The grid: a new way of doing science

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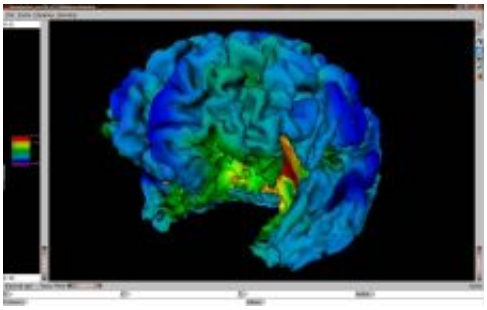

(PhysOrg.com) -- A European consortium has brought the power of grid computing to bear on problems ranging from the genetic origins of heart disease to the management of fish stocks and the reconstruction of ancient musical instruments.

A ‘grid’ is a network of high-powered computing and storage resources available to researchers wishing to carry out advanced number-crunching activities. Resources belong to individual universities, national and international laboratories and other research centres but are shared between them by mutual agreement.

In Europe the data is carried over the GÉANT grid network but the organisation that makes this possible is managed by EGEE-III, the third phase of an EU-funded project to create an infrastructure supporting European researchers using grid computing resources.

“We support the users, we operate the infrastructure and we also develop the middleware that we use to bring all those resources together in a secure manner,” says Steven Newhouse, the project’s technical director. “We take computing and storage resources owned by individual institutions and provide a middleware layer of software that allows these resources to be shared securely over the international research networks.”

Coordinated at CERN near Geneva, EGEE links about 14,000 users at 350 sites in 55 countries, both within and outside Europe. Every day, an average of 350,000 computing jobs pass through the network.

Asking what if?

Although grid computing began in the high-energy physics community - and EGEE will be on hand to process the long-awaited data from the Large Hadron Collider - many other disciplines are now using EGEE to access the world’s most powerful computing facilities.

“We're seeing increasing use from the computational chemistry area, from materials science, the life sciences, environmental sciences and so forth,” says Newhouse.

What many of the applications have in common is the simulation of experiments that would take years or decades to do in the laboratory. A common theme is to study how complex molecules interact with each other, with many applications in the search for new vaccines and other drugs.

“And this gives scientists a great way of asking 'what if?' questions and to narrow down the chemicals that they need to explore in the lab from hundreds of thousands to just a handful.”

Research published in Nature Genetics last March used EGEE to identify combinations of genes that predispose people to coronary artery disease. Scientists from the EU's Cardiogenics project were able to find four out of more than 8.1 million possible combinations of genetic markers that were strongly associated with the disease.

Earthquakes and fish stocks

A group in Taiwan is using EGEE to model the effects of earthquakes on urban areas in the hope of learning how to keep damage to a minimum. "It's combining physical sciences and social sciences to do something really practical," says Catherine Gater, the dissemination manager for EGEE-III.

Another project, AquaMaps, is using the grid to model the worldwide distribution of fish species. "Because climate change is affecting the patterns of where you might find marine species, fish stock management is quite an issue," she says. "With everything changing so rapidly, the AquaMaps project is mapping where you can find particular species of fish at any one time."

EGEE is also helping doctors to treat rare diseases through a project to create a worldwide image library. "It gives them almost instant access to medical images spread around the world but in a secure manner," explains Gater. "That's the key to the grid, that you can share this data with other trusted sources and any patient information is not going to get out beyond the circle that it should."

The benefits of EGEE have spread beyond the hard sciences and medicine into the humanities. The multidisciplinary ASTRA team in Italy used the grid to construct a digital model of an epigonion, a harp-like instrument used in ancient Greece. The virtual instrument was played in a concert in Naples last December.

New way to do science

From patterns of crime to fine-tuning of radiotherapy treatments, EGEE has brought grid computing to researchers and other professionals who would not have considered using it only a few years ago.

“One of the original motivations for this grid activity was that all this computing power could change the way that scientists do their research,” notes Newhouse. “What we're now seeing, a decade on, are the fruits of all this work.”

Next May, EGEE will come to an end and a new body, the European Grid Initiative (EGI), will take its place. Newhouse is its interim project director. “We want to move away from the short-term project model that has happened within EGEE to a model which is both more sustainable financially but also more sustainable and longer term for the users that increasingly depend upon this infrastructure."

Newhouse likens the grid to other scientific instruments that have changed the way we look at the world. “It’s like the invention of the microscope or the telescope. The grid is actually changing the way scientists think about doing their research and the questions they can pose.”

EGEE-III is an e-Infrastructures project funded under the ‘Research Infrastructures’ part of the Capacities programme of the EU’s Seventh Framework Programme for research.

More information: EGEE III project: www.eu-egee.org/

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