

GridPP

A UK computing Grid for particle physics

UK particle physicists have built a functioning prototype Grid, to analyse the data deluge from CERN's next particle accelerator. Over the next three years, this will be scaled up and integrated further with other Grids worldwide, to produce the world's first persistent, international, production Grid.

• Preparing for a data deluge

In 2007, CERN will introduce its Large Hadron Collider (LHC) - the world's largest particle accelerator. LHC will allow scientists to penetrate further into the structure of matter and recreate the conditions prevailing in the early universe, just after the Big Bang. But the four experiments at the LHC will produce more data than any previous coordinated human endeavour - 10 Petabytes each year, equivalent to a stack of CDs twice the height of Mount Everest. Careful analysis of all of this complex data will be required to look for some of the most elusive constituents of current physics, such as the Higgs particle and supersymmetry.

Rather than deal with this data on expensive supercomputers, based at a few institutions and in high demand, LHC will use distributed computing. More than 100,000 PCs, spread at one hundred institutions across the world, will allow scientists from different countries to access the data, analyse it and work together in international collaborations.

• A particle physics Grid for the UK

GridPP is the UK's contribution to analysing this data deluge. It is a collaboration of around 100 researchers in 19 UK University particle physics groups, CCLRC and CERN. The six-year, £33m project, funded by the UK Particle Physics and Astronomy Research Council (PPARC), began in 2001 and has been working in three main areas:

- developing applications that will allow particle physicists to submit their data to the Grid for analysis
- writing middleware, which will manage the distribution of computing jobs around the grid and deal with issues such as security; and
- deploying computing infrastructure at sites across the UK, to build a prototype Grid.

Physicists and computer scientists from the UK and CERN have already succeeded in building a working Grid testbed, with over 1,000 computers and equipment at 17 sites in the UK. This allows scientists to access data and processing power seamlessly, wherever they are. It is linked to other prototype Grids worldwide, and has been tested by analysing data from US particle physics experiments in which the UK is involved. Several other smaller experiments have also started to use the prototype Grid, and particle physicists are using it to run 'data challenges', that simulate the data analysis needed when LHC is up and running. In this way, UK particle physics have progressed 'from Web to Grid'.



Members of the GridPP collaboration

• GridPP2 - the next phase

The second phase of the GridPP project began on 1 September 2004. In the lead up to 2007, this will extend the UK particle physics grid to the equivalent of 10,000 PCs. The infrastructure in the UK will be continually tested, both by current experiments and by the LHC data challenges to ensure that the final system is ready by 2007. By the end of this second phase of GridPP, UK physicists will be analysing real data from the LHC, using the UK Grid for particle physics.



Simulated particle tracks from the CERN CMS experiment

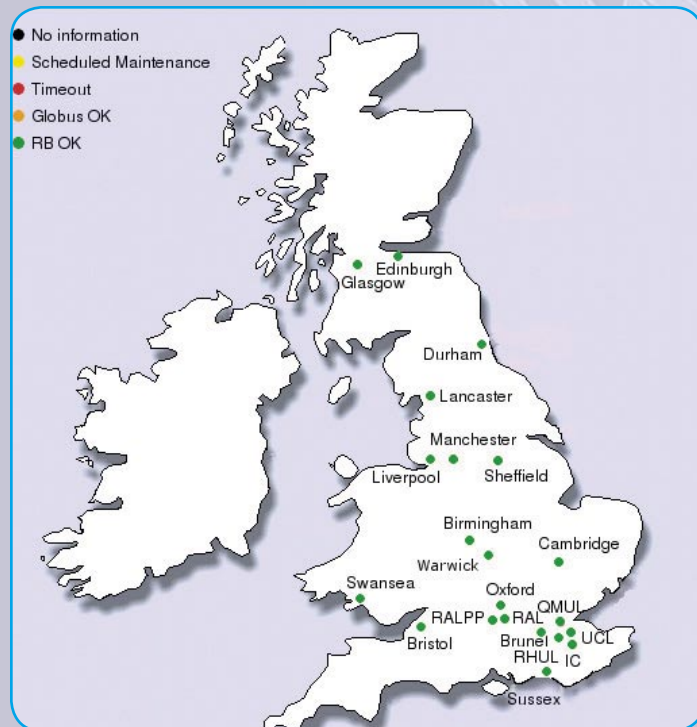
• International collaboration

As well as working with other international particle physics experiments, GridPP is playing a leading role in European Grid projects. During its first three years, GridPP personnel were integral to the EU-funded DataGrid project, which brought together scientists from Earth observation, bio-medicine and particle physics to create a prototype European-wide Grid. By the time of its final review in March 2004, EU DataGrid had produced around a million lines of code and had a testbed of 1,000 CPUs, which had run more than 60,000 jobs.

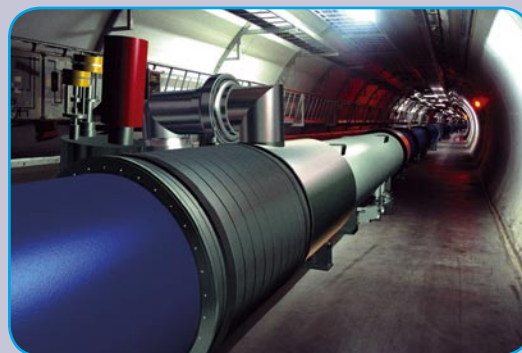
GridPP is now involved in the follow-on EGEE project (Enabling Grids for E-science in Europe), which aims to support the European Research Area by bringing together Grids from different countries and different disciplines.

• Working beyond particle physics

Within the UK, GridPP2 is also collaborating with other parts of the UK's e-science programme, such as the National Grid Service. Many of the tools developed by GridPP could be useful for other disciplines - for example, GridPP is working with clinical researchers on the potential for using its computer security tools in the health service. In addition, GridPP is open to opportunities to work with industry and discuss experience of current Grid development issues and solutions adopted.



Map of the GridPP collaboration partners



An artist's impression of the LHC tunnel at CERN