Grid TALK GridBriefings
Grid computing in five minutes

Putting the 'e' in education: eLearning and grid computing

Computers and the Internet have transformed our homes and businesses, and have the potential to do the same for education and training. Known as eLearning, using such technologies can be as simple as accessing a school timetable online, through to running virtual communities for sharing and creating knowledge. This briefing looks at the issues surrounding the topic, and how grid technologies and Europe's e-Infrastructures can play a part in this new way of learning.

Why eLearning?

eLearning is defined by the European Commission (EC) as 'the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchanges and collaboration.' The EC sees eLearning as an integral part of education and in the Communication, 'A Digital Agenda for Europe', published in May 2010, called for Member States to include eLearning in national policies.

The EC's Lifelong Learning Programme also hopes to realise the possible benefits of eLearning. Running from 2007-2013, the programme includes learning in schools, higher education, vocational training, and adult education, and one of its key activities is focused on the application of ICT.

eLearning and grids

Grid technologies help researchers worldwide collaborate, analyse data and carry out research. However grids can also be used as a means to provide education and training. For example, grids allow users to create virtual research communities and organisations, providing a platform to share resources, information and ideas.

eLearning is often based on technologies which are difficult to scale-up or share with multiple users. They also tend not to distribute computing power or storage, making data-intensive fields, such as medicine, hard to teach.

A grid computing model could offer a solution to these problems. By sharing the processing power and storage space of many learning devices, eLearning could address tasks such as medical image processing, which require significant amounts of computing power. Sharing resources would be of particular benefit for mobile learning, where learners use portable devices with limited memory and processing power.

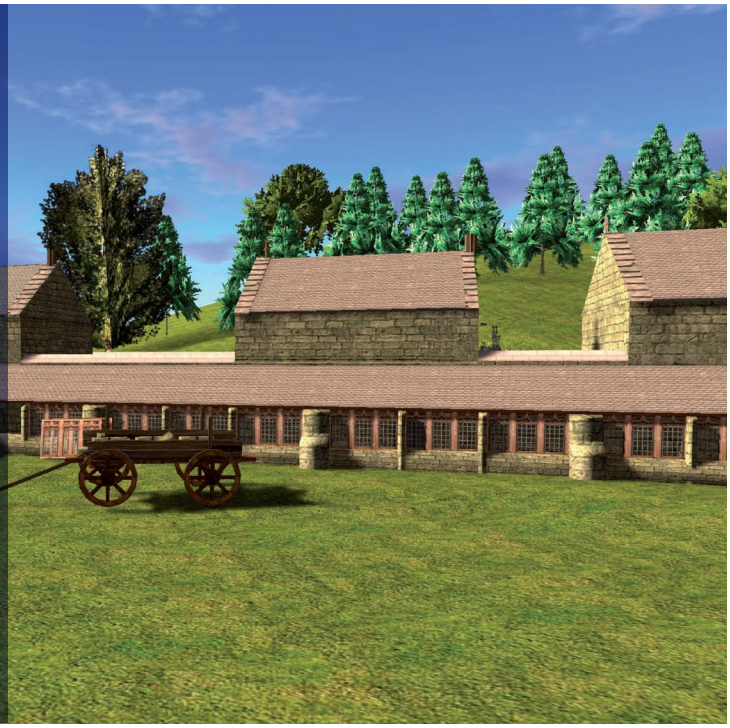
From 2004-2007 the European Learning Grid Infrastructure (ELeGI) project aimed to incorporate grids into eLearning. In its early days eLearning was used to make materials and resources more accessible to students. These eLearning tools were didactic, offering no opportunity for learners to engage in two-way discussions. Today, eLearning is not just seen as

A new world of learning

In 1398, the first Duke of Surrey founded Mount Grace Priory in Yorkshire, England. The monks at this monastery lived mainly as hermits, each occupying his own cell, and were noted for their piety, craft skills, and hospitality to travellers.

Now visitors to the New World grid, a Second Life-like environment, can learn more about the monks' way of life thanks to Devi Jankowicz, who is virtually reconstructing the priory in its rural surroundings. From a church to the monks' cells, sewage systems to a water mill and including both a herbalist's garden and the mediaeval strip-farming system, Jankowicz hopes to provide an immersive and engaging educational experience of life in a 15th century Carthusian priory.

www.newworldgrid.com



a way to spread existing knowledge, but also as a space to create, develop and discuss new ideas.

The ELeGI project promoted this second type of learning. It aimed to create environments where learners could interact and converse. It did this through developing software on which to build virtual communities based on grids.



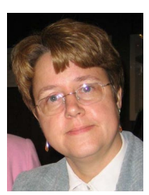
Pierluigi Ritrovato, Research Centre in Pure and Applied Mathematics (CRMPA) – *"With the ELeGI project we integrated an innovative e-Learning platform, named IWT – Intelligent Web Teacher (developed by MoMA an Italian High tech spin-off of the CRMPA – the ELeGI Scientific Coordinator) with grid middleware. This enabled us to bring together adaptive and personalised learning experiences with seamless, ubiquitous and on-demand access to distributed learning facilities such as Virtual Labs, contents repositories and video-conferencing services; all according to pedagogically sound approaches like experiential based and collaborative learning."*

Benefits of eLearning include:

- Greater flexibility in terms of time, location and structure.
- It can be tailored to the individual.
- Improved accessibility to training and education, regardless of age, ability or social integration.
- It is cost effective.
- It encourages student-to-student interactions.

The GiSHEO project is using the grid to provide higher education and training in earth observation. GiSHEO uses grids to analyse and store satellite data, and combines this with eLearning facilities.

eGLE, GiSHEO's eLearning environment, provides templates for trainers and teachers specialising in earth observation to develop lessons for others to follow. Most importantly, it gives space for trainees to experiment and innovate. In lesson related experiments, trainees have access to large amounts of data and, thanks to remote processing, they can analyse and receive results within the timeframe of the lesson. By using GiSHEO, trainees can perform earth observation tasks that are usually out of reach of desktop computers due to memory or time constraints. Furthermore, they can do all this without installing any software, or transferring large amounts of data onto their computer. A preview of the GiSHEO platform was presented at the EGEE User Forum in April 2010 and it will be available for public use later this year.



Dana Petcu, West University of Timisoara - *"Our experiments during the GiSHEO project proved the fact that grids can liberate the end-users from the burden of their local hardware limitations and can enlarge the number of applications that can be conceived for or repeated within eLearning environments."*

Training on the grid

In 2008, a report by the e-IRG Education and Training Task Force stressed the importance of training in order to fully exploit Europe's e-Infrastructure. Due to its distributed nature, training researchers on how to use the grid can be supplied through eLearning. From 2005 to 2007, the support action ICEAGE (led by University of Edinburgh) worked to extend and advance grid education. The project had a collaboration of 32 institutes, which were involved in training users at 100 events a year.

ICEAGE made use of existing academic frameworks in the universities to help with curriculum design, course development and implementation. It also organised shared educational events in the form of Summer and Winter schools. These schools gave students a chance to earn credits in topics such as computer systems architecture, which they could apply directly to Masters courses.

ICEAGE also set up and operated a t-Infrastructure (an e-infrastructure used for training) through the GILDA training infrastructure system.





Roberto Barbera, INFN - *"GILDA is an initiative triggered in 2004 by the Italian National Institute of Nuclear Physics and is currently supported by several organisations and international projects/initiatives worldwide. In slightly more than 6 years GILDA has been used in 441 training events held in 56 countries. More than 17,500 digital certificates have so far been issued by GILDA for training purposes."*

As with other eLearning schemes, the ICEAGE project found that it is not enough just to have a set of accessible resources. For online learning to provide the same quality as face-to-face learning it needs to engage students. For this ICEAGE employed three different types of eLearning course:

- Virtual classroom: A "class" is set up and limited to a manageable size. Often involves some live communication between trainer and student, with practical assignments and reading material to be completed according to a structured schedule.
- Blended learning: Following a face-to-face presentation, attendees completed tutorials using a web-based system, developed within the EGEE-III project. Attendees could complete tutorials at their own pace, following the stepped instructions.
- Self-Paced Learning: Modules were placed into the EGEE digital library, and students could select which aspects of training material they required. Tutorials were designed to allow students to work at their own pace which helps those who do not have time to commit to scheduled training sessions.

Using existing infrastructures

Existing research infrastructures (RIs), such as networks, can be vital in order to implement national or international eLearning programmes. For example, the eduroam service from TERENA allows students, researchers and staff to connect to the internet at participating institutions by simply providing their username and password from their home institute. The eduroam infrastructure is based on the GÉANT Pan-European network and provides a secure roaming service and access to internet-based materials.

A 2008 study from the EC-funded project ERINA investigated how to exploit existing RIs for the use of eHealth, eGovernment and eLearning. The opportunities of reusing RIs for education included wider access to learning resources, the mobility of teachers and students and the ability to personalise learning to the individual.

The ERINA study stated that adopting e-Infrastructures as the ICT backbone of education could lead to substantial benefits. However to realise these they made the following recommendations:

- Ensure long-term sustainable funding for such initiatives.
- Ask local and regional bodies to deploy eLearning initiatives, but ensure dissemination is European-wide.
- Identify and remove barriers, both technical and legislative, which may impede adoption of such infrastructure.

These recommendations were adopted by the EC Communication 'ICT Infrastructures for Science' published in 2009 (see GridBriefing no. 6).



Andrea Manieri, ERINA and ERINA+ - *"The ERINA study was a challenging activity which demonstrated that valuable benefits could come from the adoption of Research e-Infrastructures in other fields other than e-Science. The follow up, ERINA4Africa, is now assessing the same benefits targeting African Research initiatives, and ERINA+, an under negotiation EC Support Action, is going to help current and future e-Infrastructures projects in self-assessing expected and achieved benefits."*

Grids@school

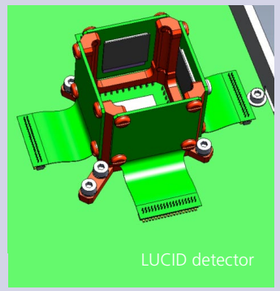
Teacher Becky Parker is using the grid to help her students at Simon Langton Grammar School, in Kent, UK, delve deeper into the universe.

In 2008, a cosmic ray detector designed by Parker's students was a winner in a competition from the British National Space Centre. Now they're preparing to send their Langton Ultimate Cosmic ray Intensity Detector (LUCID) up into space.



credit: Simon Langton Grammar School

LUCID will use Timepix chips, which were developed at CERN, to collect information about cosmic rays in space. Smaller versions of LUCID are already being piloted in schools across Kent, through CERN@school. Schools collect data with these CERN@school kits and upload it to a server so students can analyse the data via a website. Parker hopes to expand this CERN@school network still further across Europe. So with the terabytes of data from LUCID and data from potentially hundreds of schools Parker is working with GridPP to give her students a way to analyse and store the information.



LUCID detector



"Involvement with GridPP adds a fantastic dimension to CERN@school," says Parker. "Students will not only be using state of the art detector technology from CERN in their laboratories but also linking with many other students through GridPP to give them an authentic experience of a research collaboration. Many students are already finding the pilot phase inspiring so as the project rolls out there is the potential to inspire many thousands of students in physics, engineering and computing."

Challenges of eLearning

While eLearning can offer many benefits, a number of challenges arise on its implementation, including the following:

- Learners need to have the skills required to use eLearning tools. This is a particular problem for grid-based eLearning strategies, as the grid is often cited as a hard-to-use technology. However encouraging eLearning has been cited as a way to reduce the 'digital divide'.
- Learning material must be of sufficient quality: for example, easy to access, cost-effective, fulfilling its purpose, and accurate. However, defining quality can be difficult as it depends greatly on the perspective of the learner or stakeholder.
- Strategies should not be purely content driven. Instead of just a way to spread existing knowledge, eLearning environments can also provide a space to create, develop and discuss new ideas. Grids can help to offer collaborative eLearning environments.
- Ensuring technology is available for all. To be able to engage with eLearning tools, users must have access to eLearning technologies. This is a particular issue for developing countries. The ERINA and ERINA4Africa studies are addressing this issue, and schemes in schools across the EU aim to provide students with the necessary technologies for eLearning.

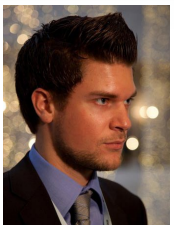
e-Infrastructures 4 Africa

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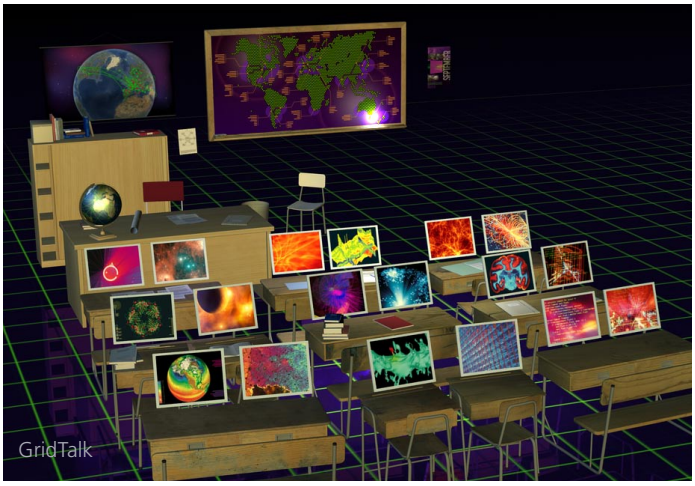
In developing countries in particular, eLearning can offer an effective way to provide the next generation with education and training. Following on from the ERINA study, the EC-funded ERINA4Africa project aims to provide African and EU policy makers with an analysis of how to exploit RIs for use in eHealth, eGovernment and eLearning.

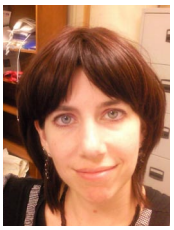
The objectives of ERINA4Africa are:

- To create a virtual observatory on trends and current evolution of e-Infrastructures in Africa.
- Develop a foresight study identifying the benefits of adopting African Research Infrastructures.
- Provide a series of virtual conferences and local meetings to promote and validate project results. The first of these was held in Rwanda in May 2010. The second will be in Malawi in October 2010.



Rolf Reinhardt - European Foundation for Quality in E-Learning, *"eLearning has accelerated changes in education from teacher-centred to student-focused skill development. Learning environments are becoming more interactive and engaging such as in learning communities or in serious games. I see the strong need for continuous development of quality in education by taking into consideration recent technological, pedagogical and organisational progresses. It is important to not see eLearning only as a way to reduce costs but also to improve educational quality. Organisational changes may be required when implementing eLearning strategies in order to boost motivation and to face resistance of involved staff."*





Elizabeth Van der Meer, National e-Science Centre, University of Edinburgh – *"The benefits of eLearning development in higher education are numerous. eLearning widens the student base by increasing accessibility to courses and training and thus it reaches "non-traditional" students. It also offers students the opportunity to become comfortable with eLearning technologies (blackboard, wikis, blogs, grids) and collaborative environments. While eLearning may never replace face to face tuition, it will continue to grow in importance due to its role in extending the educational experience in new and innovative directions."*

For more information:

CERN@school: ***www.thelangtonstarcentre.org***
EC eLearning portal: ***www.elearningeuropa.info***
e-IRG: ***www.e-irg.eu***
ERINA4Africa: ***www.erina4africa.eu***
GILDA: ***https://gilda.ct.infn.it***
ICEAGE: ***www.iceage-eu.org***
iSGTW: ***www.isgtw.org***
GridTalk : ***www.gridtalk-project.eu***

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