



THE WHITE ROSE GRID

e-Science Centre

White Rose Grid at Leeds: e-Infrastructure for Research and Innovation

Introduction

Since 2002 the White Rose Grid (WRG) consortium, which includes members of the Universities of Leeds, Sheffield and York, has been actively building and continuously enhancing the WRG e-Infrastructure. Increasingly, this well established e-Infrastructure provides underpinnings for novel multidisciplinary and national and international collaborative research as well as cross site activities.

This leaflet summarises the White Rose Grid e-Infrastructure available for e-Research and innovative projects at the University of Leeds. Information on many other related e-Research activities, including current and past e-Science projects, is available from the WRG web site [1].

WRG e-Science Centre

The WRG e-Science Centre (Figure 1) is part operated by EPSRC. The Centre is one of four such Centres across the UK (along with the National e-Science Centre based at the universities of Edinburgh and Glasgow, the Belfast e-Science Centre based at Queen's University Belfast and the South-East Regional e-Research Consortium Centre based at Oxford, Reading and Southampton universities) to receive further funding from EPSRC in March/April 2008 to continue their e-Science activities.

The WRG e-Science Centre's aims are to facilitate and be a focus for e-Research activities in the region.

Core Node Services

- Computation: (i) high performance computing (HPC) delivered via traditional means; and (ii) more innovative grid computing
- Data (and metadata) storage management using the San Diego Storage Resource Broker (SRB)

- Queuing and resource scheduling systems: Sun Grid Engine (SGE), Portable Batch System (PBS)
- Software environments
 - Compilers: PGI and Intel for C, C++, Fortran & Java
 - Libraries and tools: OpenMP, MPI, Performance analysis & debugging tools, NAG Numerical Libraries
 - Scientific visualisation: IBM Data Explorer, ParaView
- User management
- User support and training

Grid Technologies

- Authentication using PKI with X.509 digital certificates
- Online credential repository using a MyProxy server
- Job submission/batch service - Globus Toolkit 2.4.3 and 4.0.3 /SGE and PBS
- Information service – MDS
- Grid monitoring- Ganglia
- Data access/integration services (GridFTP, SRB)
- Accounting (via SGE and PBS)
- WRG portal (the EASA portal)

Registration Authority

The University of Leeds operates a Registration Authority (RA) for the UK Certification Authority (CA). RA vets users' identities for the purpose of issuing UK CA e-Science X.509 digital certificates used by users to prove their identity to remote services available over the grid.

Compute Resources

The WRG core nodes hosted at the University of Leeds are key components of a coherent e-Infrastructure for research. These compute resources, supported by Information Systems Services, deliver huge amounts of computer power to a wide range of projects, including those in earth

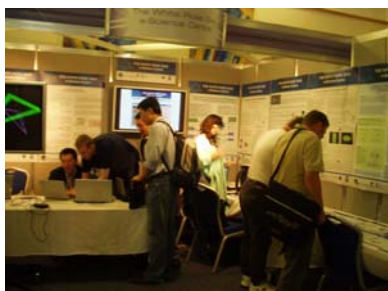


Figure 1: The WRG e-Science Centre's booth at the All Hands Meeting



sciences, engineering, particle physics, life sciences, mathematics, food science, geography, computing, and medicine; as well as to many multi-disciplinary and e-Science projects.

The WRG's distinct approach to the exploitation of computer resources is to allocate these resources in such a way as to bring together the provision of HPC services (with 80% resource allocation) and the emerging grid technology (20% resources).

Leeds Snowdon Node offers capabilities for running highly parallel programs exploiting up to 256 processors as well as serving as a platform for developing knowledge of parallel programming techniques, tools and methods. It comprises two Beowulf type clusters (named SNOWDON and SNOWFLAKE) based on 2.2 & 2.4 GHz Intel Xeon processors interconnected with Myrinet 2000 networks, and in total delivering 292 CPUs.

Leeds Everest Node constitutes a platform for highly-parallel programs using MPI, modest shared-memory parallel codes utilising OpenMP, and programs requiring large amounts of memory (up to 32 GB). This cluster is based on the latest AMD Opteron technology, and incorporates Sun Microsystems servers (V40z and V20z with 2.2 GHz dual-core processors) integrated by Streamline Computing, in total delivering 444 processor cores.

National Grid Service Node

The National Grid Service (NGS) [3] forms the foundation of the UK e-Infrastructure which underpins UK scientific research, providing standardised access to data management and compute resources and supporting collaborative computing across the UK, as well as offering a "national gateway" to related e-Infrastructures internationally.

The University of Leeds hosts one of the four core nodes of NGS (Figure 2). The service has recently progressed into its second phase which will enable researchers to take full advantage of the grid to enhance national and international e-Research and collaborations.

Visualisation Node

This facility is designed to support e-Science projects, and deliver visualization across the network to users' current desktop systems. It comprises 16 Intel dual-processor nodes with nvidia graphics cards.

Storage Infrastructure

The Storage Area Network (SAN) provides 12 TB of resilient storage for WRG users.

Archiver

The archiving facility (12TB) based on EMC Centera servers offers a robust solution with two nodes; a primary unit at Leeds replicates data to a secondary device at the University of Sheffield. Access to the archiver is via an SRB interface.

Janet Lightpath

The WRG has a connection to the Janet Lightpath service [4] which operates over the JANET network and provides separation at the network transmission level. This service enables national scientific collaborations and international collaborations through links to Europe via GEANT2 and globally through an exchange facility in the US (Chicago).

Access Grid

The Access Grid offers an advanced videoconferencing facility which enables collaboration across the WRG and beyond. It is an essential means for many large-scale events such as e-Science Centres' Directors' Forums (Figure 3), collaborative sessions with Beihang University in China as well as the Worldwide Universities Network's seminars such as the one on SRB with the San Diego Supercomputer Centre.

Node of the National Centre for e-Social Science

This research node is part of the National Centre for e-Social science [5] funded by the Economic and Social Research Council to investigate and promote the use of e-Science to benefit social science research.

Training and Support

Training is delivered through courses in the area of high performance computing (HPC) such as message passing (MPI) or parallel programming as well as e-Science seminars, workshops and talks, for example on the Globus Toolkit 4.

Further Information

Contact:

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References:

- [1] <http://www.wrgrid.org.uk>
- [2] <http://www.rcuk.ac.uk/escience>
- [3] <http://www.grid-support.ac.uk/>
- [4] <http://www.ja.net/services/lightpath/>
- [5] <http://www.ncess.ac.uk/>

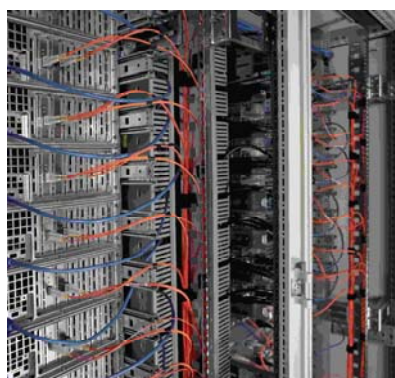


Figure 2: Inside the NGS node hosted at the University of Leeds



Figure 3: Collaboration over Access Grid