

What is the National Grid Service?

The National Grid Service (NGS) aims to provide coherent electronic access for UK researchers to all computational and data based resources and facilities required to carry out their research, independent of resource or researcher location.

You can find further information about the NGS on its website at www.ngs.ac.uk. The website contains a wide range of documentation including technical details, software listings, user case studies and online tutorials for self-guided learning.

Keep in touch with the NGS

If you would like to be kept up to date with news from the NGS then join our mailing list to receive fortnightly news updates including events and training opportunities.

www.jiscmail.ac.uk/lists/NGS-NEWS.html

If you are a user of NGS resources then join our status mailing list to be kept up to date with service news and updates.

<http://www.jiscmail.ac.uk/lists/NGS-STATUS.html>

The NGS produces a quarterly newsletter containing a large variety of news about the NGS

including user case studies, NGS site news, application updates and conference reports. The latest edition of NGS News can be found on our website in the Outreach section or join our mailing list to receive an announcement when the latest edition is released.

Contact the NGS

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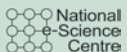
Real-time visualisation of blood flow through the brain



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Name: **Dr Steven Manos, Marco Mazzeo, Prof. Peter Coveney**

Institution: Centre for Computational Science, UCL

Research: **Real-time visualisation of blood flow through the brain**

Picture a clinician, stood at a terminal, watching a computer simulation of blood flow through their patient's brain. They're moving the model brain around to get a better look at the movement of blood through the vessels they are about to operate on.

Sound too futuristic? Not if, like Dr Steven Manos, you're working on the GENIUS project.

The GENIUS project (Grid Enabled Neurosurgical Imaging Simulation; <http://wiki.realitygrid.org/wiki/GENIUS>) has developed from the ongoing RealityGrid project (www.realitygrid.org).

Conditions such as arterio venous malformations (AVM) can be much better understood and treated if the blood flow of the patient is studied. An AVM is an abnormal tangle of blood vessels that when occurring in the brain can cause headaches, seizures, paralysis and haemorrhaging. Studying the

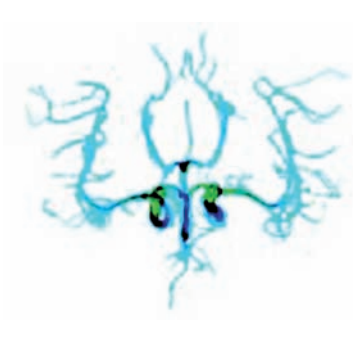
patient's blood flow around the brain with a system like GENIUS before surgery can greatly increase the chances of success.

MRI scans provide the data to reconstruct the neurovascular structure of real patients. A lattice-Boltzmann fluid flow solver called HemeLB is then used to simulate the flow of blood around the reconstructed vessels.

The GENIUS project makes use of MPI-g, a grid-enabled implementation of MPI. Geographically distributed parallelisation of simulations has many benefits:

- It allows it to run on a number of processors on several machines
- It increases the turn around time for a simulation
- It returns the results to the clinician as fast as possible

The reservation of multiple machines at a specified time is achieved using the HARC (Highly Available Robust Co-scheduler)



GENIUS allows images of the blood flow around a patient's brain to be visualised in real time.

system. The code runs on machines on:

- The National Grid Service (NGS; www.ngs.ac.uk)
- Teragrid (www.teragrid.org)
- LONI (the Louisiana Optical Network Initiative; www.loni.org)

Monitoring the results in actual time is vital for the user to interact with the simulation. Real-time visualisation is achieved by incorporating a ray-tracer into the HemeLB algorithm. This avoids the time-consuming data transmission and pre/post processing stages.

The GENIUS project involves collaborators from across the US and the UK. Dedicated optical fibre links connect supercomputers in the US and the UK (such as the NGS) to the clinicians desktop. Clinicians can then easily view the live visualisation on their desktops. They can also steer the simulation by moving the model around to get a better look at

areas of interest and altering input data.

"With GENIUS we're aiming to make patient-specific treatment a reality for neurosurgeons, by developing an efficient system which fits in with current clinical practice." explains Dr Manos. "The NGS has been actively supporting the GENIUS project, deploying HARC for advance reservation and co-reservation of resources and rolling out MPI-g across the network."

The GENIUS project is a Joint US/UK high-end computing project, co-funded by the EPSRC and NSF.

Further information

GENIUS
<http://wiki.realitygrid.org/wiki/GENIUS>
RealityGrid www.realitygrid.org
TeraGrid www.teragrid.org
LONI www.loni.org