Taking Computing Back to School

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ABSTRACT

In this paper, we discuss the use of a kind of videoconferencing technology generally referred to as an "Access Grid" to connect universities with local schools and colleges. We report on successful trials of the Open Source form of this videoconferencing technology that are part of the "Taking Computing back to school" project due to be completed in July. The project is part-sponsored by both the Higher Education Academy Subject Centre for Information and Computer Sciences, and the University of Surrey's Widening Participation initiative. We identify the importance of improving engagement with the computing curriculum to avert a potential skills crisis in the IT industry and discuss the technology, the challenges of deployment and testing, and some of the early successes.

Keywords

outreach; understanding computer science; videoconference technology; access grid; schools and colleges.

INTRODUCTION

The UK's increasing reliance on technology and falling numbers of IT graduates suggests that tough times could lie ahead for the subject. Fewer applications are being made for computer science and related degrees [10], with a small indication of consolidation in computer science this year. Studies have demonstrated that there are problems in the perception of IT as a subject and negative perceptions of the type of people who undertake IT degrees and work in the IT industry [16]. GCSE and A Level students of ICT may be being turned off further study of IT by these factors, amongst others.

The IT profession and related degrees appear to have an issue with its "brand" that is causing a decline. This issue is exemplified by the significant under-representation of women in IT, with some efforts made to understand, and change, reasons for this [11], [8]. Unless the negative perceptions and gender biases can be challenged, the outlook for UK IT could be as bleak as it is being portrayed [4]. Perceptions of the subject may be partly to blame, however there is a great opportunity, and need, for HE institutions to reverse the trend. This reversal can begin by, at least, improving engagement with younger students. Arguably, there is an even greater need to engage positively with the wider public, and to ensure the effective management of public expectations. Failures of large IT projects make media headlines, and examples, such as the NHS programme for IT, do little to help the profession.

One way the HE community has been attempting to tackle this is through engaging with school students via outreach activities. This often involves engaging with students studying for AS and A levels at the ages of seventeen and eighteen, on the verge of entering HE. The implication is that, by this stage, a proportion of students will already have been "lost" from the subject. Effective engagement to demonstrate the breadth and excitement of the subject therefore needs to occur at key decision stages early in the curriculum, in particular during the selection of GCSE and A level options in Key Stages 3 and 4.

For HE institutions and schools, increased engagement is perceived as a good thing for the subject. This is offset by the presence of ever-greater pressure on employee time and, at least, HE finances [9]. These dual pressures limit the frequency and extent of engagement. Good levels of interaction come at a cost of increased overheads in organization and time. While science buses allow trained teachers to attend schools to support the science curriculum, resources for these activities necessitates limited contact across multiple schools. In contrast, visits by schools to universities help to give the students a flavour of university life, but organisation and travel for such events requires significant efforts.

To address the multiple challenges presented here, we considered the potential for engagement using state-of-the-art technologies, variously referred to as videoconferencing, video webcasting, vodcasting and broadband television. Such computer-mediated communication technologies support real-time and interactive transmission of video content over the web and subsequent playback on a variety of devices. Large-scale videoconferencing technologies offer simultaneous real-time interaction between multiple participants at multiple locations, enabling activities to be run across geographically distributed sites.

This paper discusses the use of a kind of videoconferencing technology generally referred to as an "Access Grid" to connect universities with schools and colleges in the local area. We report on successful trials of the open source form of this videoconferencing technology. The trials are part of the "Taking Computing back to school" project that is due to be completed in July. The project is part-sponsored by both the Higher Education Academy Subject Centre for Information and Computer Sciences, and by the University's Widening Participation initiative. We discuss the technology, the challenges of deployment and testing, some of the early outcomes, and how this fits into outreach and widening participation.

BACKGROUND

Access Grid (AG) technologies, both bespoke systems and Open Source[1], have been used extensively for videoconferencing in the research community to assist and potentially enhance collaborations at distance between research groups. An Access Grid installation, referred to as an Access Grid Node (AGN) can vary from individual systems to lecture-room scale systems. Room-scale AGNs support research seminars and distributed meetings, often involving national and international participants. Examples of these include the ESRC's AGN seminar series [7] and Manchester University's seminars [17]. The Department of Computing at the University of Surrey obtained an AGN in February 2006 as part of the Science Research Investment Fund (SRIF-3) programme. Participation in AG events has increased our exposure to a variety of research, and exposed others to ours also [7].

Access Grids form a part of the so-called "e-Infrastructures", a term used as a coverall for activities that also incorporates work in the UK's e-Science programme [15] on Data Grids, Computational Grids, Semantic Grids and Knowledge Grids [3]. A certain proportion of the drive towards AGs, and a fair amount of use, has come through the UK's e-Science programme. Videoconference technologies such as Skype, NetMeeting and Click to Meet are increasing in popularity, however quality of audio and video has been an issue with such software, and this can result in a less than satisfactory experience. In contrast, AGs are characterized by large format displays, high quality digital sound, and, importantly for school, college and university audiences, the integration of presentational tools and means of sharing data. Furthermore, AGs are designed with multiple participants in mind, rather than a one-to-one experience, enabling interaction between many schools, universities and, potentially, industrial representatives, in a single session. The scale and performance of AGs might be described as "Skype on steroids" or "videoconferencing on viagra".

The Department of Computing's main AGN, currently one of three room-scale systems on the Surrey campus, consists of a 6 metre screen, 3 data projectors, 8 microphones, an interactive whiteboard, stereo sound and an induction loop for the hard of hearing, and a host of software features. Further desktop-based and laptop-based systems are also used. Such configurations have become typical for HE institutions in the UK and internationally [2]. Alternative technologies have been deployed elsewhere, for example the proprietary Click to Meet software being used by the London Grid for Learning to provide links between schools in the London area [13]. However, AG systems remain popular and are supported in the UK by provision of the Access Grid Support Centre (AGSC) [1]. Furthermore, AGs provide secure transmission, support for multiple group-based participation, and a variety of related factors and functions. Replicating this with other technologies is possible, but would require significant effort and infrastructure.

Large-scale videoconferencing systems may prove beneficial in enabling increased frequency and ease of engagement and augmenting other activities. However, virtual interaction across a video link does not (yet) replace classroom-based interaction, and hands-on activities provide an even greater challenge. AGs also provide opportunities for increasing the ways in which students can engage with the curriculum. For example, AG sessions can be recorded for later playback, and even annotated [5], though it may be easier to use the same resources for the production of video webcasts with synchronised PowerPoint slides as provided by the IET[2]. Whilst inexpensive digital video recorders could be used in the same way, by recording appropriate AG sessions, schools can access the

[1] Access Grid Website, http://www.accessgrid.org

[2] For further information see: http://www.iet.tv and http://www.cs.surrey.ac.uk/news/ietv/.

off-line content to follow-up on particular points after the session, or use the material for different classes.

The principal aim of the "Taking Computing back to school" project is to evaluate the use of AG technologies to enable participation and interaction with schools. The intention is to demonstrate the excitement of the subject, and the potential of AG technologies, through a series of sessions supporting curriculum activities in schools, relating current research activities to the everyday world, and providing course "tasters". These lectures will necessarily be adapted to delivery both over AG and for transmission by video webcast, expanding the potential audience, whilst being further adapted for offline use.

The project builds on our promising outreach activities and efforts to promote computing as a career. Our outreach programme involves the development and delivery of a range of hands on activities suitable for a variety of student age groups. The outreach team comprises a core group of academics responsible for liaising with local schools and colleges via a Schools Advisory Board – interested representatives from local schools and colleges who advise us on what activities and materials we should develop. Recent activities aimed at demonstrating the appeal of computing have included workshops on Security Technologies and Image Processing, appropriately tailored to different age groups, together with events related to national schemes, including a talk from industrials, such as EA Games, during Science and Engineering week.

Activities during the remainder of the project, and beyond, will involve presentations, project work and professional development, providing teaching support for GCSE and A Level Computing and ICT. Academics and industrialists, at the University and at collaborating and associated companies, will be involved in sessions with students at the schools and colleges to discuss topics that demonstrate the challenges, opportunities, and substantial rewards of a career in IT. Our use of AGs is for increasing the opportunities for contact with schools, to deliver curriculum support and to help improve perceptions of computing. The technology also helps to overcome some of the logistical issues and limitations of extensive co-present activities. Related work elsewhere has assessed the use of AGs in facilitating teaching at distance, and the use of mobile audio and video [6], [12], [14].

TECHNICAL DESCRIPTION

Provision of AG systems requires the development and testing of desktop-based units intended for use in small-scale rooms. Each system requires a number of hardware and software components. The systems being provided to the schools and colleges, while capable and sufficient for evaluation purposes, could be improved upon by increasing the sophistication of some of the components. The baseline system is described here:

Equipment: Viglen Genie P4 3Ghz PC with 1GB memory configured to include a Millennium G450 PCI Dualhead Graphics card, allowing for a desktop over two screens. This enables one screen to be used for viewing a presentation while the other carries video feeds. For echo-cancelling sound provision, we use either a PCI card (Soho conference card) with external amplified speakers, or a Phoenix Duet conference speakerphone (for desktop-based use). Logitech Quickcam connect cameras provide video capture.

Software: Windows OS plus the 5 freely downloadable software components of the Access Grid Toolkit[3].

Firewalls: Rules from AGSC[4] to allow for service discovery and for the video, audio and node operator text-chat traffic to be transmitted.

PROGRESS TO DATE

The project is split into three phases, and has proceeded in accordance with plan and remains on schedule. In phase 1, we established the technological and curricular requirements of the participating schools through visits and lesson observations. Phase 2 is currently underway, focused on installation and support of the technology within the schools, and the important delivery of the five pilot sessions. In phase 3, the project will be evaluated and recommendations and guidelines for expansion will be produced with the goal of wider adoption of the scheme. A project webpage has been created[5], with a link to a press release about the project.

Efforts with the original partner institutions Farnham Heath End School, Coombe Girls' School and Esher College, foundations for which were originally built through the Schools Advisory Board, have proceeded at a variety of speeds largely reliant on three different third party providers of network and firewall technologies. We learnt that the biggest hurdle in such an effort is getting AG traffic through firewalls: several months have lapsed in dealings with one of the three different third party firewall solution providers. In related work we have demonstrated that the AG technology works well when used to link-up with the Dongbei University of Finance and Economics in Eastern China. However, while we have been able to collaborate

[3] Available from the AGTk website at: http://www-unix.mcs.anl.gov/fl/research/accessgrid/software/releases/3.0.2/windows.html

[4] List available at: http://www.agsc.ja.net/support/ports.php

[5] http://www.cs.surrey.ac.uk/outreach/tcs.html

across vast geography and multiple time zones, our greatest challenge has been to do so in the local area.

At the time of writing, four AG systems have been developed and three delivered – already one greater than in the project plan – with two of those going to Coombe Schools and the third to Esher College. An unplanned success of the project has been that Coombe are using their two systems in their own day-to-day activities to provide face-to-face support between the two sites – the Girls' and Boys' schools. This demonstrates that the AG installations could also be used to facilitate interactions between the schools, to share expertise and curriculum exercises and best practice, and to support competitive and collaborative activities across schools such as hosting multiple-site Computer Clubs for Girls (CC4G) activities.

Training and support has been provided for configuration and running of installations, with a brief guide to use and workarounds for some inherent bugs. The importance of using encrypted sessions was identified with Coombe, due to the possibility of outsiders "dropping-in" on running sessions. Encryption is well-supported by the technology, and has been tested with Esher also.

The international profile of this project was raised in relation to Farnham Heath End's technology based 'concept classroom' with Tenyane School, Limpopo Province, South Africa, with a demonstration of AG technology to representatives from the South African government's e-learning team.

FURTHER WORK

The remainder of the project, subsequent to delivery of the final AG system, is focusing on the live, online and offline content for the five sessions and the evaluation of these sessions. Two of the five curriculum-supporting sessions are intended to cover Web1.0 and Web2.0 technologies, with a focus on how HTML and relational databases underpin these. We are also negotiating with IBM to deliver a session on real-world aspects of technology, and to bring an industrial perspective into the classroom.

The pilot sessions will be run, with each evaluated prior to the delivery of the next to assess use of the technology and ensure effective curriculum support. Recorded sessions will be made more widely available for use by other schools. Curriculum links are also being explored with science departments (GCSE) in conjunction with the Department of Physics at Surrey, with the possibility of further link-ups with outreach activities around the University.

Feedback from school and college students on the content of the lectures, and on the ability of the technology to provide a useful medium for delivering the message, will be obtained by (anonymous) electronic surveys. AG-mediated discussions with subject teachers at the schools and colleges will be used to tailor content to fit the curriculum, and to evaluate the overall project.

Wider availability of the recorded sessions has been discussed with two representatives of the IET.tv "broadband television service", exploring the potential provision of a "Science for Schools" channel, with concomitant video hosting and streaming capabilities, and relationship with other IET initiatives.

Further outcomes will be reported at the conference.

CONCLUSION

Access Grids have been widely used in Universities and other research institutions for group-to-group research seminars and meetings, and now they are being deployed to improve interactions with other educational institutions. The effective use of AG technologies will help us to explore distance and work-based learning in response to the changing global market.

We are keen to expand on the achievements to date in this regard, and our successful tests with Coombe and Esher demonstrate substantial potential. The outreach team, and project participants, are keen to hear from other schools and colleges in the area interested in these activities.

There are further benefits, also, in the project's use of AG technologies: reducing the demands on time and travel for such efforts, compared to traditional activities, also reduces emissions of carbon dioxide and strains on the local road network. The project will certainly have been a success if the schools, the future of the IT profession, and the environment all benefit from it.

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