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Object name: Grid-Ireland Infrastructure
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Synopsis: The computational Grid for Ireland, participant in DataGrid, EGEE, EGI, transactionally deployed and centrally managed by Dept.Computer Science, TCD.

Description:
A pilot computational grid for Ireland, *Grid-Ireland*, was established (with funding from Enterprise Ireland) in Oct-1999 on foot of experiments over 1998-9 by Dr.Brian Coghlan (TCD) with the Globus middleware. It was the first such national grid infrastructure in Europe. The initial collaboration with Dr.John Morrison (UCC) was quickly joined by Dr.Andy Shearer (NUIG). The focus on national grid connectivity was then extended to Europe when Brian Coghlan joined the EU DataGrid consortium (unfunded) in Aug-2000, and then the EU CrossGrid consortium.

Figure 1: Initial Grid-Ireland infrastructure

Initally the middleware was manually deployed, but this was soon automated by extending scripts developed by DataGrid colleagues in the Italian INFN organisation. This allowed V1.0 of the Grid-Ireland middleware to be released in Jun-2001 as a layer above HEAnet. In Jun-2002 this was replaced with V2.0, a customisation of the University of Edinburgh's LCFG automated deployment tools used by DataGrid.

The initial three sites grew to six by 2001 in collaboration with Prof.Luke Drury of Dublin Institute for Advanced Studies (DIAS), Prof.Adrian Ottewill of University College Dublin (UCD) and Prof.Ron Perrott of Queens University Belfast (QUB). The first virtual organisation (VO), Cosmogrid (*Grid-enabled Computational Physics of Natural Phenomena*), led by DIAS, was set up in Oct-2003, with 9 institutions and 60 individuals funded by the HEA PRTLI programme.

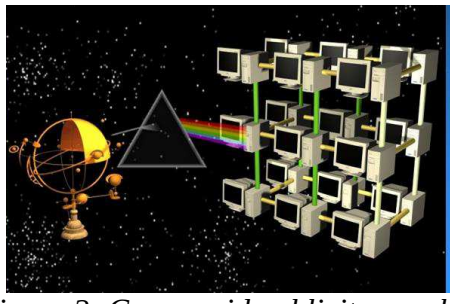
Figure 2: Cosmogrid publicity graphic

Funding also covered three Beowulf clusters and six *Grid Gateways*. The latter were points-of-presence at the six main sites virtualising all the necessary grid services, to be centrally deployed and managed by a newly established OpsCentre at TCD, see the deployment architecture papers in the associated folder of this catalog.

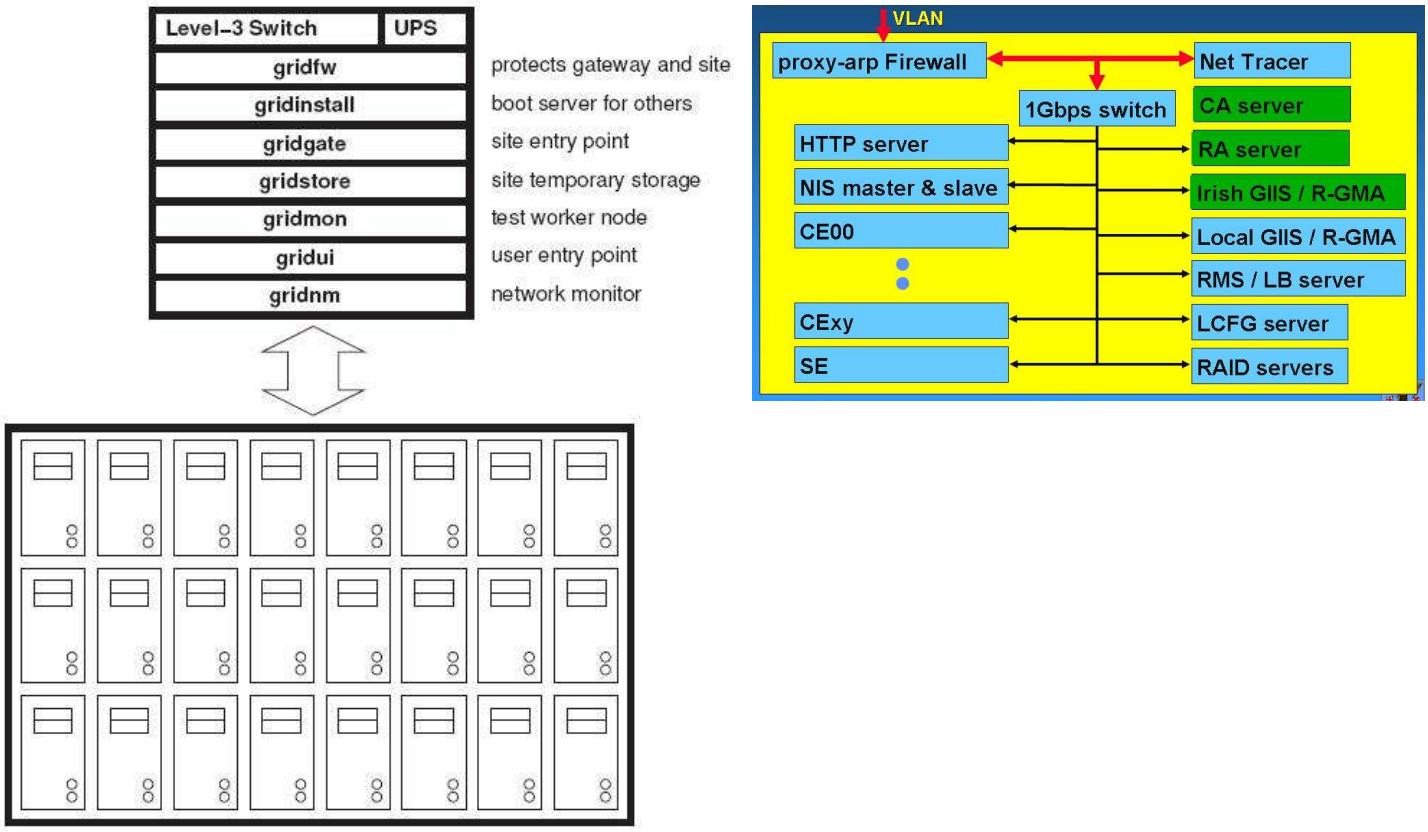

Figure 3: Architectures of (a) Grid-Ireland site, and (b) Grid-Ireland grid gateway

In 2004 Dell generously donated eleven Dell 1650 servers to Grid-Ireland to enable expansion of the grid gateway infrastructure, eventually to 18 sites, North and South, in collaboration with the national research and education network provider, HEAnet.

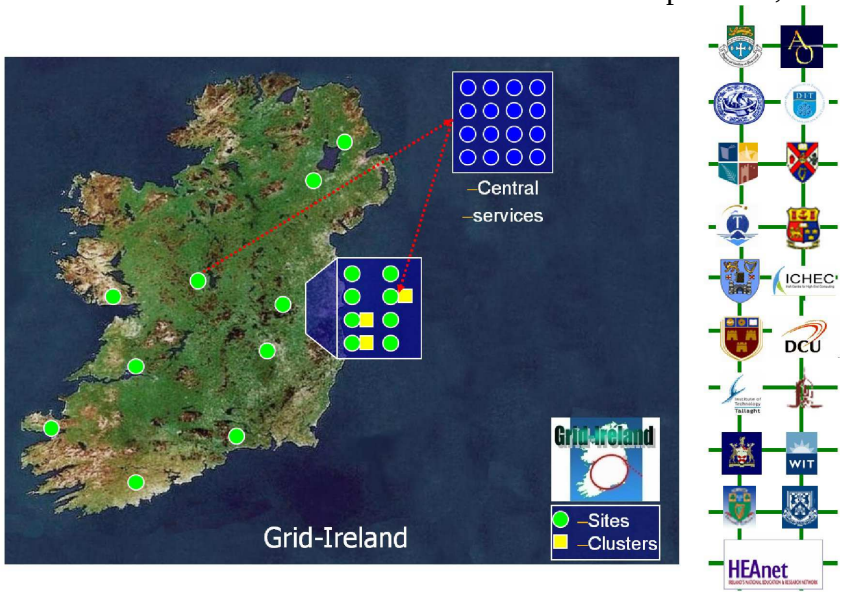

Figure 4: Grid-Ireland infrastructure showing all 18 grid sites

To support this larger infrastructure, the OpsCentre developed a transactional way to deploy middleware, again see the papers in the associated folder of this catalog.

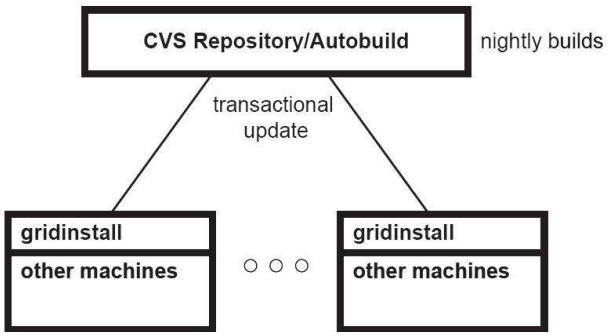

Figure 5: Transactional deployment process

This allowed push-button deployment of grid middleware, an unusual facility that greatly eased the task of maintaining the infrastructure in a consistent state.

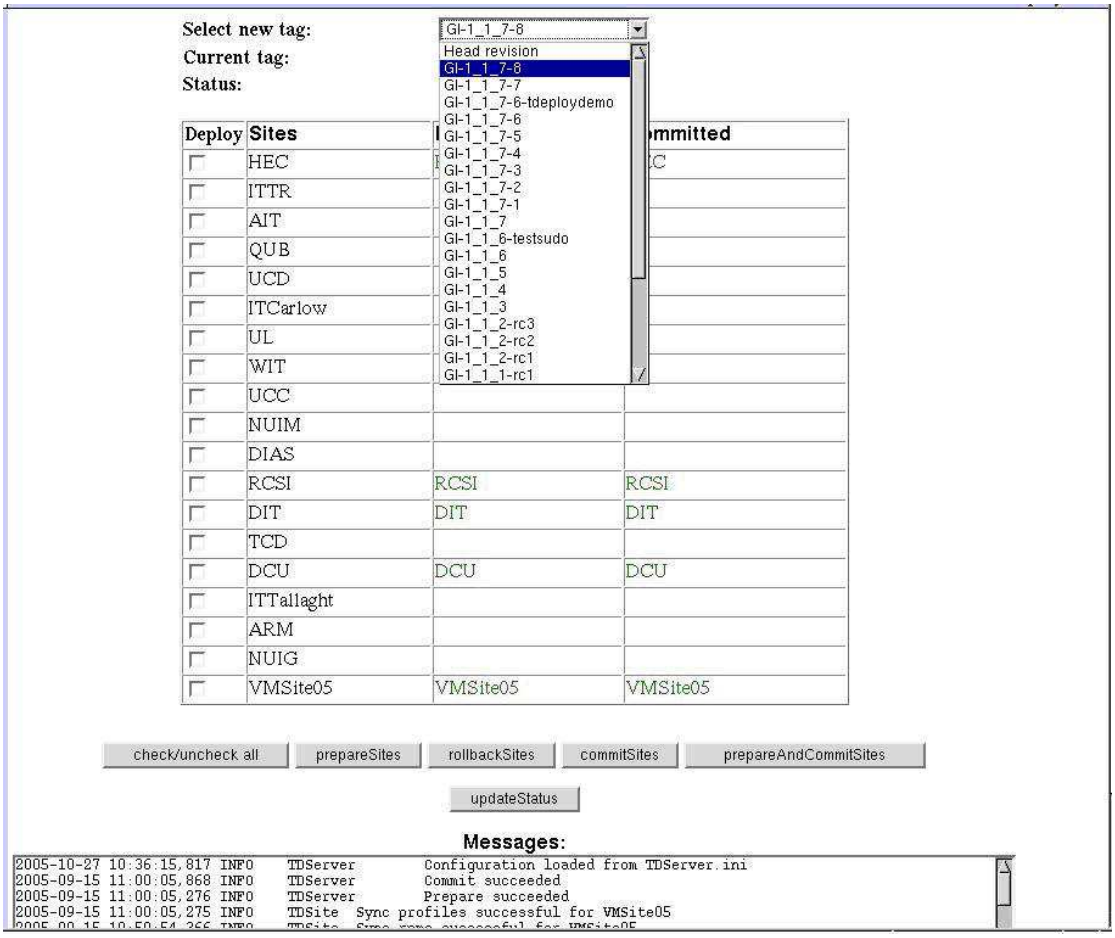

Figure 6: Transactional deployment GUI

Cosmogrid was succeeded in 2007 by e-INIS, again led by DIAS and funded by HEA PRTLI. Further national VOs were established, for example, Marinegrid to support marine science, WebCom-G to support a specific computer science project, and SoloVO to support independent grid users, but also further international VOs, particularly HELIO to support the EU heliophysics community.

This grid infrastructure was embedded in an international context. In 2004 the successor to the DataGrid project, EGEE, kicked off with its first conference in UCC. Grid-Ireland was a participant in all the major European grid developments: DataGrid, CrossGrid, EGEE, EGEE-2, EGEE-3, Int.EU.Grid, EGI-InSPIRE and eventually the pan-EU *European Grid Infrastructure* (EGI). A non-profit company with charitable status, GINGI Ltd, was founded in 2009 to enable national commitments to EGI.

Figure 7: The European context for the Grid-Ireland infrastructure

A parallel international context existed for security. Computational grids are secured with a PKI infrastructure. For the very earliest experiments, PKI certificates were acquired from the Globus Certificate Authority (CA) in America. But even before Grid-Ireland was established it was clear that an independent CA was needed, with its own policies and procedures.

Initially a *Simple CA* (from SSL) was set up, but quickly replaced with customised *OpenCA* software. When DataGrid began it was found the UK grid CA had also taken this approach (both were members of the original six in the DataGrid CA Group), and they then collaborated in solving problems in OpenCA. Until 2006 the primary CA was Dr.Brian Coghlan and the backup was David O'Callaghan, then they swapped roles. The Grid-Ireland CA was deeply involved in the evolution of the CA Group and its successor the EUGridPMA (European grid policy management authority), now one of the three PMAs of the International Grid Trust Federation (IGTF).

The CA hardware consisted of a front-end online RA (registration authority) server and an isolated back-end CA server, both within a half-height rack (actually the disk chassis of the Sequent Symmetry in this collection), along with a small safe for backups, with multiple locks securing all the panels from entry (the UK grid CA hardware actually resided inside a 6ft-high safe). Certificate requests approved on the RA server were transferred to the CA server using floppy disks and vice versa.

Grid-Ireland was also a participant in significant international research such as the EU EMI, StratusLab, Mantychore and SCI-BUS projects, as well as the EU/USA HELIO project and the global CERN LHC computing for the ATLAS and LHCb detectors.

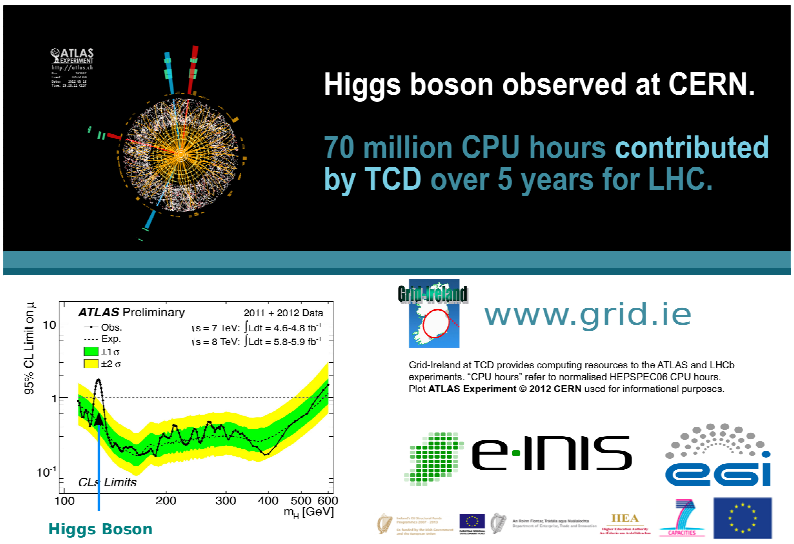

Figure 8: Grid-Ireland csTCDie site contribution to CERN LHC computing

Ultimately, however, it became a casualty of the economic crash of 2008 (aka Global Financial Crisis, or GFC), and was gracefully closed down on 31-Dec-2012.

References:

1. Wikipedia: http://en.wikipedia.org/

2. John Walsh and Brian Coghlan, *The Grid-Ireland National Grid Infrastructure*, 4th Iberian Grid Infrastructure Conference (IBERGRID'2010), Braga, Portugal, 24-27th May, 2010.

3. Stephen Childs and Brian Coghlan, *How to join the virtual revolution*, CERN Courier, 46, (5), 2006, p58 – 58.

4. Childs, S., Coghlan, B., Walsh, J., O'Callaghan, D., Quigley, G., Kenny, E., *A virtual TestGrid, or how to replicate a national Grid*, ExpGrid workshop at HPDC2006, Paris, June, 2006, pp47 – 54.

5. Childs, S., Coghlan, B., O'Callaghan, D., Quigley, G., and Walsh, J., The *Second-Generation Grid-Ireland Deployment Architecture with Quattor Centralised Fabric Management*, Proc.Cracow Grid Workshop 2005, Crakow, Poland, November, 2005, pp114 – 123.

6. Coghlan, B.A., Walsh, J., O'Callaghan, D., *Grid-Ireland Deployment Architecture*, LNCS, European Grid Conference (EGC'05), Amsterdam, February, 2005, 3470, Springer-Verlag, pp354 – 363.

7. Childs, S., Coghlan, B., O'Callaghan, D., Quigley, G., and Walsh, J., *Deployment of Grid gateways using virtual machines*, Proc.European Grid Conference (EGC'05), Amsterdam, February, 2005, 3470, LNCS, Springer-Verlag, pp761 – 770.

8. Coghlan, B.A., Walsh, J., Quigley, G., O'Callaghan, D., Childs, S., and Kenny, E., *Principles of Transactional Grid Deployment*, European Grid Conference (EGC'05), Amsterdam, February, 2005, 3470, LNCS, Springer-Verlag, pp88 – 97.

9. Coghlan, B.A., Walsh, J., Quigley, G., O'Callaghan, D., Childs, S., and Kenny, E., *Transactional Grid Deployment*, Crakow Grid Workshop 2004, Crakow, December, 2004, ACC Cyfronet UMM, pp363 – 370.

10. Coghlan, Brian and Manzke, Michael, *Grid-Ireland*, ERCIM News, (45), 2001 [ERCIM is *The European Research Consortium for Informatics and Mathematics*].

11. Astolos, J., Cecchini, R., Coghlan, B.A., Cowles, R.D., Epting, U., Genovese, T.J., Gomes, J., Groep, D., Gug, M., Hanushevsky, A.B., Helm, M., Jensen, J.G., Kanellopoulos, C., Kelsey, D.P., Marco, R., Neilson, I., Nicoud, S., O'Callaghan, D.W., Quesnel, D., Schaener, I., Shamardin, L., Sova, M., Waananen, A., Wolniewicz, P. and Xing, W., *International Grid CA Interworking, Peer Review and Policy Management through the European DataGrid Certification Authority Coordination Group*, European Grid Conference (EGC'05), Amsterdam, February, 2005, 3470, LNCS, Springer-Verlag, pp285 – 295.

12. Morrison, J.P., Coghlan, B., Shearer, A., Foley, S., Power, D., and Perrott, R., *WebCom-G: A Candidate Middleware for Grid-Ireland*, Journal of High Performance Computing Applications and Parallel Processing, 20, (3), 2006, p409 – 422.

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Further information on the CosmoGrid Project is available at www.CosmoGrid.ie or by contacting the CosmoGrid Office, 5 Merrion Square, Dublin 2.

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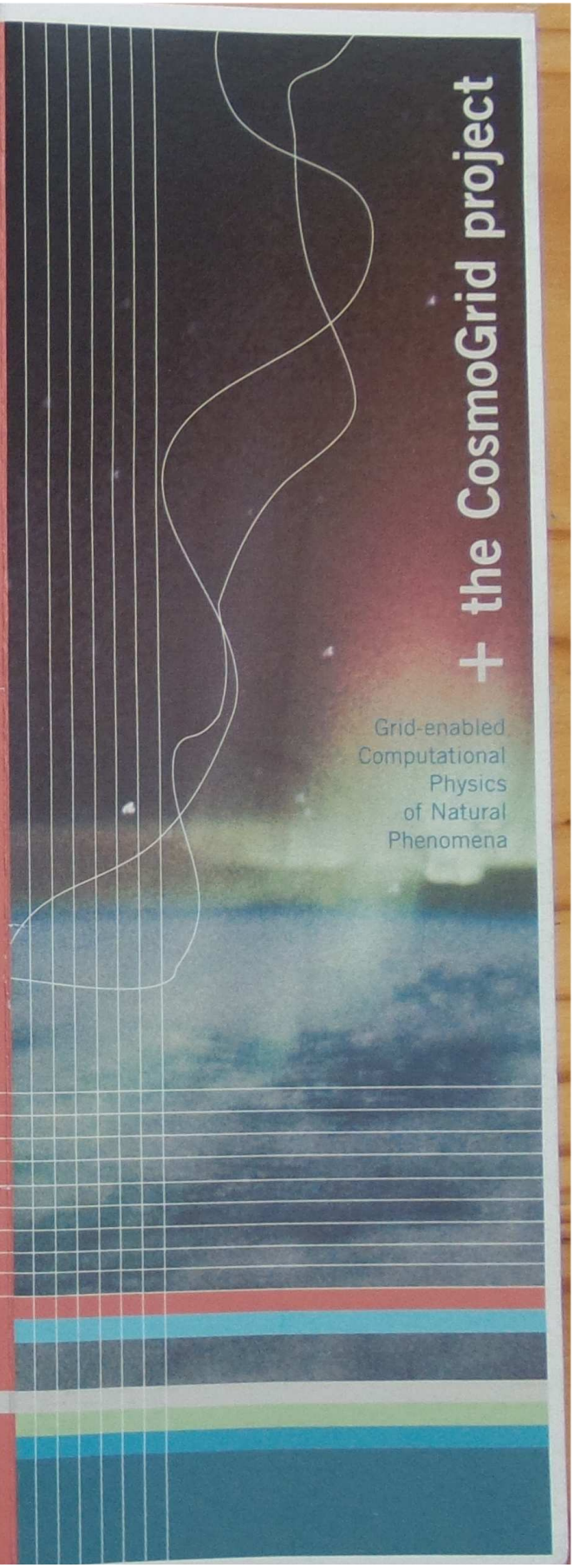

+ the CosmoGrid project

Grid-enabled Computational Physics of Natural Phenomena

+ the CosmoGrid project

The Grid-enabled Computational Physics of Natural Phenomena is a research and technology development project funded as part of the Programme for Research in Third Level Institutions (PRTLI) supported by the National Development Plan with assistance from the European Regional Development Fund.

The aim of the Project is to study natural phenomena occurring in the cosmos using a powerful computer Grid - hence, the Project's abbreviated title 'CosmoGrid'. These natural phenomena range from earthquakes to climate change to supernova explosions and are often so complex that traditional analytic approaches are difficult to apply. Computational simulations, however, offer the possibility of increasing our understanding of these phenomena by bridging the gap between experiment and theory. Until recently, computational scientists have been limited by the amount of available computing power. The introduction of new Grid technology will facilitate large-scale, data-intensive computation and analysis and enable the scientists to research and model more effectively the complex systems that make up our universe.

The main objectives of the CosmoGrid Project are to:

* develop a world-class Grid system and a culture of Grid use in Irish research;
* undertake leading-edge research in the field of the physics of natural phenomena;
* instigate and promote collaboration between a wide range of institutions and organisations involved in the study of natural phenomena;
* provide an innovative training programme in Grid-enabled research and advanced scientific computing.

The CosmoGrid Consortium

The Project draws together a large team of scientists and researchers from numerous disciplines including astronomy, astrophysics, atmospheric physics, computer science, geophysics, mathematical physics and meteorology. As well as being interdisciplinary, the project is inter-institutional in nature involving eight institutions and organisations throughout Ireland, including Northern Ireland. These include:

- The Dublin Institute for Advanced Studies
- National University of Ireland, Galway
- University College Dublin
- Dublin City University
- Grid-Ireland (a collaboration of computer scientists in TCD, UCC & NUIG)
- Met Éireann
- Armagh Observatory
- HEAnet

Scientific Projects Using Grid Technology

As part of the Cosmogrid Project a wide range of leading-edge science research projects will be undertaken. Each research project will utilise the high performance computing capabilities of the Grid to replicate a specific natural phenomena. The research projects include the:

* development of a regional climate model to generate information on recent and future climate change in Ireland;
* construction of digital virtual rocks leading to greater understanding of geophysical processes;
* creation of rheological and thermal models of lithospheric structures with particular application to the North Atlantic;
* computation of seismic waves in models of geological and geophysical structures;
* simulation of astrophysical shocks such as those that occur when a star dies (supernova event);
* simulation of astrophysical jets which are seen when a star is born and during its demise, and associated phenomena;
* intensive study of atmospheric gravity waves;
* reproduction and modelling of radiative processes in neutron star astrophysics;
* calculation of optical scattering properties of atmospheric dust particles;
* construction of computation models to advance the use of adaptive optics in ground-based telescopes;
* development of a model of the solar transition region i.e the region between the cool chromosphere and hot corona;
* analysis of data resulting from gravitational waves passing through the Laser Interferometer Gravitational Wave Observatory (LIGO) in the US.

The Grid in Operation

The construction of the Grid involves the large-scale aggregation of high-capacity computers to create three large clusters (each a 128 processor system) which will be linked together. These clusters will act as the major suppliers of computing power to the Grid and will be based at the Dublin Institute for Advanced Studies, UCD and NUIG. The clusters will be connected through Grid-Ireland by using dedicated gateway machines located at each of the remaining Cosmogrid consortium members. This will allow the three clusters to operate as a single virtual system, transparently distributing jobs across the Grid and, in the case of really large jobs, sharing the load across all 384 processors.

Effectively then, the Grid will provide a shared computational resource, with flexible access and a common interface for the user. The principle of the Grid computing system can be equated with that of an electricity supply Grid. A peak in demand in one area can be supplied from excess capacity elsewhere in the system to deliver a uniform, consistent and reliable service. A user can plug into the Grid and use the resources required to address a science problem. Ideally, the end user should consider the machine running the software as irrelevant as the power station providing the electricity to switch on a light!

Grid Technology Worldwide

The arrival of Grid computing heralds an era of 'e-science' to match that of 'e-commerce'. The existence of a wide variety of physical phenomena that require large scale computation and the rapid growth in available computing power provides a major opportunity for scientific advances. Across Europe and the US numerous computational and data grid projects are being implemented. The CosmoGrid will provide Irish scientists with the opportunity to be at the cutting-edge of scientific discovery. Before the end of the Project, it is envisaged that the CosmoGrid will form part of a distributed, Grid-based, European or even global, virtual supercomputer resource.

Training and Development

Investment in the development of a Grid System will make a very important contribution to the development of Irish research capabilities. However, equally important is the investment in education and training. To maintain a high quality research environment, researchers, postdoctoral fellows, postgraduate and undergraduate students will have to acquire the specific skills and experience needed to use and develop Grid tools in the Irish research system. As part of the CosmoGrid Project, training workshops and regular seminars will be undertaken with students of all levels. The Grid will also be used as a specialist training resource in a number of specific undergraduate courses identified in the University sector.