



★ Interconnection & Interoperability of Grids between Europe & China ★

PROJECT NUMBER: 026634

PROJECT ACRONYM: EUCHINAGRID

**PROJECT TITLE: INTERCONNECTION &
INTEROPERABILITY OF GRIDS
BETWEEN EUROPE AND CHINA**

**INSTRUMENT: SPECIFIC SUPPORT ACTION
ACTIVITY: RESEARCH INFRASTRUCTURES**

D1.1 – FINAL PLAN FOR USING AND DISSEMINATING KNOWLEDGE

Due on: 14/05/2008

Submitted on: 28/04/2008

Re-Submitted on: 16/06/2008

Start date of project: 1 January 2006

Duration: 27 months

Project coordinator name: Federico Ruggieri

Project coordinator organisation name: INFN

Revision: V2

Organisation name of lead contractor for this deliverable: INFN

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)

Dissemination Level

- PU** Public
- PP** Restricted to other programme participants (including the Commission Services)
- RE** Restricted to a group specified by the consortium (including the Commission Services)
- CO** Confidential, only for members of the consortium (including the Commission Services) X

document identifier:	EUChinaGRID-Del1-1-v2-Final.doc
date:	16/06/2008
workpackage:	WP1: Project administrative and technical management
lead partner:	INFN
document status:	V2
document link :	

abstract: The purpose of this deliverable is to describe the final plan for using and further disseminating the knowledge created in the framework of EUChinaGRID, starting from the objectives of such activities and taking into account the results obtained in the project lifetime. Initiatives to bring forward the project achievements, or exploit them in specific contexts are also discussed.

Copyrights © The EUChinaGRID Consortium. 2006.

See <http://www.euchinagrid.org/partners-engl.htm> for details on the copyright holders.

EUChinaGRID (“Interconnection & Interoperability of Grids between Europe & China”) is a project funded by the European Union within the framework of the Sixth Framework Programme for Research and Technological Development (FP6), as a part of the specific programme ‘Structuring the European Research Area’, within the “Research infrastructures” activity Call name: ‘Communication Network Development – infrastructure – Consolidating Initiatives. For more information on the project, its partners and contributors please see <http://www.euchinagrid.org>

You are permitted to copy and distribute verbatim copies of this document containing this copyright notice, but modifying this document is not allowed. You are permitted to copy this document in whole or in part into other documents if you attach the following reference to the copied elements: “Copyright © 2006. The EUChinaGRID Consortium. <http://www.euchinagrid.org>”.

The information contained in this document represents the views of EUMEDGRID Consortium as of the date they are published. The EUChinaGRID Consortium does not guarantee that any information contained herein is error-free, or up to date.

THE EUChinaGRID CONSORTIUM MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, BY PUBLISHING THIS DOCUMENT.

Delivery slip

name	partner/activity	date	signature
from:			
reviewed by:	Moderator and reviewers		
approved by:	TB		

document log

Issue	Date	Comment	Author
0-1	10/04/2008	First draft	D. Scardaci
0-2	12/04/2008	New chapters and text	D. Scardaci
0-3	20/04/2008	Comments and suggestions	D. Scardaci, R. Barbera, F. Tanlongo, G. Andronico, F. Ruggieri
0-4	28/04/2008	New Executive Summary and Conclusions	F. Ruggieri, D. Scardaci

D1.1 – Final plan for using and disseminating knowledge

0-5	29/04/2008	Review of the whole document	D. Scardaci
0-6	29/04/2008	Review of the document	F. Ruggieri
1-0	30/04/2008	Final formatting	M. Mieli, F. Ruggieri
1-1	10/06/2008	New version	F. Ruggieri
2-0	16/06/2008	Final revision	F. Tanlongo, F. Ruggieri

content

1. INTRODUCTION	6
1.1. PURPOSE OF THE DOCUMENT	6
1.2. APPLICATION AREA.....	6
1.3. REFERENCES.....	6
1.4. DOCUMENT AMENDMENT PROCEDURE	8
1.5. TERMINOLOGY	8
2. EXECUTIVE SUMMARY.....	9
3. INTRODUCTION AND PRELIMINARY REMARKS.....	10
4. KNOWLEDGE TRANSFER AND DISSEMINATION	12
4.1. OBJECTIVES	12
4.2. ACTIVITIES	13
4.3. ACTIONS BEYOND THE PROJECT'S LIFESPAN	16
5. INFRASTRUCTURE	19
5.1. CONSOLIDATING TECHNICAL SCHEMES.....	19
5.2. CONSOLIDATING ORGANIZATIONAL SCHEMES	20
5.3. INTEROPERABILITY ISSUES.....	21
6. COMMUNITIES	24
6.1. SUPPORTING NEW COMMUNITIES.....	24
7. EUCHINAGRID LEGACY AND FUTURE PLANS	26
7.1. FOLLOW-UP PROPOSAL AND COLLABORATION WITH OTHER PROJECTS	26
8. CONCLUSIONS	28
APPENDIX 1 – CHINESE OFFICERS' LETTERS TO THE COMMISSION	29

1. INTRODUCTION

1.1. PURPOSE OF THE DOCUMENT

The purpose of this deliverable is to describe the final plan for using and further disseminating the knowledge created in the framework of EUChinaGRID, starting from the objectives of such activities and taking into account the results obtained in the project lifetime. Initiatives to bring forward the project achievements, or exploit them in specific contexts are also mentioned.

1.2. APPLICATION AREA

The document mainly addresses the EC and the EUChinaGRID project community. Scientific officers in embassies and EC delegations may be as well interested in the content of the document. Existing and future projects, initiatives and organizations engaged in fostering ICT cooperation between Europe and China were identified as a secondary audience and may be inspired by some of the experiences hereinafter reported.

1.3. REFERENCES

- [R 1] SEE-GRID project <http://www.see-grid.org/>
- [R 2] EUMEDGRID project <http://www.eumedgrid.eu>
- [R 3] EELA project <http://www.eu-eela.org/>
- [R 4] 863 High-tech R&D Programme <http://www.most.gov.cn/eng/programmes/programmes1.htm>
- [R 5] EUChinaGRID workpackages http://euchinagrid.org/work_package.html
- [R 6] D5.2 “Dissemination and Outreach plan” <http://www.euchinagrid.org/deliverable/D5.2.html>
- [R 7] D5.3 “Intermediate report, with plan update, on outreach and dissemination activities” <http://www.euchinagrid.org/deliverable/D5.3.html>
- [R 8] 6DISS project <http://www.6diss.org/>
- [R 9] EUChinaGRID IPv6 website <http://www.euchinagrid.org/IPv6/index.html>
- [R 10] EUChinaGRID 1st conference website <http://www.euchinagrid.org/Conf-Roma06>
- [R 11] ECHOGRID project <http://echogrid.ercim.org/>

- [R 12] Joint ECHOGRID-
EUChinaGRID conference <http://echogrid.ercim.org/content/view/11/18>
- [R 13] Joint ECHOGRID-
EUChinaGRID press release http://euchinagrid.org/docs/Press_release_April_confere_nce.pdf
- [R 14] Bio-Algorithms and Med-
Systems journal <http://www.bams.cm-uj.krakow.pl/index.php>
- [R 15] EUChinaGRID articles on
BAMS http://www.bams.cm-uj.krakow.pl/index.php?option=com_content&task=category§ionid=10&id=51&Itemid=60
- [R 16] EUChinaGRID short
communications on BAMS http://www.bams.cm-uj.krakow.pl/index.php?option=com_content&task=category§ionid=10&id=52&Itemid=60
- [R 17] G8-UNESCO FORUM <http://g8forum.ictp.it/>
- [R 18] “Interconnection &
Interoperability of Grids
between Europe and China -
the EUChinaGRID Project”
talk at EGEE UF07/OGF20 <http://indico.cern.ch/contributionDisplay.py?contribId=16&sessionId=22&confId=7247>
- [R 19] Demonstrations at EGEE
UF07/OGF20 <http://indico.cern.ch/contributionDisplay.py?contribId=33&sessionId=24&confId=7247>
- [R 20] Poster presentations at
EGEE UF07/OGF20 <http://indico.cern.ch/contributionDisplay.py?contribId=33&sessionId=24&confId=7247>
- [R 21] Workshops on ICT
Research Collaboration
between China & the
European Union http://www.ict-china.eu/fileadmin/filessharing/WP2_Documents/SPICE-Workshops_Beijing-Xi_an-Shanghai.pdf
- [R 22] SPICE project <http://www.europe.ict-china.eu/index.php?id=66>
- [R 23] EU-IndiaGrid Project <http://www.euindiagrid.eu>
- [R 24] Press release on G8-
UNESCO forum <http://euchinagrid.org/docs/EU-GRID-PR120507en.pdf>
- [R 25] IUGG 07 <http://www.iugg2007perugia.it/>
- [R 26] CHINACOOP project http://www.eurochina-ict.org/documents/FACT_SHEET_271107.pdf
<http://www.eurochina-ict.org/>

- [R 27] GO4IT project <http://www.go4-it.org/>
- [R 28] Press releases <http://euchinagrid.org/cut.html>
- [R 29] Press cuttings about the project <http://euchinagrid.org/press.html>
- [R 30] Online support tool <https://support.eumedgrid.org>

1.4. DOCUMENT AMENDMENT PROCEDURE

In order to amend the document, please contact the Project Office at: po@euchinagrid.org.

1.5. TERMINOLOGY

Grid	The term designates a distributed infrastructure of computation and storage resources, which can be used by a VO in a transparent way (i.e. without need to know about the location of the resources etc).
GILDA	Grid INFN Laboratory for dissemination activities
Middleware	Generic terms defining a communications layer that allows applications to interact across hardware and network environments.
NGI	National Grid Initiative – with this term, we mean one legally established organisation per Country/Region with the potential to technically and/or financially coordinate the national Grid activities in that Country/Region.
VO	Virtual Organization: a Virtual Organization is a geographically independent group of collaborating scientists.

2. EXECUTIVE SUMMARY

EUChinaGRID is a Specific Support Action with the aim of supporting interoperability of major Grid infrastructures in Europe and China for the benefit of eScience applications, as well as improving the accessibility of the Grid infrastructure thanks to an ambitious dissemination action.

The document presents a plan for further initiatives that may be of help in preserving and bringing forward the work of EUChinaGRID.

Some figures may be of help in describing the project' achievements:

- The EUChinaGRID Pilot Grid Infrastructure includes 12 sites over 5 countries, for a total number of about 2200 CPU cores and more than 50 TB of storage;
- About 300 people have been inducted to the use of grid computing and more than 2 participants' years¹ of training have been delivered;
- Many applications from various scientific domains have been deployed on the EUChinaGRID Infrastructure.

The introduction (see hereinafter chapter 3) provides a brief overview of the main objectives of the project, with a special stress on dissemination and training activities.

The knowledge dissemination process guided by the training activities is a key factor to ensure that all users can fully understand the characteristics of the offered Grid services and infrastructure and that they acquire enough expertise to properly exploit them. Chapter 4 discusses in detail the strategy followed to achieve these aims and how the Scientific Community was been trained during the project lifetime. Moreover, it describe as long term sustainability of the EUChinaGRID activities and results was brought forward.

Chapter 5 describes the work performed in EUChinaGRID to deploy and manage the Grid Infrastructure, and provides indications about how the infrastructure should be maintained after the end of the project.

In order to reach new user communities and to further involve the ones already included in the EUChinaGRID project, different actions were performed, and are described in Chapter 6.

Finally, Chapter 7 introduces the future plans of the project.

¹ i.e. the total n° of attendees multiplied for the duration of tutorials. This indicator is used to quantify the total course time delivered.

3. INTRODUCTION AND PRELIMINARY REMARKS

The EUChinaGRID Project started on the 1st of January 2006 for a total duration of 27 months². Scientific and technological organizations from 6 different Countries (China, Greece, Italy, Poland, Switzerland and Taiwan) collaborated as partners and third parties in the initiative. The main aim of the project is to facilitate scientific data transfer and processing in a first sample of scientific communities that have already strong collaborations between Europe and China extending the European GRID infrastructure for e-Science to China. A second important goal, relevant in the context of this document, is dissemination and training, which aims at improving the accessibility of the Grid infrastructure for new applications and promote scientific and, possibly, industrial developments.

EUChinaGRID provided specific support actions to foster the integration and interoperability of Grid infrastructures in Europe (EGEE) and China (CNGrid) for the benefit of e-Science applications and worldwide Grid initiatives, in line with the support of the intercontinental extension of the European Research Area (ERA).

The project studied and supported the extension of a pilot intercontinental infrastructure using the EGEE-supported applications and promoted the migration of new applications on the Grid infrastructures in Europe and China by training new user communities, and supporting the adoption of grid tools and services for scientific applications.

As of today, the pilot infrastructure includes 12 sites (8 in the first year) 5 of which are in China (4 in Beijing and one in Shandong). All the relevant Grid services were started and are maintained to facilitate the access of users and Virtual Organizations (VO) through the web portal (www.euchinagrid.eu). Some of those core Grid services are now in China.

A special stress was posed on designing an e-Infrastructure allowing full interoperability, both horizontally (i.e. between European and Chinese middleware) and vertically (i.e. between Grid middleware and the different versions of the IP protocol). The impact of achieving both “interoperabilities” is far beyond the scope of the project itself, as the former implies the possibility for European and Chinese e-Infrastructures to work effectively together, while the latter allows the deployment of grid nodes in an IPv6 environment. Although at the moment the IPv6 protocol is not widely used for grid purposes, such applications could indeed take advantage from

² The duration was extended of three months, without funding changes. Further information about the reasons and benefits of this choice can be found in the periodical reports.

some features; furthermore, the deployment of the first double-stack Grid nodes has proved to be useful in order to overcome IPv4 bottlenecks and give resilience to the e-Infrastructure.

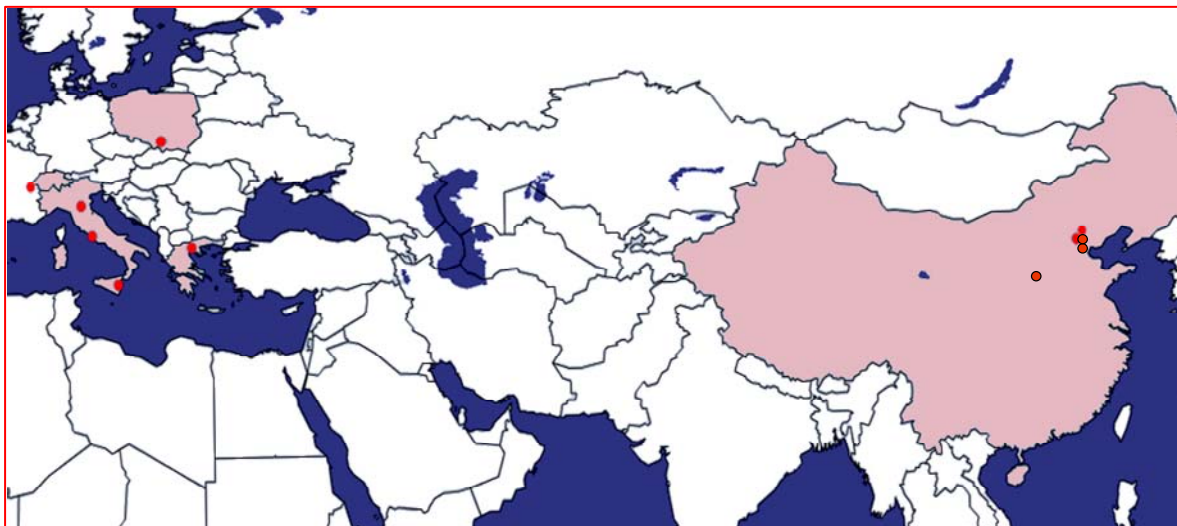


Figure 1 - Operating sites on the EUChinaGRID e-Infrastructure

Application deployment has also advanced in several science fields:

- ▶ High Energy experiments (ATLAS and CMS) at the CERN Large Hadron Collider (LHC) are running their applications on the pilot infrastructure.
- ▶ Astroparticle experiment ARGO-YBJ, a joint collaboration between Chinese and Italian researchers, is currently collecting data on Cosmic Ray showers in the YangBaJing laboratory in Tibet; a complete system has been deployed to perform the data transfer from YangBaJing to IHEP (Beijing) and INFN-CNAF (Bologna) sites, using Grid Middleware and EUChinaGRID Grid Infrastructure.
- ▶ EUChinaGRID also supported Biological applications in the field of simulation and discovery of new proteins.

More than 180 Chinese researchers, engineers and students took part to the advanced knowledge tutorials held in China during the second period of 15 months (to be added to 100 in the first year) and many of them became tutors and vehicles of further dissemination of Grid knowledge in their Country.

4. KNOWLEDGE TRANSFER AND DISSEMINATION

The knowledge dissemination process, guided by the training activities, is a key factor to ensure that all users can fully understand the characteristics of the offered Grid services and infrastructure and that they acquire enough expertise to properly exploit them. Hence, several induction courses were organised, targeting mainly users and system administrators. However, as trained people gained more grid knowledge, new training needs emerged and advanced, tailored courses were demanded. This led EUChinaGRID to create special knowledge dissemination events, such as the School for Application Integration on Grid and a best practices tutorial for EUChinaGRID site managers.

At the end of the project, the legacy left by EUChinaGRID can be quantified by its results in terms of trained people, i.e., 223 users and 101 system administrators mainly from China. The training material produced consists of 83 presentations and hands-on exercises, in addition to videos and user guides. All of this constitutes the groundwork for the EUChinaGRID partners, enabling them to keep disseminating the acquired knowledge even after the end of the project.

During the EUChinaGRID project several local training teams were created in China; these groups organized and lead new induction courses, acting as dissemination vectors in China and Asiatic countries. These local teams are fundamental for the long term sustainability of the e-Infrastructure.

Other training activities focused on specific issues of IPv6 compliance and interoperability between different middleware. These activities mainly targeted middleware developers and were carried out in cooperation with the workpackages 2 and 3 of the project; furthermore, they often benefited of the collaboration with external projects and initiatives. These activities were complemented by dedicated workshops to bring together developers, related initiatives and projects etc. and by the production of dissemination/documentation materials. The single aim of both events and materials was to focus on open issues and diffuse, amongst middleware developers and other relevant actors, information and best practices in order to overcome them. Although both were often co-organised, or co-produced (or advertised) with relevant projects such as ETICS, so that to maximise their impact, it should be highlighted the proactive role played by EUChinaGRID in addressing these topics and raising awareness about the connected issues.

4.1. OBJECTIVES

The main objectives concerning knowledge dissemination in the framework of the EUChinaGRID project can be summarised as follows:

- provide adequate dissemination and training materials and make them available to project members and beyond;
- provide advanced training events to make the application porting on the project infrastructure easier and faster allowing a full exploitation of the Grid infrastructure at all levels;
- provide advanced training events for site administrators to improve the level of management of the project infrastructure;
- expand local training teams increasing the number of person involved and the geographic spreading to cover new Chinese regions and Asiatic neighbouring countries, so that, a local support will be available for the different Scientific Communities and applications across the region;

A detailed plan for pursuing these objectives was given in the deliverable D5.2 and revised in D5.3 and set out by partners during the project lifetime.

4.2. ACTIVITIES

The knowledge transfer effort materialised in 13 knowledge dissemination events organised.

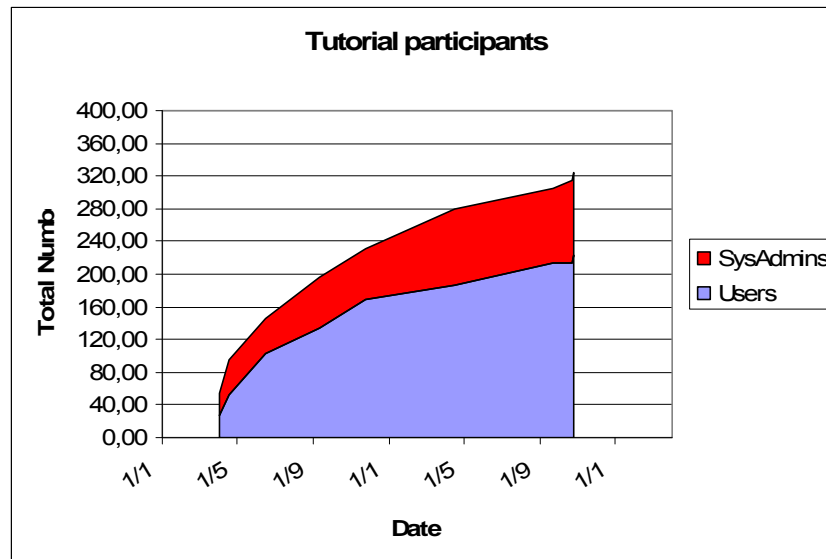


Figure 2 - Growth of the number of trained people during the whole project lifetime

Final figures³ are of more than 300 trained people (one of the measurable objectives of the project), including researchers, application developers, system administrators and university students. The following knowledge dissemination events have been organized during the whole lifetime of the EUChinaGRID project:

Table 1 – summary of EUChinaGRID training events

Location	Dates	N° of Attendees	Audience
Beihang University – Beijing, China	03-05 April 2006	27	System administrators, Site managers
Beihang University – Beijing, China	05-07 April 2006	27	Users
University of Roma Tre – Rome, Italy	18-19 April 2006	25	System administrators, Site managers
University of Roma Tre – Rome, Italy	20-21 April 2006	16	Users
IHEP – Beijing, China	15-16 June 2006	50	Users
University of Roma Tre – Rome, Italy	11-12 September 2006	19	Users and application developers
University of Roma Tre – Rome, Italy	13 September 2006	32	System administrators, Site managers
Peking University – Beijing, China	25-26 November 2006	35	Users
CNIC, Beijing (China)	16-17 April 2007	18	Users
CNIC, Beijing (China)	18-20 April 2007	30	System administrators, Site managers
ShanDong University, Jinan, China	22-23 September 2007	26	Users
ROC-on-Duty tutorial	23-24 October 2007	9	Site managers
School for Application Porting	25 October – 3 November 2007	10	Application developers

³ The training activity is documented in previous deliverable and reports, especially D5.3 [R 7] and the 1st yearly report (with special reference to the annex on use and dissemination). See also D5.1, D5.2 and D5.4 for a wider view.

The training events were organized mainly in China to help the spread of the Grid Knowledge in this country. The dissemination strategy was shaped on some peculiarity of EUChinaGRID, such as linguistic differences, geographical distance between European and Chinese partners, relevant travel costs, and an important time zone difference. This implied the need for local teams in Europe and China, which had to maintain strong cohesion as to actions and objectives. The establishment of two groups of dissemination teams, respectively located in Europe and China, was already achieved during the first project year. The training events managed by the Chinese local teams were performed in Chinese language to overcome linguistic differences and to better contextualize topics to the attendees expectations and information needs. Localization will be also of help in further disseminating EUChinaGRID findings and achievements and answer the users' demands after the end of the project, making more durable and re-usable the knowledge created by the project works.

The most important event organized by the EUChinaGRID was the School for Application Porting held From October 25th to November 3rd in the premises of IHEP in Beijing. The event also speeded-up the process of porting a few pilot applications, used at the same time as case studies for the hands-on sessions. At the end of the school, 4 applications were ported on the grid and were ready to run on the EUChinaGRID Infrastructure:

- Grid-based Statistical Analysis of Fe Abundances Gradients in the Galaxy [Organization: CNIC/CAS - Contact Person: Hao Xu (morrise@cnic.ac.cn)]: The astronomical application aims to study the abundances gradient within the Galaxy in order to understand its chemical evolution. The application needs to analyze heterogeneous data source and it's also CPU intensive.
- The Human Cancer Project [Organization: Beijing Genomics Institute – Contact Persons: Chen Jie (xiaoliw001@163.com), Wang Xiaoli (wangxiaoli@genomics.org.cn)]: Three applications that will be used in the Chinese Human Cancer Project have been ported on the grid (1) BLAST, (2) Blat, (3) SIM4. A biological application with data and CPU intensive aims to share bioinformatics analysis to find out some useful genes or gene mutations.
- ZEN [Organization: CPPM Contact Person: André Tilquin (tilquin@cppm.in2p3.fr)] - Cosmological parameter constraints with the combination of different probes: The ZEN Project aims to solve the dark energy enigma combining various cosmological probes.
- Drug Discovery [Organization: BUAA - Contact person: Bo Li libo@buaa.edu.cn] - The application will be running to test the docking rate of viruses with different

drug molecules and getting top molecules for real experiments. The application was developed by IMM, CAS based on open source projects. And it was written in C and partly in FORTRAN with no external requirements at the moment.

Moreover a new Grid service, born with the aim to create a Chinese national virtual collaboration for earthquake analysis, has been designed:

- Grid-enabled Structural health monitoring, Experiment and Simulation in Civil Engineer [Organization: Beijing University of Technology – Contact persons: Yi Liang (yliang@bjut.edu.cn), Li Wang (wl@emails.bjut.edu.cn)]: The goal of the “Engineering Structure Experiment and Simulation Grid” application is to establish a virtual collaborative environment which links civil engineering researchers with leading-edge computing resources, data resources, experimental equipments and simulation software across the internet, thus allowing different teams to cooperate in their daily research work. With the collaboration and resource sharing, this collaborative environment is expected not only to improve the utilization of the massive spot/experimental data and expensive equipments, but enhance the accuracy of structure damage prediction and pre-warning in the civil engineering structure health monitoring.

4.3. ACTIONS BEYOND THE PROJECT'S LIFESPAN

In order to facilitate the long-term sustainability of the project, big efforts have been made towards the creation of local training teams in China: these are actually seen as key enabler for bringing further the progresses made during the project. After attending training events, the trainees were able to act themselves as further dissemination vectors, helping the spread out of the knowledge inside the Chinese EUCINA GRID participants. At the end of the first year of the EUCINA GRID project, groups of experienced people were already available in BUAA, CNIC, IHEP and PKU, who then acted as further dissemination vectors. Furthermore, the local trainers have delivered talks in Chinese during the tutorials in which they contributed, improving the effectiveness of the induction courses and easing the transfer of knowledge from them to the audience. The use of native language, together with the knowledge of the Academic and Research environment, curricula, common practices that local trainers share with their audience were indeed of great help in contextualizing the topics and answer in the best – and most tailored – possible way to the needs of the (potential) user communities, thus ultimately improving the quality of knowledge transfer.⁴

⁴ This is also visible in the significant raise of the level of feedback from the tutorials during the second period of the project, when the transfer of duties to local training teams was complete.

Table 2 presents a view of EUChinaGRID knowledge dissemination activities where non-EU partners were involved as tutors⁵. These tutors matured their expertise during the project; therefore, the swiftness in becoming tutors themselves is remarkable.

Table 2 - dissemination activities where non-EU partners were involved as tutors

Location	Dates	N° of Attendees	Audience
IHEP – Beijing, China	15-16 June 2006	50	Users
Peking University – Beijing, China	25-26 November 2006	35	Users
CNIC, Beijing (China)	16-17 April 2007	18	Users
CNIC, Beijing (China)	18-20 April 2007	30	System administrators, Site managers
ShanDong University, Jinan, China	22-23 September 2007	26	Users



Figure 3 - Picture of participants and tutors at the training event in ShanDong University

⁵ The table does not include tutorials, seminars and courses organised by partners at a national level without the direct involvement of EUChinaGRID.

The training and creation of local training teams started a human exchange chain reaction, capable of multiplying competences involving new user communities.

Their expertise can be exploited to consolidate and further extend these results also beyond the end of the project. This will be ensured because, in most cases, members of the tutors' team are permanent staff at their organizations and, in turn, their organizations are part of CNGrid and/or other Grid projects and initiatives in their countries; furthermore, they are well-connected through institutional channels (mainly CAS) with other projects, existing and potential user communities etc. This condition will mitigate the risk that at the end of the project these people will cease working on Grids, thus thwarting the mentioned chain effect in knowledge transfer, at least in the shorter term⁶. Of course, the capability of continuing working on interoperability of Grids in the longer term is closely connected with the opportunity of getting funds, either at a national or international level..

⁶ As a matter of fact, several Grid initiatives are funded by the Chinese Government, in the framework of the Chinese 863 High-tech R&D Programme, so no immediate concern for lack of funding in the sector exists.

5. INFRASTRUCTURE

The formation of Local Training Teams in China can be considered as one of the major effects of the knowledge dissemination activities organised by EUChinaGRID, but not the only one. As a matter of fact, the provision of advanced training also created the needed competences for managing (maintenance, update, troubleshooting, issue of certificates, user support, etc.) an interoperating Grid infrastructure⁷. Also thanks to the appreciation of projects' achievements, and the interest raised amongst decision makers, most of the existing EUChinaGRID sites will continue to survive after the lifetime of the project. The people trained during the project will continue to maintain deployed Grid services. Thus, ported applications can continue to exploit the existing e-Infrastructure, while new applications can be involved to join.

5.1. CONSOLIDATING TECHNICAL SCHEMES

The technical approach used to train users was initially based on Gilda due to the consolidated experience gained inside INFN. The usage of a parallel and almost completely duplicated infrastructure dedicated to training and tests had several advantages in all the cases where no local knowledge and Grid services were available and the dissemination activity had to start from scratch.

The second phase of the training, dedicated to advanced users and Site Administrators, however, showed that the production infrastructure was best tuned for a hands-on training in Grid operations.

The experience gained has led to produce new schemes in the training packages that will best address all the different needs of a diversified audience.

The technical documentation produced in the framework of WP3 will be the starting point of the works in this area, it includes guidelines about CA/RA schemes, Operational, organisational and policy schemes, and the features and functions of Pilot infrastructure, as well as a knowledge base created during the project lifetime, which is available through the web-based online support tool (<https://support.euchinagrid.org>). The tool will be kept up and running after the end

⁷ It should be highlighted that, although grid technology is used by numerically relevant groups in China, Chinese middleware is completely different from the most diffused ones amongst the European R&E community. For this reason, even experienced grid professionals needed some training in order to maintain the EUChinaGRID infrastructure.

of the project and people working on the infrastructure will continue increasing the knowledge base[R 30].

5.2. CONSOLIDATING ORGANIZATIONAL SCHEMES

One of the EUChinaGRID main aims (reflected as well in the considerable budget devoted to this task) was dissemination. The EUChinaGRID dissemination plan⁸ based on two complementary approaches: the top-down, addressing decision makers, and bottom-up approach, addressing the user base. The underlying idea is that both approaches were - and still are - critical for establishing/consolidating effective grid initiatives in the area, and needed to working together in order to produce the best results.

Actions addressing the user base were aimed to:

- Raise grid awareness in the scientific community and especially attract new user communities amongst existing collaborations between EU and China, so that to reach a critical mass of EUChinaGrid active users;
- Disseminate new competences amongst such community, to make them able to profit of this shared infrastructure and become further vehicle of dissemination and promotion for it;
- Train IT professionals to become grid site administrators, thus enabling the maintainance of Grid sites also beyond the project scope and lifespan.
- Foster the deployment on the infrastructure of shared applications that may enhance the quality and effectiveness of existing EU-Chinese collaborations and enable new ones.

Actions addressing decision makers aimed at getting in contact with them as well as their technological/scientific advisors in order to:

- Provide information about the opportunities that Grids (and e-Infrastructures in general⁹) cater for R&D communities and the society at large;

⁸ The EUChinaGRID dissemination plan is extensively described in D5.3 "Intermediate report, with plan update, on outreach and dissemination activities", which provided also corrections and adjustments to the overall dissemination strategy, basing on the first year experiences. Therefore, it is only briefly outlined in this document and we recommend referring to the quoted for any information that may go beyond the scope of this deliverable. Being dissemination one of the specific activities in the project Workplan, detailed information about the proceeding of works can be found in the periodic reports.

⁹ As it will be discussed in the next chapters, the integrated e-Infrastructure approach proved to be more effective in terms of communication. Moreover, one of EUChinaGRID's major concerns was to ensure a reasonable R&D network connectivity between China and Europe: for this reason, creating awareness about the network level was deemed as a integrating part of the message.

- Suggest a model that enables interoperability of solutions and applications for R&D, exploiting the Grid framework for the mutual benefits of Chinese and European Research communities and for sustaining and enhancing collaboration between them;
- Foster the discussion on the previous points and providing input to the agenda of Chinese and European/international funding bodies, with the main aim of fostering long-term sustainability of interoperable e-Infrastructures between Europe and China;

These schemes have been consolidated during the EUChinaGRID project and there are good expectations that they will continue to survive after its end. These expectations are supported by the existence of a committed human network, which means that EU and Chinese e-Infrastructures are in a position to further cooperate with each other and bring forward the achievements reached so far.

5.3. INTEROPERABILITY ISSUES

The interoperability between gLite and GOS middleware and, then, the interconnection between EGEE and CNGRID infrastructures, is fundamental to achieve EUChinaGRID objectives. by creating an interoperable, common infrastructure, the project aimed at harmonizing, for the benefit of several e-Science applications, the European and Chinese e-Infrastructures in terms of computing resources, services, and application software.

Several existing joint research activities, between Europe and China involve analysis of large amounts of data and require large amounts of computing power. The interoperability of the European and Chinese grid infrastructures provides the research and education communities of the two regions with transparent access to a larger distributed amount of storage and computing resources allowing the development of a new scale of powerful applications.

Another important topic to interconnect the two different infrastructures is the IPv6 compliance. Both above mentioned topics, interoperability and IPv6 compliance, were deeply studied in the framework of EUChinaGRID technical activities and can be regarded as the most innovative content of the project. For both activities, however, the assessment made within the project needed to be disseminated to the wider Grid community in order to be beneficial. In fact, no middleware development activities were foreseen in the EUChinaGRID project¹⁰. As a matter of fact, any

¹⁰ Nor they could, as the project is a Specific Support Action and does not foresee this kind of activities.

middleware development intended to overcome the interoperability issues highlighted by the assessment would have been pretty useless without this action. The surveys of WP2 and WP3 were performed on the middleware developed by external projects, i.e. mainly EGEE and CNGrid, but also third parties. Specific components developed by third parties are often integrated in the EGEE and CNGrid middleware, so that it is not always easy to change the code, even for developers from these projects.

For this reason, the interaction with middleware developers from different projects was of the utmost importance in order to build upon the results of the EUChinaGRID studies and implement the needed changes on the code. Workshops were intended as occasions to bring together developers from different context and discuss with them about possible solutions and development. Of course, this was part of a wider strategy, which foresaw a large interaction with relevant projects and working groups such as the EGEE-JRA1 activity, the ETICS, ECHOGRID, OMII-Europe projects etc.

Table 3 - Organised & co-organised Workshops on interoperability & IPv6 compliance

Event	Location	Dates	Related link
Workshop on gLite middleware IPv6 compliance (in conjunction with 1 st EUChinaGRID workshop)	IHEP – Beijing, China	13 June 2006	https://agenda.euchinagrid.org/conferenceDisplay.py?confId=a0620
Workshop on gLite-GOS interoperability (in conjunction with 1 st EUChinaGRID workshop)	IHEP – Beijing, China	13 June 2006	https://agenda.euchinagrid.org/conferenceDisplay.py?confId=a0620
Workshop on Grids and IPv6	EGEE Conference, Geneva, Switzerland	26 September 2006	http://indico.cern.ch/sessionDisplay.py?sessionId=132&slotId=0&confId=1504#2006-09-26
Workshop on Middleware interoperability	EGEE Conference, Geneva, Switzerland	26 September 2006	http://indico.cern.ch/sessionDisplay.py?sessionId=133&slotId=0&confId=1504#2006-09-26
Joint EUChinaGRID/ EGEE/ ETICS Workshop on "Grids and IPv6"	EGEE Conference, Budapest, Hungary	1 October 2007	http://indico.cern.ch/sessionDisplay.py?sessionId=4&slotId=0&confId=18714#2007-10-01

Joint EUChinaGRID/ EU-IndiaGrid workshop on "Grid Interoperability between Europe and Asia, status and future strategies"		5 October 2007	http://indico.cern.ch/sessionDisplay.py?sessionId=54&slotId=0&confId=18714#2007-10-05
---	--	----------------	---

As to Grid Middleware-IPv6 compatibility, focused workshops were complemented by four specific tutorials targeting middleware developers. The events were held in Europe, as the European middleware is the one with heavier issues in complying with the new version of the IP protocol, so that to raise awareness about this problem and involved overall 93 developers.

Table 4 - IPv6 tutorials aimed at Grid middleware developers

Location	Dates	N° of attendees	Link
University of Catania, Catania, Italy	06 June 2007	19	http://indico.ct.infn.it/conferenceOtherViews.py?view=cdsagenda_olist&confId=15
University of Roma Tre, Rome Italy	26 October 2006	39	https://agenda.euchinagrid.org/conferenceDisplay.py?confId=a0672
University of Thessaloniki, Thessaloniki, Greece	18 September 2007	27	http://www.euchinagrid.org/IPv6/tutorial.html
CASPUR, Rome, Italy	16 January 2007	8	https://agenda.euchinagrid.org/conferenceDisplay.py?confId=58

The information was complemented by a set of supporting materials, also in collaboration with other project i.e. 6DISS [R 8] (see for example: [http://www.euchinagrid.org/IPv6/6DISSCDEuChinaGrid\).zip](http://www.euchinagrid.org/IPv6/6DISSCDEuChinaGrid).zip). Other materials were made freely available by the project staff on a dedicated website [R 9].

6. COMMUNITIES

No significant constraints in promoting eScience applications between Europe and China were encountered during the project lifetime. As a matter of fact, a great interest and awareness in eScience applications has been demonstrated by the partners involved in the project and by new communities involved in the training events and in the School for Application Porting that took place in Beijing in the autumn 2007.

There was a poor answer to the survey for new potential user communities (only 55 responses in two years). This, and the opinion of Chinese partners, who did not deem the questionnaire an appropriate mean for reaching the Chinese user community, led to eventually abandon this strategy. Apparently, Chinese researchers are not used to self-completing questionnaires – which have indeed a low response rate also amongst very motivated users.

The questionnaire as a mean of contacting new communities was hence discarded, in favour of direct contacts, through Chinese Academy of Science and other institutional channels, or contact taken at events etc. The new strategy proved to be very effective, as witnessed by in the participation of novel partner institutions to the EUChinaGRID-2 proposal to EU. The EUChinaGRID-2 proposal included indeed eight novel Chinese institutions from different regions of China and from several scientific fields, from life sciences and medicine (such as the Beijing Genomic Institute and the Shanghai Institute of Materia Medica), to earth science and technology (such as the Institute for Hydrology and Environmental Geology, the Xi'An JiaoTong University, the Beijing University of Technology and the Network Research Centre of Tsinghua University)

6.1. SUPPORTING NEW COMMUNITIES

The large number of interested communities posed, however, the problem of support when the EUChinaGRID-2 proposal did not pass the selection. The lack of funding and limited time remaining in the project were not only limiting the expansion of the activity to new communities but there was even the risk of de-motivating the existing ones.

This can be considered a critical point which was addressed by an intensification of involvement of the partners. Two main lines of activities were followed.

1. The project management solicited the partners to request letters of support from Ministers or Ministerial Officers to the European Commissioners and Officers, highlighting the successful experience of EUChinaGRID and showing the strong commitment that has been taken by the Chinese Government in Grid

Infrastructures and in the scientific cooperation with Europe. Two such letters were written and received by EC Officers.

2. Exploitation of funds available in bilateral agreements for scientific cooperation between China and Europe. Many Countries in Europe do have independent bilateral agreements with Chinese Ministry of Science and Technology (MoST) and/or the Chinese Academy of Science. There were then two proposals made to the Italian Ministry of University and Research (MiUR) on basic research funds (FIRB) regarding the usage of Grid Infrastructures with China in the scientific domains of Cultural Heritage and Earth Observation.

The failure of the EUChinaGRID-2 proposal was thus reverted in a stimulating pressure to disseminate the EUChinaGRID activities and increase the awareness of the new communities on the benefits of using a Grid Infrastructure for new approaches in their scientific domains.

7. EUCHINAGRID LEGACY AND FUTURE PLANS

EUChinaGRID has produced relevant results in its 27 months of activity. The main legacy to the follow-up activities is mainly related to:

- A powerful Grid Infrastructure that is based on two different approaches to Grids (gLite and GOS) made interoperable by means of a Gateway. The experience gained and the tests made have been invested in a new, more general, gateway architecture that was presented at the last EGEE'07 Conference in Budapest in a Workshop organized jointly by EUChinaGRID and EU-IndiaGrid on Interoperations and Interoperability.
- An awakened interest in the compliance of middleware to IPv6 protocol. Apart from the creation of a code checker plug-in for the ETICS building system an IPv6 test-bed has been set up, where future software codes can be tested. The future adoption of Grid tools in environments related to mobility and the expansion of Grid Infrastructures in countries where the IP address limitations are a dominant issue, will be decided also by the compliance to IPv6.
- A relevant scientific community was created where researchers of different domains from HEP, to Astroparticle and Biology, exchanged useful experiences and scientific approaches to large, computing intensive, simulations. New ideas were suggested by the gained experience and a real valuable scientific work has been produced with a long list of publications on scientific journals.

7.1. FOLLOW-UP PROPOSAL AND COLLABORATION WITH OTHER PROJECTS

As already mentioned a follow-up proposal (EUChinaGRID-2) was not approved by EC, but other proposals were launched in a specific call related to a bilateral agreement between Italy and China. There are, however, several EC calls foreseen in the FP7 programme for 2008 and 2009 and the collaboration is intending to exploit all the opportunities. Also, further activities are foreseen towards MoST, for trying and securing matching funding from the Chinese side.

It should be noticed, however, that relevant budget lines are already available in Europe (EGEE III) and in China (CNGrid) to sustain the main Grid Infrastructures in both countries.

Moreover, some of the Chinese sites (CNIC, IHEP, PKU) are participating to Worldwide LCG and will take part to the activities of the LHC experiments ATLAS and CMS.

The EUChinaGRID community intends then to continue to support the existing communities and keep operational the Grid Infrastructure and the interoperability between gLite and GOS based middlewares.

Follow-up activities will then be dedicated to new proposals to:

- Consolidate the existing achievements in a stable e-Infrastructure.
- Expand the Infrastructure to new sites willing to join it.
- Support new user communities such as: Earth Observation, Cultural Heritage, Archaeology, Geology, Hydrology, Bio-Medical, etc.
- Coordinate the activities and the studies for new organisational approaches to long term sustainability.

EUChinaGRID will thus extend its influence well beyond the end of the project and the accumulated experience will be used to build upon the results already achieved.

8. CONCLUSIONS

The e-Infrastructure left by the EUChinaGRID project will continue supporting the dissemination of Grid knowledge during the next years. Most EUChinaGRID members have their own plans to keep using and disseminating the knowledge acquired thanks to their participation in the long term sustainability of the e-Infrastructure

Additionally, liaisons with other projects have also increased the synergy amongst relevant actors and helped establishing a strong human network, that could be further exploited for establishing thematic collaborations.

The EUChinaGRID effort on dissemination activities was worth. E-Science technologies are currently a promising research tool used by many communities.

As already mentioned in the previous sections, although EUChinaGRID is not yet supported by the 7th Framework Program of the European Commission, the original EUChinaGRID management staff, together with all involved partners, are taking several actions in order to sustain the existing infrastructure. This is possible, due to the very remarkable results achieved by the project and to the recognition of the strategic importance of the collaboration between China and Europe. Moreover, the result obtained on the interoperability between the European and Chinese grid infrastructures and the opportunity to continue this work should provide the research and education communities of the two regions with transparent access to a larger world widely distributed amount of storage and computing resources allowing the development of a new scale of powerful applications.