APPLICATIONS ON EGEE

The Enabling Grids for E-sciencE (EGEE) project began by working with two scientific groups — High Energy Physics (HEP) and Biomedicine. As it has progressed into its second phase it has grown to support research domains in areas as diverse as multimedia, astrophysics, archaeology, and computational chemistry. Researchers form Virtual Organisations (VOs), allowing them to collaborate, to share resources, and to access common datasets via the EGEE Grid infrastructure.

High Energy Physics (HEP) applications

The HEP community was one of the two pilot user domains for EGEE and remains a major user of the EGEE infrastructure, providing vital input that allows EGEE to ensure it provides a user-orientated service.

The original EGEE HEP community was formed from the experiments of the Large Hadron Collider (LHC), currently under construction at CERN (European Organization for Nuclear Research) near Geneva, Switzerland. These four experiments, ALICE, ATLAS, CMS, and LHCb, are estimated to produce some 15 petabytes per year when the collider starts up in 2008. These data will be managed and processed using the EGEE infrastructure.

Other international HEP experiments are also making use of the EGEE infrastructure, including BaBar (B and B-bar experiment), CDF (Collider Detector at Fermilab) and DØ experiments using particle accelerators in the USA, and the ZEUS and H1 experiments using the HERA collider at the DESY laboratory in Germany.

Biomedical applications

Applications in the biomedical field have been included in the EGEE project from the outset and are now exploiting the infrastructure in a sustained production mode. The biomedical community benefits from the Grid by enabling remote collaboration on shared datasets as well as carrying out high throughput calculations. The applications cover the fields of medical imaging, bioinformatics, and drug discovery, with many individual applications deployed or being ported to the EGEE infrastructure.

Notable among the biomedical sector is the WISDOM initiative, which has carried out a number of high-profile drug discovery calculations. The EGEE infrastructure's ability to perform these large, complex tasks validates its use as a tool in the fight against diseases such as malaria and avian flu.

Astronomy & Astrophysics applications

The two major VOs in this domain, Planck and MAGIC, share problems of computation involving large-scale data acquisition, simulation, data storage, and data retrieval. The Planck satellite of the European Space Agency (ESA) will be launched in 2008 and aims to map the microwave sky with an unprecedented combination of sky and frequency coverage, accuracy, stability and sensitivity. The MAGIC application simulates the behaviour of air showers in the atmosphere, originated by high-energy primary cosmic rays. These simulations are needed to analyse the data of the MAGIC telescope (located in the Canary Islands) to study the origin and the properties of high-energy gamma rays.

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Earth Science Research (ESR) applications
Earth Science covers a large range of topics related to the earth's atmosphere, ocean, crust, core and their interfaces as well as other planets' atmospheres and cores. For instance, members of the ESR Virtual Organisation have worked on rapid earthquake analysis, helping the scientific community better understand these devastating natural disasters.

Geophysics applications
The Geophysics domain is closely related to the Earth Sciences domain and supports EGEODE (Expanding GEOsciences on DEmand), EGEE's first industrial application, initiated by the private company CGG-Veritas. It allows academic researchers to use the company's Geocluster software on the EGEE infrastructure.

Fusion applications
The capability of Grids for meeting the needs of the fusion community has been demonstrated. Several applications are already running on the EGEE infrastructure: massive ray tracing to estimate the trajectory of a microwave beam in plasma; kinetic transport and optimisation of special magnetic confinement fusion devices (stellerators). Several computational tasks related to the ITER (International Thermonuclear Experimental Reactor) project were successfully ported to the EGEE infrastructure and will be further expanded.

Computational Chemistry applications
The initial and primary user in computational chemistry is the GEMS a-priori molecular simulator. Several applications have already been ported to the Grid and have been run in production to calculate observables for chemical reactions, simulate the molecular dynamics of complex systems, and calculate the electronic structure of molecules, molecular aggregates, liquids and solids. Recent work has focussed on expanding the number of software packages, both open-source and commercial, available on the grid for chemists. A notable success was making the commercial Gaussian software package available via the "gaussian" virtual organization.

Finance & Multimedia applications
These two newest application domains are just starting out with EGEE. The multimedia domain is currently in testing through EGEE's GILDA Grid testbed. The financial applications involve work with the Abdus Salam International Centre for Theoretical Physics, which is implementing a national Italian Grid infrastructure for financial and economic research in the framework of the Egrid project.

Related Projects
EGEE also supports a number of related European and national projects using the EGEE middleware, EGEE infrastructure or both. DILIGENT develops Grid software for creating and maintaining digital libraries. DEGREE aims to promote Grid technologies throughout the large and diverse Earth Sciences community. GRIDCC aims at integrating instrumentation with the Grid. BEinGrid aims to foster the adoption of Grid technologies by realizing several business experiments and creating a toolset repository of Grid middleware.

For more information about the applications running on EGEE, visit the User and Application Portal at http://egeena4.lal.in2p3.fr/

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