EUAsiaGrid

D2.1 Survey of Requirements

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Abstract: This document provides an analysis of requirements for the workpackages of the EUAsiaGrid project. It is based on a collection of existing material from other projects and initiatives as well as data collected from the project partners. It details requirements as well as information about the status of implementation of services, implementation plans and requirements for interventions to be made through the EUAsiaGrid workpackages. In addition, it describes the design of data collection instruments to elicit requirements from researchers and project partners throughout the project lifetime to inform actions supporting the development of an Asia Pacific e-Infrastructure for research.

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1. INTRODUCTION

1.1. PURPOSE

This document summarises work to date in EUAsiaGrid workpackage (WP) 2.1 – Survey of Requirements. It presents the instruments created to collect general requirements for the development of an integrated European and Asian/Pacific Grid infrastructure. The document also presents an analysis of data collected to date from a review of existing material and from the project partners about the status of implemented services, plans for service delivery and requirements to be address by EUAsiaGrid through its workpackages. This analysis will guide further work in the different workpackages of the project and will form the basis for the formulation of a roadmap for a coordinated Asia-Pacific e-Infrastructure. In addition, a data collection from applications researchers through an online survey as well as through direct contacts is currently ongoing. An analysis of the resulting data will be fed directly into the work in workpackage 3 on application support and infrastructure requirements emerging from this data will be fed into the development of a roadmap in workpackage 2.3 and 2.4.

1.2. AUDIENCE

This interim report is for the benefit of all project stakeholders (see section 3.1) and will be made publicly available after sign-off from the Executive Board and the European Commission.

1.3. DOCUMENT AMENDMENT PROCEDURE

The responsible editor for this document is Alex Voss at NCeSS (UniMan), please send any comments directly to him at alex.voss@ncess.ac.uk.

2. EXECUTIVE SUMMARY

The collection of data to inform the definition of requirements is essential for the successful delivery of EUAsiaGrid's outputs and the achievement of its aims. Work on this aspect of workpackage 2 was therefore carried out at the beginning of the project, focusing on a stakeholder analysis, a review of existing material, the development of data collection instruments and the collection of data from the EUAsiaGrid partners. We have developed:

- a review of existing documents of and information about related initiatives,
- a format for documenting the status of, plans for and requirements for service implementation and a collection of data from the partners,
- a survey instrument for gathering data from scientific communities,
- the basis of a supporting division of labour that will ensure the effective execution of the data gathering and analysis work.

The data gathered so far and analysed in this document describes the status of implementation of grid infrastructures in the partner countries (with special emphasis on countries in the Asia Pacific region) the plans for developing the infrastructure over the lifetime of the project and the requirements this gives rise to. The analysis provided will inform activities in all the workpackages of EUAsiaGrid and will form the basis for the development of a roadmap for a coordinated grid infrastructure in the Asia-Pacific region, based on the gLite middleware, integrated with the EGEE infrastructure and aligned with its ongoing evolution.

One crucial element of the strategy under development is to develop ways to overcome the differences in the state of adoption of grid infrastructures in the partner countries. It is crucial for the project to ensure that certain baseline goals are achieved across all partner countries in order to provide a common basis that can be taken for granted and built on to foster stable and growing research communities that use e-Infrastructures regularly in their daily work.

At the same time, it is crucial to drive forward leading example of grid adoptions and to avoid the trap of orienting to the lowest common denominator. A two-strand strategy is presented that is characterised by:

- a stepwise raising of the bar for the baseline functionality to underpin the common infrastructure and to achieve alignment,
- while driving developments forward through concrete applications that demonstrate the value of the e-Research approach in different research areas and drive forward the state of the art. We envisage that such innovation will be disseminated from the leading institutions throughout the project and that the differences in grid adoption currently visible in the consortium will diminish over the lifetime of the EUAsiaGrid project.

While this workpackage and, consequently, this document are mainly concerned with the development of the underpinning infrastructure and policy framework, there are clear links with workpackage 3 on support for applications and workpackages responsible for dissemination (WP 4) and training (WP 5). We describe these and where appropriate describe instruments that will be used to ensure that the information gathered and the analysis developed informs work in these other areas.

3. AIMS AND CONTEXT OF WORKPACKAGE 2.1

The overall aims of workpackage 2.1 – survey of requirements – are to elicit requirements for the development of e-Infrastructure and new scientific collaborations through an ongoing process of interaction between the project partners, related activities and the scientific communities. The mechanisms for this involve requirements workshops, surveys and interviews. In contrast to the data gathered as part of workpackage 3, the data is aimed not at informing the development of concrete applications but at developing strategies for collaboration and infrastructure development that go beyond individual applications. The work in workpackage 2.1 precedes and informs the work on other parts of workpackage 2 and other workpackages. It also forms the basis for work on formulating a roadmap towards a coordinated Asia-Pacific e-Infrastructure (WP 2.3 and 2.4).

3.1. STAKEHOLDER ANALYSIS

In order to plan the activities in this workpackage and to assess their impact, it is important to understand who the relevant stakeholders are that will benefit from the collection of data to be conducted in this part of the workpackage and from the analysis produced.

3.1.1. Scientific communities

Scientific communities are the main stakeholders as, ultimately, it is their work that we wish to enhance and as they are a key constituency for e-Infrastructure providers, policy makers and funders. Members of scientific communities are at the same time important informants that contribute to the formulation of requirements, both at the policy and infrastructure development level in workpackage 2 and at the application level in workpackage 3.

Scientific communities may be interested in learning about EUAsiaGrid as a potential source of support for their activities, they may wish to provide input to and review the requirements negotiated as part of the project as well as find out about the status of implementations and implementation plans. Their practical work will be supported through the EUAsiaGrid VO and the resources provided by it and their practical experience will help to harden the infrastructure and improve its accessibility, usability and usefulness. The EUAsiaGrid VO effectively serves as a staging post for other, more specific VOs.

3.1.2. e-Infrastructure providers

e-Infrastructure providers need sound evidence about requirements to develop their services in a way that meets the needs of scientific communities. Whatever the funding model that service provision relies on, sustainability will ultimately depend on meeting the needs of scientific communities. In addition, service providers will be interested in establishing the baseline state of implementation at the beginning of the project, in making plans, measuring progress and coordinating activities and interventions.

Another need that e-Infrastructure providers have is to see their resources embedded in a common infrastructure governed by a common set of policies that allow the value of their resources to be effectively utilised and leveraged through the contribution of other partners.

3.1.3. Research Institutions

Research institutions may be both providers and users of e-Infrastructures for research. They have to make provisions for the adequate, effective and efficient use of resources both locally and remotely. The emergence of grid infrastructures significantly changes the roles of institutions and their IT service departments. In a connected world, an increased emphasis needs to be put on mediation and coordination of usage as well as provision of ICT resources.

Institutions are also important stakeholders at the level of policy and funding. They often take a proactive role in trying to influence decisions and in trying to enable their members to effectively act in particular policy contexts and funding climates. They are therefore in need of accurate information about the needs of researchers as well as the trajectories of technological development, policy development and funding arrangements.

3.1.4. Policy makers and funders

Policy makers and funders set the wider context for the development of e-Infrastructure services. Their interests are therefore not only to ensure that services are provided that meet the needs of scientific communities but also to ensure that the wider context is shaped in a way that allows sustainable forms of service provision and use to emerge. In order to achieve this, they require information about barriers to uptake that exist at the policy level as well as possible interventions at this level. The actions taken by policy makers and funders will directly influence the actions of other stakeholders and will significantly impact on their effectiveness. The wide impact of decisions made by these stakeholders means that the provision of adequate information and analysis to inform them is of crucial importance.

3.1.5. The general public

As the ultimate beneficiaries of research outcomes and as the providers of funding for publicly funded research, the general public have an interest to ensure that resources are used in a way that maximises the generation of knowledge through scientific endeavour. Another aspect comes in when we consider the role of society members as research subjects. Here they have an interest in the ethical conduct of scientific work and the protection of their interests in such areas as data protection, safe conduct of clinical trials etc.

3.2. REVIEW OF EXISTING MATERIAL

Our first activity was to compile and review a list of material that already exists from previous and related projects in order to find out what existing findings and approaches could inform our own work. In particular, we have identified documents from the following sources:

- The Asia Federation Report (to appear in: Proceedings of ISGC 2008, Springer)
- APGrid PMA[1]
- The SHARE roadmap[2]
- The AVROSS study[3]
- The EGI Design Study[4]
- The JISC Community Engagement Projects[5]
- EUChinaGrid[6]
- EUIndiaGrid[7]
- EELA[8]

The following paragraphs summarise each of the sources listed above and analyse their relevance for the EUAsiaGrid project.

3.2.1. Asia Federation Report

The Asia Federation Report provides an overview of EGEE activities in Asia, including an outline of planned activities within EGEE III in the region. It also provides detailed information about networking, Grid and EGEE activities in each of the twelve countries covered (including all the EUAsiaGrid partner countries). This latter information will be covered in section 6.

The main grid application areas in the Asia-Pacific region within EGEE activities are high-energy physics and biomedical applications. In the area of biomedical applications, the drug screening work is worth noting in particular, as exemplified by the Avian Flu project.

EGEE and ASGC have established a regional operations centre (APROC), which acts as a catch-all for the whole region and provides support for deployment and operation, regional monitoring and troubleshooting as well as a regional certification authority. As of July 2008, there are 23 production sites in 8 countries, supporting 15 virtual organisations with over 3300 cores and about 1.5 petabytes of storage. It currently takes one to four months of consultancy and support to fully certify a site for EGEE compliance, depending on a number of factors such as the skills and effort available at the site.

Reliability of service across the region has improved significantly, from 60-70% in 2007 to 70-80% in 2008. A major cause of problems is congestion in WAN and LAN networks, causing performance issues to arise that in turn cause common tests to fail. While networking provision varies significantly

[1] www.apgridpma.org

[2] roadmap.healthgrid.org

[3] web.fhnw.ch/plattformen/avross

[4] web.eu-egi.eu

[5] www.engage.ac.uk

[6] www.euchinagrid.org

[7] www.euindiagrid.eu

[8] www.eu-eela.eu

between different countries (and between sites), it seems fair to say that networking is still a major topic when it comes to the deployment and operation of e-Infrastructures in this region.

The existence of a catch-all certification authority (CA) provided through Academia Sinica Grid Computing ensures that researchers can access resources. However, for uptake to widen, more CAs and local registration authorities (RAs) need to be established to enable a larger number of researchers to obtain certificates from local contacts.

The report suggests a number of activities within EGEE III for the areas of applications, operations, training and networking. For the applications side, it identifies high-energy physics, biomedical applications and earth science applications as key areas of interest. The extension of grid operations to a larger number of partner countries is flagged as a key concern as current arrangements are strongly centralised. While APROC is an extremely valuable asset, at the same time wider adoption requires more local provision of support. The Asia Federation will play an important role in assessing which countries have the potential to not only use and provide EGEE resources but also to establish national operation centres supporting national resource providers. Similarly, a recommendation is made to further the establishment of domestic certification authorities and for a 'train the trainer' programme to increase the training capability and capacity.

As networking issues affect grid operations and the uptake of e-Infrastructures generally, the report recommends a coordinated approach to tackling the main issues of low bandwidth, fragmentation of effort causing routing problems and the usage-based charging structures that limit adoption in some areas. As networking is outside the scope of both EGEE and EUAsiaGrid, effective coordination with relevant networks and projects such as ASGCnet (Taiwan's main link to GÉANT), APAN and TEIN3 is essential.

This Report gives a baseline understanding of EGEE activities in Asia. It covers all EUAsiaGrid partners from the region but also China, India, Korea and Japan and therefore provides information about the wider context as well. As it is intended to inform activities within EGEE III, its recommendations are directly relevant to EUAsiaGrid.

References

- Asia Federation Report 2008. Eric Yen and Min Tsai (editors). To appear in: Proceedings of ISGC 2008, Springer.

3.2.2. APGrid PMA

The Asia Pacific Grid Policy Management Authority[9] (APGrid PMA) supports Grid communities in the Asia Pacific region to implement a common trust domain across organisations, acting as the representative policy management authority. Its main activity is to coordinate the public key infrastructure for use in grid authentication. It is not specific for any existing grid communities in the Asia Pacific region but supports grid authentication in different contexts such as the Asia Pacific Partnership for Grid Computing (ApGrid) and Pacific Rim Applications and Grid Middleware Assembly (PRAGMA).

The APGrid PMA is a member of the International Grid Trust Federation[10] (IGTF), which is a body to establish common policies and guidelines between the Policy Management Authorities (PMAs) that are its members and to ensure compliance with these amongst the participating PMAs. The IGTF does not provide identity assertions but instead ensures that within the scope of the IGTF charter the assertions issued by accredited authorities of any of its member PMAs meet or exceed an authentication profile relevant to the accredited authority. The other members of IGTF are the

[9] www.apgridpma.org

[10] www.igtf.net

European Policy Management Authority (EUGridPMA), the Americas Grid Policy Management Authority (TAGPMA), and the Trans-European Research and Education Networking Association (TERENA) Academic CA Repository (TACAR). The APGrid PMA pursues the following core activities:

1. IGTF CA package distribution: The CA package contains root certificates of IGTF trusted CAs. The package is maintained and distributed by IGTF, so it can be installed in grid systems that accept the IGTF trust model.
2. Meetings: Ex officio members and general members of APGrid PMA meet regularly to report on their status and activities. The meetings are mainly conducted by video conferencing; face to face meetings are also held at less frequent intervals.
3. Production CA approval: The APGrid PMA reviews the Certification Policy and Certification Practice Statement (CP/CPS) of its members and conducts an interview before approving members as a production level CA.
4. CA auditing: Member CAs conduct their own internal auditing. Auditing by external auditors occurs at less frequent intervals.

The certificates are not issued by the APGrid PMA, but by its member CAs. Each member CA has CA operators and RA operators to review the certificate requests and issue the certificates according to its CP/CPS. Each member also maintains its repository for its root certificate, signing policy, certificate revocation list, CP/CPS and other information.

The APGrid PMA has two types of memberships: ex officio membership and general membership. Currently, there are 14 ex officio members.

1. Australia APAC represented by David Bannon
2. China CAS represented by Kai Nan
3. China IHEP represented by Gonxing SUN
4. India C-DAC represented by Subrata Chattopadhyay
5. Japan AIST represented by Yoshio Tanaka (Chair)
6. Japan KEK represented by Takashi Sasaki
7. Japan NII/NAREGI represented by Kento Aida
8. Korea KISTI represented by Sangwan Kim
9. Taiwan ASGC represented by Eric Yen
10. Taiwan NCHC represented by Weicheng Whuang
11. Thailand NECTEC represented by Sornthep Vannarat
12. Thailand Thai National Grid represented by Sugree Phatanapherom
13. Singapore NGO represented by Jon Lau
14. USA UCSD represented by Mason J. Katz

The APGrid PMA also has 4 general members.

1. Hong Kong U. of Hong Kong represented by P. T. Ho
2. India U. of Hyderbad represented by Arun Agarwal
3. Japan Osaka U. represented by Susumu Date
4. Malaysia U. Sains represented by Boon Yaik

The production-level CAs are:

1. AIST GRID CA, Japan

2. APAC Grid CA, Australia
3. ASGC CA, Taiwan
4. CNIC Grid CA
5. SDG CA
6. IGCA, India
7. IHEP CA, China
8. KEK Grid CA, Japan
9. KISTI Grid CA, Korea
10. NAREGI CA, Japan
11. NCHC Grid CA, Taiwan
12. NECTEC GOC CA, Thailand
13. NGO-Netrust CA, Singapore
14. PRAGMA-UCSD CA, USA

The experimental-level CAs are

1. CMSD CA, India
2. HKU CC Grid CA, Hong Kong
3. KISTI CA, Korea
4. Osaka U. CA, Japan
5. USM CA, Malaysia

References

- APGrid PMA Website at www.apgridpma.org
- APGrid PMA Charter (http://www.apgridpma.org/docs/APGridPMA-charter-1.3.doc)

3.2.3. SHARE Roadmap

The SHARE roadmap seeks to identify the key requirements for widening the adoption of healthgrids in Europe, covering technical as well as ethical, legal, social and economic (ELSE) issues. The SHARE roadmap begins by spelling out the advantages of a healthgrid approach for health care practice as well as biomedical research. In fact, a better integration between research and clinical practice is one of the potential benefits of healthgrids, leading to translational research that links the research lab to the bedside and delivers patient-specific treatment.

In the area of biomedical and healthcare research, ELSE issues are of crucial importance as such research often uses data and/or biological material from living individuals and as it may have implications for these individuals or their relatives. These issues lead to increased organisational and technical complexity that needs to be handled appropriately. In addition, biomedical research often creates intellectual property of significant commercial value, so ownership and usage rights are important, in addition to the need for appropriate legal/ethical frameworks and provisions for the secure and confidential handling of data.

Another issue that is of particular interest in biomedical and healthcare research is the complexity of the data. While the development of coding schemes in healthcare has a long history, the state of adoption of such standards is still relatively poor and practices can differ significantly between different locations or national contexts. The issues of coding are intimately related to the conduct of healthcare and healthcare research. Integrating data across organisational domains and different practices remains a significant challenge, as does the integration of ‘legacy’ data and systems into

integrated healthgrids. The issue of trust in information systems and regulatory frameworks under which data are processed is of crucial importance given the sensitive nature of the data and the implications that incorrect results of processing might have for patients' welfare.

The SHARE Roadmap outlines a set of requirements and outlines a roadmap for the development of computational, data, collaboration and knowledge grid infrastructures. It indicates a parallel development and gradual maturing of different elements such as improved distributed data management; infrastructure interoperability; distributed data models; on demand access; data integration tools and standards; usability; knowledge management tools and standards; quality of service and domain-specific knowledge management and ontologies. Of particular interest are the requirements related to the ELSE issues:

- Liability issues
- Trust and Acceptance
- Data Protection
- Sustainability
- Education and Skills
- Intellectual Property
- Governance and Delegation
- Policies and Codes of Conduct
- Dissemination and Publicity

The SHARE roadmap is relevant primarily with respect to the support of applications in the biomedical domain. Many of the ethical, legal, social and economic issues raised also apply to social scientific research. In fact, there is a relatively large area of overlap between medical and social scientific research, e.g., in the area of epidemiology and public health.

While the issues mentioned affect biomedical and healthcare research applications anywhere, we feel that potential solutions require local action. Also, while these may be specific to healthgrid or similar applications, they need to be taken at a wider infrastructure and policy level and thus transcend the requirements for individual applications (and are hence within scope for this workpackage).

References

- The complete SHARE roadmap is available at: roadmap.healthgrid.org
- Further information is available on the SHARE website at: www.eu-share.org

3.2.4. AVROSS Study

The Accelerating Transition to Virtual Research Organisation in the Social Science (AVROSS) study has investigated promising applications of e-Infrastructure in the Social Science and Humanities with the aim of assessing the potential for a large-scale roll-out of technologies and services supporting virtual organisations in these research areas. The main findings from a survey of early adopters of e-Infrastructures relate to the importance of:

- personal contact in the spread of information about e-Research;
- seed funding to support early exploration of e-Research technologies and approaches;
- access to adequate long-term funding and access to relevant skills;
- a supportive local support environment;
- user-involvement at an early stage of any technology development and implementation;
- the role of disciplinary champions for dissemination and widening of uptake;

- and community-building and mutual learning across e-Infrastructure services as a key success factor.

A number of concerns about social and technological issues were identified:

- the importance of data management and data assurance;
- the lack of usability and dependability of current technologies;
- the fact that disciplines with highly individualised ways of working find it difficult to follow the model of hierarchically organised disciplines such as particle physics.

The project also observed marked difference in the funding arrangements for and consequent structure of research projects. Projects in continental Europe and the US tended to be larger than those in the UK. Each approach has its respective benefits and drawbacks. While small projects allow the exploration of a range of approaches, larger projects are needed to create sustainable e-Infrastructures and build communities. Sustainability and community building are closely related issues and approaches to addressing them are currently underdeveloped.

Another aspect is the fact that e-Research involves disruptive technological interventions that require the modification of established ways of working and career structures. These are especially problematic where data protection or other ethical issues are concerned or where reward structures do not provide sufficient incentives for important aspects of building e-Infrastructures.

Finally, measuring the impact of e-Research is notoriously difficult and benefits may accrue only over longer timescales. Evidence of the impact of e-Research on substantive Social Science and Humanities research is still relatively thin although some strong demonstrators exist.

The AVROSS study focused specifically on the needs of Social Science and Humanities researchers. It is therefore of relevance to EUAsiaGrid in that it defines requirements for e-Infrastructure in these areas, which are different in many respects from other research areas. Arguably, the findings of the AVROSS study are not limited to the Social Sciences and Humanities but are representative of the situation in other disciplines that are late adopters of e-Research approaches. The EUAsiaGrid project should therefore consider the findings in any activities aimed at establishing new communities of use.

References

- The AVROSS final report can be found at: http://web.fhnw.ch/plattformen/avross/papers-and-prensentations/final-report

3.2.5. EGI Design Study

The European Grid Initiative Design Study (EGI DS) represents an effort to establish a sustainable grid infrastructure in Europe. Driven by the needs and requirements of the research community, it is expected to enable the next leap in research infrastructures, thereby supporting collaborative scientific discoveries in the European Research Area (ERA). The main foundations of EGI are the National Grid Initiatives (NGI), which operate the grid infrastructures in each country. EGI will link existing NGIs through a central, coordinating body (the EGI organization, EGI.org) and will actively support the setup and initiation of new NGIs. Currently, the EGI DS effort has resulted in European Grid Initiative (EGI) Blueprint describing the proposal to establish a sustainable grid infrastructure in Europe in place by the end of EGEE-III in spring 2010.

The main aim of EGI is to provide a common access infrastructure to national or international projects or disciplines, enabling the sharing of computing and data resources with minimal overhead. Without the EGI, each project or each discipline would have to develop its own solution for computational and data interoperability. This would spread the cost of the infrastructure between all the projects, but it would also replicate the same work by different groups, adding to the overall cost. For governments

and national funding bodies who fund research across a broad range of disciplines, the additional cost of a piecemeal solution would be considerable.

The EGI is composed of a small central coordinating body (EGI.org) and National Grid Initiatives (NGIs) performing the following tasks:

- Authentication of individual users as the people they claim to be.
- Allocation of project or discipline collaboration members to VOs where resources are shared.
- Allocation of computing resources to those VOs which VO members will be authorised to use.
- Authorisation of VOs to run computing jobs, store and retrieve data on individual computing resources (machines, data centres, facilities, etc.).
- Distribution and scheduling of computing jobs, workflows, data retrieval and access requests to authorised computing resources.
- Monitoring of the jobs submitted, processed, and the data stored by individuals.
- Accounting of users and VO in their allocations and usage of computing resources.
- Reporting to each NGI of their allocation of resources to VOs, and the use of those resources by individual users, in order to enable the NGI and the national funding bodies to account for the use of funds in terms of the research results produced by VOs.
- Coordinated management of software updates and hardware upgrades while maintaining a continuous service.

The EuAsiaGrid consortium covers various grid-related activities within the Asia-Pacific region involving the following geographically distributed project partners: Philippines, Australia, Taiwan, Singapore, Thailand, Vietnam, Indonesia and Malaysia. Similar to the EGI, the project itself is not building an infrastructure but rather focuses on fostering available infrastructures, computational and/or storage resources, user support, tools and primarily end user communities to serve as a coordination action of previously separated local efforts. Taking into account the framework that has been set up by the EGI DS, the EUAsiaGrid project can help to setup a similar framework within the Asia-Pacific region and also to function as a suitable showcase to demonstrate how a new, active user community can join the already established worldwide production grid environment.

This involves significant challenges specific to the Asia-Pacific region, where existing Grids are often built using solutions based on the Globus Toolkit or utilise desktop grids. With some exceptions, there are no mature and stable infrastructures utilising the gLite middleware, which would offer the potential of integration across national boundaries. In addition, the EUAsiaGrid consortium does not represent a hierarchy like the WLCG but a flat model of communities (scientific end-users and application developers/maintainers) that are strongly interdisciplinary and international. The coordination and support it provides is aimed at ensuring that at least a baseline service exists in each partner country, aligned within the operational framework of the APGrid PMA and supporting the EUAsiaGrid virtual organisation. These developments are informed by the experience gained through the EGI DS.

On the other hand, the feedback from such a process can be used to validate the procedures—their smoothness and applicability—suggested within the currently final version of the EGI DS Blueprint. The mutual learning enabled by the interaction between EGI DS and EUAsiaGrid can help to elicit the strengths or weaknesses of current efforts invested in solving interoperability issues. A set of areas has been identified for detailed investigation:

- A general framework for the setup of EGI-like organizational structure in the Asia-Pacific region
- Application support organisation (does not built on any already established structure)
- Installation of gLite (and later on UMD) sites
- Uptake of established EGEE tools (RESPECT-like recommended instruments)

- VO-related issues (central regional catch-all VO, light-weight procedures)
- Evaluation of EGEE tools (ticketing clearing system, collaborative environments)

References

- EGI Design Study website at web.eu-egi.eu
- EGI Blueprint document at www.eu-egi.eu/blueprint.pdf

3.2.6. JISC Community Engagement Projects

The Joint Information Systems Committee (JISC) in the UK has funded three related projects[11] within its Community Engagement Strand to study and widen the uptake of e-Infrastructures in research. The projects focus on the recent past, the present and the future respectively:

- The e-Infrastructure Use Cases and Service Usage Models (eIUS) project studies and documents examples of e-Infrastructure usage in order to inspire and inform uptake.
- The ENGAGE project focuses on uncovering barriers that can be overcome and opportunities that can be realised in a short timeframe.
- The e-Uptake project studies systematically barriers to and enablers of e-Infrastructure usage with a view to informing future service provision and the development of supporting measures to increase uptake more widely.

All three projects have gathered data from researchers and other stakeholders through interviews and questionnaires. A common framework of understanding allows sharing of the data between the three projects where participant consent exists.

The e-Uptake study has interviewed more than 50 researchers across different institutions and different areas of research as well as more than 50 representatives of e-Infrastructure providers, local IT services and intermediaries such as e-Science Centres. The interviews have been transcribed and coded up to yield a detailed analysis of the issues raised. A typology of issues has been developed as a result of the first phase of interviews (with researchers) and is currently being revised in the light of the results from the second phase. The coding is hierarchical in order to reconcile the needs of different stakeholders. Some need detailed information about particular issues they might need to address (e.g., a particular technical problem with one of their services) while others are interested in the overall outcomes in order to steer the formulation of policies and the provision of funding. At the highest level, the analysis distinguishes between issues that are predominantly technical in nature, those that are social or socio-technical issues and, finally, those that are to do with the production, curation and usage of data. It is clear that this is just an analytical distinction used to organise the wealth of data available and that there are many overlaps between these categories.

In total, the project has identified more than 150 issues and about 80 enablers that might address these issues. At the highest level, the study has identified a number of issues leading to recommendations of relevance to the EUAsiaGrid project:

- there is still a lack of awareness of e-Infrastructure services amongst researchers and a lack of understanding of the possible use of e-Infrastructures in some research areas as well as their implications;
- there is a lack of adequate communication between technology providers, service providers and end users, hindering the development of stable communities underpinning the continuing evolution of e-Infrastructures and leading to a lack of fit between e-Infrastructure provision and researchers' needs;

[11] www.engage.ac.uk

- sustainability of services remains a major issue that hinders the development of a stable e-Infrastructure and trust in it;
- short-term funding arrangements lead to a shift of focus in service provision;
- concerns about confidentiality and security hinder the adoption of e-Infrastructures in some areas.

These issues are just examples of the kinds of findings the e-Uptake study is producing. A full final report will be available within the current timeframe of the EUAsiaGrid project, as will a database of findings that will be available for public use.

The eIUS project is working to investigate current usage of e-Infrastructures and to document it in the forms of use cases and service usage models. Like e-Uptake, it has interviewed researchers and is documenting their work first in experience reports, which get distilled into more general and re-usable use cases. While these are focused on research practice, service usage models present a view from the technical functionality to its usage in a wider context. They may, for example, describe how authentication mechanisms allow researchers to log into a portal, create proxy credentials and access remote resources. The e-Framework for Education and Research[12] is an international initiative aiming to foster the usage of service-oriented approaches in institutions in the higher education sector. Originally founded by the Australian Department of Education, Employment and Workplace Relations (DEST) and the UK's JISC, the initiative has been joined by New Zealand's Ministry of Education and the Netherland's SURF Foundation. The eIUS project has collaborated closely with this initiative and will feed its service usage models into the repository managed by the e-Framework.

The work done in the three JISC Community Engagement projects provides a wealth of material about the issues involved in using e-Infrastructure for research – from concrete technical problems to wider issues related to research policy and the organisation of research disciplines. All three projects are coming to an end in June 2009 and are currently working on a sustainability plan that will aim to make as much of the data collected available for further usage (subject to confidentiality constrains). As the data touches on a wider number of issues that are relevant not just in a UK context but in e-Research anywhere in the world, we expect this work to provide valuable input into EUAsiaGrid activities in the medium and long term.

At the same time, the methodologies used in the three projects are of relevance to EUAsiaGrid in that they can be adopted and used to collect information about issues involved in the provision, uptake and usage of e-Infrastructures for research. The educational material produced by the eIUS and e-Uptake projects can potentially be adopted and re-used and synergies between education and training events supported by e-Uptake and EUAsiaGrid can be explored. The long established International Summer School on Grid Computing in particular would be of interest here. The experiences of the ENGAGE project in running short-term projects to increase uptake could provide a model for support activities to be developed through EUAsiaGrid (with the provision of additional funding where necessary).

References

- Voss, A. *et al.* Widening Uptake of e-Infrastructure. International Conference on e-Social Science, Manchester 2008.
- Voss, A. *et al.* e-Research Infrastructure Development and Community Engagement. Proceedings of the UK e-Science All Hands Meeting, Nottingham, 2007.
- e-Uptake Draft Deliverable D1.2: Community Engagement Interim Report (unpublished document)
- ENGAGE Portal at www.engage.ac.uk

[12] www.e-framework.org

3.2.7. EUChinaGrid

The EUChinaGrid project was funded by the European Commission through the 6th Framework Programme and was led by INFN. The project aims to foster interoperability and integration between EGEE and the China National Grid project[13] (CNGrid) through extending a pilot intercontinental infrastructure using EGEE-supported applications and promoting new applications by training new user communities and supporting the adoption of grids for research applications.

The project has focused on applications in the areas of astrophysics, high-energy physics and molecular biology. One of the most interesting aspects of the project is that at the core of each application area are specific research activities that require grid computing capabilities:

- The cosmic ray experiment ARGO in Yangbajing produces large volumes of data (around 200 Tbyte/year) that were previously distributed through the movement of magnetic tapes. In addition the application has significant processing requirements, which will be distributed between centres in China and in Italy.
- Chinese researchers are involved in the ATLAS and CMS experiments at the LHC. The storage and processing requirements are significant and connections need to be managed to the higher levels in the tiered hierarchy of the WLCG.
- The systematic prediction of protein structure to screen them for potential medical applications is a typical high-throughput computing application (with estimated runtime at $2x10^7$ minutes) with large-scale storage requirements.

EUChinaGrid has characterised the application requirements for the three driver applications in terms of the database of middleware and infrastructure requirements collected by the EGEE Project Technical Forum[14]. The discussion of these requirements shows clearly how the driver projects help to inform the development of infrastructure in the EUChinaGrid project, a topic we will come back to in section 7.

References

- EUChinaGrid Website at www.euchinagrid.org
- EUChinaGrid Deliverable D4.1: Applications Specifications and Requirements, available at http://www.euchinagrid.org/deliverable/D4.1.html

3.2.8. EUIndiaGrid

India and Europe have established a good collaboration within scientific research, and in the ICT field in particular. They also share a common vision about the paramount importance of supporting international collaboration in e-Infrastructures. The aims of the EUIndiaGrid project are to join European and Indian grid infrastructures in order to support e-Science collaborations, to build a network of communities that benefit from this joined-up infrastructure, promote the use of e-Infrastructures through the production of documented pilot applications and to disseminate and leverage existing investments in grid infrastructures.

EUIndiaGrid builds on the Indian National Education and Research Network (ERNET), which links some 1389 institutions, including 152 universities, 284 agricultural universities and other research institutions using a mix of terrestrial and satellite links. ERNET is linked to GÉANT at 45 Mbps and further upgrades are in preparation that would provide redundant connections and additional bandwidth. Collaboration between the Indian Department of Atomic Energy and CERN has established a 1Gbps link serving the LHC experiments. In addition, India is a candidate partner

[13] www.cngrid.org

[14] https://savannah.cern.ch/support/?group=egeeptf

country for TEIN3, opening up new opportunities for collaboration with European and Asian partners and improving sustainability. Plans are also underway to strengthen the connectivity of research and other institutions through a Gbps speed National Knowledge Network.

India has invested in grid computing through the GARUDA initiative funded by the Department of Information Technology (DIT). It connects 45 institutions across 17 cities through a virtual private network, a precursor to the planned Gbps national knowledge network. As the resources committed to GARUDA are heterogeneous, emphasis has been placed on interoperability and integration, with the aim of running applications seamlessly across the grid. Applications have been demonstrated in a range of areas such as natural disaster mitigation and bioinformatics.

The Indian Department of Atomic Energy (DAE) has been involved in the construction of the LHC and Indian scientists are taking part in the CMS and ALICE experiments. For this purpose, India has set up Tier-2 centres in Mumbai and Kolkata. India is also active in the area of middleware development, covering areas such as grid fabric management, data management and security, workload scheduling, monitoring and fault tolerance. The DAE has invested in a DAE-wide computing grid connecting a number of sites and with a view to connecting all DAE sites using the gLite middleware and achieving full compatibility with the WLCG, supporting both sequential and MPI job execution.

The EUIndiaGrid project, funded under the European Commission's 6th Framework programme and led by INFN, has facilitated the integration of the Indian GARUDA infrastructure with the W-LCG and EGEE. The first phase of the project has come to an end in September 2008 and has reported the following activities and outcomes:

- support improvement of Indian network infrastructures both at national and international level;
- establishment of collaboration with the Indian National Grid Initiative, GARUDA and with the Department of Atomic Energy grid project (WLCG-GRID);
- availability of a grid infrastructure to research communities;
- a bridge across European and Indian grid initiatives supporting international cooperation;
- access for Indian researchers to grids worldwide through the establishment of an internationally recognised Indian Grid Certification Authority.

EUIndiaGrid provides an example of an initiative aimed at widening the reach of EGEE as a worldwide grid infrastructure in an Asian context. As such, it can provide a number of valuable lessons for EUAsiaGrid. Some of these are discussed in section 7. In addition to utilising the lessons at a strategic level by factoring them into the development of the EUAsiaGrid roadmap, there is an opportunity to make use of experiences gained at an operational level.

References

- EUIndiaGrid website at www.euindiagrid.eu
- EUIndiaGrid: e-Infrastructures across Europe and India, available at: http://partners.euindiagrid.eu/docs/Booklet.pdf

3.2.9. EELA

The EELA and EELA2 projects were funded by the European Commission under its 6th and 7th Framework Programmes to foster the e-Infrastructures of Latin American countries and to align them with developments in Europe. The EELA2 project has project partners in Colombia, Cuba, Ecuador, Mexico, Peru, Argentina, Brazil, Chile and Venezuela as well as in European countries. Its aim it to build a production-quality, scalable grid infrastructure providing dependable service to researchers in Europe and Latin America with a focus on meeting application requirements and achieving sustainability.

The first phase of EELA established an infrastructure comprising 730 CPU cores and 60 Tbytes of storage space, which the EELA2 project aims to expand and consolidate. In addition to the technical expansion, the description of work specifies the objective to establish regional operation centres and new certification authorities in Latin America under the framework of TAGPMA. The objective to expand the usage of the EELA infrastructure aims to make it an indispensable tool for wider research communities and therefore to galvanise the support for the longer-term sustainability plan.

In order to produce a sound sustainability plan, EELA is working to produce documents describing and costing the operation of the grid infrastructure and to work out possible financial operation models. The development of a Latin American Grid Initiative (LAGI) is modelled after the EGI Design Study and expected to collaborate with an emerging European Grid Infrastructure.

EELA2 provides an interesting example of an infrastructure aiming to move from project funding to a different sustainability model and the lessons learned will be important input to the EUAsiaGrid activities. While there are probably limits to such a comparison, the situation the various Latin American partners in EELA is similar to the situation of the partner countries in EUAsiaGrid to some extent and such similarities should be explored and lessons exploited where possible, in particular, approaches for mitigating the effects of relatively low bandwidth connections. Another interesting aspect is the extension of the consortium in the second phase, which is seeing grid initiatives grow in the partner countries and core institutions taking the lead as coordinators of growing national grid initiatives.

References

- EELA website at www.eu-eela.eu
- EELA2 Description of Work at http://documents.eu-eela.org/record/1086/files

4. DATA GATHERING INSTRUMENTS

The data gathering instruments developed for EUAsiaGrid WP2.1 aim to elicit information at a number of different levels and from different stakeholders and informants. They form a set of complementary activities that will inform the development of the EUAsiaGrid strategy in its crucial early stages as well as in the longer term.

4.1. STATUS, PLANS AND REQUIREMENTS DOCUMENTS

The EUAsiaGrid wiki is being used to develop a collection of data about the status of e-Infrastructure implementation, concrete implementations plans, support requirements and roadmapping activities. This data is collected directly from the partners and serves a purpose similar to the EGI DS Knowledge Base. The initial data was collected using a questionnaire distributed at the EUAsiaGrid kick-off meeting in Taipei in April 2008. The list of topics has since been revised and the content extended, to form an overview of the state and trajectory of grid adoption in each partner country:

Status of Implementation

- What existing resources does your organisation have access to and what exists at a national level? List what is well-established, what services are being developed, what prototypes exist and where no capacity exists
- What level of network connectivity does your institution have with other countries and regions?
- Are you part of (inter-) national grid infrastructures? Which ones? Do you have a regional operating centre (ROC) of reference?
- Are there community engagement programmes in your country that aim to increase uptake amongst researchers?

Implementation Plans

- What resources do you plan to commit to the EGEE infrastructure?
- Is there a (national) roadmap? What other coordinating structures exist?
- What are the relevant funding mechanisms that support implementation?
- What concrete plans exist to develop services?
- What concrete plans exist to develop prototypes?
- What concrete plans exist for applications or generic research environments?
- What concrete plans exist for developing support activities?

Requirements

- What are the major gaps in provision of services, training and support?
- What support do you expect EUAsiaGrid to provide to address these?

Community Engagement

- What scientific communities are you engaging with?
- What mechanisms are you using for this engagement?
- Are there any funded initiatives to widen the uptake of e-Infrastructures generally or grid computing in particular?

Obstacles

- What problems are you facing that are keeping you from achieving your implementation goals?

Responses to these questions have been factored into the partner profiles presented in section 6. We will continue to review this data collection instrument, add information where needed and update information where progress is being made so that the SPR documents will reflect the visible outcomes of the EUAsiaGrid project.

4.2. SURVEY

In order to elicit requirements from scientific communities and potential adopters of e-Infrastructure, we are conducting an online survey. At the time of writing, we started the data collection in three different languages (English, Thai and Chinese, with Bahasa in preparation for Malaysia, Indonesia and Brunei). Local survey coordinators have been appointed in each country to manage the process of administering the survey and to recruit respondents.

Familiarity of candidate respondents with English is expected to vary, so a decision was made to translate the survey questionnaire into other languages where this is seen essential or where the benefits are seen as outweighing the costs. The survey coordinators have overseen the localisation of the questionnaire and will be responsible for the translation of responses back into English where necessary.

We will make use of all available routes for advertising the survey and will also seek to identify respondents directly as well as through snowball sampling in order to maximise our coverage. As the intended target audience is applications researchers, we have tried to keep the survey relatively simple, to avoid overly technical language where possible and to provide a link to a glossary containing clarifying explanations for technical terms used.

The survey questions fall under the following headings:

- Welcome
- General Information
- Data Resources
- Compute Resources
- Visualisation
- Teleconference and Remote Instrumentation
- Network Connectivity
- Applications and Usage
- Support and User-Designer Relations
- Training
- Future Plans
- Personal Information

The complete list of the questions is included in Appendix A. Most questions are factual although some ask respondents for their views or ask them to state intentions. Most questions are pre-coded with an option to include a free-text entry in order to allow the respondent to record information not covered by the codes. Some questions require free text answers. The final page of the questionnaire allows the respondents to optionally record their contact details, to ask to be contacted as well as to subscribe to the EUAsiaGrid mailing list.

As our target population is broadly defined as researchers in the partner counties, the size of this population is unknown, so we cannot estimate response rates in relation to the overall population. However, as we will be approaching candidate respondents directly, it makes sense to reason about the response rate in relation to this sample. We would expect it to be comparable to other studies. For example, the EARNEST study achieved a 39% response rate and the AVROSS study reports 23.4%.

Considering that we are aiming the survey at researchers in 8 different countries and across 7 research domains and expecting 10 responses per country and research domain, we would like to set ourselves the target of gathering at least 560 responses, a figure roughly comparable to the AVROSS study. Based on an estimated 30% response rate, we would need to approach about 200 candidates per country. This is a significant effort but realistic over the lifetime of the EUAsiaGrid project.

Efforts to advertise the survey will be focused on the partner countries in the Asia-Pacific region as the questionnaire is tailored to collect data relevant to this context and because responses from this region will directly inform work in other workpackages.

4.3. FOLLOW-ON INTERVIEWS

In the survey, we encourage (but we do not require) respondents to give us their contact details so that we can contact them for follow-on interviews by email, telephone or similar mechanisms. These interviews will give us valuable additional information that will not only complement the survey data but will enable us to check our interpretation of it. In addition, these interviews will provide an initial contact with researchers who might wish to engage further with the project, for example to attend training courses or to develop applications. We envisage that the interviews will be guided by the survey questionnaire but that they will be fairly open-ended and conversational in style.

We expect the number of interviews to be significantly lower than the number of responses to the questionnaire, the ultimate number being determined by the minimum of the number of people who are willing to be contacted and the number of interviews that can be conducted in the given time with the given resources. Based on the target defined for the survey, we might say that a ratio of about 10:1 would be adequate, i.e., we would be aiming to conduct 56 interviews of about half an hour each. Interviews will be prioritised where we feel that the potential for engagement is high and where we may enable respondents to take up use of e-Infrastructure, potentially with the help of workpackage 3.

4.4. WORKSHOPS

After baseline information has been collected through the instruments described above, we will validate our analysis by running workshops involving key stakeholder groups. Where possible, these workshops will be co-located with conferences or other events to maximise their effectiveness for dissemination as well as a validation tool. Events will be organised at ISGC'09, at OGF25 and the EGEE User Forum as well as other suitable conferences. We will place emphasis on establishing contact with relevant user communities and covering events in the Asia-Pacific region.

5. DATA COLLECTION AND DIVISION OF LABOUR

5.1. KICK-OFF SURVEY

The collection of data has started at the EUAsiaGrid kick-off meeting in Taipei in April 2008. A questionnaire was used to elicit baseline information from project partners. The data has been used on the one hand to form the basis of the status, plans and requirements (SPR) documents and on the other to inform the management of work in the workpackage and the wider project.

5.2. STATUS, PLANS AND REQUIREMENTS DOCUMENTS

The project partners have further developed the SPR documents (cf. section 4.1) on the EUAsiaGrid wiki. They will be updated throughout the project to reflect the development of e-Infrastructure services in the partner countries and developing requirements. An analysis of the data collected to date has been fed into the country profiles presented in section 6 and the analysis in section 7.

5.3. SURVEY

5.3.1. Coordination through workpackage leaders

NCeSS as the institution leading the workpackage is playing a central role in the study design, bringing to bear expertise available on the conduct of social research. NCeSS will ensure effective coordination of all activities throughout the stages of study design and execution and will play a key role in the analysis of the resulting data.

5.3.2. Local Survey Coordination

The execution of the survey will require local support and coordination by the EUAsiaGrid partners. It is envisaged that at least one local survey coordinator will be appointed per partner country, with appropriate holiday and illness cover arrangements. The responsibilities of the local survey coordinators will be to:

- Translate the survey questionnaire into the predominant language used in their country;
- Identify candidate respondents and approach them directly by email;
- Disseminate information about the survey;
- Conduct follow-on interviews with respondents;
- Feed back to the workpackage leaders statistics about effectiveness and flag up any issues arising;
- Translate free text responses into English for analysis.

The importance of the role of the local survey coordinators cannot be stressed enough. Effective local support is crucial in order to achieve good response rates across a wide range of countries that are geographically distributed and culturally diverse.

At the moment, the survey questionnaire is available in English, Chinese and Thai, with a version in Bahasa under development for Malaysia, Indonesia and Brunei. Dissemination of the survey has begun at events, through direct contact with researchers and through the EUAsiaGrid website.

6. STATUS, PLANS AND REQUIREMENTS

This section describes, for each partner country, the status of grid implementation and operation, immediate and longer-term plans for service development and the requirements emerging from this for EUAsiaGrid. Each country section is divided into subsections:

- Available Grid Infrastructures
- Grid Strategy, Policy and Funding
- Applications and Communities
- Implementation Plans
- Training and Staff Development
- Analysis and Requirements

Taken together, these profiles represent an up-to-date snapshot of the background for EUAsiaGrid activities and the roles that the partner institutions play in their national as well as in wider international contexts. This information provides essential input for planning work in all the workpackages of the project as it represents the immediate needs of consortium partners, e.g., for support by the project.

6.1. AUSTRALIA

Australia is represented in the EUAsiaGrid consortium through the Australian National University (ANU) in Canberra. The ANU has agreed to be the main point of contact to the many collaborative initiatives currently being established in Australia, almost all of which ANU is a member of, and in some cases a lead institution. ANU is also Australia's leading research university, with a rich diversity of discipline interests (including, e.g., Humanities, Medicine, Astrophysics), and including specialisations that are rare or unique nationally (e.g. in Social Sciences) and internationally (e.g. Asia-Pacific studies)

6.1.1. Available Grid Infrastructures

There are currently no EGEE resources at ANU. Other grid resources exist and ANU hosts a supercomputing facility for its own researchers, and is the lead institution for the peak facility in the National Computational Infrastructure (NCI) of the National Collaborative Research Infrastructure Strategy (NCRIS) Platforms for Collaboration[15] (PfC). Previously, from 1998-2007, ANU was the host and member of the Australian Partnership for Advanced Computing (APAC). The University of Melbourne is also part of several NCRIS programs and has deployed and operated an EGEE/LCG site since 2006 to support high-energy particle physics researchers, however this is specific to support their particular projects, not a national role. The Australian Research Collaboration Services (ARCS, also a part of NCRIS) has taken on much of the grid infrastructure planning and development, and they provide an overview of the key platforms they provide[16], many of which are globally developed toolkits. The model developed in APAC to interface facilities to a national grid has been continued in ARCS; it relies on the use of gateway systems to translate between the national 'standard' offered by ARCS and the very site-specific installations at each location. This deals with many of the regional politics inherent in such programs. If required by Australian projects, the ARCS community could develop an EGEE framework interface – at this stage it is tied to the HEP community which is mainly based in Melbourne and Sydney.

Compute and Storage Resources

Australia has developed a multi-tiered infrastructure of compute resources. While many institutions have their own spectrum of compute facilities, the major nodes formed around the members of APAC, one per state and territory (with the exception of the Northern Territory). These members have now become partners under the ARCS program and include iVEC (WA), eRSA (SA), VPAC (Vic), TPAC (Tas), the ANU (ACT), ac3 through Intersect (NSW) and QCIF (Qld). Each member has one or more major compute resources, and from time-to-time they leapfrog in performance. Each member tends to have major discipline areas that they focus on, which in turn sometimes drives the selection of architecture. As part of the NCI program the major nationally-funded facility is hosted by the ANU, on behalf of its members around the country. Other partners include research groups such as the CSIRO and the Bureau of Meteorology. Details about the NCI and ARCS programs are available under the PfC website at www.pfc.org.au. The current peak facility was funded under APAC and is based on an SGI Altix 3700 with around 10 teraflops of performance. The next upgrade funded under NCI will see this be increased at least tenfold[17]. Details about the ARCS partners' facilities are available through http://www.arcs.org.au/about.

[15] www.pfc.org.au

[16] at www.arcs.org.au/products-services/system-services/grid-technology

[17] details at nci.org.au/facilities-and-services-1/national-facility

The ANU Supercomputer Facility, as part of the NCI, offers significant disk storage (around 60TB) directly associated with the peak facility. It also provides a large-scale tape-robot facility, currently supporting around 1.2Petabytes of storage, with an associated high-performance disk-storage facility.

This scale of infrastructure is roughly mirrored, on smaller scales, at several of the ARCS partner sites. ARCS has recently started deploying a national data fabric project, based on SRB, across these partner facilities, along with a range of other storage-related services[18]. These are made available to researchers on request, and on merit once the request becomes sufficiently large or sufficiently specific.

Certification

Australia has a production certification authority, initially provided by the Australian Partnership for Advanced Computing (APAC) and now managed by ARCS. This is being integrated with the Australian Access Federation[19] (AAF, another NCRIS/PfC program), which seeks to provide a national framework for the research and education needs for PKI-based cryptography, as well as support for Shibboleth/SAML-based services.

Other Resources

Because of Australia's large geographic structure and small population (21 million people, about 40 Universities), various realtime and asynchronous collaboration technologies have been adopted enthusiastically for research and education. These include a very mature H323/SIP infrastructure, partly managed by AARNet, and by the individual Australian institutions, and ranges from low-bandwidth desktop services through to high-end, high-quality telepresence systems. Participation in ENUM was well advanced but has quietened recently with changes in international enthusiasm. Alongside this infrastructure there are a large number of AccessGrid nodes (around 40-50 room-based sites, plus a large number of desktops) which is mostly community supported. ARCS has introduced a service based around VRVS/EVO.

There are also several high-end visualisation facilities and support groups across Australia. Most are attached to Universities, such as ANU, Uni Queensland, Sydney Uni, RMIT, and Uni Western Australia, and offer services to institutional researchers, government agencies and the private sector.

Apart from the basic Storage services outlined above, there is also a significant effort going into long-term retention and management of primary research data, through institutional repositories and integration with national frameworks. A key element of this is the work being undertaken (with ANU, Monash and CSIRO as lead institutions) on the Australian Research Data Commons, initially through the Australian National Data Service (ANDS, another NCRIS/PfC program). This will see institutional data management capabilities (i.e. above storage) being coordinated and integrated as appropriate, on a discipline-by-discipline basis, and the provision of support, including training and outreach. This builds on the successful Australian Partnership for Sustainable Repositories program (APSR, led by ANU, together with other Universities and the National Library of Australia).

User Support

The mechanisms for User Support are directly associated with each of the resources above. At the very front, institutions, regardless of whether they are members of these partnerships or not, take responsibility for providing support to end-users in all of the 'e-Research' functions described above. Where they make use of broader capabilities and functionality under the PfC programs, they are provided with helpdesk, training and at-elbow support to various levels. ARCS, ANDS, NCI, AAF

[18] www.arcs.org.au/products-services/data-services

[19] www.aaf.edu.au

and AARNet each offer their own support channels, with some coordination between them where appropriate. Between the national and institutional levels sit the state-based partnerships, such as Intersect and VERSI, who are tasked with providing more strategic support to a set of institutions. These can include at-elbow support for specific strategic projects, as well as training of researchers and institutional support staff. These partnerships tend not to manage infrastructure directly, but provide support for access, and in some cases the development and operation of specific services for research.

6.1.2. Grid Strategy

Australia has introduced its National Collaborative Research Infrastructure Strategy[20] (NCRIS) in 2005 and the Australian government is providing $542 million over 2005-2011 to provide researchers with major facilities, supporting infrastructure and networks necessary for world-class research. The investment programme is divided into a range of specific priority capability areas as described above. NCRIS provides funding to coordinated collaborative efforts in around 10 strategic discipline areas, plus the PfC infrastructure program above. The PfC programme in turn has provided support for, or initiated the creation of, the NCI, ARCS, ANDS, AAF, and AREN as separate entities.

6.1.3. Networking

AARNet, the Australian national research and education network (NREN), owns and operates a resilient and redundant multi-Gbps network across Australia, providing a 10Gbps backbone stretching across much of the country from Brisbane to Perth. ANU is connected to the 10Gbps backbone with 1Gbps for general traffic. A 10Gb link to the national facility was recently enabled. Australia has multiple international links including two of 10Gb east to the US and one 622Mb northwest into Asia.

6.1.4. Applications and Communities

ANU has several specific research strengths and interests in a range of disciplines, and a deep infrastructural and service approach to supporting those disciplines. ANU has played key roles in developing national centres of excellence in various research areas including population health, biomedicine, climate studies, legal, business and financial research, the physical sciences, and is very strong in the Humanities, Arts and Social Sciences, as well as being a global leader in research about the Asia-Pacific region across a range of disciplines. On the infrastructure side the ANU has held a lead role in representing Australia across the Asia-Pacific region, especially through initiatives such as APAN, APEC-Tel, PRAGMA, APGrid, and is keen to continue this facilitation role in the EUAsiaGrid group.

The main focus at Melbourne for the EGEE activities has been on support for the Atlas experiment but biomedical applications as well as the Belle VO have also been supported. This support is not through a national mandate or formal funding for that role, but an extension of their skills-base.

6.1.5. Analysis and Requirements

Australia is a fairly resource-rich country in terms of infrastructure and support, and institutions such as ANU have a strong history in supporting Pan-Asian activities, especially in the developing countries. Various groups in Australia have supported the deployment of tools such as the Access Grid toolkit (in some countries driven in large part by the SARS outbreak), h323/sip collaboration services, certificate authority frameworks, and integration of the grid world with the Shibboleth authentication world. The intention is to support multi-lateral international research projects to work as effectively as possible. The EUAsiaGrid projects provide another avenue to build a community of support, and working with our Asian network of colleagues on support initiatives would benefit Australian, EU and

[20] ncris.innovation.gov.au

Asian researchers. This can be supported through existing project funds with the additional contribution from the EU for this program. Any specific discipline research projects can seek funding through existing grant programs including several bilateral funding agreements such as the Australian-EU (FEASTS) and various Australian-Specific-country agreements (with the UK, France, Germany and others) as well as several between Australia and various Asian countries. Several Australian senior analysts have been directly involved in supporting EU funding programmes (5th and later frameworks) and US funding programs (NSF and others), so have a broad understanding of research infrastructure needs

6.2. INDONESIA

Indonesia is represented in the EUAsiaGrid consortium by the Institut Teknologi Bandung[21] (ITB). ITB has experience with scientific computing applications in a number of application areas such as weather prediction or computational chemistry.

6.2.1. Available Grid Infrastructures

Compute and Storage Resources

An EGEE site is currently being set up at ITB comprising a compute element with 10 worker nodes (2x quad core each) and 10TB of storage space. The configuration of the resource will be based on the configuration used at ASGC and will be expanded over time. Other compute and storage resources exist that utilise a virtualisation infrastructure.

Networking

In 2006, Indonesia set up the Indonesia Higher Education Research Network[22] (INHERENT), which connects 200 universities. The INHERENT network provides connectivity at different speeds in different regions of the country. In the Jawa region, it provides 155 Mbps. ITB and INHERENT are connected to the TEIN2(3) network with 45 Mbps, to be upgraded to a 155 Mbps connection to South Asian Countries as well as being connected to GEANT2 and Transpac/Internet2 to USA.

Certification

ASGC CA is the relevant certification authority for Indonesia.

User Support

APROC is the ROC of reference for Indonesia.

6.2.2. Grid Strategy, Policy and Funding

ITB is pursuing an academic grid initiative in collaboration with the University of Indonesia. There is currently no national strategy but a number of institutions are developing initiatives. As there is no funding for grids *per se*, initiatives are dependent on funding streams connected to one of the application areas. While this has advantages in creating strong links between technology initiatives and applications, it has clear disadvantages for building a comprehensive, generic technical infrastructure. Dedicated funding is still needed for the development of a production e-Infrastructure.

6.2.3. Applications and Communities

INHERENT supports applications in weather and climate prediction, computational chemistry, health informatics, bioinformatics, disaster mitigation and astronomy. ITB hosts the only climate prediction centre in the country.

6.2.4. Training and Staff Development

ITB plans to have at least two workshops, one 3-day workshop and a conference during the lifetime of the EUAsiaGrid project. These events will be used to disseminate knowledge about grid computing to other universities in Indonesia and to foster wider interest and uptake of the EGEE e-Infrastructure.

[21] www.itb.ac.id

[22] www.inherent-dikti.net

6.2.5. Implementation Plans

ITB is in the process of developing its production infrastructure and have it certified through APROC. Once fully operational, it will be contributing its 10 worker nodes to the EUAsiaGrid VO. The development of e-Infrastructures is driven by application needs and there is a clear requirement to develop education and research environments with sufficient high performance computing resources. Weather and climate prediction activities in particular place high demands on compute storage and network infrastructures.

6.2.6. Analysis and Requirements

The major problem in the provision of services is that grid computing is just beginning in Indonesia and has started with specific applications rather than an overarching vision. The major constraint is the change of paradigm towards sharing resources and sharing application among the education and research institutions. The other aspect is the state of infrastructure in Indonesia (general) and in ITB. The development of the INHERENT network in 2006 has opened up the possibility of developing a national grid infrastructure.

Grid computing initiatives started in 2007/2008 and are at an early stage. On the other hand, some researchers have been using applications with the limited resources they had available locally, for example in areas like computational chemistry, bioinformatics, weather and climate prediction and astronomy. The idea of grid computing to allow sharing of resources (compute, storage, application, etc.) opened up the opportunity to have higher capacity and capability as well as better utilisation in the educational and research areas.

EUAsiaGrid will play an important role in developing grid computing in Indonesia, in particular at ITB and other universities leading the development. By providing access to technical expertise and training for staff, it will enable the development of a grid computing infrastructure in Indonesia.

Lack of awareness about grid computing and e-Research in general are the main obstacles EUAsiaGrid needs to address as well as the lack of trained staff familiar with gLite and the EGEE e-Infrastructure. In order to get more organisations to join as resource providers, the benefits of a shared infrastructure need to be clearly advertised and at the same time discussions need to take place with funders to ensure that sufficient funds are made available for a larger and sustainable infrastructure.

6.3. MALAYSIA

Malaysia is represented in the EUAsiaGrid consortium by Universiti Putra Malaysia (UPM) and MIMOS Berhad (MIMOS).

6.3.1. Available Grid Infrastructures

Compute and Storage Resources

A compute element has been installed at UPM with 40 worker nodes (Dual Quad Core each with mixed Gigabit Ethernet and Infiniband connects). In addition, 10 nodes are available as a sandbox environment for development and training of both staff and students. UPM's Nucleus Cluster has been set up in close collaboration with ASGC and the technical configuration is similar to ASGC's resource. Once fully operational, the production cluster will be a Certified gLite/EGEE Site. Access to certified users from Malaysia and other countries will be guaranteed.

MIMOS has installed 2 gLite infrastructures, one is a production setup[23] integrated with the EGEE infrastructure and certified through APROC. The other is an engineering setup for internal development and testing purposes. The production setup consists of a compute element with a worker node with 16 CPUs. Currently this setup is part of the APSECI VO. Researchers can request access to the production resource from the registration authority. Once significant numbers of users start using the VO more resources will be added as required. As for the engineering setup, it is a self contained setup which is not part of the EGEE infrastructure. It consists of a compute element with a worker node with 4 CPUs.

20TB of storage have been made available through storage elements at UPM with an option to add more capacity through a storage resource broker. A nominal storage resource also exists at MIMOS.

There are two user interface machines at MIMOS. Users can connect through ssh to our command line UI at grid01.knowledgegrid.net.my. To have access to the UI, users have to request a user account from MIMOS and to request a certificate from the Malaysia RA for accessing the production gLite setup. There are four RA representatives in Malaysia, two at UPM and two at MIMOS.

Users can also access our P-Grade Portal for workflow job submissions through https://pgrade.knowledgegrid.net.my:8443/gridsphere/gridsphere. The flow of requesting permission to use this portal is the same as for the command line UI.

Networking

The Malaysian Research and Education Network (MYREN) provides dedicated network connectivity for the major Malaysian universities and research institutes. MYREN is linked through TEIN2 (soon TEIN3) at 45 Mbps to South-East Asian countries and the rest of Asia as well as to Europe. It is also connected via Internet2/TransPac to the US.

UPM is connected to MYREN with 8 Mbps but an upgrade to MYREN2 is scheduled for Q2 2009 that will provide bandwidth between 155 Mbps to 1 Gbps. MIMOS is already connected to MYREN with 100 Mbps and also has a commercial 300 Mbps connection to the Internet through JARING.

Certification

Malaysia has established RAs at UPM and MIMOS and a CA is currently being established at UPM under the Academic Grid Initiative.

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[23] Detailed monitoring information about the production setup is located in this page: gstat.gridops.org/gstat/MY-MIMOS-GC-01/

User Support

At the moment, the ROC of reference is ASGC.

6.3.2. Grid Strategy, Policy and Funding

The UPM Campus Grid is part of the Academic Grid Initiative supporting the National Grid Initiative. MIMOS has been designated as national coordinating organisation of the Malaysia National Grid Initiative. UPM is the domain leader for the policy and governance part of the roadmap. The value proposition of the Academic Grid Initiative is the empowerment of academics and students to use grid computing facilities as a learning and discovery grid alongside a production grid. The learning and discovery grid will be the platform where academics and students will have the opportunities to explore all aspects of the grid technology ecosystem that will enhance further Malaysia's ambition to develop human capital in frontier technologies such as ubiquitous and cloud computing. The Academic Grid Initiative has a concrete future plan to grid-enable all clusters/CEs at institutions of higher learning using MYREN/MYREN2 with an access bandwidth of 155 Mbps to 1 Gbps. It will eventually be connected to the Knowledge Grid Infrastructure (see below) as well as independently to other grid infrastructures within and outside Malaysia to make it a truly distributed grid infrastructure.

UPM has allocated about USD 1 Million of internal funds to support HPC and network infrastructure as well as application support for bioinformatics and natural resource informatics. Funding for MYREN2 is estimated at around USD 15 Million. Once fully rolled out, it will have the Ministry of Higher Education as the new custodian. Funding is being sought from the Malaysian Ministries of Higher Education and Science, Technology and Innovation for a Data Centre at UPM and other scientific grants. Additional funding is currently being pursued through the EU-FP7 Framework for Culture and Heritage. Lead by UPM as convener, the Malaysia Grid Forum Society (MGF) is in the process of being registered as a society under Registrar of Society (ROS) and its charter and constitution are modelled after the Singapore Grid Forum (SGF) and OGF. The MGF will involve members from research communities, students, and the public.

KnowledgeGRID Malaysia is a strategic initiative by Malaysia Government, which is being spearheaded by MIMOS with a close collaboration with local universities, R&D institutions and industry. KnowledgeGRID Malaysia will provide a knowledge infrastructure for the nation that maximises high performance computing resources to accelerate research and industrial development for national wealth and value creation. The National Grid will be the knowledge infrastructure that combines networked resources.

6.3.3. Applications and Communities

UPM currently supports bioinformatics, health informatics, earth monitoring/sensing and cultural heritage applications. As part of EUAsiaGrid, UPM will support applications in bioinformatics and computational biology, media and cultural heritage applications through 3D rendering support as well as generic grid applications/services. Contacts also exist with researchers working on disaster mitigation and forest biodiversity.

UPM is working very closely with Malaysian Society for Bioinformatics and Computational Biology (MASBIC) and the Qualitative Research Association of Malaysia to engage both communities and create awareness among researchers who still have little or no knowledge about the usefulness of grid technology in their research. Participation of UPM in formal and informal meetings and conferences of these communities will also be the avenue for exchanging ideas and promoting grid awareness.

The MIMOS Grid offers computing and collaborative resources on bioinformatics, product design, manufacturing, multimedia, financial analysis, defence & public safety and natural disasters & climate studies.

6.3.4. Training and Staff Development

Enabled by EUAsiaGrid, UPM and MIMOS plan to undertake an extensive training programme, both to increase the training capability and capacity in the country and to widen uptake of grid services. Presentations and booths at conferences, roadshows, training events and a summer school will help to increase usage and to foster collaborations between Malaysian and Asian as well as European partners.

6.3.5. Implementation Plans

During the lifetime of EUAsiaGrid Project, UPM's gLite Nucleus Clusters will be established as a certified EGEE site and the lessons learned will be used to help other universities to establish similar gLite resources on campus and to connect all these resources using MYREN2.

6.3.6. Analysis and Requirements

Lack of awareness of the possibility of using Grid technology to enhance research in specific domains is by far the main stumbling block to UPM implementation goals. The second is the lack of trained staff well versed in grid deployment as well as on the development of interfaces to facilitate the use of grids.

The outreach and training activities described above will help to address the issue of awareness and will increase interest and uptake amongst researchers. Recruitment of staff, their training and embedding in a context that facilitates the exchange of experiences with other partners will help to reach a critical mass of trained and experienced staff, who can deploy and operate an effective e-Infrastructure and support scientific collaborations conducted in an international context.

The provision of technical infrastructure is adequate for the purposes of EUAsiaGrid and network provision is improving through the rollout of an upgraded connection at UPM and through work in MYREN Phase II as well as TEIN3. Emphasis needs to be placed on the development of sustainable staffing arrangements and the development of application areas and user communities. The aspect of 'training the trainers' and of training for technical staff is therefore of crucial importance in the Malaysian context.

6.4. PHILIPPINES

The Philippines is represented in the EUAsiaGrid project by Ateneo de Manila University (AdMU) and the Advanced Science and Technology Institute (ASTI).

6.4.1. Available Grid Infrastructures

Compute and Storage Resources

ASTI is currently in the process of configuring an EGEE compute element and worker nodes. Other compute resources comprise 256 CPUs with a theoretical peak performance of 2 TFLOPS. So far, 4 out of 32 nodes have been configured as compute element and worker nodes. Having the latest and most powerful computing nodes in the country, ASTI will bear most of the computing burden for local e-Science research. A 9 TB storage element is currently being configured at ASTI. ASTI also provides 8TB of other storage resources.

AdMU runs a Beowulf cluster used for computational science applications and linked to grid initiatives in biomedical research, high-energy physics collaborations such as the ONCO-MEDIA Project[24], the MEDGRID Project[25] and the PANDA Grid Project[26]. AdMU has purchased a 1TB storage element to be used as a server for medical images such as digital mammograms and functional MRI images.

Networking

Networking for education and research in the Philippines is provided by the Philippine Research, Education and Government Information Network[27] (PREGINET), run by ASTI, which has connections to Europe via TEIN2 (155 MBps), to the US via APAN (155 Mbps) and to AI3 (256 Kbps).

Certification

Registration authorities for the ASGCCA are established at AdMU and at De La Salle University. ASTI is currently drafting the required documents to set up a national certificate authority. An initial test bed is now available[28].

Other Resources

A portal for bioinformaticians and meteorologists is currently being developed, which will provide a user-friendly interface to access FPGA-based bioinformatics applications and numerical weather prediction software.

User Support

User support is currently provided through a wiki page containing a range of resources related to the key application strands of PSiGrid as well as a description of available resources.

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[24] www.onco-media.com

[25] www.medgrid.org

[26] www-panda.gsi.de

[27] www.pregi.net

[28] at https://ca.psigrid.gov.ph

6.4.2. Grid Strategy, Policy and Funding

The Department of Science and Technology (DOST) has provided funding for a three-year programme to implement the Philippine e-Science Grid[29] (PSiGrid). The programme will be implemented by ASTI, which is an attached institute of the DOST with AdMU as one of the partner institutions. PSiGrid covers three main projects focusing on reconfigurable hardware, federated geospatial information systems for hazard mapping and assessment as well as boosting capabilities for bioinformatics research.

The PSIGrid initiative currently plays the role of establishing a grid infrastructure providing support for the three key areas identified. There is currently no wider initiative for a national grid forum or a national roadmap. The Philippine Grid Computing Forum and Workshop held last December 2008 was an advocacy activity to promote grid computing to academic and research institutions across the country. Participants were informed about this technology and taught how to use it.

In addition to running PSiGrid and being a member of the EUAsiaGrid consortium, ASTI also participates in PRAGMA and there are plans to participate in GEOGrid and PANDA Grid. AdMU is already participating in PANDA Grid and MEDGRID and it plans to participate also in PRAGMA and GEOGrid.

6.4.3. Applications and Communities

Established user communities in the Philippines work on molecular dynamics simulations of natural products such as carrageenan and indigenous plants with potential medicinal uses. Under PSiGrid, the strand entitled "Boosting Social and Technological Capabilities for Bioinformatics Research" aims to increase the research outputs of local bioinformaticians.

A second application area of interest is the mitigation of natural disasters. Researchers at AdMU are engaged in landslide modelling and simulation, climate change studies, and mitigation of natural disasters such as landslides, pyroclastic material flow, and volcano eruptions. Grid infrastructures will enable these researchers to establish international collaborations towards building data grids on natural disaster mitigation and to utilise grid computing technology for modelling and simulation of natural disasters.

6.4.4. Training and Staff Development

The High Performance Computing Group at AdMU has conducted training programs in the past in the area of high performance computing and computational science. ASTI has attended various training events and workshops on grid computing and is also in the process of drafting course modules for planned training events.

AdMU is organising an International Workshop on Grid Computing to be held in the Philippines from May 4 – 8, 2009. Tutorials on grid computing and gLite will be incorporated in the Workshop.

6.4.5. Implementation Plans

Work on establishing an EGEE site is under way at ASTI and a commitment has been made to contribute half of the available resource to EGEE through supporting VOs such as EUAsiaGrid. Other gLite components are also being configured with help from ASGC. A number of nodes are fitted with BioBoost hardware accelerators to speed up HMMER, Smith-Waterman, ClustalW and BLAST bioinformatics algorithms. An optical fibre connection will be established in 2009 to connect ASTI and AdMU, significantly improving the network connectivity between these two partner institutions.

[29] www.psigrid.gov.ph

6.4.6. Analysis and Requirements

The development of an EGEE site with ample capacity is going to put ASTI in a position to participate fully in the application areas of interest and the establishment of a CA will further uptake in the context of the PSiGrid initiative. In the shorter term, the focus should be on the completion of this work. In the longer term, areas that require attention are the development of user support capabilities and improved information and outreach material delivered through the PSiGrid website. Training and outreach material developed by EUAsiaGrid will be an important contribution to this. In addition to these practical measures, a national roadmapping process in line with the EUAsiaGrid roadmap should be instigated.

6.5. SINGAPORE

Singapore is represented in the EUAsiaGrid consortium by the Infocomm Development Authority (IDA). The National Grid Office[30] (NGO) is a division within IDA.

6.5.1. Available Grid Infrastructures

Compute Resources and Storage Resources

The NGO itself does not own massive computational resources, but has established a National Grid Pilot Platform[31] (NGPP) in which stakeholders have contributed resources. The NGPP comprises a combined 1,000 CPUs provided by a number of partner institutions such as the Bioinformatics Institute (BII) and the Institute for High Performance Computing (IHPC) of the Agency for Science, Technology and Research (A*STAR), the National University of Singapore (NUS), the Nanyang Technological University (NTU) and the Singapore Management University (SMU). These compute and storage resources are linked via 1Gbps links through the SingAREN network.

The NGO has deployed and operated an EGEE production site for more than 2 years. Singapore has contributed significant resources to both the EGEE HEP and BioMed VOs during this period.

IDA has also commissioned National Grid Service Providers (GSPs) to provide compute and storage resources on a utility model basis for commercial use. GSPs have rapid provisioning capabilities, virtualisation layers and schedulers to ensure that resources using various software stacks and applications can be flexibly provisioned. The concept of the GSPs includes the delivery of software-as-a-service to industry (SMEs and enterprises), with business-level Service Level Agreements and provided through fault-tolerance infrastructures. As of 1 November 2008, the GSPs have made available utility provisioning of a total of 2,600 compute cores and 56 TB of storage for academic, government and industry use.

Under the Intelligent National (iN2015) infocomm masterplan, IDA seeks to realize an Infocomm Resource Marketplace (IRM) by 2015, a vibrant marketplace whereby businesses, large and small, will be able to share, buy and sell infocomm resources such as software, computing, and storage. This platform offers more innovative services using new business models.

Networking

The Singapore Advanced Research Education Network[32] (SingAREN) is connected to TEIN2 (where Singapore is one of the 3 network hubs) and to other countries such as Taiwan, Japan and Australia. This links the R&D community and academia in Singapore to these other countries and regions to enable collaborations.

Singapore's Next Generation National Infocomm Infrastructure comprises an ultra high-speed next generation national broadband network (Next Gen NBN) and a pervasive wireless broadband network (WBN). By 2012, homes and offices nationwide will be connected to the Next Gen NBN. In two years' time, 60 per cent of homes and offices can already expect to have access to this new, pervasive, all-fibre network. Next Gen NBN will be capable of ultra high speeds of symmetric 1 Gbps or more, with initial provisioning of 100 Mbps.

[30] www.ngp.org.sg

[31] www.ngpp.ngp.org.sg

[32] www.singaren.net.sg

Certification

The Netrust certification authority is an IGTF-accredited CA that is appointed by NGO for grid resources sharing and access.

6.5.2. Grid Strategy, Policy and Funding

The National Grid Office was established in 2003 to facilitate grid activities in Singapore and to increase adoption of grid computing technology by the R&D community and industry. In 2007, it began to focus on adoption of grid computing by business and industry users. It commissioned three GSPs in June 2008 to provision commercial services in order to maximise the benefits of grid computing to all sectors of the economy.

A SaaS Incubation Center was established in September 2008 to provide technical guidance and consultancy as well as a staging platform for software companies that are porting their applications to the SaaS model.

Funding for grid activities is provided by IDA and A*STAR[33] (Singapore's government organisation dedicated to charting the course in science and technology). Mechanisms for funding are varied depending on the specific nature of the projects. Examples include:

- Adaptive Enterprise @ SG – a 2-year collaboration between Singapore and HP Labs, where IDA provided funding for Singapore researchers (from NTU, IHPC and SMU) to work with their counterparts from HP Labs.
- A*STAR-NGO Call for Proposals in Grid Computing – This call resulted in 10 grid-related projects from researchers from NTU and NUS being supported for a 2-year timeframe with funding from A*STAR, after review and recommendation from a panel of international renowned Grid experts.
- NGO funding for Multi-Organization Grid Accounting System (MOGAS) – The development was awarded to NTU to design, implement and deploy a method of accounting and monitoring usage of grid resources. MOGAS is deployed at nearly 20 sites on the PRAGMA testbed.

Other examples include:

- Tera-scale Campus Grid (TCG) @ NUS – Funded by NUS, this campus grid is built upon idle PCs in instructional labs. To date, over 2600 processor cores have been tapped to run large-scale bioinformatics, financial engineering and data-mining applications[34].
- Nanyang Campus Grid[35] – Set up by NTU, this grid aggregates resources from 11 server clusters, totalling 181 processors. This grid serves the departments of NTU that are partnering in this campus grid effort, who are involved in collaborations locally between NTU and Temasek Polytechnic and internationally between NTU and Honda as well as NTU and the Southampton e-Science Centre in the UK.

The NGO facilitates the subsidy for Gigabit Ethernet links for computational resources on NGPP. It provides manpower resources to help grid-enabled applications and facilitates the execution of these applications on NGPP resources.

The IDA provides a 3-year funding to GSPs to offer robust grid services and SLAs to R&D, business and industry users. IDA also funds the rolling-out of optical fibre to every addressable location in Singapore under its Next Gen NBN. This will increase, inter alia, the opportunities for adoption of

[33] www.a-star.edu.sg

[34] See the iSGTW Article: Cycle-harvesting around campus in Singapore www.isgtw.org/?pid=1001458

[35] NTU Campus Grid: www.ntu-cg.ntu.edu.sg

grid services and bandwidth intensive applications. This effort will make the bandwidth subscription and purchase of dark fibres very affordable.

6.5.3. Applications and Communities

Singapore leads the APEC TEL Grid Initiative (Phase 2), which has several on-going projects: Sensor Grids for Environmental Monitoring, Access Grid for Distance Learning, and PC-Grids. Singapore also project leads the Access Grid for Distance Learning.

The NGO has been engaging researchers in A*STAR, NUS, NTU and SMU, as well as the polytechnics. The focus of Singapore's R&D is primarily biomedical and science & engineering.

NGO seeks lighthouse projects, which could significantly benefit selected industry verticals, providing compelling reasons to leverage subsidised compute resources for a trial period. Non-R&D projects that have benefited include:

- Digital animation rendering: NGO enabled a Singapore-based animation and special effects studio, Omen Studios – which does commercials and animation – to leverage grid resources to carry out their rendering needs.
- Web Archives Singapore (WAS): WAS is an initiative by the National Library Board of Singapore to archive "snapshots" of some 70,000 Singapore-registered websites that are of historical, heritage and informational value. By tapping into more than 30 computers on the NGPP, to index and archive these .sg sites, NLB was able to increase the rate of web crawling by as much as eight times.

A cloud computing testbed, as part of the Cirrus Cloud initiative in collaboration with Yahoo, HP and Intel, is being established for both the R&D and developer communities to explore Internet-scale data intensive computing and services. Involving GSPs to provide support activities will ensure that the desired service levels are rendered based on the respective communities' requirements and necessary due diligence.

Singapore is well connected with research partners across the world. For example NGO, BII and IHPC are partners in PRAGMA. The UK-Singapore "Partners in Science" programme fosters research collaboration between Grid scientists in Singapore and UK, while Singapore has been the chair of the e-Science Working Group in the Asia Pacific Advanced Network (APAN) since 2005.

NGO has also been a member of APGrid Policy Management Authority since 2005. The Certificate Authority (CA) of NGPP was outsourced to a commercial CA provider, Netrust Private Limited. The Netrust CA was accredited as an International Grid Trust Federation Classic (IGTF) Authentication Profile Compliant CA on 10 July 2008 and has been added to the IGTF CA distribution since 29 July 2008. This is the first time that a commercial CA from Asia has been accredited for use by the international Grid community. A Netrust certificate will lower barriers to cross-border collaboration, as users from research organisations can be recognised easily and globally.

6.5.4. Training and Staff Development

The GSPs cater for the provisioning of services as well as supporting users of grid services. While such services are niche-specific and currently focused on specific needs, we expect user demand to provide the trigger to offer more services that better meet a wider set of user requirements.

Under the Grid Computing Competency Certification programme (GCCC), the NGO has appointed training service providers to conduct training in grid computing at both basic and advanced levels. Getting Grid Computing into the curriculum of the institutes of higher learning (universities and polytechnics) is an on-going effort to bring it into mainstream. An on-going effort is to continue to promote awareness and raise adoption of grid computing, as part of an endeavour to reach out to the R&D and business communities. It is crucial to make available compelling applications that user organisations are prepared to share as well as case studies and demonstrations of real benefits.

The NGO, together with its partners, has been organising an annual conference series known as GridAsia. The event has an average attendance of 400 participants.

6.5.5. Implementation Plans

We currently do not have any concrete plans to integrate resources into EGEE infrastructure. The computational resources under the Global Operational Grid project expired recently. The WebUI server is still available to allow submission of jobs to the EGEE platform. Depending on the needs of researchers in Singapore, we could provision compute resources as needed using the GSPs.

6.5.6. Analysis and Requirements

As Singapore has a well-developed grid infrastructure and established user communities, the main focus is on fostering new international collaborations enabled by the EGEE infrastructure as well as on the development of applications that demonstrate clear benefits. As the underlying technical and organisational support infrastructure is mature, it seems reasonable to let these new collaborations drive the requirements for concrete activities. Specific application areas to consider are:

- Sensor grids for environmental monitoring, especially with the launch of the Earth Observatory of Singapore[36].
- Using Access Grids for a non-scientific domain e.g., heritage and culture.
- Financial Services Industry related applications on EGEE.

Furthermore, the maturity and scale of the operations raises issues about the involvement of industry in the provision of grid infrastructures (both for commercial and research applications) and of sustainability. These issues should be taken up in the EUAsiaGrid road-mapping activity, including training of grid administrators and on platform-specific grid development.

The interest in supporting specific industrial verticals should be taken up in dissemination activities such as events and seminars that showcase successful real-world scientific, industry and business applications.

[36] www.ntu.edu.sg/EarthObservatory

6.6. TAIWAN

Taiwan is represented in the EUAsiaGrid consortium through the Academia Sinica Grid Computing Center (ASGC) in Taipei. ASGC is the first grid computing center in Taiwan, established in 2002 for the development of e-Science infrastructure, application, service and collaboration. ASGC is now acting as the only Worldwide LHC Computing Grid (WLCG) Tier1 Center in Asia and the Asia Federation representative of the Enabling Grid for E-sciencE (EGEE) project (since 2005). In addition to high energy physics, a rich variety of large-scale e-Science applications have been initiated ranging from life science, earth science, high performance computing, social science to digital archives etc.

6.6.1. Available Grid Infrastructures

Compute and Storage Resources

ASGC is a very stable WLCG/EGEE site supporting the ATLAS and CMS experiments at the LHC as well as the Biomed, TWGrid, APeSci VOs and providing 4,000+ CPU cores as well as 1.5 PB storage of both disk and tapes. It operates the EUAsiaGrid VO and supports it with a 200 CPU core resource and initially 20 TB of storage. Based on the WLCG/EGEE experiences, TWGrid was initiated by ASGC as the collaboration infrastructure for e-Science with domestic institutes, universities and industry, and serving as the gateway between Taiwan and the e-Science world. gLite is still the primary Grid middleware of TWGrid, which has been directly integrated with the EGEE e-Infrastructure. Resources are scalable in accordance with the extending applications, collaborations and e-Infrastructure of TWGrid. Resources of TWGrid will grow to have over 8,000 CPU cores and around 3 PB disk and tapes in 2009.

Networking

The Taiwan Advance Research & Education Network[37] (TWAREN) operates the domestic research and education network for Taiwan, providing connectivity to the US with a bandwidth of 1.2Gbps. ASGCNet extends Taiwan's international network connectivity and provides the backbone of Taiwan's e-Infrastructure. Currently, ASGCNet reaches to the Asia-Pacific region at speeds of 2.5 Gbps to Japan and Hong Kong respectively, as well as 622 Mbps to Singapore. In 2007, ASGCNet also established the first 10 Gbps direct link to Europe from the Asia-Pacific region. In addition, there is another link to StarLight at Chicago with 2.5 Gbps bandwidth, linking to Fermi National Laboratory and extending to Amsterdam and CERN as the backup route of the Taiwan-Europe line. Academia Sinica is one of the founding members of the Asia Pacific Advanced Network (APAN[38]), and ASGCNet is shared with APAN members as part of the regional backbone.

Certification

ASGC established the Academia Sinica Grid Computing Certification Authority[39] (ASGCCA) in 2002. It is serving as a regional "catch-all" CA for e-Science applications and e-Infrastructure under the framework of the International Grid Trust Federation[40] (IGTF) and Asia Pacific Grid Policy Management Authority[41] (APGrid PMA).

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[37] www.twaren.net

[38] www.apan.net

[39] ca.grid.sinica.edu.tw

[40] www.igtf.net

[41] www.apgridpma.org

User Support

ASGC established the Asia-Pacific Regional Operations Centre[42] (APROC) in 2005 and as of December 2008 the centre supports 24 gLite sites in 10 countries, which it has helped to deploy, certify and has provided operations support for. APROC also aims to maximise the availability of regional grid resources and to extend the production e-Infrastructure. ASGC provides support for requests coming from grid novices, from users of specific applications and from site administrators. Within the EGEE Global Grid User Support (GGUS) infrastructure, a portal is used where users can find support for their daily use of the grid, in a manner which helps experts and support personnel to keep track of problems that have been submitted. APROC is part of the Core Infrastructure Center (CIC) on-duty to take care of global user support across timezones within EGEE. In addition, acting as the Asia Federation Coordinator in EGEE, ASGC not only provides WLCG/EGEE global grid operation and CA services, but also participates in WLCG/EGEE technology development, application and user support as well as dissemination and training.

6.6.2. Grid Strategy, Policy and Funding

The national TWGrid initiative[43] was established and operated by ASGC since 2002. E-Science application support and community building are the foremost objectives in the first five-year stage. A production e-infrastructure is being established and extended at the same time. Compute-intensive, data-intensive and cross-disciplinary applications are the priority users of TWGrid. Institutes willing to join the e-Infrastructure are encouraged and supported as well. A portal-based environment will be provided and tailored to user requirements to make the Grid as easy to use as possible. Workflow support will ensure extendibility. To make grid components reusable, to further reduce the cost of grid-enabling applications and integrating them into an overall virtual research environment, the Grid Application Platform (GAP) is being developed based on standards and common specifications defined by the Open Grid Forum (OGF).

At the international level, ASGC is participating in EGEE, OSG, PRAGMA and cooperations with other grid initiatives based on user communities and scientific applications. Requirements of TWGrid will be mainly based on large-scale scientific and industrial applications, user communities, and the advancement of related technology. A combination of the service grid and desktop grids will be the infrastructure for a wider spectrum of user communities in the future.

At the moment, the primary funding for e-Science development in Taiwan is provided by the National Science Council and by Academia Sinica. As the evolution and expansion of TWGrid user communities progresses, more funding support from other government or private institutes and also from industry are foreseeable.

6.6.3. Applications and Communities

Under the support of the National Science Council, ASGC has provided the grid-related technology and infrastructure support for the LHC experiments (ATLAS and CMS) in Taiwan since 2002. In 2005 ASGC has formally become one of the 11 WLCG Tier-1 centres (the only Tier-1 in Asia) providing services, coordination and support to HEP scientists worldwide. Based on these experiences, ASGC joined the EGEE project extending grid services to other fields such as biomedical applications, earth science, digital cultural archives, astronomy, computational chemistry and social sciences.

As of 2008, production grid services are provided for high-energy physics, drug discovery, an earthquake data centre and wave simulation, global earth observation (GEOGrid), digital archive long-term preservation, material science, and carbon flux analysis. The success of e-Science applications is

[42] aproc.twgrid.org

[43] www.twgrid.org

highly dependent on the combined efforts of user communities and the grid support centre providing continuous application support.

6.6.4. Training and Staff Development

Since 2004, Taiwan has provided 12 tutorials domestically and 6 training events in the Asia-Pacific region (Beijing, Mumbai, Manila, Singapore, Hanoi and Kuala Lumpur). General grid introduction, grid system administration as well as grid application development were covered and around 1,100 participants joined these activities as of the end of 2008. Moreover, several training for trainer events have been held at ASGC in order to establish more regular lectures on grid technology. In the future, once all partners have set up their gLite resources, the focus of training will be on site administration and application integration. It is foreseeable that more training events will take place in the other partner countries as activities in the EUAsiaGrid project evolve.

6.6.5. Implementation Plans

ASGC is already a large EGEE site with a well-defined service level agreement (SLA) and supports the BioMed, TWGrid, APeSci and EUAsiaGrid VOs with significant resources. Over the course of the EUAsiaGrid project, the resources will be upgraded as described in section 6.6.1 above.

6.6.6. Analysis and Requirements

The emphasis at ASGC will be on supporting large applications in collaboration with EUAsiaGrid partners, working within the applications support workpackage. The principle challenge lies in the engagement of user communities. It is important to utilise an application-driven model to have more specific requirements, clear scope, focus, and incentive to make it easier to reach consensus. Demonstrations of use cases and production applications are very effective to encourage users to utilise the EUAsiaGrid resources. Close linkage between domain experts and Grid service provides are fundamental as grids are fundamentally about collaboration. Ease-of-use is another issue that hinders user from taking advantage of grid on a day-to-day basis.

ASGC's experience in this area will help to foster uptake in the other partner countries and to develop models of uptake that are widely applicable and supported by ASGC through the provision of the EUAsiaGrid VO, APROC and the work in APGrid PMA. Work is underway to simplify the procedures for becoming a grid user and models for the development of grid applications are being developed and tested. The development of new applications needs to be supported from the requirements definition stage to the development of appropriate computing models, workflows, resource provision, data management etc. to final deployment on production grids and validation.

Support for user communities is crucial to the success of EUAsiaGrid. Leveraging the achievements of EGEE is the best strategy for this project. ASGC, as a key EGEE player located in the Asia-Pacific region has an important role to play. While the Asia-Pacific region has great potential to make use of e-Infrastructure, there is still little uptake of applications of grids by researchers. Changing this picture through the development of a mature production infrastructure, adequate support mechanisms and vibrant communities is the key goal of EUAsiaGrid and ASGC has an important role as a key resource provider, in delivering support activities and as a mediator and facilitator within the consortium.

6.7. THAILAND

Thailand is represented in the EUAsiaGrid consortium by the National Electronics and Computer Technology Center[44] (NECTEC) and the Hydro and Agro Informatics Institute[45] (HAII).

6.7.1. Available Grid Infrastructures

Compute and Storage Resources

NECTEC has a 64 processor Itanium cluster and 12TB of storage capacity and is in the process of deploying an EGEE site consisting of recently procured servers for a user interface, a monitoring node, a storage element and a compute element with worker nodes. HAII has 12TB of storage capacity and non-EGEE compute resources.

Networking

The Thai Research and Education Network[46] (ThaiREN) connects over 130 research and education institutions in Thailand and provides service speeds of 155 Mbps to 2.5 Gbps in Bangkok and 34-155 Mbps elsewhere in the country. ThaiREN is connected to Europe via TEIN2 at 155 Mbps and to Japan via JGN at 50 Mbps.

Certification

NECTEC runs the NECTEC Grid Operation Center Certification Authority[47].

User Support

NECTEC provides following user support and services[48]:

- Computing resources, which support C, C++, F77, F90 in both sequential and parallel applications environment
- Application software such as Gaussian, Amber, Autodock, Sybyl, and ANSYS
- Continually organize training on FEM, CFD, cluster computing, and HPC

Services provided by HAII are as follows:

- Integrated data services related to water management, e.g. precipitation, weather data (humidity, wind, temperature, etc.), short-term forecasting, warning system, data assimilation, modeling, etc.
- Telemetering technology and its applications, e.g. rainfall, pollution, remote controlling, etc.
- Application services, such as Geographic Internet GIS, data warehouse, and knowledge management.

6.7.2. Grid Strategy, Policy and Funding

The Thai National Grid Project[49] is a national project under the Software Industry Promotion Agency, Ministry of Information and Communication Technology. The project started in 2005 with 14 member

[44] www.nectec.or.th

[45] www.haii.or.th

[46] www.thairen.net.th

[47] gridca.hpcc.nectec.or.th

[48] www.lsr.nectec.or.th/index.php/HPC_Service

organisations. It expanded to 22 organisations in 2008, including NECTEC. The project is mainly conducted by the project office formed within the project, the Thai National Grid Center (TNGC). Its objectives are to better drive research and education using grids and HPC as enabling technology and to make Thailand more competitive by applying these technologies. It provided a project-based coordinating structure. Its funding ended in 2008 and a renewal is currently under investigation. Thailand does not yet have a national grid strategy.

Funding in general is available for scientific resources in a number of areas such as biotechnology research, material science, electronics, synchrotron facilities, etc. but there are no dedicated funding streams to develop grid computing.

NECTEC plays a significant part in the development of grid testbeds, small-scale services and key infrastructure such as the certification authority. At the wider international level, NECTEC is involved in initiatives such as PRAGMA or the Global Earth Observation Grid.

6.7.3. Applications and Communities

NECTEC has led Thailand's high performance computing and computational science and engineering community since 1995 when it launched Computational Science and Engineering Program. Since then, it is the coordinator of computational science and engineering as well as computer engineering groups, who work together to use computer simulations to understand and find the solution to important problems. A major activity of the group is holding the Annual Symposium on Computational Science and Engineering[50] (ANSCSE). The symposium allows interaction among researchers involved in computational science and engineering research, providing an important mechanism for the development of a community of researchers familiar with the principles of grid computing. The main application area for NECTEC within EUAsiaGrid is computational chemistry. Other practical collaborative applications of interests are in the area of disaster mitigation, bioinformatics, and high-energy physics. A number of licenses for certain important codes exist in research institutes and universities but there are currently no plans for integrating them into virtual research environments.

For HAII, the intended focus in EUAsiaGrid will be the support for applications in environmental modelling and natural disaster mitigation such as coastal flooding simulation. HAII is specifically interested in disaster mitigation and contributes important expertise in the area of remote instrumentation and data collection from a number of different sources. Grid technology will be used to enhance and extend the access to shared databases, data exchange, R&D and technical assistance with similar institutes in the Asia Pacific region.

6.7.4. Outreach, Training and Staff Development

To get local grid developers and potential user communities involved, NECTEC plans to join various events to disseminate information about the project. Training workshops are also planned for users; however, the schedule and contents cannot yet be specified. NECTEC staff have experience in setting up grid systems using the Globus middleware but gLite is new to them. Workshops organised by Academia Sinica have provided essential introductory information and NECTEC has successfully set up essential gLite servers, which support the EUAsiaGrid and Gaussian VOs. This was achieved with the assistance from Academia Sinica and the managers of the Gaussian VO.

6.7.5. Implementation Plans

The services developed at the moment are relatively small-scale, limiting the potential for take-up and the awareness of researchers of services that exist. A problem is that high-performance and distributed

[49] www.thaigrid.or.th

[50] csep.hpcc.nectec.or.th/anscse/

computing have not been recognised as important research infrastructure at the policy level. While the National Grid Project did manage to establish a cluster computing resource, it did not yet reach the necessary maturity in the area of grid computing to allow wider application deployment.

The EUAsiaGrid project will help to improve the quality of the services provided and leverage local resources through their integration into an international context. It can be expected that this will feed a virtuous cycle of adoption in Thailand. There is potential for the inclusion of further existing resources in this and for the development of applications that clearly demonstrate the value of a grid infrastructure.

6.7.6. Analysis and Requirements

Specific requirements of NECTEC activity plan in EUAsiaGrid project in relation to the different workpackages are:

- Select and install existing scientific applications (M7-9)
  - WP3: Instruction and coordination with VO
- Accept users (M10)
  - WP5: Training course for users
- User training: Gaussian on EUAsiaGrid (M12)
  - WP3: Gaussian VO membership for training
- Organise workshop for technology roadmap development plan for Thailand (M13)
  - WP2: EUAsiaGrid roadmap, and how-to develop technology roadmap
- Develop technology roadmap (M14)
  - WP2: EUAsiaGrid roadmap
- Organise seminar to exchange ideas and collect needs in wider context (M24)
  - WP2: Summary from other partners in EUAsiaGrid project
- Dissemination of EUAsiaGrid project (until end of project)
  - WP4: Dissemination materials

6.8. VIETNAM

Vietnam is represented in the EUAsiaGrid consortium by the Institute of Applied Mechanics and Informatics of the Vietnamese Academy of Science and Technology (VAST).

6.8.1. Available Grid Infrastructures

Compute and Storage Resources

EGEE sites have been installed in Hanoi and Hi Chi Minh City, comprising a user interface as well as compute and storage elements. Certification of these sites is currently underway but incomplete as the sites are currently connected using a commercial internet service provider. They will be operating through VinaREN and TEIN2 once an upgraded VinaREN/TEIN2 connection is in place. Other institutions have local resources and IAMI will be encouraging all universities and research institutions in Vietnam under the Vietnam Reasearch and Education Network and the Vietnam Grid Forum Society to use gLite and get to share compute nodes and storage resources.

Networking

At the moment, IAMI/VAST is connected through the Vietnam Research and Education Network[51] (VinaREN) at 155 Mbps/1Gbps. VinaREN is connected to TEIN2 at 45 Mbps via Hong Kong and from Hong Kong to the EU at 2.5 Gbps. Future VinaREN connectivity will be at 155 Mbps / 1 Gbps.

Certification

A registration authority exists at IAMI and a certification authority is being established.

User Support

IAMI is planning to build up the ROC in the near future.

6.8.2. Grid Strategy, Policy and Funding

The Ministry of Science and Technology (MOST) and the Vietnamese Academy of Science and Technology (VAST) facilitate grid computing activities in Vietnam, and have established a National Grid Pilot Platform in which research institutions and universities have contributed resources. Resources are provided by the following entities on National Grid Pilot Platform:

- o Institute of Applied Mechanics and Informatics (IAMI) (former IOIT-HCM/VAST)
- o Vietnam Institute of Information Technology (IOIT)
- o Hanoi University of Technology (HUT)
- o Vietnam National University at Hanoi (VNU-Hanoi)
- o Vietnamese Military Technical Academy (VMTA)

Computing capacity and storage resources of research institutions and universities on the National Grid Pilot Platform will be linked up via 155 Mbps / 1 Gbps through VinaREN.

IAMI leads the VNGrid[52] research project to create a grid computing environment for e-Science in Vietnam, working with domestic research communities on applications of gLite-based infrastructures. A roadmap document ("Towards a Grid Infrastructure for Vietnam") has been produced and funding for Grid activities is provided by MOST and VAST. In addition, a grant was established between

[51] www.vinaren.vn

[52] www.cse.hcmut.edu.vn/~vngrid/wiki/Main_Page

CNRS, VAST and some major universities in Vietnam. At the international level, IAMI has links with EGEE and PRAGMA.

6.8.3. Applications and Communities

Under VinaREN, the primary e-Science areas are represented by the bioinformatics and computational biology working group, medical informatics working group and remote sensing working group. Contacts with researchers and physicians are maintained with the support of VAST for bioinformatics and computational biology (ITB and IBT). Work to date has covered the following applications:

- Access Grid (Lac Hong University HCMC, Institute of Information Technology Hanoi/ VAST, Vietnam National University at Hanoi VNU-Hanoi).
- Physics (University of Natural Science HCMC).
- Bioinformatics (Institute of Tropical Biology/VAST, Institute of Biotechnology/ HUT).
- Medical Informatics (University of Medicine and Pharmacy HCMC).
- GeoGrid (HCMC Institute of Resources Geography/ VAST).
- Monitoring and Alert system in Public Health (University of Public Health, Department of Health of HCMC).

AMI will support applications of Access Grid, health informatics, bioinformatics/computational biology, e-culture as well as generic grids applications and services. IAMI/VAST is an institution in the Vietnamese Academy of Science and Technology (VAST) and other institutions such as the Institute of Tropical Biology (ITB/VAST), the Institute of Biotechnology (IBT/VAST), the Institute of Resources Geography (IRG/VAST) and the Institute of Physics (IP/VAST) are very closely coordinating activities to develop the collaboration in all of the science research areas. The LIA project funded by VAST/CNRS complements the EUAsiaGrid project's activities to widen the uptake of e-Infrastructures for research.

6.8.4. Training and Staff Development

IAMI has plans to implement an e-learning platform such as Rice University's Connexion[53] on its grid systems for development and training of students and technical staff involved in grid development. This will support IAMI's approach to education and training and widespread adoption of grid services with principal emphasis on the use of gLite middleware. It strengthens greater adoption of the technology and greater research collaboration between Vietnam and other partners in Asia with their EU counterparts.

Lack of technical staff trained in grid development is the greatest gap of IAMI to provide services, training and support. While IAMI strives to send staff for training at ASGC, there is still the need for the staff to undergo further training until a reasonable level of grid knowledge is acquired and this takes time. More intensive 'training the trainers' sessions are absolutely necessary to reach a critical mass of trained grid technical staff.

It is expected that EUAsiaGrid will be able to provide solid support for grid development at IAMI by providing the necessary funds to send staff for training and hosting the Grid Computing Summer School in Vietnam in 2009. Furthermore, the sharing of knowledge and experience, advice and suggestions from European and Asian project partners is invaluable and injects the necessary confidence in IAMI technical staff to progress in the development and deployment of grid applications and grid services.

[53] vocw.edu.vn/news/news_item.2007-05-20.6594428124

6.8.5. Implementation Plans

Within the timeframe of the EUAsiaGrid project, a production grid consisting of 5 nodes will be established: 1 node for Access Grid, Bioinformatics Grid and GeoGrid research and application (IAMI), 1 node for Virtual Reality research and application, 1 node for Meterology application (HUT). Other nodes exist at IFI and CNRS office in Hanoi.

Through the internship program and with the support of ASGC (Taiwan), CNRS-IN2P3 (Corpuscular Physics Laboratory) (France), ITRI/ AIST (Japan), and KISTI (Korea) in 2009, IAMI will develop the compute facilities as mentioned above to fully comply with EGEE/gLite and to support Access Grid applications that will be combined/integrated with the activities of the Multimedia and Networking Technology laboratory at IAMI. Applications will be supported in the areas of bioinformatics, health informatics, virtual reality, meterology, cryptography and e-culture and heritage

6.8.6. Analysis and Requirements

At the moment, availability of staff trained for grid deployment and the lack of resources to send staff to training events are key concerns. The development of simplifies interfaces to the grid is an important aim that will foster the wider adoption of grids in Vietnam.

7. ANALYSIS & CONCLUSIONS

Based on the information collected as part of workpackage 2, we can start to define requirements for the other EUAsiaGrid workpackages as well as an input to the development of the EUAsiaGrid roadmap. One overall observation is that a comparison between the different partner countries reveals a rich variety of different approaches to building and sustaining grid infrastructures. A key element of work in EUAsiaGrid will therefore be to find some common ground in order to develop interventions that benefit the largest number of players possible.

Before considering the concrete recommendations for the workpackages, we provide a short summary of important issues the project will need to deal with. Conceptually, we can break down the requirements into technical aspects, organisational aspects and wider ethical, legal, social and economic (ELSE) issues. Of course, these issues are intimately related, so we will cross-reference where appropriate.

7.1. TECHNICAL ISSUES

7.1.1. Site Installation and Certification

The installation of EGEE sites and their certification through APROC is being tracked on the EUAsiaGrid wiki, summarising more detailed information available on the APROC wiki[54]. At the time of writing, three sites were fully certified, three in the process of certification and two in preparation. The process of site installation and certification is well-defined and supported by APROC and most new installations follow the model provided by the installation at ASGC. As site installation and certification progresses, more and more resources will become available to members of the EUAsiaGrid VO and will be accessible through local user interface nodes, the default UI at ASGC or other end-user interfaces such as g-Eclipse.

7.1.2. Networking

The provision of network connectivity differs widely between partner countries and can also differ between different partners in the same country. The APAN network comprises network circuits provided by major member countries such as Japan, Korea and Taiwan, etc. and currently provides the widest geographical coverage in the area. The situation of Taiwan is interesting as it hosts the only WLCG Tier-1 Centre in Asia as well as APROC. It has to provide its own 10Gbps circuit from Asia to Europe (the only such link for the moment) as well as several 2.5Gbps circuits within Asia (Japan, Hong Kong, 622 Mbps with Singapore) to support the grid network traffic. TEIN2 is another important player in the region and provides connectivity to the less well-connected in Southern Asia and the recent launch of TEIN3 may further strengthen the connections both within the Asia-Pacific region and with Europe. Unfortunately, Taiwan is not currently a TEIN3 member despite its important role in the areas of networking and grid computing. Therefore, in order to mutually benefit from better network provision in the region, one must find a way for all the major networks in Asia to work together. As the EUAsiaGrid project can only influence network provision indirectly, it should seek to work through organisations like APAN and important network providers like ASGCnet.

7.1.3. Grid Middleware Stack & Interoperability

Some partners have established grid infrastructures, yet these may be based on middleware stacks other than gLite. Work is therefore required to make existing resources interoperable. Also, for partners deploying new resources, a number of decisions need to be made about the adoption of one or more middleware components or stacks. It may not always be feasible to devote resources to the

[54] wiki.twgrid.org/apwiki/

EGEE exclusively. This may affect both compute and storage resources. Work on interoperability has been undertaken in a number of contexts, e.g., within the Open Grid Forum and the project should seek to disseminate knowledge about practical solutions to interoperability issues. Collaborations with NGIs working towards participation in the EGI should also be exploited where appropriate.

7.1.4. Certification

Through work conducted under the APGrid PMA, through the establishment of the ASGC CA as a fall-back CA for the whole region and through the creation of a network of RAs (as well as CAs) in the region, the prerequisites for a trust infrastructure in the Asia Pacific region are already met. This provides an important baseline infrastructure to ensure that it is possible for researchers to access existing resources today. The project has established an EUAsiaGrid virtual organisation, through which researchers can gain access to resources.

What is important is to make access as easy as possible for researchers to obtain a certificate, VO membership and access to a user interface machine. At the moment, this involves three separate steps, each different and relatively complex. The project should seek to unify the instructions for going through this process, improve the documentation available and advertise the EUAsiaGrid VO through the project website and other dissemination channels. In order to gain input into this process and to quality assure the results, the project partners should let staff members sign up and report back on their experiences. Once the process is streamlined, efforts should be undertaken to sign up significant numbers of researchers through dedicated online events organised by the local RAs.

7.2. ORGANISATIONAL AND COORDINATION ISSUES

The development and operation of a sustainable e-Infrastructure for research requires a number of organisational arrangements that need to be made and coordinated between the different partners. The development of regional operating centres is an important example. At the moment, APROC provides a fallback solution for the other countries but it is highly desirable to have local ROCs established that can provide more specific, tailored and relevant support for researchers in the different countries. Setting up these ROCs requires not only a transfer of relevant knowledge from APROC to the partners but also the development of an organisational infrastructure that can support the various functions of a ROC while providing a dependable service. An important aspect of the task of establishing regional ROCs is their integration with the EGEE Global Grid User Support[55] (GGUS) infrastructure.

Another important issue is the integration and coordination with EGEE activities. As the EGEE e-Infrastructure consists of a federation of independent resource providers, effort has been invested in enabling organisational alignment and collaboration at a number of different levels. For example, in the case of managing software provision, the RESPECT[56] programme helps to identify software packages that integrate well with the gLite software environment and provide functionality of interest to EGEE communities. The tools and software packages listed under the RESPECT programme should be considered as candidates when making choices about software provisioning within EUAsiaGrid. Another example is the use of collaboration tools and ticketing systems to manage requests and issue reports. Aligning with EGEE and reusing what has been developed will not only reduce costs but will also ease collaboration in this wider context.

The EGI Blueprint provides an important example of the kind of coordinating superstructure that is required to bind a number of different, independently evolving national grid initiatives into a coherent and coordinated whole. The authors of the blueprint estimate that about 51 FTE per year of person effort will be required to realise the EGI.org superstructure. While this is only a fraction of the overall

[55] www.ggus.org

[56] Recommended External Software for EGEE CommuniTies

effort spent on providing e-Infrastructures in Europe, it does nonetheless represent a significant resources commitment, which needs to be complemented by a commitment by each NGI to provide effort at a national level (the size of which depends on the size of the NGI).

For EUAsiaGrid, the implications are clear: the emergence on an EGI will mean the existence of a powerful template and, potentially, a precedent that might encourage policy makers and funders to pursue a similar strategy. Clearly, EUAsiaGrid has a role to play here in gathering evidence, making it relevant to the local context and lobbying for the emergence of appropriate coordination and funding structures that can underpin a sustainable Asia Pacific e-Infrastructure.

7.3. SOCIAL, ECONOMIC, LEGAL AND ETHICAL ISSUES

In addition to the technical and organisational challenges relating to the development of sustainable e-Infrastructures, there is a wide array of issues relating to social, economic, ethical and legal issues that affect the provision and usage of such an infrastructure. Studies such as AVROSS or the three JISC Community Engagement projects have started to uncover evidence about the importance and the nature of these issues and they have started to outline ways in which they can be addressed. However, interventions will be required at a number of different levels and in some cases, it is already clear that there is no 'quick fix' solution. Where barriers to wider uptake of e-Infrastructures and e-Research approaches are deeply rooted in disciplinary structures and traditions, change will take a long time and will require sustained effort by change agents at a number of levels.

The EUAsiaGrid project should consider investigating some of the ELSE issues identified in order to find out what barriers exist that are specific to or of particular importance in the Asia Pacific region. A number of issues have been identified by the e-Uptake project and the SHARE Roadmap. While these are not all specific to the Asia Pacific region, they do play a local role and candidate solutions would necessarily be local ones:

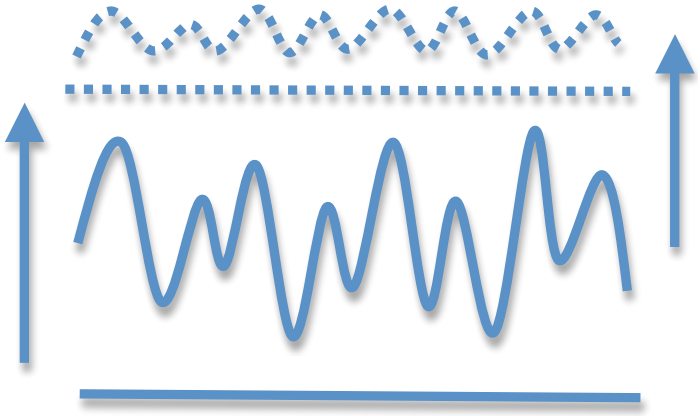
- A lack of sustainable, long-term funding streams hinders adoption. Existing initiatives are often funded as relatively short-term projects, leading to discontinuities when they need to apply for new grants – both because uncertainty leads to staffing issues and because project funding mechanisms and the funding requirements for infrastructure provision are at often odds with each other. Here, EUAsiaGrid needs to work with funders to develop funding arrangements beyond short-term project funding and oriented to more strategic investment. The development of the roadmap will help to achieve this.
- Concerns over confidentiality and security hinder the release of data for research purposes or to research e-Infrastructures, severely limiting the potential for uptake in areas such as biomedical research or social science. EUAsiaGrid has an important role to play in generating trust in the infrastructure, the research communities and the uses made of sensitive data. It can also demonstrate the societal value of the research and enter into a debate that weighs these against the potential risks of harm through disclosure or inappropriate use of data. Another important function is the generation of an overview of relevant legislation in this area and a comparison of different forms of data guardianship and usage models (e.g., through virtual safe settings for research).
- Economic considerations relate to the use of public funds and issues about the exploitation of intellectual property derived from e-Research, especially in biomedical research. The potential value of research data often leads to resistance to data sharing even where this would be of greater overall benefit to society. Workable e-Infrastructures for research need to allow researchers to protect their interests (be they of a commercial nature or about exploitation in the academic realm), to control the extent to which they share their data and to attribute research outputs to contributors. In addition to technical mechanisms to guarantee security, appropriate service level agreements, operational procedures, provenance management

systems and sanctions need to be in place to engender the necessary trust that allows e-Infrastructures to be used for work involving commercially sensitive information.

The wider social, economic legal and ethical issues can only be addressed through coordinated action by a range of actors. Cooperation with relevant initiatives is therefore crucial for the success of EUAsiaGrid and for the sustainability of e-Infrastructures in general. This report has highlighted a number of projects and initiatives that EUAsiaGrid should be seeking to collaborate with and benefit from. For example, the ongoing work in the e-Framework and the Open Grid Forum provide avenues for furthering the development and uptake of standards. Collaboration with networking initiatives such as APAN and TEIN as crucial not only because of the importance of networking for the successful development of e-Infrastructures but also because these initiatives have already developed successful dissemination strategies and are influencing policy making and the development of research disciplines through interventions such as the development of exemplars.

7.4. IMPLICATIONS FOR THE WORKPLAN

From the description of the adoption of grid technologies in the different countries, it should be clear that the state of current infrastructure provision and adoption is quite heterogeneous. Some partner countries have mature infrastructures and a growing user base, while others are only beginning to build up the necessary resources. This is not surprising in the context of EUAsiaGrid but means that the project needs to consider its investment of effort carefully and needs to take an approach that allows it to increase the overall level of adoption to a similar baseline level while not falling into the trap of orienting to the lowest common denominator. It is clearly important to push forward developments in the countries that are currently leading the field while not forgetting the needs of the followers.



Progressing from uneven adoption to alignment

The figure above illustrates the progression from an uneven level of adoption to a better alignment through progressing a baseline that allows assumptions to be made about what can be expected of partners while at the same time addressing the specific needs of partners. There needs to be a constant flow of lessons learned from the leaders to the followers, allowing the latter to speed up their adoption and to eventually catch up.

As a consequence, the project is planning a number of activities aimed at these complementary strands. An example of efforts aimed at raising the baseline is the current focus on certification – of users and of sites. This involves tracking the status of certification authorities and sites on the EUAsiaGrid wiki and running dedicated online events to aid people through the process of obtaining a certificate, registering for the EUAsiaGrid VO and gaining access to a UI machine. Not only does this allow participants to be signed up more rapidly, it also gives them the opportunity to feed back to the project by raising any issues they encounter. This will lead to a much improved and better documented process for grid adoption.

The need to adapt activities to the specific needs of individual partners is reflected in the site certification status table. Two sites, at MIMOS and at NECTEC, have already been certified, in April and October 2008 respectively, while others are at various stages of implementation or are in the process of being certified. The individual country profiles in section 6 give an overview of the status of partner countries at the time of writing. We will track progress through the ongoing development of the status, plans and requirements documents and will advertise the achievement of milestones to the EUAsiaGrid community as well as the wider grid community through dissemination events.

7.5. IMPLICATIONS FOR WORKPACKAGE 3 – APPLICATIONS

The above description of implications for the overall workplan mentions the importance of having a set of driver projects that are ambitious enough to push the boundaries of what the e-Infrastructure can deliver and can therefore inform the next steps in its evolution (cf. EUChinaGrid). While it is important for the project to widen the uptake by making a wide range of applications available to a large number of researchers, there is also a need to deepen the uptake by fostering key examples of e-Research that have requirements beyond the norm and can therefore help to inform the further development of the e-Infrastructure.

The application porting activities within an EGEE project, run by the NA4 and more specifically the Grid Application Support Centre (GASuC)[57] can serve as an excellent template for EUAsiaGrid. After identification of major scientific users and needs, a substantial man power is dedicated to selected areas to help porting complex code into an EGEE grid environment.

The ENGAGE initiative funded by the UK's JISC provides another example of the kinds of interventions that are suited to further the adoption of e-Infrastructures and to overcome particular obstacles that researchers face. Through a series of interviews and subsequent analysis, a small number of projects were chosen that were elaborated to identify how a small injection of funding or effort in collaboration with technology and service providers could help to overcome barriers to uptake of e-Infrastructure services.

The latter approach, which actively seeks to elicit information from potential users about potential uses and which follows this up by providing a seed resource has proven successful and should be considered by the EUAsiaGrid project as a potential model for furthering wider adoption and the development of new application areas. The more focused effort of GASuC like initiatives must be complemented with a continuous daily work with researchers, helping them to overcome even small existing barriers that otherwise make an adoption of grid technologies too difficult a task they are not willing to go through.

7.6. IMPLICATIONS FOR WORKPACKAGE 5 – TRAINING

The training workpackage is of crucial importance for the success of the project. Our initial collection of information from the partners has highlighted that there is a need to establish a virtuous cycle of education, training and uptake. At the moment, much of the required expertise is available only in a small number of partner institutions. However, all partners have significant roles to play in their countries in the area of education and training. Therefore, it is important that the initial training of technical staff required to set up and operate resources needs to be followed by effort to 'train the trainers', where staff members in the partner institutions are enabled to become trainers themselves in order to be able to increase the training capabilities and the capacity in the region.

Another aspect that has been highlighted is the fact that researchers often lack a clear understanding of how e-Infrastructures may be used in their areas of research and what it would take to start using them (this is an observation made also in the European context). What is required, therefore, is the development of educational material that presents the opportunities of e-Research in a number of different research areas in a way that they can be appreciated and taken up by researchers. In the UK, the e-Infrastructure Use Cases and Service Usage Models project has a similar mission and it should be possible to adapt some of the material (in written form and in videos) for the purposes of EUAsiaGrid. Similarly, the e-Uptake project is producing a brochure entitled "Research in a Connected World" that will combine contributions from key figures in the field explaining the key principles of e-Research with examples from a range of disciplines.

[57] www.lpds.sztaki.hu/gasuc/

The involvement of INFN in the project is already ensuring that the development of training material and the organisation of training events are making good use of synergies with activities within Europe and the wider international context. In particular, the use of the GILDA training infrastructure is of importance. Additional synergies exist with the International Summer School on Grid Computing[58] (ISSGC) and its online counterpart, the International Winter School on Grid Computing[59].

In the long run, training needs to be embedded in standard curricula, both for researchers and for technologists. While this may be a long-term ambition that can only be realised over a number of years, the early crucial steps need to be taken now. It is important for EUAsiaGrid as a project to participate in activities such as the Education and Training Community Group within OGF and to be fully aware of the recommendations developed.

7.7. INFORMING THE DEVELOPMENT OF A ROADMAP

The existing experiences from previous projects such as EUChinaGrid, EUIndiaGrid and EELA provide an opportunity for the EUAsiaGrid project to formulate an outline of a roadmap early on in the project.

The following elements will need to be considered:

- The interoperability work demonstrates how a *seamless grid environment* can be achieved on the basis of heterogeneous resources using an approach emphasising common standards and technical harmonisation.
- The establishment of operator-on-duty teams, which can later become national or regional operation centres serves as a crucial step to *build local support capacity*, taking load off the central coordinating site (currently APROC at ASGC).
- Work on specific scientific applications such as protein folding has demonstrated the ability of international collaborations to *innovate* and to enable grid computing platforms to be substituted for relatively expensive HPC platforms, thus *widening access* to important scientific applications.
- The variety of scientific applications supported by EUIndiaGrid, EUChinaGrid and EELA shows that other research domains can *take up the lead* established by the high-energy physics community with its strong commitment to invest in grid infrastructures.
- An important element in the development of e-Infrastructures that cross national boundaries is the development of *driver projects* that clearly demonstrate the value of a coordinated approach and of an integrated e-Infrastructure.
- Training of researchers to use e-Infrastructure needs to be *embedded* in normal undergraduate and postgraduate education in order to achieve the possible utilisation of investments made.
- Sustaining the achievements of the project requires the *mobilisation* of national resources in conjunction with bi-lateral and international programmes to provide funding in the medium and long-term.
- *Alignment with European initiatives* such as the e-IRG and ESFRI as important drivers is a valuable device that allows for the rapid condensation of the necessary political will in partner countries to support the development of a sustainable e-Infrastructure for research.
- In the longer term, investments in e-Infrastructure will need to be *extended* from research institutions into corporate R&D and wider society.

[58] www.issgc.org

[59] www.iceage-eu.org/iwsgc09

- *Collaboration with partner projects* such as EUIndiaGrid and EUChinaGrid is essential in order to benefit from their experiences and to exploit synergies with their ongoing work.

7.8. CONCLUSIONS

The requirements activity in EUAsiaGrid is providing important input for the workpackages and is beginning to outline the shape of the roadmap, which will need to address the specific objectives of the EUAsiaGrid project as defined in the Description of Work.

This document has outlines what existing experience is available to inform the development of a coordinated Asia-Pacific e-Infrastructure as well as the requirements emerging from the partners and their implementation status and plans. A parallel activity has been started to gather requirements from researchers in order to inform the development of the e-Infrastructure in response to specific application needs and to gather intelligence about the developing communities for the other workpackages.

A number of specific recommendations have been made on this basis for the various EUAsiaGrid activities and work will continue to ensure that the effort invested in them leads to the required outcomes. Ongoing monitoring, in particular of the site deployment and certification, will help to ensure that the significant increase in capability will be achieved and that the resulting e-Infrastructure is being actively used for genuine research applications.

8. APPENDIX A: SURVEY INSTRUMENT

Dear Colleague,

The EUAsiaGrid project aims to promote the use of e-Infrastructures for research, in particular the EGEE Grid, in the Asia Pacific region. We would like to ask for your kind help in establishing requirements for the implementation of resources in the partner countries and for the necessary coordination policy and community engagement process.

Best wishes,

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General Information

Which country is your institution in?

❑ Australia
❑ Indonesia
❑ Malaysia
❑ Philippines
❑ Singapore
❑ Taiwan
❑ Thailand
❑ Vietnam
❑ Other (please specify): .....

Is the institution you work for a:

❑ University or technical university
❑ Polytechnic / university of applied sciences
❑ Non-university public-funded research institute
❑ Science foundation or research council
❑ Private research institute
❑ Other (please specify): .....

What research domain(s) do you work in?

❑ Arts and Humanities
❑ Economics and Social Sciences
❑ Medical Sciences
❑ Natural Environment Sciences
❑ Engineering and Physical Sciences
❑ Particle Physics / Astronomy
❑ Biotechnology and Biological Sciences
❑ Other (please specify): .....

Can you please describe your specific research area?

Can you please name projects you are involved in and give us links to their websites?

What is your function / job title?

❑ Full Professor
❑ Associate Professor, Reader or Senior Lecturer
❑ Assistant Professor, Lecturer or Senior Research Fellow
❑ Research Fellow, Research Associate
❑ PhD Student
❑ Postgraduate Student
❑ Administrative Offcier
❑ Other (please specify): .....

Do you collaborate with other researchers?

❑ Yes, internationally
❑ Yes, at a national level
❑ Yes, in institutions close by
❑ Yes, at my institution
❑ No

Can you please describe the nature of your collaborations?

Data Resources

On the following pages we would like to ask you a few questions about the use that you or your research group make of e-Infrastructures in your research.

First, we would like to know if you are using any advanced data management resources or data archives in your work. Please think of any resources you use that are not available on your desktop computer or local servers run by your research group or department.

Are you using data archives or advanced data management resources in your research?

❏ Yes ❏ No ❏ Don't Know

If you answered 'yes' above please continue below, otherwise please skip to page 63.

Do you use any of the following?

❏ General national or international data archives

❏ Discipline-specific national or international data archives

❏ Instrumentation data sources (e.g., radio telescopes, satellites, sensor networks)

❏ Institutional data repositories

❏ Large-scale data facilities

❏ Other (please specify): .....

Can the data you are dealing with be characterised as being:

❏ Record-type data (small fields, many records)

❏ Numerical data

❏ Textual data

❏ Audio-visual data

❏ Other bulk data (large individual data items)

❏ Other (please specify): .....

Do you make use of data provided by external partners?

❏ Yes ❏ No ❏ Don't know

Do you provide data to others?

❏ Yes ❏ No ❏ Don't know

Do you face issues related to any of the following?

❏ Data storage requirements (size)

❏ Performance (speed of access)

❏ Data formats, standards and semantics

❏ Data quality

❏ Meta-data management

❏ Long-term preservation and curation

❏ Confidentiality / security requirements

❏ Intellectual property rights / data licenses

❏ Usability

❏ Other (please specify): .....

Compute Resources

We would like to ask you is you are using any advanced computing resources, i.e., any resources that provide computational power beyond what would be available through your desktop PC or individual local servers.

Are you currently using advanced computation resources in your research? (For example, high performance computers, compute clusters, grids, cloud computing, etc.)

❑ Yes ❑ No ❑ Don't Know

If you answered 'yes' above please continue below, otherwise please skip to page 64.

What kinds of compute resources do you use?

❑ National high-performance computers
❑ High-performance computers in other countries
❑ Local high-performance compute resources
❑ Local mid-range compute resources
❑ Local compute clusters
❑ Compute grids
❑ Desktop compute pools (e.g., Condor)
❑ Internet cycle scavenging networks
❑ Other (please specify): .....

Would you characterise the computations as:

❑ Well-scalable
❑ Difficult to scale
❑ Memory-intensive
❑ Real-time
❑ Long-running (> 1 week on current resource used)
❑ Interactive (requiring user input / steering)

Do you use:

❑ Commercial packages
❑ Existing freely-available packages
❑ Custom-made programs
❑ Other (please specify): .....

Do you use any of these technologies?

❑ ARC
❑ Maui/Moab
❑ Catus
❑ MPI
❑ Nimrod
❑ Naregi
❑ PBS (PBS Pro, OpenPBS, Torque, etc.)
❑ gLite
❑ Condor
❑ Legion
❑ PVM
❑ Platform / LSF
❑ Globus Toolkit
❑ Sun Grid Engine
❑ Java CoG
❑ OpenMP
❑ Unicore
❑ Other (please specify): .....

Do you face issues related to any of the following?

❑ Access to adequate resources
❑ Long-running jobs
❑ Security
❑ Workflows
❑ Other (please specify): .....
❑ Scalability
❑ Usability
❑ Job scheduling

Visualisation

Research often involves visualisation of data. Again, we would like to ask you if you are using any resources beyond what your desktop PC provides.

Do you use advanced visualisation resources in your research?

❑ Yes ❑ No ❑ Don't Know

If you answered 'yes' above please continue below, otherwise please skip to page 65.

What kinds of advanced visualisation techniques do you use?

❑ Immersive environments (caves)

❑ Collaborative visualisation environments

❑ Geographic visualisation tools

❑ Visualisation tools for non-numerical information

❑ Real-time visualisation tools

❑ Multimodal immersion and visualisation

❑ Discipline-specific visualisation packages

❑ Other (please specify): .....

Can you please describe the visualisation resources you use?

Are you facing any issues related to the following:

❑ access to resources

❑ reservation / co-scheduling of resources

❑ quality

❑ performance

❑ scale

❑ Other (please specify): .....

Teleconference / Remote Instrumentation

Research today is often carried out collaboratively by partners distributed geographically. Likewise, scientific instruments are often in remote locations. We would like to know what use you make of teleconferencing, remote instrumentation and other collaboration technologies.

Are you using teleconferencing, remote instrumentation or other collaboration systems in your research?

❑ Yes ❑ No ❑ Don't Know

If you answered 'yes' above please continue below, otherwise please skip to page

Are you using any of the following tools?

❑ Access Grid

❑ H.323 videoconferencing

❑ Desktop conferencing tools (e.g., Evo, Skype, iChat)

❑ Hosted videoconferencing (e.g., Adobe Connect, Conference XP, DimDim)

❑ Instant messaging

❑ Telephone conferencing (incl. IP Telephony)

❑ Other (please specify): .....

Do you use asynchronous collaboration tools?

❑ Groupware systems (e.g., Notes, Sharepoint, phpGroupware)

❑ Wikis or content management systems

❑ Hosted collaboration tools (e.g., Google Apps)

❑ Shared remote filesystems (e.g., WebDAV, AFS)

❑ Repositories (e.g., Fedora)

❑ Source code repositories (e.g., CVS, Subversion)

❑ Project management tools (e.g., Basecamp)

❑ Conference management systems

❑ Other (please specify): .....

Can you please describe your use of videoconferencing / remote instrumentation in your research?

Are you facing issues related to the following:

❑ Picture / sound quality ❑ Organisational support

❑ Interruptions of service ❑ Technical support

❑ Usability ❑ Interoperability

❑ Access ❑ Scheduling

❑ Other (please specify): .....

Network Connectivity

Networks are an essential tools for much scientific work but often go unnoticed, especially when they are working well. New scientific applications give rise to new and increased demands, so we would like to know what network functionality you have access to and what your requirements are.

What network connectivity does your institution have to a national backbone?

❏ Less than 100 MBit/s

❏ Between 100 MBit/s and 999 MBit/s

❏ Between 1 GBit/s and 9 GBit/s

❏ 10 GBit/s or more

❏ Don't know

Do you have specific requirements relating to network provision?

Are you facing issues with any of the following?

❏ Bandwidth

❏ Latency

❏ Access restrictions (e.g., firewall restrictions)

❏ Service level (e.g., reliability, support)

❏ Reservation

❏ Security

❏ Support for special services (e.g., multicast, quality of service & reservation, lightpaths)

❏ Other (please specify): .....

Applications and Usage

Can you please list the most important applications you use that are specific to the research you do?

What mechanisms do you use to access applications and resources?

❑ Desktop applications

❑ Web-based applications or portals

❑ Command-line applications / scripting

❑ Other (please specify): .....

Does your work require commercial or special license software?

❑ Yes ❑ No ❑ Don't know

Do you have a concrete application that you would like to develop so that it can make use of e-Infrastructure services?

❑ Yes ❑ No

Please describe the applications and its requirements (computational, data, etc.):

Support and User-Designer Relations

The use of e-Infrastructure often requires support as well as some custom development. Availability of the necessary skills is therefore important. We would like to ask you about your access to support and any collaboration with IT specialists.

Are you aware of successful research projects in your discipline area enabled by e-Infrastructures?

❑ Yes ❑ No

If yes, then please describe them:

Are you aware of any national initiatives related to e-Infrastructures?

❑ Yes ❑ No

If yes, can you please name them?

How many colleagues do you have with experience in using e-Infrastructures in research?

❑ Many ❑ A few ❑ Very few ❑ None

Do you have IT specialists working closely with you or your research group?

❑ Yes, we collaborate closely

❑ Yes, we work together when needed

❑ Yes, I know a few but do not have ready access to them

❑ No, I don't know any

❑ Other (please specify): .....

Is there a support group that deals with use of e-Infrastructures in your discipline area?

❑ Yes ❑ No ❑ Don't know

If yes, then please describe:

Do you have access to institutional support beyond generic IT support?

❑ Yes ❑ No ❑ Don't know

If yes, then please describe:

Training

We would like to ask you a few questions about training you may have taken part in or would be interested in.

Are you aware of relevant training courses or learning material that are accessible to you?

❑ Yes ❑ No

Have you taken part in training in any of the following areas?

❑ Introduction to e-Infrastructures / e-Research
❑ Grid computing concepts
❑ Specific grids / middlewares
❑ Security / virtual organisations
❑ Porting applications
❑ Application development
❑ Data integration
❑ Data management
❑ Visualisation techniques
❑ Teleconference, collaboration tools, remote instrumentation
❑ Virtual research environments
❑ Other (please specify): .....

Do you think that the provision of training is adequate?

❑ Yes ❑ No ❑ Don't know

What training would you be interested in, in the near and medium term future, either for yourself or for members of our group?

Future Plans

Do you think your research could benefit from the use of e-Infrastructures?

❑ Yes ❑ No ❑ Don't know

If yes, please describe how you might make use of e-Infrastructures:

If you answered yes above, do you face any obstacles hindering usage? If you answered no, are there any specific reasons why you think usage of these technologies would not further your research aims?

Which of these factors do you think might have the most impact on your future work?

❑ More CPU power
❑ More storage capacity
❑ Improved data management tools
❑ Improved data analysis tools
❑ Improved visualisation techniques
❑ Improved collaboration tools
❑ A single point of access to resources
❑ Better networks
❑ Better support
❑ Better training
❑ Different funding arrangements
❑ Clear roadmaps and sustainability plans
❑ Other (please specify): .....

Do you have concrete plans to start using e-Infrastructures that could benefit from support? Please give us a short description:

Personal Information

We would like to invite you to give us information about yourself if you would like us to get in touch with you. Please note that this information is optional and if you decide to provide us with your contact details, we will keep these confidential and use them only for the purposes of conducting this study.

Please provide us with contact information:

Given Name(s):

Surname:

Institution:

Address:

City / Town:

ZIP / Postal code:

State:

Country:

Email address:

Phone number (incl. country code):

Please subscribe me to the EUAsiaGrid mailing list:

❑ Yes ❑ No

I would like to know more about EUAsiaGrid, please contact me by email

❑ Yes ❑ No

I would like to get support in enabling a concrete application so that it can make use of e-Infrastructure services, please get in touch with me by email.

❑ Yes ❑ No

Additional comments:

Additional comments about this survey:

Thank you very much for filling in this questionnaire. Your answers will help to inform the development of an AsiaPacific e-Infrastructure.