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The Grid: The Next-Gen Internet?

Douglas Heingartner 03.08.01 | 2:00 AM

AMSTERDAM, Netherlands -- *The Matrix* may be the future of virtual reality, but researchers say the Grid is the future of collaborative problem-solving.

More than 400 scientists gathered at the Global Grid Forum this week to discuss what may be the Internet's next evolutionary step.

Though distributed computing evokes associations with populist initiatives like SETI@home, where individuals donate their spare computing power to worthy projects, the Grid will link PCs to each other and the scientific community like never before.

The Grid will not only enable sharing of documents and MP3 files, but also connect PCs with sensors, telescopes and tidal-wave simulators.

IBM's Brian Carpenter suggested "computing will become a utility just like any other utility."

Carpenter said, "The Grid will open up ... storage and transaction power in the same way that the Web opened up content." And just as the Internet connects various public and private networks, Cisco Systems' Bob Aiken said, "you're going to have multiple grids, multiple sets of middleware that people are going to choose from to satisfy their applications."

As conference moderator Walter Hoogland suggested, "The World Wide Web gave us a taste, but the Grid gives a vision of an ICT (Information and Communication Technology)-enabled world."

Though the task of standardizing everything from system templates to the definitions of various resources is a mammoth one, the GGF can look to the early days of the Web for guidance. The Grid that organizers are building is a new kind of Internet, only this time with the creators having a better knowledge of where the bottlenecks and teething problems will be.

The general consensus at the event was that although technical issues abound, the thorniest issues will involve social and political dimensions, for example how to facilitate sharing between strangers where there is no history of trust.

Amsterdam seemed a logical choice for the first Global Grid Forum because not only is it the world's most densely cabled city, it was also home to the Internet Engineering Task Force's first international gathering in 1993. The IETF has served as a model for many of the GGF's activities: protocols, policy issues, and exchanging experiences.

The Grid Forum, a U.S.-based organization combined with eGrid - the European Grid Forum, and Asian counterparts to create the Global Grid Forum (GGF) in November, 2000.

The Global Grid Forum organizers said grid communities in the United States and Europe will now run in synch.

The Grid evolved from the early desire to connect supercomputers into "metacomputers" that could be remotely controlled. The word "grid" was borrowed from the electricity grid, to imply that any compatible device could be plugged in anywhere on the Grid and be guaranteed a certain level of resources, regardless of where those resources might come from.

Scientific communities at the conference discussed what the compatibility standards should be, and how extensive the protocols need to be.

As the number of connected devices runs from the thousands into the millions, the policy issues become exponentially more complex. So far, only draft consensus has been reached on most topics, but participants say these are the early days.

As with the Web, the initial impetus for a grid came from the scientific community, specifically high-energy physics, which needed extra resources to manage and analyze the huge amounts of data being collected.

The most nettlesome issues for industry are security and accounting. But unlike the Web, which had security measures tacked on as an afterthought, the Grid is being designed from the ground up as a secure system.

Conference participants debated what types of services (known in distributed computing circles as resource units) provided through the Grid will be charged for. And how will the administrative authority be centralized?

Corporations have been slow to cotton to this new technology's potential, but the suits are in evidence at this year's Grid event. As GGF chairman Charlie Catlett noted, "This is the first time I've seen this many ties at a Grid forum."

In addition to IBM, firms such as Boeing, Philips and Unilever are already taking baby steps toward the Grid.

Though commercial needs tend to be more transaction-focused than those of scientific pursuits, most of the technical requirements are common. Furthermore, both science and industry participants say they require a level of reliability that's not offered by current peer-to-peer initiatives: Downloading from Napster, for example, can take seconds or minutes, or might not work at all.

Garnering commercial interest is critical to the Grid's future. Cisco's Aiken explained that "if grids are really going to take off and become the major impetus for the next level of evolution in the Internet, we have to have something that allows (them) to easily transfer to industry."

Other potential Grid components include creating a virtual observatory, and doctors performing simulations of blood flows. While some of these applications have existed for years, the Grid will make them routine rather than exceptional.

The California Institute of Technology's Paul Messina said that by sharing computing resources, "you get more science from the same investment."

Ian Foster of the University of Chicago said that Web precursor Arpanet was initially intended to be a distributed computing network that would share CPU-intensive tasks but instead wound up giving birth to e-mail and FTP.

The Grid may give birth to a global file-swapping network or a members-only citadel for moneyed institutions. But just as no one ten years ago would have conceived of Napster -- not to mention AmIHotOrNot.com -- the future of the Grid is unknown.

An associated DataGrid conference continues until Friday, focusing on a project in which resources from Pan-European research institutions will analyze data generated by a new particle collider being built at Swiss particle-physics lab CERN.

'The Grid' Could Soon Make the Internet Obsolete

Monday , April 07, 2008

THE TIMES

The Internet could soon be made obsolete. The scientists who pioneered it have now built a lightning-fast replacement capable of downloading entire feature films within seconds.

At speeds about 10,000 times faster than a typical broadband connection, “the grid” will be able to send the entire Rolling Stones back catalogue from Britain to Japan in less than two seconds.

The latest spin-off from Cern, the particle physics centre that created the web, the grid could also provide the kind of power needed to transmit holographic images; allow instant online gaming with hundreds of thousands of players; and offer high-definition video telephony for the price of a local call.

David Britton, professor of physics at Glasgow University and a leading figure in the grid project, believes grid technologies could “revolutionise” society. “With this kind of computing power, future generations will have the ability to collaborate and communicate in ways older people like me cannot even imagine,” he said.

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The power of the grid will become apparent this summer after what scientists at Cern have termed their “red button” day - the switching-on of the Large Hadron Collider (LHC), the new particle accelerator built to probe the origin of the universe. The grid will be activated at the same time to capture the data it generates.

Cern, based near Geneva, started the grid computing project seven years ago when researchers realised the LHC would generate annual data equivalent to 56m CDs - enough to make a stack 40 miles high.

This meant that scientists at Cern - where Sir Tim Berners-Lee invented the web in 1989 - would no longer be able to use his creation for fear of causing a global collapse.

This is because the Internet has evolved by linking together a hotchpotch of cables and routing equipment, much of which was originally designed for telephone calls and therefore lacks the capacity for high-speed data transmission.

By contrast, the grid has been built with dedicated fibre optic cables and modern routing centres, meaning there are no outdated components to slow the deluge of data. The 55,000 servers already installed are expected to rise to 200,000 within the next two years.

Professor Tony Doyle, technical director of the grid project, said: “We need so much processing power, there would even be an issue about getting enough electricity to run the computers if they were all at Cern. The only answer was a new network powerful enough to send the data instantly to research centres in other countries.”

That network, in effect a parallel Internet, is now built, using fibre optic cables that run from Cern to 11 centres in the United States, Canada, the Far East, Europe and around the world.

One terminates at the Rutherford Appleton laboratory at Harwell in Oxfordshire.

From each centre, further connections radiate out to a host of other research institutions using existing high-speed academic

networks.

It means Britain alone has 8,000 servers on the grid system – so that any student or academic will theoretically be able to hook up to the grid rather than the internet from this autumn.

Ian Bird, project leader for Cern's high-speed computing project, said grid technology could make the internet so fast that people would stop using desktop computers to store information and entrust it all to the internet.

"It will lead to what's known as cloud computing, where people keep all their information online and access it from anywhere," he said.

Computers on the grid can also transmit data at lightning speed. This will allow researchers facing heavy processing tasks to call on the assistance of thousands of other computers around the world. The aim is to eliminate the dreaded "frozen screen" experienced by internet users who ask their machine to handle too much information.

The real goal of the grid is, however, to work with the LHC in tracking down nature's most elusive particle, the Higgs boson. Predicted in theory but never yet found, the Higgs is supposed to be what gives matter mass.

The LHC has been designed to hunt out this particle - but even at optimum performance it will generate only a few thousand of the particles a year. Analysing the mountain of data will be such a large task that it will keep even the grid's huge capacity busy for years to come.

Although the grid itself is unlikely to be directly available to domestic internet users, many telecoms providers and businesses are already introducing its pioneering technologies. One of the most potent is so-called dynamic switching, which creates a dedicated channel for internet users trying to download large volumes of data such as films. In theory this would give a standard desktop computer the ability to download a movie in five seconds rather than the current three hours or so.

Additionally, the grid is being made available to dozens of other academic researchers including astronomers and molecular biologists.

It has already been used to help design new drugs against malaria, the mosquito-borne disease that kills 1m people worldwide each year. Researchers used the grid to analyse 140m compounds - a task that would have taken a standard internet-linked PC 420 years.

"Projects like the grid will bring huge changes in business and society as well as science," Doyle said.

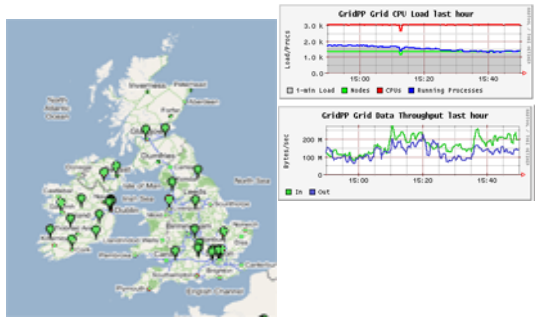
"Holographic video conferencing is not that far away. Online gaming could evolve to include many thousands of people, and social networking could become the main way we communicate.

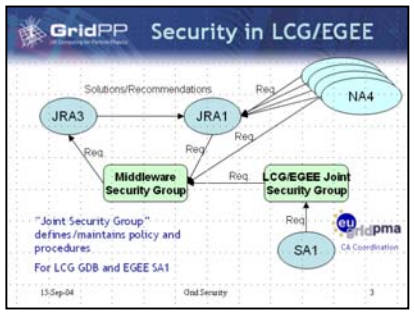
"The history of the internet shows you cannot predict its real impacts but we know they will be huge."

What Is GridPP?

Data from CERN's Large Hadron Collider will be analysed by more than 100,000 PCs in 100 institutions. GridPP is the UK's contribution. It is a six year project, and it is part of the Particle Physics and Astronomy Research Council's e-Science Programme.

GridPP has built a fully functional grid, with more than 3,000 computers across 17 UK institutions. This allows scientists to access data and processing power seamlessly, wherever they are. Over the next three years, this will be extended to the equivalent of 10,000 CPUs.

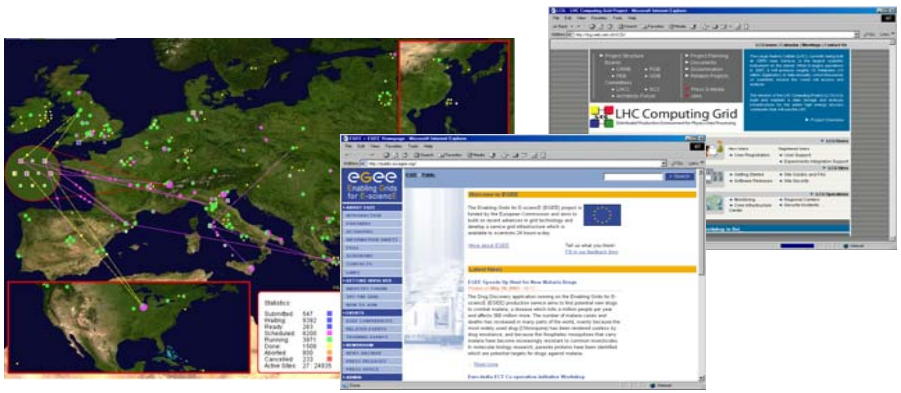




Middleware:

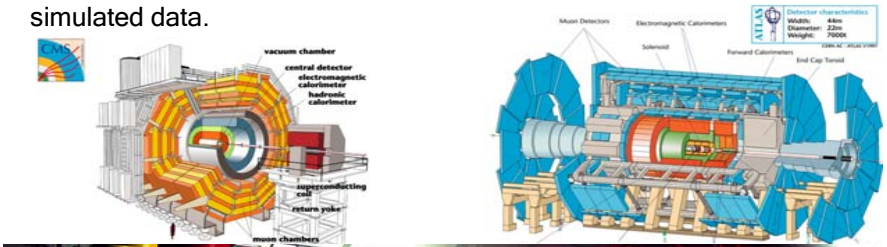
Middleware is the key to a successful Grid. Middleware allows the software being used by the scientists to talk to the Grid's hardware, distributing computing jobs efficiently around the network. It also deals with issues such as security, ensuring that only authorised users can access the Grid. GriddPP has written over 3,000 lines of Middleware code.

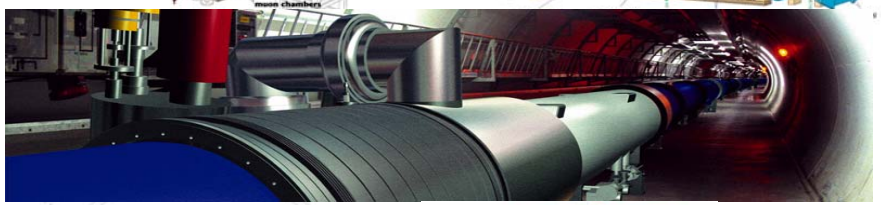
GridPP is part of **international projects** such as Enabling Grids for e-SciencE and the Global Grid

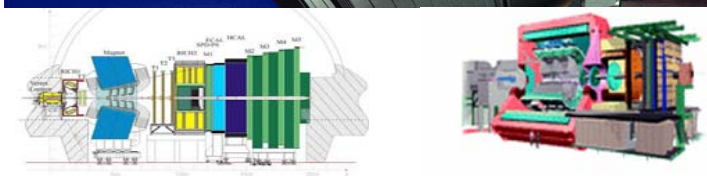


Applications for the Grid

GridPP is developing applications to allow the four future LHC experiments to use the Grid. It is testing them using Monte Carlo simulated data.



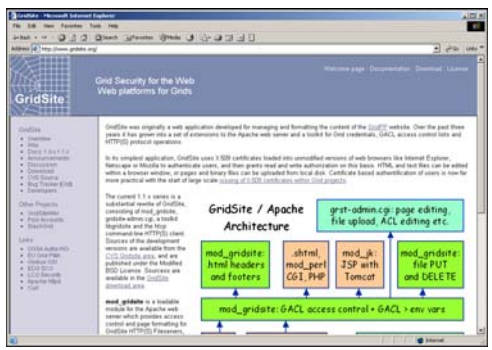




It is also testing applications for US experiments and testing them using real data, and working with other disciplines such as bio-informatics and computer science.

GridSite

GridPP has developed the open source GridSite tool (www.gridsite.org). This lets grid users to identify themselves to websites using their personal e-science certificate, rather than needing to remember lots of passwords. Users can then edit and upload webpages and images. GridSite is available for any website to use.



Members of the GridPP collaboration

THE UNIVERSITY OF BIRMINGHAM
University of BRISTOL
Brunel UNIVERSITY WEST LONDON
CERN
CCLRC
MANCHESTER 1824
UNIVERSITY OF CAMBRIDGE
Imperial College London
Durham University
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The University Of Sheffield.
Royal Holloway University of London
THE UNIVERSITY of LIVERPOOL
WARWICK
Queen Mary University of London
University of Sussex
PPARC
GridPP
UK Computing for Particle Physics

Resources:
www.gridpp.ac.uk

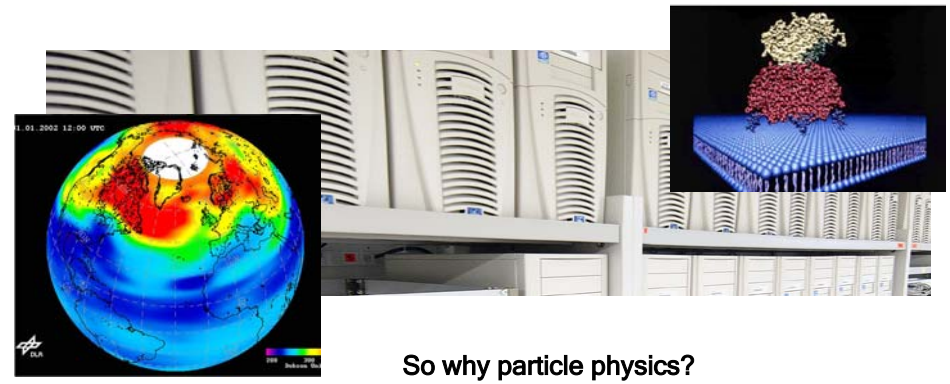
www.cern.ch

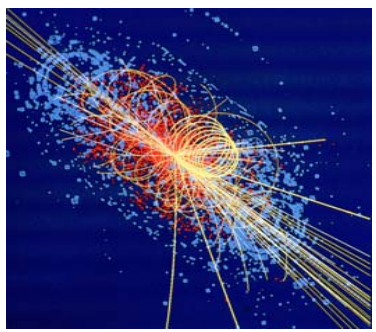
www.eu-egee.org

GridPP
UK Computing for Particle Physics

GridPP is a collaboration of 20 UK universities, research centres and CERN. It is building a UK computing grid for particle physics

What is the Grid?
Experiments everywhere, from biology to earth observation, are producing billions of bytes of data every day. Dealing with such huge amounts of data needs a new type of computing. It's not possible for one single institution to store and analyse all this data, so scientists have to share computer storage and processing power around the world at hundreds of different locations. This is called Grid computing





So why particle physics?
The problem is particularly acute for particle physicists. In 2007, CERN, the European Laboratory for Particle Physics will introduce the Large Hadron Collider (LHC). The 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 in the search for answers to questions such as why particles have mass, the LHC's detector will produce more than 10 Petabytes (10 Million Billion Bytes) of data each year – equivalent to a stack of CDs twice the height of Mount Everest.