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2nd International Workshop on Campus and Community Grids

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Abstract

This is the proceedings from the 2nd International Workshop on Campus and Community Grids, held in Manchester, UK on 7th May 2007, as part of OGF20. This document includes the presentations that were accepted by the program committee.

Contents

Abstract 1
Contents 1
1. Foreword 2
2. Organizers 2
3. Speakers 2
3.1 David Wallom, University of Oxford Campus Grid, OxGrid 2
3.2 Karim Djemame, White Rose Grid 3
3.3 Hugh Beedie and James Osborne, A Condor Grid @ Cardiff University 3
3.4 Martin Dove, eMinerals MiniGrid 3
3.5 Kashif Saleem, UKNEESGrid 3
3.6 Andrew Richards, UK National Grid Service 3
3.7 Wolfgang Gentszch, D-Grid 4
3.8 Erwin Laure, EGEE 4
3.9 John Brooke, NWGrid 4
3.10 Satoshi Matsuoka, NAREGI 4
3.11 Michael Gronager, Nordic Data Grid Facility 5
3.12 John McGee, Open Science Grid 5
3.13 Charlie Catlett, TeraGrid 5
4. “Roundtable” Discussions 5
4.1 Data in Grids: Authenticity and Integrity, Access Controls and Technology Evolution Management 5
4.2 User management, passing identities and accounting 6
4.3 Support models, both systems and users 7
4.4 Licensing within cross organizational systems 7
5. Author/Editor Information 8
6. Intellectual Property Statement 8
7. Disclaimer 8
8. Full Copyright Notice 8
Appendix: Presenter contact details 9

1. Foreword

This workshop continues the series of Campus Grid workshops that was started at GGF-16 (Boston) where the workshop was hosted in collaboration with Harvard University. As well as providing a forum for local campus based grids this workshop also had the added benefit of being able to call on the experiences of the community and national/international grid attendees to ensure that issues arising and applicable lessons learned are not missed. This provided a balanced view of connectivity and expansion issues between local, regional, national and international grid endeavours.

With the success of the GIN activity at getting interoperability between national infrastructures it is important that we now expand and move this activity to show how already existent Campus Grid systems can be included in this activity and hence use this to connect them with the national grids. There is also an increasing realisation that a federation of smaller campus and community activities will eventually construct these themselves and here the lessons already learned by GIN can be most readily utilised.

The workshop used a mix of invited speakers from institutions that have already joined differing scales of infrastructures together and breakout sessions to identify key areas where further work is needed both within areas such as user lifecycle (including implementations of usage records and improvements to e-source usage specifications) and distributed systems management. There is also the large underlying area of data, storage, management and accounting that will be addressed.

2. Organizers

This workshop was jointly organized by the OGF Production Grid Services Research Group (PGS-RG) and German D-Grid project.

Prof. Dr. Wolfgang Gentzsch is Coordinator of the German D-Grid Initiative, Area Director for Major Grid Projects on the Steering Committee of the Open Grid Forum, visiting scientist at the Renaissance Computing Institute at UNC Chapel Hill, and an adjunct professor of computer science at Duke and NCState universities. Before, he was managing director for Grid Computing and Networking Services at MCNC and Sun Microsystems senior director for grid computing.

Dr. David Wallom is the Technical Manager of the Oxford e-Research Centre, Chair of the UK e-Science Engineering Task Force and co-chair of the Production Grid Services Research group within the OGF. Before arriving at Oxford he was Operations director for the Centre for e-Research Bristol at the University of Bristol.

Laura McGinnis is a Project Manager with the Systems and Operations Group at the Pittsburgh Supercomputing Center. She represents PSC to the National Science Foundation's TeraGrid project as an active member of the Accounting and Education, Outreach and Training Working Groups. She also serves OGF as chair of the Usage Record Working Group and co-chair of the Production Grid Services Research Group.

3. Speakers

3.1 David Wallom, University of Oxford Campus Grid, OxGrid

The volume of computationally and data intensive research in a leading university can only increase. This though cannot be said of funding, so it is essential that every penny of useful work be extracted from existing systems. The University of Oxford has invested in creating a campus wide grid. This will be used to connect not only all large-scale computational resources within the university but also those shared use systems within teaching and student labs. This will also provide a uniform access method for 'external' resources such as the National Grid Service and the Oxford Supercomputing Centre.

Presentation located at:: http://www.ogf.org/OGF20/materials/715/OxGrid.pdf

3.2 Karim Djemame, White Rose Grid

The White Rose Grid (WRG) e-Science Centre brings together those researchers from the Yorkshire region that are engaged in e-Science activities and through these in the development of Grid technology. The initiative focuses on building, expanding and exploiting the emerging IT infrastructure, the Grid, which employs many components to create a collaborative environment for research computing in the region.

Presentation located at: http://www.ogf.org/OGF20/materials/715/ogf20-WhiteRoseGrid.pdf

3.3 Hugh Beedie and James Osborne, A Condor Grid @ Cardiff University

The introduction of Full Economic Costing in UK universities has meant that these organisations must capitalise on their entire computing infrastructure to support the computing needs of their researchers. It is also clear that cycle-stealing from existing IT infrastructure provides an extremely high return on investment (ROI). Information Services deployed the first version of Cardiff University's campus grid infrastructure back in April of 2004. Today the campus grid contains over 1400 Windows workstations providing a theoretical 800 GFLOPS of computing power to our researchers whilst at the same time increasing the ROI made by workstations originally purchased to support teaching and learning activities. With the current procurement of a cluster expected to provide a peak 20 TFLOPS of computing power, and the potential to expand the campus grid to provide an additional 10 TFLOPS of peak power, we expect to be able to support the research computing needs of our researchers both now and well into the future.

Presentation located at: http://www.ogf.org/OGF20/materials/715/OGF-Cardiff.pdf

3.4 Martin Dove, eMinerals MiniGrid

Many environmental problems, such as transport of pollutants, development of remediation strategies, weathering, and containment of high-level radioactive waste, require an understanding of fundamental mechanisms and processes at a molecular level. Computer simulations at a molecular level can give considerable progress in our understanding of these processes. The vision of the eMinerals project is to combine developments in atomistic simulation tools with emerging grid-computing technologies in order to stretch the potential for undertaking simulation studies under increasingly realistic conditions, and which can scan across a wide range of physical and chemical parameters. The project brings together simulation scientists, applications developers and computer scientists to develop UK escience/grid capabilities for molecular simulations of environmental issues.

Presentation located at: http://www.ogf.org/OGF20/materials/783/ogf20-eMinerals.pdf

3.5 Kashif Saleem, UKNEESGrid

Due to a growing requirement for state-of-the-art research facilities for conducting sophisticated and large-scale structural dynamic experiments, there is a paramount need to have a network of collaborative experiments and computational infrastructure. United Kingdom Network for Earthquake Engineering Simulation (UK-NEES) aims to collaborate to build such a network for the United Kingdom. It will act as another tool to benefit earthquake engineering technology in a quest to relieve the devastation caused by earthquakes. It will use grid technologies to enable a smooth interface with other similar network systems both in the UK and overseas, potentially allowing Oxford researchers to collaborate with other leading researchers across the world to further the understanding of seismic design through integrated experimentation, computation and simulation.

Presentation located at: http://www.ogf.org/OGF20/materials/783/OGF-UKNEESGrid.pdf

3.6 Andrew Richards, UK National Grid Service

The National Grid Service, funded by JISC, EPSRC and CCLRC, was created in October 2003 and the service entered full production in September 2004. The NGS is led and coordinated by the STFC in collaboration with the University of Manchester, the University of Oxford, the University of Edinburgh and the White Rose Grid at the University of Leeds. The UK's National

Grid Service (NGS) provides a core e-Infrastructure that underpins UK research, providing standardized access to compute resources, data resources and large scale facilities, enabling collaborative computing across the UK. The NGS also provides a national "gateway" to international collaborations.

Presentation located at: http://www.ogf.org/OGF20/materials/783/ogf20-NGS.pdf

3.7 Wolfgang Gentszch, D-Grid

Scientists in the D-Grid Infrastructure project are developing and implementing a set of basic grid middleware services which will be offered to the other Community Grids. Such services are, for example, access to distributed resources, applications, and large amounts of data in the grid, managing of virtual organizations, monitoring and accounting. In addition, a core-grid infrastructure is available to the community grids for testing and experimenting. High-level services will be developed which guarantee security, reliable data access and transfer, and fair usage of computing resources. This core-grid infrastructure will then be further developed into a reliable, generic, long-term production platform which can be enhanced in a scalable and seamless way, adding new resources, distributed applications and data, new services, and a support infrastructure, on the fly.

Presentation located at: http://www.ogf.org/OGF20/materials/783/OGF20-D-grid.pdf

3.8 Erwin Laure, EGEE

The EGEE project brings together experts from over 27 countries with the common aim of building on recent advances in Grid technology and developing a service Grid infrastructure which is available to scientists 24 hours-a-day.

The project aims to provide researchers in academia and industry with access to major computing resources, independent of their geographic location. The EGEE project will also focus on attracting a wide range of new users to the Grid. The project will primarily concentrate on three core areas:

- Build a consistent, robust and secure Grid network that will attract additional computing resources.
- Continuously improve and maintain the middleware in order to deliver a reliable service to users.
- Attract new users from industry as well as science and ensure they receive the high standard of training and support they need.

Presentation located at: http://www.ogf.org/OGF20/materials/783/ogf20-EGEE.pdf

3.9 John Brooke, NWGrid

The NW-GRID project, a collaboration between CCLRC Daresbury Laboratory and the Universities at Lancaster, Liverpool and Manchester, will establish a computational Grid comprising large-scale commodity computing systems coupled by a high-speed network. It will establish, for the region, a world-class activity in the deployment and exploitation of Grid middleware technologies (the software that glues together the various data and computing resources) and demonstrate the capabilities of the Grid in leading edge computational science and engineering applications.

Presentation located at: http://www.ogf.org/OGF20/materials/784/OGF20-NWGrid.pdf

3.10 Satoshi Matsuoka, NAREGI

The main objective of NAREGI is to research and develop grid middleware according to global standards to a level that can support practical operation, so that a large-scale computing environment (the Science Grid) can be implemented for widely-distributed, advanced research and education. NAREGI is carrying out R&D from two directions: through the grid middleware R&D at the National Institute of Informatics (NII), and through applied experimental study using nano-applications, at the Institute for Molecular Science (IMS). These two organizations advance the project in cooperation with industry, universities and public research facilities.

NAREGI, the National Research Grid Initiative, was created in 2003 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). From 2006, under the “Science Grid NAREGI” Program of the “Development and Application of Advanced High-performance Supercomputer project “ being promoted by MEXT, research and development will continue to build on current results, while expanding in scope to include application environments for next-generation, peta-scale supercomputers.

Presentation located at: http://www.ogf.org/OGF20/materials/784/ogf20-NAREGI.pdf

3.11 Michael Gronager, Nordic Data Grid Facility

The Nordic Data Grid Facility, NDGF, is a collaboration between the Nordic countries (Denmark, Finland, Norway, Sweden). The motivation for NDGF is to ensure that researchers in the Nordic countries can create and participate in computational challenges of scope and size unreachable for the national research groups alone. NDGF is a production grid facility that leverages existing, national computational resources and grid infrastructures.

Currently, several Nordic resources are accessible with ARC and gLite grid-middleware, some sites with both. Today, the first operational user of the NDGF is the Nordic High Energy Physics community - the ALICE, ATLAS and CMS Virtual Organizations - through the operation of the Nordic Tier-1, which together with the Tier-0, CERN, and the other 10 Tier-1s collects, stores and processes the data produced by the Large Hadron Collider Experiment at CERN.

Presentation located at: http://www.ogf.org/OGF20/materials/784/OGF20-NDGF.pdf

3.12 John McGee, Open Science Grid

The Open Science Grid is a distributed computing infrastructure for large-scale scientific research, built and operated by a consortium of universities, national laboratories, scientific collaborations and software developers.

The OSG Consortium's unique community alliance brings petascale computing and storage resources into a uniform grid computing environment. Members of the OSG Consortium contribute effort and resources to the OSG infrastructure, and reap the benefits of a shared infrastructure that integrates computing and storage resources from more than 50 sites in the United States, Asia and South America.

Presentation located at: http://www.ogf.org/OGF20/materials/784/OGF20-OSG.pdf

3.13 Charlie Catlett, TeraGrid

TeraGrid is an open scientific discovery infrastructure combining leadership class resources at nine partner sites to create an integrated, persistent computational resource. Using high-performance network connections, the TeraGrid integrates high-performance computers, data resources and tools, and high-end experimental facilities around the country. These integrated resources include more than 102 teraflops of computing capability and more than 15 petabytes (quadrillions of bytes) of online and archival data storage with rapid access and retrieval over high-performance networks. Through the TeraGrid, researchers can access over 100 discipline-specific databases. With this combination of resources, the TeraGrid is the world's largest, most comprehensive distributed cyberinfrastructure for open scientific research.

Presentation located at: http://www.ogf.org/OGF20/materials/784/OGF20-TeraGrid.pdf

4. “Roundtable” Discussions

For each of the following topics a primer of the topic was displayed and the chair started discussion between each of the previous presenters.

4.1 Data in Grids: Authenticity and Integrity, Access Controls and Technology Evolution Management

Data on grids exacerbates existing issues with data provenance and conservation. In a traditional computing environment, if you have data currently in large volume, you know what it means. Data integrity, though important, is something that can be monitored. Within a project that has a longer lifetime, as well as when depositing research data into an institutional repository infrastructure, data integrity and provenance become serious issues, since the creators and primary users may not be interested in maintaining schemas etc. Since a lot of this data may be considered legacy with little or not metadata already, a lightweight way to authenticate and tag integrity context of data is needed.

Communities are collecting data and setting the standards for their organizations with respect to the integrity and identification of their data. Of the speakers within this workshop there are many different policies, for example:

- EGEE states when users arrive on the system that integrity is up to the user and community
- OSG plans inherently for data integrity, with periodic checking and if necessary reloading from a secondary store when there is corruption

It is clear though that there is a situation where a combination of engineering challenge versus identity and authentication mandates must be satisfied. Another issue that was then raised by the eMinerals project was whether this also included data provenance management? A suggested solution that could be considered is through commercial DRM.

From the production point of view there is also a threshold where retrieval of data from tape becomes insupportable, it is normally a product of equipment that is involved as well as pure data volume. An example was given by Reagan Moore of retrieval of 10TB within hours, though this required special hardware etc. The overall data loss threshold will vary from project to project but should be defined when the project starts and appropriate steps taken before the first data loss incident occurs. It should be remembered though that moving data around can trigger error correction that might not otherwise be needed, but it can actually help with the preservation of the data.

The other key problem is concerning metadata is that older collections are highly likely not to have it. Easy mechanisms must be devised for the addition of minimal metadata to legacy data sets being made available via grid technology.

Recommendations:

- We recommend the Data groups within OGF engage commercial DRM vendors in their discussions, either through attendance at one of their own meetings or off-site.
- There could be value in an information paper on data volumes as a reference which collects current practices in this area.
- Automated metadata generation should be another informational document, which would collate current practices in this area

4.2 User management, passing identities and accounting

As we move to federating local into regional and then national grids, the traceability of users, accounting for what they have done etc. becomes increasingly important. We should ensure that existing mechanisms are fully exploited before deciding that new mechanisms must be devised. It was noted that for most identity on the web Username/email address seems to be working, but has problems e.g. identity theft. It is an example, though, of a federated identity method based on local authentication.

The most pressing identity challenge is that for current grid methods, e.g. certificates, scalability challenges are still un-tested. It was also clear that the majority of groups that presented are at least looking at Shibboleth for identity management. Questions raised, though, include:

- Will Shibboleth deal with shortcomings identified in Kerberos?

- Will national federations also scale in their levels of trust to the same scale as other mechanisms?

Wit respect to accounting the question was raised about how to account for the heterogeneity of resources within a true grid environment. CPU weighing, for example, is based on the trustworthiness of the partners, who must report unbiased performance results for their resources to be fairly compared across the grid organization. It is also important to consider who wants/needs to look at accounting information and adjust solutions to their needs/requirements. There really can be no one size fits all solution.

Some sites are concerned about ”fair share”, especially if there are multiple consumers and providers, since there are real costs associated with usage (e.g. electricity, machine depreciation). Some sites need to be very precise with respect to usage so they can charge back to the resource user.

It was also noted that MPI across the WAN will change the charging model (CPU versus walltime). In general though schemes need to be agreed upon among the member organizations before service has started.

In any schema introduced by an organization there needs to be extensibility to include mechanisms for attaching measures of quality of service and charging for non-compute resources. An example of this could be taken currently from Amazon, who are charging for storage. In the end though how you charge is not too important for users as long as the model is clear. Users will normally decide where they want to compute and the charging method is part of their decision process. There are also technical requirements that must be taken into account including how charging schemas fit into the needs of metaschedulers and resource brokers.

Recommendation:

- OGF should continue to support activities that engage the support projects involved in user identity management, allocations, and usage tracking.

4.3 Support models, both systems and users

Within a production grid environment there are normally multiple levels and types of support, both formal and informal. In most instances though the balance between users and ‘resources’ needs for support is different. They can both be heavy, though, normally at around the same time, for example when a system change is made. All of the grids present try to deliver either a single point of contact for users, or to separate into user and site support (resource) calls.

Even though we do try to make grids easier to use, they are still very complicated and that users have to change how they do their work. These changes, ideally, should be as minimal as possible, which means the grids need to support users and site services to make the required changes on practice and process.

Since the majority of grids that were represented here make use of Open Software, the question was raised about who should be supporting it. It was resoundingly clear that this can only be done by the operating site, though this doesn’t scale in the long term. Generally grid software is complex; developers need to take this complexity into account as they further refine grid software.

Recommendations:

- Keep developers aware of the support costs of the software they are deploying, so that they can fix it; otherwise we’ll keep paying in more complex user services.
- Identify current and best practices for user and site support. This will provide a reference for existing grid implementations, and for new groups that are considering deploying grid technology.

4.4 Licensing within cross organizational systems

About half of the speakers at this workshop have grid issues that include software licenses. The target populations include wholly academic users or increasingly collaborative projects between multiple organizations and industrial/academic collaborations. For wholly commercial organizations that use the grid there are problems where the internal methods of license control either don't scale or don't work. Non-optimal solutions discussed include

- Purchasing both commercial and non-commercial license, which could be cost prohibitive
- Mechanisms to isolate users from the inappropriate licenses adds extra management overhead to the system
- Utilizing traditional licensing models (e.g. per-CPU) that don't scale for grid computing

It is important that vendors are clear that we are not suggesting making their software free etc. But it is necessary for licenses to be both clear and sensible in their application so that both parties can benefit. We want to work with the vendors/suppliers to resolve these issues

Recommendation:

- OGF should support the creation of a Software Licensing Research Group. A BoF session is scheduled for later in this (OGF20) conference.

5. Author/Editor Information

Contact information for authors: Relevant contact information for the presenters is available in the appendix.

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6. Intellectual Property Statement

7. Disclaimer

8. Full Copyright Notice

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