



# THE WHITE ROSE GRID

## e-Science Centre of Excellence

## White Rose Grid Technologies

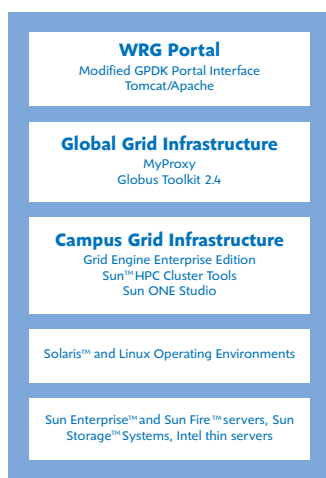


Figure 1: The WRG software and hardware stack

“The WRG software stack is composed largely of open source software”

### Hardware

The White Rose Grid (WRG) offers a computational infrastructure for e-Science projects undertaken by its researchers and their partners. It comprises four newly acquired compute nodes, funded with over £3M investment mainly from HEFCE SRIF allocations, of which two are located at the University of Leeds, one at the University of Sheffield and one at the University of York. These nodes are being expanded locally to campus Grids, and furthermore to the Worldwide Universities Network.

WRG provides a heterogeneous computing environment based on Sun Microsystems' shared-memory multiprocessor computers, and Intel Xeon processors-based systems built by Streamline Computing. In total there are over 450 CPUs delivering integrated computational facilities with a large data storage capacity.

Each of the four Grid nodes across the three Yorkshire Universities is named after a white rose, which is a historic emblem of this area.

These are:

- Maxima – Solaris/SUN SPARC processors-based node at the University of Leeds

- Snowdon – Linux/Intel processors-based node at the University of Leeds
- Titania – Solaris/SUN SPARC processors-based node at the University of Sheffield
- Pascali – Solaris/SUN SPARC processors-based node at the University of York

### Software

The WRG software stack is composed largely of open source software. To offer a stable HPC platform for local users at each site, Grid Engine Enterprise Edition<sup>1</sup>, HPC ClusterTools<sup>4</sup> and SunONE studio provide DRM, MPI support and compile/debug capabilities respectively.

Grid Engine Enterprise Edition (GEEE) has been used to manage computing resources across each WRG node. The share tree policy of GEEE enables the administrator at each site to guarantee a share of local resources both to local HPC users and to the Grid users developing Grid-enabled applications. Users of each node use the Grid Engine interface (command line or GUI) to utilise their local resource.

The Grid aspect of WRG is provided by Globus Toolkit 2.4<sup>2</sup> (GT). Each WRG node provides the Globus interface to



THE UNIVERSITIES OF LEEDS, SHEFFIELD AND YORK

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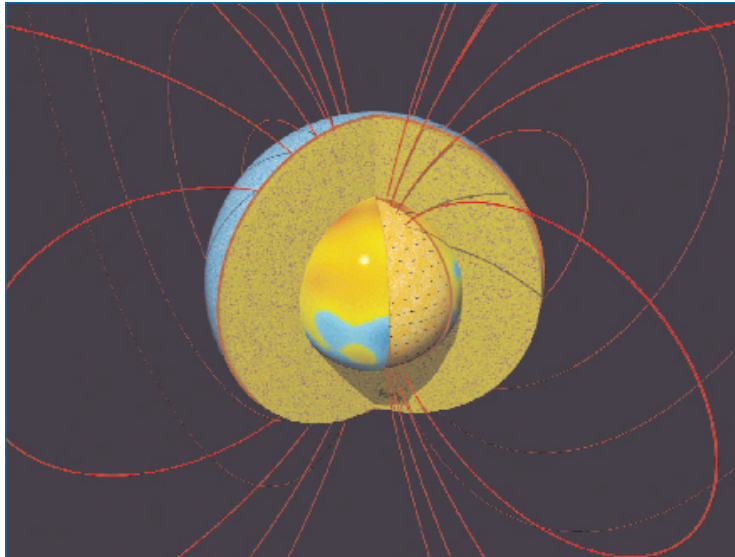


Figure 2: Magneto-hydrodynamics in the Earth's liquid iron core creates the magnetic field - research carried out on Snowdon by Geomagnetism Group, School of Earth Sciences, University of Leeds

“White Rose Grid users have the option of accessing the facility via a web-based Grid portal”

the campus systems. GRAM, MDS and GridFTP are employed in WRG.

Grid Engine Enterprise Edition is integrated with GT2.<sup>4</sup> via both GRAM and MDS. The GRAM integration enables job submission and control through the Globus layer. The MDS integration allows GEEE information, such as queue length, to be passed up through the Globus layer.

A secure authentication to WRG is ensured through the use of Public-Key Infrastructure (PKI) employing digital certificates. Users authenticate to the WRG using their personal X.509 v3 digital certificates. A single sign-on capability to all WRG resources is an important feature for users. The MyProxy software<sup>3</sup> provides a credential repository for the White Rose Grid.

White Rose Grid users have the option of accessing the facility via a web-based Grid portal. The WRG portal offers a self-contained, web-based environment that enables aeronautical engineers to carry out their computational simulations and visualise results, all within a web browser, potentially from anywhere in the world.

### Future Developments

White Rose Grid future developments include further work on application specific portal interfaces as well as a generic portal that can be rapidly customised by application researchers. Through e-Science projects across the WRG, we are investigating an evolutionary move to support Web Services and Grid Services.

### Further Information

Contact:  
Dr Joanna Schmidt,  
WRG e-Science Co-ordinator,  
email: whiterosegrid@leeds.ac.uk

- The relevant web pages are at:
1. The Grid Engine source code is at:  
<http://gridengine.sunsource.net>
  2. The Globus website is at:  
<http://www.globus.org>
  3. MyProxy web pages are at:  
<http://grid.ncsa.uiuc.edu/myproxy/>
  4. The source for Sun HPC ClusterTools can be downloaded from:  
<http://www.sun.com/solutions/hpc/communitysource/>
  5. The project's web pages are at:  
<http://www.wrgrid.org.uk>

