be satisfied with the use of adequate middleware. The Architecture Team is defining these requirements on terms of services implemented, having in mind the next Globus release, Globus3, that will be based on the OGSA (Open Grid Services Architecture). Services could be implemented defining new testbed elements, in comparison with the current basic ones. The testbed will consequently have to support these services and elements, and some of them will impose clear requirements. As an example, the use of MPI for distributed job processing in parallel could require low level constraints, such as having public IP addresses for all the working nodes, or high level ones, like the necessity for advance reservation across different sites.

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## 2.2. TESTBED COORDINATION (TASK 4.0)

Coordination between all tasks inside this work-package, and between WP4 and other work-packages, is handled in task 4.0. Jesus Marco from CSIC (IFCA, Santander, Spain) is the responsible person.

### ***Collaborative Tools***

The first step for this coordination is the adoption of common collaborative tools. This includes use of e-mail, web, and videoconference (using the VRVS tool for regular meetings each two or three weeks). General meetings will be organized twice a year, with more specialized meetings when needed (for example for dedicated integration efforts, etc).

In the first three months we have set the wp4 e-mail list, [wp4-crossgrid@lists.cesga.es](mailto:wp4-crossgrid@lists.cesga.es), specific web pages, <http://grid.ifca.unican.es/crossgrid/wp4>, with an internal area including links to testbed site pages describing the progress and situation on that test-bed site, and more specific e-mail lists and pages for different tasks.

Videoconferencing via VRVS has been organized through the Parthenon virtual room, with 10-15 participants in each session, and seems to work satisfactorily after several tests for all sites.

Meetings take place following a previously announced agenda, and minutes are recorded (see <http://grid.ifca.unican.es/crossgrid/wp4/meetings> ). Presential meetings have taken place in the kick-off meeting and launch workshop in Cracow (17-20 March 2002), and for the Integration Team at CERN (11-15 of April, see below) and at the IN2P3 Computing Centre in Lyon (23-24 of April).

### ***The Integration Team***

The Integration Team is the basic technical force to manage testbed releases. The core of this Integration Team (ITC) has been defined taking into account expertise and availability inside the Collaboration, and is composed by Brian Coghlan (TCD Dublin, Ireland), Jorge Gomes (LIP Lisbon, Portugal), Marcus Hardt (FZK Karlsruhe, Germany), Rafael Marco (IFCA Santander, CSIC, Spain) and Javier Sanchez (IFIC Valencia, CSIC, Spain).

One of the objectives for this ITC is the collaboration with the EDG Integration Team; a first meeting took place at CERN, to get an in-site knowledge of the EDG testbed 1 setup, and with French EDG colleagues at Lyon to review issues regarding testbed setup and computing centre operation.

This ITC is being extended to include two more responsables for testbed sites (Christos Kanellopoulos from AUTH, Thessaloniki, Greece and Pawel Wolniewicz from PSNC, Poznan, Poland) as the testbed is also extended to more countries.

The full Integration Team includes also technical representation from WP1 responsables for application deployment (contact is Dick van Albada) and from WP2 (contact is Roland Weissmuller) and WP3 (Santiago Gonzalez).

### ***Sites selected for first testbed setup***

The first testbed setup will take place at sites with experience in the EDG software installation and where hardware is already installed and available. The list of sites includes IFCA (Santander) and IFIC (Valencia) for CSIC (Spain), FZK (Karlsruhe, Germany), LIP (Lisbon, Portugal), and TCD (Dublin, Ireland). Note that all these sites have a member in the ITC. The initial setup for this testbed sites should be ready by June 2002. It will be followed by other sites as soon as the hardware is bought and installed (funding for equipment is being received now). All sites should have the initial testbed installed before September 2002. Finally, UvA (Amsterdam, the Netherlands) will use the available EDG testbed site at NIKHEF, formalities being arranged.

### 2.3. TESTBED SETUP (TASK 4.1)

The testbed setup task 4.1 includes participation from all 15 institutions with testbed sites, and is coordinated by Rafael Marco from CSIC (IFCA, Santander, Spain),

#### **Requirements from WP1, WP2, WP3 and Architecture Team**

The testbed planning is prepared with the aim of supporting the application deployment in an interactive Grid framework. Even if the first application prototypes will be ready only at the end of the first year, and will run in a local testbed, they affect significantly the testbed planning.

The interactive nature of applications in the CrossGrid project means that more emphasis has to be given in the testbed setup to aspects related to the quality of service and availability of resources, when compared to testbeds supporting large batch production jobs, as can be seen in the corresponding deliverables including the application descriptions:

**The Biomedical application** [1], requires computing resources, *“it will need access to shared grid resources for the blood flow simulation engine”, with “no special hardware (high performance parallel computing system)”*. It poses no special constraint *“all modules will interface with the underlying computing and communication hardware through a (standard) operating system, such as Linux...”*. For the visualization subtask, *“GVK will provide sophisticated compression and abstraction mechanisms, depending on the available network throughput”, and in particular “QoS concerning the available is very interesting for GVK visualization, hence there will be a possibility to specify the required network bandwidth within the visualization request”*. Also *“GVK is relatively loosely connected to the grid middleware, however GVK would benefit from improvements within the following grid technologies: QoS concerning network bandwidth; possibly resource reservation”*.

**Flooding crisis team support** [2], *“will need a minimum of three geographically distributed clusters, of 16 nodes each”, and “QoS management in networking should be able to guarantee a stable interconnection of Problem Solving Environment components: in crisis operation mode we need to guarantee its stability and speed”*

**The high energy physics interactive application** [3], indicates that *“two critical points are data storage and network connection” and “efficiency in data access and processing depends upon the local hardware storage configuration”*. Also *“more critical information on the hardware status is expected via the monitoring mechanisms (task 3.3), in particular for possible decision while waiting for a MPI collective regarding dead or extremely slow nodes”*. Regarding the hardware, *“proposed for use in LHC is based on IA32 with Linux RedHat as OS”*.

Finally, **the weather Forecasting and air pollution modeling application** [4] explicitly requires *“a testbed setup (defined in WP4), with a Virtual Organization (VO) dedicated to weather forecasting (CROSSGRID-WEATHER), including the possibility of interactive use of at least 100 WORKER nodes, distributed across at least three different sites, with replication facilities for databases”, and also states that “performance of linux cluster should be comparable to the performance of HPC”*.

We can conclude that the requirements of the applications to run in a distributed grid environment can be fulfilled with the proposed configuration based on local linux clusters interconnected via high-speed network, with the following conditions: possibility of advance reservation service for use in interactive and parallel mode of the distributed resources, fulfillment of basic QoS criteria, and existence of a “production” testbed with a significant (at least 100) number of interconnected distributed machines, including at least three sites with a powerful local cluster.

These requirements are propagated to the WP2 programming environment and the WP3 middleware, and considered also in the Project Architecture proposal regarding the possibilities provided by external middleware from EDG and Globus.

Interactive use will proceed through User **Portals** developed in task 3.1 [5], supporting roaming access. This will require, from the testbed side, setting up the corresponding services in the Virtual Organization, likely sharing the hardware resources with those used for implementing the V.O.

**Scheduling Agents** are proposed in task 3.2 [6] as “*responsible for deciding the allocation of application tasks to computing resources*”, indicating that “*Condor-G is going to be adopted as grid resource manager*”, and “*the glide-in mechanism evaluated as a candidate to support MPI applications distributed over multiple sites*”. The architecture is an open issue, with two possibilities: one based on a tight design where all the components are integrated, or a modular one with subcomponents distributed across the V.O. Existence of Resource Brokers and Job Submission Services is assumed. All these points will be considered on the testbed architecture. Also Scheduling Agents will take advantage of any available service of advanced reservation, and the implementation of a reservation service at the Resource Broker (RB) level will be studied during the second year of the project. A second design in later stages of the project would include more than one RB within a V.O.

**Monitoring** middleware (task 3.3 [7] ) does not impose any extra constraint on the testbed setup, and will provide very valuable information for its operation, as the Jiro technology in task 3.3.3 will monitor infrastructure components. The initial testbed, following EDG, will use the Globus MDS information service, which will become obsolete by end 2002, and replaced by the R-GMA: “*for the MDS, an appropriate extension to the DataGrid MDS schema will need to be formulated and populated with details of the CrossGrid Testbed 1 (CG-TB1); this should also be done for the R-GMA, again for CG-TB1*”. Site adaptations include “*for OCM-G, and SANTA-G, a nearby host must have the DataGrid R-GMA software installed and configured; for Jiro-based monitoring a nearby host must have the Jiro services installed.*”

Finally, the **Optimization of Data-Access** task 3.4 ([8]), includes “*support for local-site optimization for data storage strategy*”. Related hardware nodes (Storage Elements, Metadata and Replica Catalog) “*should have at least one public IP address*” and “*there are no special hardware requirements for nodes sustaining SE software*”. Additionally the larger sites should have installed the ‘Component-Expert Subsystem’.

### **Definition of Security and Administrative Policy**

There are two main issues in security access: Authentication and Authorization.

Secure **Authentication** will be guaranteed through the use of Certificates. A **Certification Authority (CA)** working group has been created for assuring an efficient certification infrastructure. The plan is to extend the CAs infrastructure already existing from the DataGrid project following the policy of having one CA per country. It will include managing and improving CAs in Germany, Ireland, Portugal and Spain, and setting up and managing new CAs in Slovak Republic (II SAS in Bratislava), Cyprus (University of Cyprus), Greece (University of Thessaloniki) and Poland (PSNC in Poznan). The centers participating in the ‘first testbed setup’ (in Germany, Ireland, Portugal and Spain) have CAs already working and ready to support testbed deployment. Contact with DataGrid CA working group has been established, cross compatibility and acceptance has been checked. A ‘CA Matrix Acceptance’ is under development to enhance the quality through cross inspections and simplify the CA acceptance at each center. For sharing information a web site <http://grid.ifca.unican.es/crossgrid/wp4/ca> and an e-mail list [crossgrid-ca@lists.cesga.es](mailto:crossgrid-ca@lists.cesga.es) have been created. CA issues are discussed in WP4 VRVS meetings, and specific meetings organized if necessary. Also participation in CA meetings inside EDG WP6 takes place (last one in the EDG workshop on March 5th in Paris, next one expected by 27th of June in Praha) .

**Authorization** will be managed with the creation of **Virtual Organizations (V.O.)** and use of special tools at each grid site. A virtual Organization will be created for CrossGrid users, for each application, and for specific uses as needed. Development of new authorization mechanisms like CAS will be studied and implemented if found adequate. A Virtual Organization for CrossGrid test issues is under construction, being supported by IFCA (CSIC, Santander, Spain). Apart from this technical implementation, some ‘good use policies’ will be defined to adequate to every local computing policies.

In a more general framework, all the details that could affect the security over the CrossGrid testbed will be studied by an expert working group created for this purpose. This group will care about adequate implementation of a general security computing infrastructure, and their work will include defining patches for operative systems, define appropriate firewall configurations, suggest and/or apply security mechanisms to guarantee the integrity of the original installation and keep running services and open ports under control and trace security problems. Specific grid security will be studied by this group in coordination with the DataGrid team (contact with DataGrid has already been established and CrossGrid members are participating in DataGrid Security meetings; see also below details on the meeting at Lyon).

### ***Basic Infrastructure for testbed installation***

A typical CrossGrid production testbed site will be based on several minimal independent components/services with different roles:

- **Installation Server** (LCFGS), installs and helps in the whole software installation and management process
- **User Interface** (UI), allows users to connect to the grid
- **Storage Element** (SE), exports file-systems to local cluster grid sites
- **Computing Element** (CE - worker node), provides CPU computing power
- **Information Service** (IS), concentrates information for local resources
- **Registration Authority** (RA), send certification requests to CA (this is an organizational procedure)

Besides, some central services for the project are needed:

- **Certification Authority** (CA), provides certificates (one per country)
- **Resource Broker** (RB), assign resources to requests
- **Root Information Server** (RIS), works as root of the structured IS
- **Virtual Organizations** (VO), helps in authorization procedure

In the “First Testbed Setup” period, the plan is to integrate CrossGrid testbed as much as possible in the DataGrid testbed. It likely will include sharing of their central RB and central IS. CrossGrid generic VO will be provided by IFCA (CSIC). Each site will assign at least the following dedicated hardware nodes: 1 LCFGs, 1 UI, 1 SE, 2 CE, 1 IS, (plus one CA at each country). See section 2.5 and Appendix 1 for more technical details.

Central services like RB, IS (Root) and later Relational Grid Monitoring Architecture (R-GMA), and more VOs will be implemented in the next testbed extension phase. Depending on possible computing or data challenges, more CE-Worker, SE and UI nodes will be added to this basic infrastructure.

### ***Testbed incremental release procedure***

Once a minimum CrossGrid production testbed infrastructure is working, an incremental life cycle approach will be adopted. It means that maintaining as much as possible the working infrastructure, new improvements and developments will be added in an as soft and stepped way as possible. An example of incremental work could be the setup of a new dedicated Resource Broker.

The integration of new technologies, currently under development, will have to be studied in coordination with other WPs requirements and keeping as much as possible the compatibility with the DataGrid testbed.

The plan for 2002 is to run the same testbed software in the DataGrid project (initially the 1.2 testbed configuration corresponding to the middleware release 1.1.4) for the production testbed. For 2003, new middleware, based on OGSA, is expected to be released by the Globus project. An

evaluation of pros and cons including the initial experience in the development testbed and checks and tests in the validation testbed, will have to be done before a new release is deployed in the production testbed. In the same way new middleware developments from WP3 will be added in an incremental procedure in the production testbed once they have been first deployed in the development testbed and then tested in the validation one. See section 2.6 for further details.

#### **2.4. INTEGRATION WITH DATAGRID (TASK 4.2)**

The integration with DataGrid task 4.2 is coordinated by Marcel Kunze from FZK (Karlsruhe, Germany), in collaboration with TCD, CSIC, UAB and LIP, that have experience working with DataGrid WP6.

The CrossGrid Testbed Integration and Architecture Teams met with the EDG corresponding teams in April at CERN. CrossGrid is interested in using the EDG current testbed setup in production to provide a solid start point and assure interoperability.

EDG testbed is running on several clusters of Linux RH6.2 machines at CERN, Italy, France, UK, and Holland. Our aim is to integrate in the EDG testbed 1.2 by mid June 2002, released in April 2002.

##### ***Review DataGrid testbed situation***

After the first year of operation the DataGrid has built up a testbed consisting of 5 sites (NIKHEF.NL, RAL.UK, CERN.CH, IN2P3.FR and CNAF.IT).

Following is a list of major current working issues in EDG:

1. Installation: EDG provide a way for testbed installation based on the LCFG tool from Edinburgh University (Large scale ConFiG <http://www.lcfg.org>). LCFG is a server process offering configuration and binary files to its clients. The complete configuration of all clients is prepared on the server. The client nodes are installed and configured using these files from the server. EDG provide templates of the complex configuration of its software, to ease installation. One Issue about LCFG is that it claims to be the one and only solution to install the clients, i.e. for the whole testbed cluster. This approach is not feasible for medium or large computing centers, when they are already using different automatic installation tools. In that case they cannot benefit from the easy configuration using LCFG. Thus EDG are developing LCFG-Lite, targeted to automate the installation and configuration of only their software on already existing nodes.  
Another issue is the configuration language of LCFG. A High Level Description Language (HLDL) will be added in the Next Generation Version of LCFG (LCFG-NG), which aims to simplify configuration. It will be included within the next (1.3) release of EDG installation software. There will be some more features among which the most important will be the support of RedHat 7.2. Solaris support is also a goal, but lacking manpower.
2. Authentication: EDG have built up a hierarchy of Certification Authorities (CAs) (one in every country) and Registration Authorities (RAs, assigned to the Country-CA). They are working (issuing certificates) and trusting each other, thus allowing each of their members to be identified at every site.
3. Authorization: The decision whether to grant access to a site is made after a user is successfully authenticated (not authorized). This decision is based on the membership of the user in a defined Virtual Organisation (VO). There is one VO for each Application, allowing site managers to grant local cluster usage per Application. A bit more fine-grained access control is added through modification of the "gridmapfile", rejecting or allowing certain users or groups. Still this solution does not cope with thousands of users and lots of VOs. This is

why the Globus CAS (Community Authorization Service) is likely to be integrated in a future EDG release.

4. Information Services are used for providing a way of finding resources in the grid. Currently two different implementations of LDAP (i.e. MDS and Ftree) are used in DataGrid. The layout of the LDAP tree (schema) is currently being designed by the GLUE project (a Group committed to interoperability of European and American Grids). DataGrid are participating in this project and suggested CrossGrid to do so as well.  
For future use EDG are developing the "Relational Grid Monitoring Architecture" (R-GMA). This is a Relational Database system, which will be used not only as the basis of an information system but also for monitoring. One issue of R-GMA development is to have a compatible interface to seamlessly replace MDS or Ftree.  
Extending the look into the future, EDG believe that the upcoming OGSA, included in Globus 3.0, will have a big impact on EDG releases.
5. Storage: EDG have just launched a group to address storage, that will provide a seamless interface for access to a wide range of storage technology and a variety of protocols. It will be optimized for big files that can be accessed with high latency.  
Furthermore, a filesystem named "/grid" (slashgrid) has been developed. This filesystem is not based on Unix User IDs (UIDs) but on the Distinguished Names (DN) from certificates. The integration into the default EDG installation is yet to come.
6. Licensing: EDG are evaluating to publish the complete Software that is produced within the project under the Open Grid License Agreement (OGLA). This is a BSD-like license, that has been developed by the GLOBUS project. It allows GPL software as well as commercial companies to use their code.
7. Development policies: EDG found to need well defined policies for the organizational part of their software development and deployment. This is work in progress and will be coordinated with and/or adapted by CrossGrid.  
Another current issue on this topic is the variety of programming languages in EDG. This situation is not desirable for project internal interoperability. Thus a common effort with CrossGrid, to decide on one or two high-level languages and two or three scripting languages would be welcome. A document regarding the CrossGrid policies may be released soon.
8. EDG Roadmap: the most important issues are the shift towards RedHat-7.2 for testing in EDG-1.3, by end of May and an stable release based on RedHat-7.2 with EDG-1.4 by end of July. EDG is partner of Globus for early beta releases of Globus middleware and thus will stick to the newest Beta releases of Globus. CrossGrid will be EDG partner in test of early beta releases of EDG middleware and thus will stick to the latest EDG-releases. This is considered as the first step towards interoperability of both grids.

#### ***Establish participation in DataGrid WP1/WP5 meetings:***

Already CrossGrid members from Germany, Ireland Portugal and Spain, are actively taking part in EDG testbed Organization. Both projects are interested in an extension of this common work to all CrossGrid testbed partners. In the TAT and ITC meetings with the corresponding groups from EDG at CERN in April, a final Framework for CrossGrid and EDG Collaboration was agreed on. It is the "Framework for CrossGrid DataGrid Collaboration", spanning many points in the fields of:

1. Grid Architecture
2. Applications
3. Benchmarks and monitoring
4. Testbeds
5. Software testing

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## 6. Dissemination

## 7. Management

For a commented and more detailed list of common points of interest, please refer to the Deliverable from WP5 [9]. In particular, regarding the testbed, collaboration will address:

- interoperability of both Grids, initially for HEP applications
- mutual recognition of Certification Activities
- elaboration of common access and usage policy and procedures
- common work of testbed integration teams and testbed support teams
- elaboration of common installation and configuration procedures
- joint effort with migration of software to Solaris platform

CrossGrid will be EDG's partner in test of early beta releases of EDG middleware. This is considered as the first step towards interoperability of both grids.

In a later meeting in April in Lyon with our French colleagues in EDG, regarding mainly cluster setup and user support, the following additional topics were found interesting for collaboration:

1. User Support/Helpdesk: both Projects will have to support the technical staff installing the specific software on their clusters as well as the users running applications on these clusters. The idea is to install a simple but powerful e-mail and/or web-based tool. See the description of task 4.3 below for more details.
2. Infrastructure: both projects have very similar requirements to infrastructure in terms of publishing source code, software releases, compiling and testing tools. Collaboration will include
  - Exchange of experience in running the infrastructure
  - Co-development of an automated build tool (autobuild)
3. Installation: due to the compatibility to EDG, CrossGrid needs to solve the same problems as EDG. Thus the effort enhancing the LCFG/LCFG-lite tool will be joined.
4. Set up of a common security task force: security is a common and very serious issue for all sites. New solutions have to be found to cope with problems arising in Grid environments. For example which measures have to be taken if a trusted site is compromised, or how far a hacker could come and what damage could he cause. These are questions that a common security task force would address (see [4.2.3] for details).

### **2.5. INFRASTRUCTURE SUPPORT (TASK 4.3)**

The infrastructure support (task 4.3) is coordinated by Josep Salt from CSIC (IFIC, Valencia, Spain) and includes participation from FZK, UCY, UAB, USC, AUTH and LIP.

The aim of this task is to provide testbed sites with easy and flexible fabric management tools, and network support for the deployment of local grid infrastructures and their interconnection.

The organization into subtasks is as follows:

1. User Support, including an Installation Kit, and Help Desk definition and operation
2. Fabric Management tools: review of existing and definition or adoption of those adequate for the CrossGrid testbed
3. Network support

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In this first planning phase, there are two objectives: provide expertise on hardware and network configurations, and the definition of the User Support and Help Desk requirements

### ***Hardware and Network configuration***

The first step to establish a new testbed site is the planning of the hardware acquisition and installation. In the case of the CrossGrid testbed, the starting point is a configuration adequate for joining the DataGrid testbed, as already indicated.

Some of the testbed sites (in particular LIP, CSIC (Santander and Valencia), TCD and FZK) already had bought and installed themselves in the months previous to the project start, a hardware configuration with this purpose, and based on this experience provided a short document as orientation for other sites. This document is included in Annex 4.2, and the basic configuration includes the hardware to support the basic services (see 2.3 above), with the following elements:

- Gatekeeper: a computer system configured to be an interface between local computing facilities and the Grid. The gatekeeper receives remote requests for job submission through the Grid middleware and submits these requests to a local farm using the farm job scheduling software.
- Worker Node: a computer system configured to perform computing operations such as running user programs.
- Storage Element: a computer system configured as a data storage server. Each set of Computing Elements must have one or more corresponding Storage Elements from which data is retrieved for processing and stored at the end.
- Installation Server: a computer system configured to provide the components to manage and store centrally the site fabric configuration information. The installation server software provides a configuration language and a central repository of configuration specifications and RPMs used to install and upgrade automatically individual Grid nodes.
- Replica Catalogue: the replica catalogue server contains a database with the mapping between logical file names and the location of the corresponding physical copies. Associated to the logical name additional attributes are stored as metadata.
- Root information index server: the system hosting the root index server of the information tree. This is the point from where the resource broker starts searching for suitable resources.

The CrossGrid testbed will be based mainly on IA32 linux machines; the starting OS will be RH6.2, the one supported currently in the DataGrid testbed 1.2, that will evolve soon to RH7.2 .

The basic local network backbone interconnecting these machines should be at least Fast Ethernet, and a dedicated switch is recommended.

As indicated before, many of the sites are yet in the process of hardware acquisition and installation. For monitoring and coordinating this process, a status web page has been defined ([http://grid.ifca.unican.es/crossgrid/wp4/internal/status\\_of\\_installation](http://grid.ifca.unican.es/crossgrid/wp4/internal/status_of_installation)) with links to the details at each testbed site. A snapshot of the situation is included in the information in Appendix B.

Regarding the local network setup, currently the provision of public IP numbers is highly desirable as the MPI mechanism needs public IP addresses. Moreover, a dedicated subnetwork (C-class) is a good starting point. However the local network setup is not always in the hands of the CrossGrid testbed site responsables, but these have to agree with the local network authorities (Academic Computing Centers usually). This also includes the essential point of the connection to the national network provider, and then to the Geant European network. The use of the Geant network is

considered as a basic ingredient, and assured through the agreement with all national network providers in the framework of an European Research Project. Note that all testbed sites correspond to academic or basic research public institutions. All the testbed sites have contacted their local and national network providers and checked explicitly the possibilities regarding the network use. This is described also in Appendix A.

**Quality of Service (QoS)** has been identified as one of the network topics of possible interest, regarding the deployment of interactive applications and in particular parallel interactive jobs using MPI. The possibility of using for example priority criteria on MPI communication packets, has been considered, and a working group lead by USC and CESGA, including participation of LIP, CSIC, and the universities of Thessaloniki and Cyprus, has been established. The Spanish academic network provider, RedIris, involved via CSIC, will collaborate in this study, in particular regarding the current possibilities inside a country and between two sites connected through the Geant network. Specific middleware, like MPICH-GQ from the Globus team, will also be considered.

### ***User Support: Installation Kit and Help Desk requirements***

This subtask aims to support the work of all testbed “users”, from testbed site administrators, to final application users, regarding points related to the testbed installation and use.

The two main tools to organize this support are the Installation Kit and the Help Desk.

The **Installation Kit** will allow, as indicated by its name, an easy installation of all the software needed for a new deployment of the CrossGrid software at a testbed site, including applications and middleware from WP1, WP2 and WP3, and also external software including Globus and DataGrid middleware. Considering that the CrossGrid will work in an open-source framework, it is possible to consider an almost self-contained installation pack, including most of the relevant software, plus a set of configuration files to be defined at each site.

The starting point for the preparation of this kit is the review of the installation kit from the DataGrid project (see Appendix C).

For CrossGrid, a complete web server project support based on the Source Forge (SF) open source software, will be setup, hosted primarily by FZK. It will include access via CVS to the CrossGrid software, provided as source and binary RPM files, and also use configuration files containing the information to download the relevant RPM files for a given installation. Access to the Globus, DataGrid and required external software will be also provided.

**The Help Desk** will be the main tool for user support activities that will allow the cohesive progress of the testbeds of our project, so a big effort will be devoted to this aspect. This essential tool will be implemented for WP4, and later extended to the other workpackages. Due to the importance of the testbed organization the main subjects to cover are the ones related with the deployment, evolution and working of the testbed of the sites. According to the guidelines of the CrossGrid Kick-off meeting, a close interaction with the User Support Group of DataGrid is recommended because of the overlapping of interests in our projects.

First of all we need to establish the set of requirements of our User Support and Help desk facility. Let’s consider the characteristics of our collaboration: we are 22 partners distributed across Europe, from Portugal to Cyprus. The different level of implementation and deployment of the testbed infrastructure implies that the flux of information and expertise must be an important aspect for the success of our project. Our User Support system must be robust and well designed in order to give a complete service to all the sites involved in CrossGrid.

The main tool of the User Support System is the Help Desk Tool. After a first round of discussions involving CrossGrid people and the DataGrid User Support people we can point the following requirements (a more detailed description in Appendix C):

1. To follow the evolution of a given question.

2. To include a 'Frequently Asked Questions' (FAQ)
3. To define the User Support Team with two levels of service (basic and expert)
4. To generate Installation Recipes
5. To provide access to tutorials
6. To build a Knowledge Data Base
7. To have access to fast links to different services
8. To provide inputs to the Bug Tracking System

Moreover, the User Support program must have a flexible system in which different media (phone, e-mail, fax, etc) will not be excluded although it would be essential to include the involved knowledge in the Help Desk Data Base.

There are many tools in the market, both commercial and free. A brief review of different Help Desk products is given in Appendix C (including [www.sourceforge.org](http://www.sourceforge.org) and its commercial version from Vasoftware, SourceForge 3.1, [www.helpdesk.com](http://www.helpdesk.com), [www.liberum.com](http://www.liberum.com), [www.remedy.com](http://www.remedy.com) ). The initial conclusion is that Standard Commercial tools are expensive and do not fit adequately to the CrossGrid Testbed usage. The choice of the Help Desk product will be based on the fulfillment of the previous requirements, giving preference to non expensive and, if possible, Open Source possibilities.

The first actions that have been taken are: a) the creation of an e-mail list ([crossgrid-wp4-support@lists.cesga.es](mailto:crossgrid-wp4-support@lists.cesga.es)) to obtain the first feedback of the different problems found by the users and system administrators, to provide the initial categories of the knowledge database, and b) implement an initial knowledge database using MySQL with a web php based interface.

## 2.6. VERIFICATION AND QUALITY CONTROL (TASK 4.4)

The verification and quality control task is lead by Jorge Gomes from LIP (Lisbon, Portugal), and includes participation from CYFRONET, CSIC, and DEMO.

For this detailed testbed planning phase, the **verification and quality control procedure**, aiming to establish a validation process, has to be defined. The description of its main points is given below, while Appendix D includes its complete description and operational documents.

The main objective of this procedure is to improve the stability of the CROSSGRID testbed by:

- Reducing the number of middleware problems that would pass unnoticed to developers;
- Preventing the wide deployment of components with critical problems;
- Assuring the conformance of the middleware with the specifications;
- Detecting design errors;
- Identifying potential bottlenecks;
- Detecting software security issues;
- Evaluating the middleware documentation;
- Testing installation kits;
- Testing the middleware components;
- Providing feedback to developers;
- Producing recommendations to system managers and users.

The test process will be divided in two phases (see Annex 4.4 for further details):

- 1) ALPHA – Internal validation and testing by a reduced set of WP4 (Testbed) members
- 2) BETA – Testing by a reduced set of knowledgeable users using applications.

A separate testbed infrastructure is required for the test activities, in order not to disturb the “production” and “development” testbeds over which stable middleware is being used and applications are being developed. The test infrastructure should be kept small with up to four sites experienced in the deployment and test of Globus and DataGrid middleware. The test infrastructure should be maintained closed to all end users until each ALPHA phase is finalized. Then it should be open only to authorized BETA test users. Each site will appoint a contact person responsible for local installation and configuration issues. Different site configurations will be required based on the tests to be conducted, therefore the installation server will play an important role by storing pre-defined configurations which will allow to change the site configuration according to test requirements with a reduced management effort.

Tests will need to be scheduled to assure a smooth workflow. Different tests may require different software versions and configurations therefore tests of different components may not be able to be performed simultaneously. Scheduling will be based on:

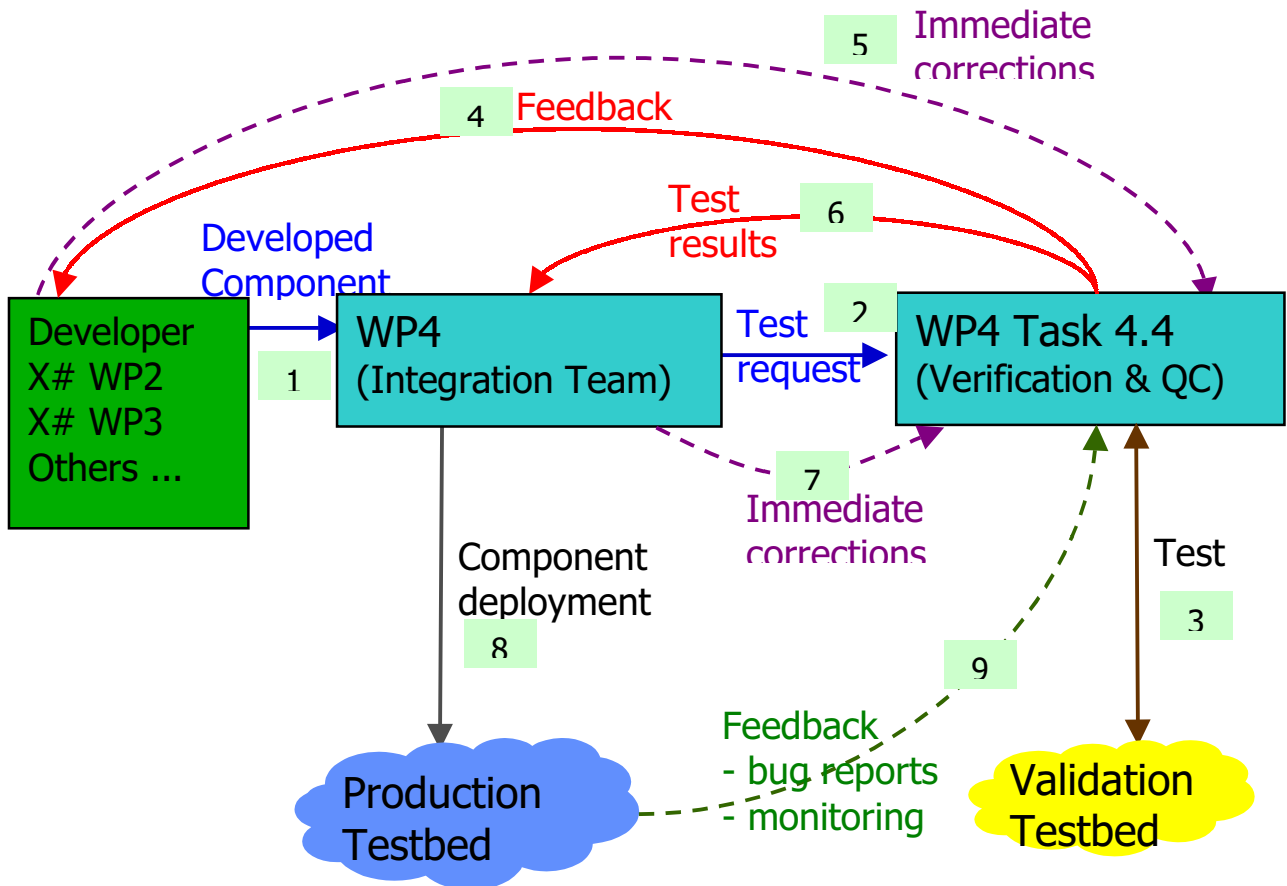
- Priority of the request. The priority is an indication of the necessity of the test results for the requester.
- Number of sites required to perform the tests. A test may require one or more sites.
- Amount of configuration work required to prepare the sites.
- Availability of human and material resources for testing at each site.
- Availability of suitable test programs. Test programs may need to be developed.

Initially the testbed will be based on middleware produced by Globus and DataGrid to which CrossGrid developed components will be added later. This means that middleware produced by other projects will be installed in all CrossGrid testbed sites and therefore needs to be tested jointly with CrossGrid middleware components and applications before deployment. Feedback on problems found in external components will be provided to the developers whenever possible thus contributing to the reliability and usability of the common middleware. Finally, collaboration with DataGrid on testing of common middleware components will be established.

### ***Test Procedure***

The procedure for middleware test and validation is outlined in the figure below that describes the flow of actions from the development to the final deployment. The steps are as follows:

- 1) The WP4 integration team identifies or receives new or updated middleware components.
- 2) A component test request is issued to the task 4.4 verification and quality control team. This can be a request for testing an individual component or a set of integrated components.
- 3) The test is performed in a separated testbed infrastructure.
- 4) Feedback on identified problems is sent to the developers.
- 5) If possible developers will answer with immediate corrections.
- 6) Feedback on integration problems is sent to the integration team. Once the test is complete a full report is also sent to the integration team.
- 7) If problems in the WP4 component integration are found then the integration team may issue immediate corrections.
- 8) The integration team deploys the tested middleware in the production testbed.
- 9) Task 4.4 will monitor the stability of the production testbed through bug reports and monitoring information aiming to identify the need for further tests and to make the test and verification process more efficient.



**Figure 1 Testing procedure steps.**

The WP4 integration team chooses the middleware to be integrated in the CROSSGRID testbed. In order to test and validate each component or fully integrated middleware release the integration team issues a test request to the testbed verification and quality control team. The verification and QC team performs the requested validation tests using a separated testbed infrastructure and reports back the results to the integration team and whenever possible to the developers. Corrections introduced by the developers and the integration team during the test procedure will be accepted for retest whenever possible. Upon receiving the test results the integration team decides whether to deploy the components in the production testbed. Checking the production testbed bug reports and monitoring data will help verify the effectiveness of this test procedure and the need to perform further tests. The monitoring and bug report information will be gathered from the WP4 monitoring and bug tracking services. Middleware developed in the CROSSGRID context is to be delivered to the WP4 integration team with the basic functionality tests already performed by the corresponding work-package integration task. This will allow WP4 task 4.4 to focus on testing the delivered middleware integrated with other components and verify their correct interoperation. These activities should be performed in close collaboration with the developers and integration teams from WP2, WP3 and WP4. Direct contact with them will help resolve detected problems and clarify doubts that may appear contributing to reduce the test duration and effort.

Validation and test of middleware can be requested by the following entities:

- The CROSSGRID integration team;
- The WP4 manager;

Problems found while performing the validation tests will be classified regarding their severity and priority, these two attributes define the urgency and impact of the problem and help to determine which issues must be addressed first. For each severity level described below a guideline action is recommended. The severity classification is as follows:

- **Critical** – When a problem causing a failure of the complete software system, subsystem or program within the system is found.  
ACTION: The component should not be released. Further tests on the component and on all components depending on it will not be performed until the problem is corrected.
- **High** – When a problem that does not cause a failure, but causes the system to produce incorrect, incomplete, inconsistent results or impairs the system usability is found.  
ACTION: Developers MUST perform the required corrections but the component can pass to the next phase. A deadline will be given to the developers to make the corrections;
- **Medium** – When a problem that does not cause a failure, does not impair usability, and does not interfere in the fluent work of the system and programs has been found.  
ACTION: Corrections should be performed but since the component critical functionalities have been successfully tested and the component can be deployed. However the problem must be mentioned in the documentation.
- **Low** – When the problem found is aesthetic is an enhancement or is a result of non-conformance to a standard.  
ACTION: The problem does not interfere with the functionality or operation therefore the component can be deployed. However the problem must be mentioned in the documentation.

The priority classification is as follows:

- **Immediate** – When the problem should be resolved immediately.
- **High** – When the problem should be resolved as soon as possible in the normal course of development activity, before the software is released.
- **Medium** – When the problem should be repaired after all other more serious problems have been fixed.
- **Low** – When the problem can be resolved in a future major system revision or not resolved at all.

CrossGrid components to be tested must be delivered with:

- Software installation kit and download instructions;
- Test software and corresponding source code. The provided test software will be used to perform the first basic tests, and may be changed to perform more comprehensive or intensive tests. The test software must at least cover the basic component functionality and interoperation with other lower level components.
- Documentation:
  - Installation, configuration and test manual.
  - User manual when applicable. User interfaces must be extensively documented.
  - Development manual when applicable. APIs and dependencies on other components must be extensively documented.
  - Developer contact information including name, partner, address, E-mail, phone, fax.

Non-CROSSGRID components can be delivered without the elements described above, although their absence will make the test procedure harder and longer. Test of components based on faulty lower level services should not be requested. However test requests will be accepted if the low level problems do not collide with the features to be tested. Components to be tested must be delivered with a Component test request form (Appendix D, annex 1) correctly filled.

The validation steps are the following:

- Verify the middleware documentation;
- Verify the delivered middleware against the software requirements;
- Compare the delivered middleware interfaces against the architecture documents;
- Test the middleware.

The testing procedure, as indicated, involves two phases:

- **Alpha test phase:**
  - Test each delivered component alone if possible;

These tests should be performed with test software provided with the component. If needed these tests will be enhanced to perform a thorough evaluation on issues such as reliability or performance.

For non-CROSSGRID components basic tests will have to be developed when unavailable.
  - Test each component locally integrated with other components;

The objective of these tests is to verify the functionality and interoperation of the component with other deployed components from CROSSGRID and external sources.

Programs will have to be developed to test the middleware features available to user applications. These programs will be submitted as a succession of real user jobs with increased complexity using intensively the middleware features in several combinations.

The middleware performance will be evaluated using benchmark software developed by CROSSGRID WP3 as soon as available.
  - Test each component across test sites;

In these tests the component is deployed in several test sites. Jobs of increased complexity are submitted between sites in order to test the component behaviour in situations as similar to real production as possible.
  - Problems found are immediately reported back to the developers for correction and a deadline will be given for the submission of required corrections after which the report will be sent to the WP4 integration team.
- Once the Alpha test phase is finished:
  - A report is sent to the test requester;
  - The Beta phase is started only when the Alpha phase is finished successfully or with low or medium severity problems;
  - The Beta phase might be started for components with high problems at request of an entitled entity when properly justified.
- **Beta test phase:**
  - Knowledgeable users and other middleware developers are invited to use the testing infrastructure and perform their own tests preferably using real applications.

- 
- Testers should receive:
    - Information on what new components are being tested;
    - All middleware documentation available;
    - Information on which sites can be used for testing;
    - Recommendations and results from the ALPHA phase.
  - Users must report back immediately any problems found.
  - Once the Beta test phase is finished:
    - A final report is sent to the test requester and developer.

Task 4.4 will provide the following tools for test and validation activities.

- Web site for testbed and activity coordination;
- Mailing list to exchange information between testers;
- Bug reporting system for testers;
- Test software:
  - General test suite;
  - Specific tests for specific functionalities.

### 3. SCHEDULE AND ACTIONS

The detailed testbed planning described before, requires also a realistic schedule, extending the Workflow specification given in Annex I [10] for the first months for each task.

This schedule has to take into account several issues:

- The interoperability with the DataGrid testbed, means in practice that the CrossGrid testbed will follow DataGrid testbed release along its lifetime. This will extend for months 3-21, and doesn't collide with the necessary evolution to support the application prototypes by month 22
- The evolution of the basic Grid middleware, like the change from Globus 2.0 toolkit to the OGSA based version, with ALPHA releases for high level services scheduled for summer 2002, and for core services by end of 2002, beginning of 2003.
- Computing and Data challenges from DataGrid, and likely from the LCG, will have an impact on the production testbed setup, as they will likely be considered in the large European grid testbed.
- Availability of dedicated hardware and manpower at the different testbed sites: an initial group of sites with available hardware and expert personnel has been identified, and will lead the effort to setup the first testbed on these selected sites.

#### 3.1. GENERAL COMMON DESCRIPTION OF SCHEDULE

##### **Organization**

The schedule is organized in several **phases** as described in Annex I:

1. Detailed testbed planning phase, extending from month 1-3 (April to May 2002)
2. Setup of first testbeds in selected sites, M 4-6 (June-August 2002)
3. Release of testbed prototype 1, M 7-10 (September-December 2002)
4. Support for Application Prototypes 0 and Middleware, M 11-21 (January to November 2003)
5. Support for Application Prototypes 1, M22-30 (December 2003 to August 2004)
6. Final Testbed with Integration of Applications, M31-36 (September 2004 to February 2005).

For each of these phases, the work is organized in different tasks and subtasks previously described, is organized into actions. Actions are proposed, revised and discussed at each meeting.

There are four main **milestones**:

1. M4.1: Testbed setup plan: at the end of the detailed testbed planning phase, in month 3 (May '02); this milestone has been reached: the proposed planning follows what was proposed in Annex I, in particular the decision to join the current EDG testbed 1.2.
2. M4.2: First testbed on selected sites: at the end of the second phase (month 6, Aug'02); an important milestone, based on the the experience at these selected sites.
3. M4.3: First CrossGrid testbed release, month 10 (Dec'02); it involves all testbed sites, and will provide solid base for the support phase for applications and middleware development.
4. M4.4: Final testbed (month 33, Dec'04); also the final milestone, aiming to show a testbed "running" the interactive applications.

As result of this work, the workpackage includes nine **deliverables**, in the form of working prototypes at the end of the testbed setup phases (M6, M10, M33), and detailed reports describing the

planning (M3), the experience supporting applications and middleware and the proposed evolution (M9, M15, M21), and the final demo and report (M36).

### ***Current and next phases overview***

The setup of first testbed on selected sites, as expected, is taking place along the first three months (March-May 2002). The integration in the DataGrid testbed will take place in month 4, June 2002, once its Integration Phase for release 1.2 at CERN is finished (this is happening along the last three weeks of May 2002). This testbed will start with a “development” and a “validation” testbed. The other testbed sites should be ready to join the DataGrid testbed 1.2 by September (month 7), when a first “production” testbed will be released. So, by September the user support tools, including the installation kit and the help desk, should be working in a first “production” framework version.

By October the CrossGrid testbed will likely participate in a Computing or Data Challenge, including mainly High Energy Applications from DataGrid and the LHC Computing Grid Project.

From month 11 (January 2003) the development testbed will start to support application prototypes 0 and middleware development. It is likely that this new software will use the new Globus release Globus 3 based on the OGSA.

By month 13 (March 2003) it is expected to have a fully operational testbed, running the first application prototypes on the production testbed. This will require an intensive integration phase that will be hosted by FZK, and result in a demonstration setup for the first project review.

The detailed list of actions after the first 15 months will be included in due time in the Testbed Project document, considered a working evolving document that will be released updated with each report. This schedule information is briefly reviewed below.

## **3.2. TESTBED COORDINATION**

Meetings are regularly arranged, with VRVS (videoconference) meetings taking place each two/three weeks (up to now: 26 March, 8 April, 18 April, 13 May, 23 May...)

The proposed calendar regarding general meetings for the first project year is as follows:

- Review Meeting dedicated to a complete release testbed version (hosted by CSIC in Valencia, October 2002, Month 8, 3 days): complete prototype release compatible with EDG testbed (1.2)
- General Annual meeting in the general CrossGrid meeting (in Santiago de Compostela, Month 14, 3 days), after selective deployment of WP1 prototype 0 applications

A similar scheme will be followed for the following two years.

Other specific meetings will affect mainly to the Integration Team. In particular the Integration Team will meet each 3 months (minimum of four meetings per year), the first two meetings taking place at CERN to attack the integration in the DataGrid testbed (first one 10-12 April, already took place, second one around 10-15 June also at CERN, to be confirmed). As indicated before, by month 13 (March 2003) it is expected to have a fully operational testbed, running the first application prototypes on the production testbed, that will require an intensive integration phase hosted by FZK, and result in a demonstration setup for the first project review.

ID	Task Name	2003														
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
33	Task Name															
34	<b>4.0 TESTBED COORDINATION AND MANAGEMENT</b>	[Solid black bar]														
35	<b>Collaboration Tools</b>	[Solid black bar]														
36	<b>Web Pages:</b> <a href="http://grid.ifca.unican.es/crossgrid/wp4">http://grid.ifca.unican.es/crossgrid/wp4</a>	[Dotted bar]														
37	Setup Server, Basic Layout Internal Pages	[Dotted bar]														
38	Mail list: crossgrid-wp4@lists.cesga.es	[Dotted bar]														
39	Meetings through VRVS	[Dotted bar]														
40	<b>Presential meetings</b>	[Solid black bar]														
41	Krakow EUCGC-1 (Kick-off meeting)	[Dotted bar]														
42	Valencia (Testbed release meeting)	[Dotted bar]														
43	Karlsruhe (Pre-review meeting)	[Dotted bar]														
44	Santiago EUCGC-2 (General X# meeting)	[Dotted bar]														
45	<b>Integration Team</b>	[Solid black bar]														
46	Integration Team Definition	[Dotted bar]														
47	First Meeting at CERN with EDG	[Dotted bar]														
48	Meeting at Lyon	[Dotted bar]														
49	Second Meeting at CERN with EDG	[Dotted bar]														
50	<b>Definition of first testbed setup</b>	[Solid black bar]														
51	<b>Preparation of report document D4.1</b>	[Solid black bar]														
52	<b>Management Tools</b>	[Solid black bar]														
53	Setup Microsoft Project Tool	[Dotted bar]														
54																
55	<b>4.1 TESTBED SETUP AND INCREMENTAL EVOLUTION</b>	[Solid black bar]														
56	<b>Site Report (PPT)</b>	[Dotted bar]														
57	<b>Technical Info (XML)</b>	[Dotted bar]														
58	<b>Hardware Infrastructure Recommendations</b>	[Dotted bar]														
59	<b>Hardware Acquisition, Installation, Connection to network</b>	[Dotted bar]														
60	<b>Preparing for EDG 1.2 Testbed at each site</b>	[Solid black bar]														
61	Installation of Network Time Server	[Dotted bar]														
62	Installation of LCFG Server Machine	[Dotted bar]														
63	Installation of LCFG Software	[Dotted bar]														
64	Set CE, SE, UI nodes	[Dotted bar]														
65	<b>Setup of V.O. CrossGrid for Development testbed</b>	[Solid black bar]														
66	<b>Certification Authority</b>	[Solid black bar]														
67	Define CA Sites	[Dotted bar]														
68	Installation of CA in dedicated machines	[Dotted bar]														
69	CA Policy documents	[Dotted bar]														
70	Emission of Certificates for users	[Dotted bar]														
71	Inclusion in CA matrix acceptance	[Dotted bar]														
72	<b>Meetings with EDG CA group</b>	[Solid black bar]														
73	Paris, 5 March 02	[Dotted bar]														
74	Prague, 27 June 02	[Dotted bar]														
75	Requirements from WP1,WP2,WP3,TAT	[Dotted bar]														
76	<b>Security Group</b>	[Solid black bar]														
77	Discussion Meeting in Lyon	[Dotted bar]														
78	Meeting with EDG (at CERN)	[Dotted bar]														
79	Establish Security Group	[Dotted bar]														
80																
81	<b>4.2 INTEGRATION WITH DATAGRID</b>	[Solid black bar]														
82	<b>Review EDG Testbed Situation</b>	[Solid black bar]														
83	Discussion and Presentations in EDG meeting in Paris	[Dotted bar]														
84	Discussion and Presentations in Krakow	[Dotted bar]														
85	Meeting with IT at CERN	[Dotted bar]														
86	<b>Establish Participation in EDG meetings</b>	[Solid black bar]														
87	Discussion and Presentations in EDG meeting in Paris	[Dotted bar]														
88	Meeting with EDG WP6 in Lyon	[Dotted bar]														
89	<b>Participation in EDG 1.2 testbed integration</b>	[Solid black bar]														
90	<b>Participation in the development testbed of EDG 1.4</b>	[Solid black bar]														
91	<b>Participation in EDG Data Challenge</b>	[Solid black bar]														
92																
93	<b>4.3 INFRASTRUCTURE SUPPORT</b>	[Solid black bar]														
94	<b>Hardware and Network Configuration</b>	[Solid black bar]														
95	Report on hardware configuration	[Dotted bar]														
96	Consideration of special hardware requirements from application side	[Dotted bar]														
97	<b>Quality of Service</b>	[Solid black bar]														
98	Setup QoS group	[Dotted bar]														
99	Review State of the Art and analyze Premium Services	[Dotted bar]														
100	Analyze Network Equipment	[Dotted bar]														
101	Analyze impact of QoS on applications and ways to implement it	[Dotted bar]														
102	Build Pilot QoS at testbed site	[Dotted bar]														
103	Report on the network topology and QoS possibilities	[Dotted bar]														
104	<b>User Support</b>	[Solid black bar]														
105	<b>Installation Kit</b>	[Solid black bar]														
106	Setup Code repository CVS using SourceForge 2.6	[Dotted bar]														
107	Preparation of first Installation Kit	[Dotted bar]														
108	Updates of Installation Kit	[Dotted bar]														
109	Consideration of realistic requirements from applications	[Dotted bar]														
110	Final testbed with integration of applications	[Dotted bar]														
111	<b>HelpDesk</b>	[Solid black bar]														
112	Review possibilities in coordination with EDG	[Dotted bar]														
113	Mail list for basic support	[Dotted bar]														
114	Preparation of HelpDesk Setup	[Dotted bar]														
115	Extension of HelpDesk Support	[Dotted bar]														
116																
117	<b>4.4 VERIFICATION AND QUALITY CONTROL</b>	[Solid black bar]														
118	Component Testing Procedure	[Dotted bar]														
119	Define Tests for testbed	[Dotted bar]														
120	Setup Validation Testbed	[Dotted bar]														
121	Follow application/middleware evolution	[Dotted bar]														

### 3.3. TESTBED SETUP AND INCREMENTAL EVOLUTION

The current schedule includes:

1. Acquisition and installation of equipment expected to be finished by end of June
2. Security :
  - a. Setup of Certification Authorities, and certificates for users, ready now in FZK, TCD, CSIC, LIP, and ready by end of June for other sites, including Policy Documents.
  - b. Participation in DataGrid CA meetings (next: June 2002 in Praha)
  - c. Participation in DataGrid WP7 meeting (May 2002), setup of Security WorkGroup, in June, first report by September.
3. Installation of DataGrid testbed 1.2, and integration will be completed in June for FZK, CSIC, TCD, LIP; by September (month 7) for the other sites
4. Setup of V.O. should be ready by end of June (initially at CSIC, Santander)

### 3.4. INTEGRATION AND COORDINATION WITH EDG

Most of the coordinated work is described in 5.1 as part of the agreement with EDG.

Regarding the testbed issues:

- Participation in the EDG 1.2 testbed integration in June 2002.
- Preview in the development testbed of EDG 1.4, with RH 7.2, by October
- Participation in EDG data challenge testbed by October 2002

### 3.5. USER SUPPORT

Time scheduling as follows:

- First 3 months
  - 1.- review and setup the local infrastructures
  - 2- to provide a Help Desk
  - 3.- reinforce connection with DATAGRID
  - 4.- setup the code repository using open source SourceForge 2.6
- Months 4-6
  - 1.- Prepare Installation Kit
  - 2.- Prepare Help Desk setup
- Months 7-10
  - 1.- Update Installation Kit
  - 2- Extend Help desk Support
  - 3.-Report on experience
- Months 11-21
  - 1- Update Installation Kit
  - 2- Consideration of special hardware requirements from application side
- Months 22-30
  - 1.- Update Installation Kit

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2.- Consideration of realistic requirements from application side

- Months 31-36

1.- Final testbed with integration of applications

Regarding the **Quality of Service**, a group is being defined, and the activity schedule is as follows:

- Month 3-12

1. Review the state of the art in current QoS technology and analyze the possibility of using IP Premium services from Geant and National Research Networks.
2. Analyze the network equipment from testbed sites to the National Networks from the point of view of QoS Technologies.

3. Analyze the impact of QoS on the applications on WP1 and changes in middleware.

4. Investigate about the mechanisms needed for getting QoS from the applications point of view

- Month 10

1. Build a pilot for QoS at a local testbed for testing purposes.

- Month 12

1. Elaborate a report describing the current network topology and identify the parts of the network where QoS is possible and the benefits that can be achieved.

In the case we can use IP premium at some sites, a decision should be taken at this point and a new planning will be done for the next year.

### **3.6. VALIDATION PROCESS**

Schedule will follow the testbed and application/middleware evolution.

The first validation testbed should be ready by June, to work with EDG on the validation of testbed 1.2

Start establishing the “test and verification” testbed:

First step: establish a V.O.

Second step: establish a RB

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## 4. APPENDIXES

### 4.1. APPENDIX A: MINIMUM INITIAL HARDWARE REQUIREMENTS FOR THE CROSSGRID TESTBED SITES

To start building the CROSSGRID testbed infrastructure a minimum hardware setup is required at each site.

The purpose of this appendix is to specify the initial minimum hardware requirements for CROSSGRID sites and at the same time provide advice on what to buy with the corresponding budget.

The configuration specified in Annex I, and also reviewed at CERN in December seems reasonable as a start point.

Basically each testbed site needs:

- A dedicated Fast Ethernet switch with remote management through SNMP. The switch will provide a minimum LAN backbone. The switch must access the Internet/Géant through a router.

As an example, Santander bought a 3COM 4400 with 24 10/100 Mbit ports to which a Gigabit Ethernet module can later be added. The price is around 1250 Euros.

Choosing a switch from the same manufacturer as the local router can sometimes be an added value allowing the better integration/interaction of the two devices, this can be of special interest when using for instance QoS or multicast.

- The Internet connectivity should be provided through a router connected to Géant (the Gigabit European Academic NeTwork) through your local academic Internet service provider.

If your site is connected to the Internet then a router is probably already available. However if you site is planning to buy a new router then the recommendation is that all routers should be similar to facilitate the general routing configuration, buffer management optimizations, security configuration, QoS configuration, monitoring, establishment of tunnels, parsing of log files etc. Also when all the routing equipment is similar configuration recommendations can be established for all sites and help can be easily provided. Without any intent of marketing it must be said that the most deployed routers in grid sites are from Cisco systems. However for very large infrastructures Juniper (Géant routers are from Juniper) is also a good option.

- Several PCs:
  - Essential:
    - One PC to host the “gatekeeper”.
    - One PC per country for the CA signing machine (must be kept offline).
    - Several PCs for computing elements.
    - At least one PC to act as storage element.
  - Non-essential
    - One PC for network monitoring.
    - One PC to host the “resource broker”. A central resource broker can be deployed and used for scheduling jobs. However one resource broker per site will be required at a later stage.
    - One PC per country for the national Information Index server. This service might be installed temporarily in the gatekeeper.

- One PC per country for the CA LDAP and WEB server. These services can be installed in your existing WEB server machine (if you have one), however the LDAP server will have to be installed hence you need root access to this machine.

Our advice is get good support and dual CPU for the computing element nodes. Again as an example:

- Santander bought IBM servers X220 with 512 MB RAM, 18 GB SCSI HD, one processor PIII at 1.26 GHZ but dual capability, for around 2000 Euros.
- LIP bought GIGABYTE rack mountable servers GS-SR101 with 1 GB RAM, 40 GB IDE HD, two PIII processors at 933 MHz, dual fast Ethernet, and IDE RAID capability for around 2000 Euros.

For the computing element nodes Intel Pentium 4 CPUs could do better and cheaper. SCSI is not a requirement, cheaper IDE disks can be used.

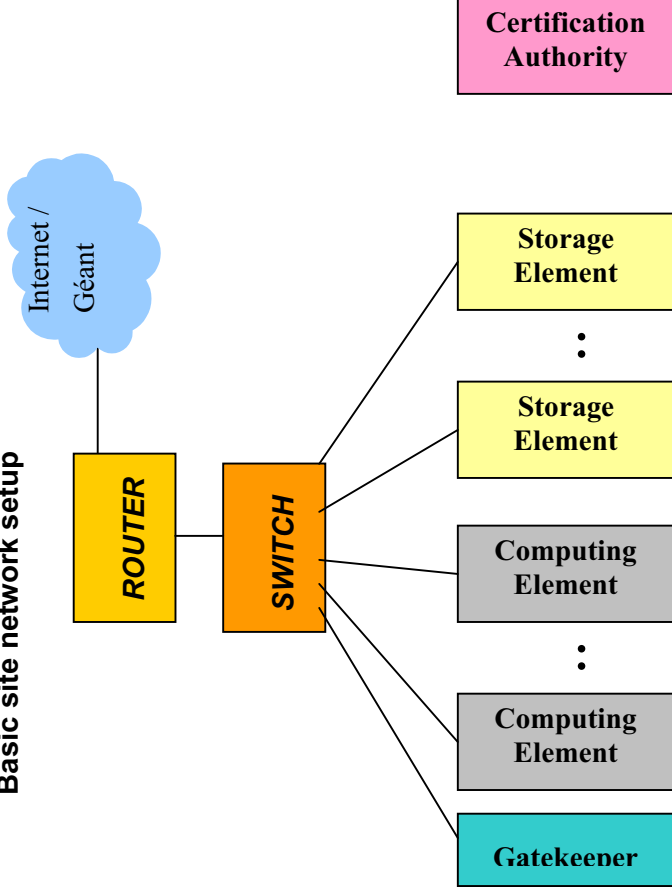
An inexpensive PC with a few IDE or SCSI disks can provide an initial storage element. SCSI is more expensive but also has higher performance and may allow the later addition of external storage devices.

If the budget is not a problem then a redundant array (RAID) should be considered. Most RAID solutions are based on SCSI disks. However lower cost RAID storage can be built with a large PC box, a RAID IDE adapter (such as the 3ware Escalade 7850) and several IDE disks. However this option will likely require local Linux expertise for deployment and is out of the scope of the minimum requirements.

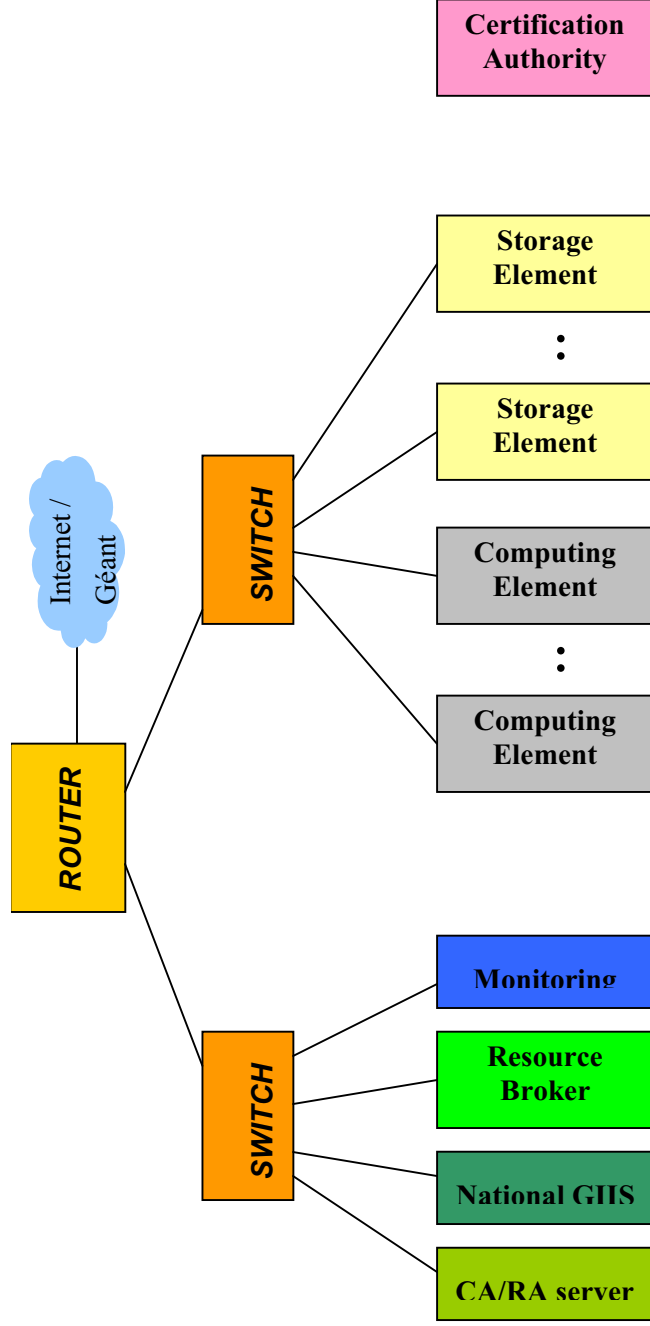
When buying PCs for the project check explicitly for Linux compatibility assurance by the manufacturer.

The minimum setup is 5 PCs and they all should be DEDICATED to CROSSGRID. This amounts to around 10-15 Keuros per testbed site.

Basic site network setup



More complex site network setup



#### **4.2. APPENDIX B: TESTBED SITES AND RESOURCES DESCRIPTION**

See attached document CG-4-D4.1-002-SITES.DOC

Abstract: This document summarizes the information from the detailed testbed sites presentations, that can be found in the CrossGrid WP4 pages: <http://grid.ifca.unican.es/crossgrid/wp4>

#### **4.3. APPENDIX C: INFRASTRUCTURE SUPPORT**

See attached document CG-4-D4.1-003-SUPPORT.DOC

Abstract: This document details the planning on Infrastructure Support.

#### **4.4. APPENDIX D: MIDDLEWARE TEST PROCEDURE**

See attached document CG-4-D4.1-004-TEST.DOC

Abstract: This document details the planning for Test and Validation.