The Ring

The Newsletter of the University of Cambridge Computer Laboratory Graduate Association
Chairman: Professor Ian Leslie
President: Stephen Allott

COMPUTER LABORATORY UPDATE

A talk to the Cambridge Computer Lab Ring by Frank King, Peter Robinson, Alan Blackwell, Ian Pratt, Steven Hand and Ian Leslie

March 17th 2003

Meeting report by Stephen Allott
Director of Development, Cambridge University Computer Lab

TEACHING

The 50th anniversary of the Diploma course is in October 2003. The Diploma is the oldest taught computer science course in the world. Frank King who has special departmental responsibility for teaching, said that he admired the people who had set up the course. They had not been able to borrow from other courses around the world but had had to design the Diploma from scratch. This was a bit like setting up the world's first flying school. Originally called the Diploma in Numerical Analysis and Automatic Computing, Numerical Analysis was kept in the name until 1970. Today's exams still contain 4 questions on numerical analysis. Frank showed a question from a 1954 exam which harked back to an era when number crunching was done by hand. He also showed an example from the same paper on Boolean algebra which heralded the modern era.

Peter Robinson then took over to explain how the course had developed over the years. After the Diploma course was established in 1953, extra departmental teaching started in 1964, the University Computing Service was started in 1970, a one year Tripos course in 1971 which was a Part 2 Natural Science Tripos. A 2 year Tripos course started in 1978. The MPhil in Speech and Language started in 1985 and the 3 year Tripos course in 1988. The total number of students in the department has now grown to over 500 with the biggest growth coming in the past 10 years. There were only 300 students 10 years ago. Numbers on the Diploma have shrunk because Government funding has been with drawn.

The idea is still to teach principles so no C++ is taught for example. The course is pretty self contained and there is no collaboration with other departments. From a base in engineering, hardware and software, the course has expanded to cover systems, applications, maths and theory, users, psychology and linguistics.

Admissions to the University have changed. In 1973, the University had 3422 applicants for 1786 places. Only 900 of those gained 3 A's at A level. In 2000, Cambridge had 9600 applicants for 2840 places but 5000 people had 3 A's at A level.

The Department is moving towards a 4 year course due to a growth in the breadth and depth of the subject, increased overlap with Engineering and other disciplines, more 1st year options, a modular 3rd and 4th year and more practical work.

DIGITAL DESIGN

Alan Blackwell gave an overview of the Department's work on Digital Design. Before joining the faculty, Alan worked in software engineering and developed advanced programming tools for Cambridge Consultants. He developed an interest in the psychology of how programmers do their work. Alan explained that the issue is often *what* to build rather than *how* to build it. This requires an understanding of usability, the context in which a system is used, creativity and collaboration with other disciplines.

Alan's research includes work on remote controls for consumer systems, user programmable parameterised Excel functions, next generation enhancements to Microsoft Internet Explorer and tangible user interfaces for children using the Web in the classroom.

Alan has established the Crucible research network in interdisciplinary design in Cambridge. This has explored creativity in design, bringing painters to Cambridge. A face on a screen was programmed to mimic the expression of people looking at the screen. They also modelled turbulent flow graphically. There are many departments already working on digital design including Architecture, Moving Images, the Urban Design Studio, the Engineering Design Centre and Modern Languages.

SYSTEMS RESEARCH

Ian Pratt explained that the Systems Research group was a large active group in the Department. He gave a detailed overview of the Xenoserver project.

Steven Hand mentioned some other current projects. Palimpsest provides scalable wide area storage. Symphony improves I/O speeds to make machine response faster by predicting what code which be used. Planet Lab is a global networking test bed made available by Intel.

OVERVIEW

Ian Leslie concluded by saying that the Department has started to grow, now that we have moved into the new building. The embedded Intel Lab is now open. The Computer Lab is part of the Technology School in the University along with Engineering, Chemical Engineering and the Judge Institute. The West Cambridge site will be the focus of development for technology.

After some questions we adjourned to Churchill College for dinner.

The Rainbow Group

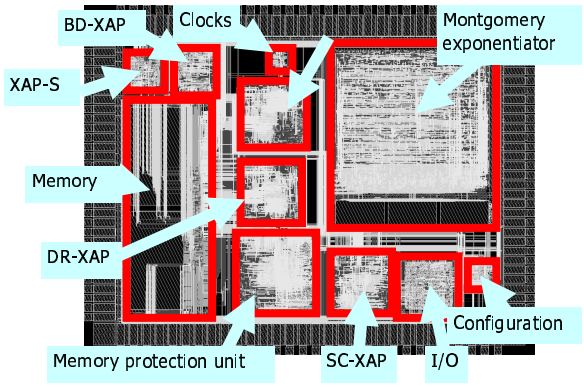
The Rainbow Group is the Computer Laboratory's research group in computer graphics, human computer interaction, and electronic computer-aided design.
http://www.cl.cam.ac.uk/Research/Rainbow/

"*Research work in computer graphics has been done in the Computer Laboratory for many years and the title* Rainbow Group *goes back to 1965 when a very early DEC PDP7/340 display system was purchased, and we thought we were about to discover pots of gold. Maybe we did.*"
Neil Wiseman, the founder of the group, wrote those words around 1990. The group's original work was in the use of computers for ECAD: the design of electronic circuits on a computer. In those early days the group had to develop its own graphics systems, input devices and display drivers in order to be able to do its research in ECAD. Over the intervening years, computer technology has developed considerably; the group still works in ECAD, graphics and interaction, but the three research areas have become somewhat separated
In recent years there have been projects to build innovative display systems (Rainbow, Garland, an HDTV system, and a succession of autostereoscopic 3D displays), to explore techniques for image generation and storage, to study applications in printing, publishing, television, cartography and animation, to develop novel user-computer interaction mechanisms, and a return to the group's roots with new research projects in ECAD. The group currently includes four full-time members of the Computer Laboratory's academic staff:

- Peter Robinson (Reader in Computer Technology) works on applications and interaction;
- Neil Dodgson (Senior Lecturer) works on modelling, imaging, and displays;
- Simon Moore (Lecturer) works on ECAD and architectures; and
- Alan Blackwell (Lecturer) works on interaction and design.

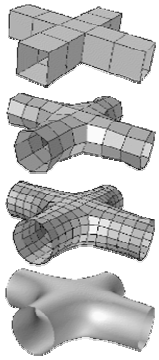
They are supported by eight post-doctoral associates working on research contracts and twenty research students working towards the PhD degree. They collaborate with a variety of other organisations within the University, including the Engineering Design Centre and Laboratory for Communications Engineering in the Department of Engineering, the Cambridge University Moving Image Studio (CUMIS), the Cambridge Centre for Applied Research in Educational Technologies (CARET), the Cambridge-MIT Institute (CMI), and Crucible, the Cambridge University network for research in interdisciplinary design. Other projects are supported by the European Union, the EPSRC, and through links with companies such as Altera, ARM, Cambridge Animation Systems, Cambridge Consultants, IBM, Intel, Microsoft, Numerical Geometry, Seiko-Epson, and Sun. A number of companies have spun out of research in the Rainbow Group, including ASD Systems (autostereoscopic 3D displays) and Advanced Rendering Technologies (hardware-assisted ray tracing).
Current research is divided into the three broad areas of ECAD, graphics, and interaction.

ECAD & Architecture



This sub-group is led by Simon Moore. Recent work has included the design and comparative analysis of a variety of self-timed microcontrollers, that is: micro-controllers which do not require a clock. Five different implementations of a 16-bit processor were built: a conventional synchronous (clocked) version and four asynchronous (self-timed) versions (bundled data, dual rail, one of four, secure). Comparisons were made between the devices to ascertain which were best under various conditions. This has led to work on the use of self-timed circuitry for secure smart cards, an EU funded project on which the Rainbow Group and the Security Group are collaborating. Smart cards, such as your credit or debit card, now contain small chips which can do various pieces of processing, including cryptographic calculations. It is important that they cannot be cracked by criminals. We have made significant advances in defeating one of the key attacks which can be made on "secure" smart cards.
Other work in this sub-group has been in the use of self-timed concepts for building embedded processors, systems on a chip, and multi-threaded processors.

Graphics, Modelling, Imaging & Animation



This sub-group is led by Neil Dodgson. The principal research over the last two years has been in subdivision surfaces. These are a mechanism for representing 3D shape which has been around since 1978. Sufficient memory to implement them efficiently has only recently become available and this has led to the widespread use of subdivision in the computer

animation industry. For example, Pixar's early movies, *Toy Story* (1995) and *A Bug's Life* (1998), were modelled using the traditional NURBS surface representation, while their more recent work, *Toy Story II* (1999) and *Monsters Inc.* (2001), have used subdivision surface representations. Unfortunately it transpires that, while subdivision has advantages over NURBS, it produces artifacts in the surfaces which make it unusable as a CAD design tool for, say, the design of cars or aircraft. Our current work is in the analysis of these artifacts and in the investigation of mechanisms which do not produce the artifacts.
Other work in this sub-group includes intelligent down-sampling of 3D geometry, texture synthesis and editing, intelligent image compositing, human figure animation based on psychological theories of behaviour, the synchronisation of sound and animation, and typography.

Applications & Interfaces

This work is led by Peter Robinson. The over-arching theme is the use of technology to improve user-computer interaction. The group has a long history of the use of video cameras and video projectors as input and output devices to add functionality to conventional objects. *BrightBoard*, for example, was a perfectly ordinary whiteboard with a video camera pointing at it. Software analysed the camera's images and provided extra functionality. The simplest example being that drawing the letter P in a box on the white board would cause the nearest printer to produce a hard copy of whatever was currently on the board. The *DigitalDesk* project was another take on this, with a video projector projecting onto a standard desk and a video camera looking at the desk. This work has been continued with the *Escritiore*, which is a large desk whose interface mimics sheets of paper. Two projectors create a foveal display where there is a small high-resolution area just in front of the user and a large low-resolution display area over the rest of the desk. Interaction is via two pens, one held in each hand. The dominant hand does fine work (drawing, handwriting), while the other hand is able to drag pieces of digital paper around on the desk.
Other work in this area considers giving computers emotional information through analysis of the user's face or the user's voice, leading to interesting questions; for example, should your computer respond differently if you are unhappy, angry, or bored? This sub-group are also looking at context-aware applications (e.g. if your PDA is aware of its location, what useful extra functions can it perform?), adaptive tutorial systems, easy-to-learn interfaces for domestic appliances, and interfaces for users with special needs.

Interdisciplinary Design

This work is led by Alan Blackwell. He participates in a wide variety of projects which, by their interdisciplinary nature, involves him with a range of departments across the University. He is co-director of Crucible, the Cambridge University network for research in interdisciplinary design. He is currently managing research associates on two projects in the Rainbow Group: the EU funded Webkit project, providing tangible interfaces to the world-wide web in schools, and the Joint Urban Design Studio, a CMI-funded project investigating the use of technology in collaborative design between sites in the US and UK.

Cambridge Computer Lab Ring events calendar (see also www.camring.ucam.org)

If you have any suggestions about events you would like held or speakers you would like to hear, please contact jan.samols@cl.cam.ac.uk

22nd May 2003
Spring Drinks
At Equisys plc, Equisys House, London, SE1 9EU

For a ticket, please send a cheque for £8 (made payable to Cambridge Computer Lab Ring) to Cambridge Computer Lab Ring, William Gates Building, JJ Thomson Avenue, Cambridge, CB3 0FD. For further details, please contact Jan Samols on 01223 763585 or email jan.samols@cl.cam.ac.uk

Profile – Apama

In the second in the series of articles profiling companies founded by Computer Lab graduates, 'The Ring' talked to John Bates, President and Chief Technology Officer of Apama, which he founded in 1999. John completed his PhD in mobile and distributed computing in 1993 and was a Lecturer and Fellow of St Catherine's College until 2000.

TR: John, to start with can you give me a brief description of Apama in terms of history, product and geographical scope of your activities?

JB: Apama aims to be the market-leading provider of software to power the *real-time enterprise*. Driving business in real-time is emerging as an important requirement. Rather than collecting data about your business and storing it in a data warehouse for later analysis at end of week, month or quarter, real-time is about analysing data as you go along – so you always know the state of your operations and you

can make instant informed decisions. An example is an Investment Bank spotting a money-making pattern in the market and carrying out the necessary stock buys and sells immediately. Apama provides the software to make this possible.

The company was founded by Computer Lab graduates. One of my co-Founders, Dr. Giles Nelson (also a CL PhD), is now our Chief Architect. Apama evolved from a consultancy company we founded in 1995, and aimed to capitalize on some ideas developed in the area of real-time information analysis. At the time, database technology was the principal way of analysing information. However, databases fall over if pushed with too many updates, and too many queries – exactly the requirements when dealing with real-time changing information. New algorithmic approaches turned the problem on its head, enabling the real-time data to be flowed through the queries that users wanted to monitor. As an illustration of what this approach gives you, Apama's software is powerful enough to monitor all the world's stock exchanges concurrently looking for trade opportunities for an Investment Banking customer.

Apama is currently selling its real-time technology into the US market, out of New York, and into the European market out of London. R&D is based in Cambridge – where the talent is!

TR: Is the downtrend in the economy affecting business?

JB: Initially it certainly caused a pretty rapid rethink of strategy and now it is actually helping us in some ways! We needed to build a base of reference customers through direct selling, and we went after telco business to start with. But, as the telco sector went into meltdown, because we had a generic technology, we had the luxury of being able to shift into another sector. We selected capital markets, because the downturn can actually provide us with a business opportunity. In capital markets, Apama is selling a platform for creation and management of real-time trading strategies. A number of factors in the downturn help to make this compelling. Firstly, traders are being laid off – and the remainder need powerful tools to help them plug the gaps. Secondly, the market is more volatile and getting new strategies into the market quickly to capitalize on an opportunity is important. Thirdly, as IT staff are laid off, Apama offers a cost saving alternative to the brute force approach of teams of programmers.

TR: What are the key factors and challenges to the company's ongoing success?

JB: The key challenge is not the technology. It's ensuring that the solutions built on top of the technology address compelling business pain points, that can't be solved easily without our technology, and have a high value attached to them.
TR: Where do you see the company heading in the next 3-5 years?

JB: There is a huge opportunity in what the Gartner Group call BAM: Business Activity Monitoring. This is part of the real-time enterprise and is perfect for Apama to enable – providing personalized dashboards that plot real-time views on the changing underlying business data. Within the next 3-5 years, Gartner and other analysts agree that this will be a multi-$billion market. And Apama aims to be the market leader. We are already working with partners, such as IBM and HP, to provide BAM solutions to their customers.

TR: If you could tell me just one thing about Apama, what would it be?

JB: There is only 1 member of the technology team that does not have a Ph.D. (and that's my fault for dragging him with me before he got a chance to do one!)

TR: What advice would you give other graduates thinking of starting their own business?

JB: The technology is not as important as you think! It only becomes important when you sell things and they have to work. But there is SO much to do before you get there. Get in a CEO who has done it before (in a similar company, in a similar sector, and in a similar climate) to build your company for you. You'll learn loads and avoid a lot of pain!

TR: John, thank you very much. I wish you every success with Apama.

Xenoserver project

By Systems Research Group

OVERVIEW

The Xenoserver project is building a public infrastructure for wide-area distributed computing. We envisage a world in which Xenoserver execution platforms will be scattered across the globe and available for any member of the public to submit code for execution. Crucially, the sponsor of the code will be billed for all the resources used or reserved during the course of execution. This will serve to encourage load balancing, limit congestion, and hopefully even make the platform self-financing.

A global infrastructure such as we propose is essential to address the fundamental problem of communication latency. By enabling principles to run programs at points throughout the network they can ensure that their code executes close to the entities with which it needs to interact. As well as reducing latency this can be used to avoid network bottlenecks, to reduce long-haul network charges and to provide a platform over which code provided by transiently-connected mobile devices can maintain a network presence.

Our approach is distinguished from existing work on mobile agents, execution platforms, code hosting and the like by two principles:

Tackling difficult problems at the same time. Acceptable designs for execution environments, resource management, resource discovery, authentication, privacy, charging, billing, payment and auditing are all crucial to the success of our platform as an infrastructure service open to and accepted by the public. Existing work has tackled individual subsets of these problems, but tensions between the issues concerned mean that solutions proficient in some dimension are lacking in another.

No brave new world. Our platform will host applications written in today's programming languages against existing APIs -- and, we believe, those written with tomorrow's languages and

libraries. We do not want to mandate a particular code distribution format or a particular middleware toolkit for distributed programming.

Test-bed deployment During the project we are building and deploying a test-bed set of XenoServers around the globe and making these available to authenticated members of the public. In this environment accurate resource accounting and pricing is critical -- whether in an actual currency or one that is fictitious (but still scarce). As with our existing work on OS resource management, we believe that these prices will provide the necessary feedback for applications that can adapt, or act to prevent over-use by applications that cannot.

Xenoservers are useful for:

- hosting network services such as multiuser games,
- media stream transcoding and distribution
- mobility; providing a platform for distributed applications
- networking facilities such as multicast
- rapid deployment of active web content and services

Our initial deployment of the XenoServer Open Platform will provide:

- Quality of Service guarantees available for all resources. Timely CPU scheduling, network transmit limiting, guaranteed disk bandwidth, memory usage and external response times, for instance.
- Fair charging for all resources used, and all temporal and spatial resource reservations.
- Vertical structure to avoid denial of service attacks and crosstalk in system servers, using our experience from our work on Nemesis
- Flexible protection between all different services and applications.
- Resource managed Java Virtual Machine for Java applications.
- Distributed trader for discovering Xenoservers.

WITHER THE TELECOMMUNICATIONS INDUSTRY

A talk to the Cambridge Computer Lab Ring by David Cleevely, Chairman and Founder of Analysys Ltd.

January 23rd 2003

Meeting Report by Stephen Allott
Director of Development, Cambridge University Computer Lab

The telecommunications industry has passed through an extraordinary boom and bust cycle. It has also seen a huge rise in the volume of data communications. Networking is now central to computing. Dr. David Cleevely, Founder and Chairman of Analysys Ltd in Cambridge, the leading specialist consulting firm in telecom economics, came to talk to the Ring about the future of the industry. With a highly expert audience including Andy Hopper, Ian Leslie, Derek McAuley,

Robert Sansom and many others, David gave us an upbeat view on the industry's future.

David covered 3 topics:

- ¶ Where is the industry in the economic cycle?
- ¶ What will drive a return to health?
- ¶ What is hot in the industry?

WHERE IS THE INDUSTRY IN THE ECONOMIC CYCLE?

It is not the end of history but the industry is at a turning point. Although there were some visionaries over 30 years ago who foresaw elements of the Internet, David gave an example of how he found the Monty Python dead parrot sketch on the internet using Kazaa. This type of usage was unforeseen. Despite the huge growth in the internet and the rise of telecommunications traffic, there has been a huge boom / bust in telecom share prices. What went wrong?

Madness took over in the autumn of 1999. Share prices of France Telecom and Deutsche Telekom reached a peak in March 2000 enabling these companies to go on a buying spree. Deutsche Telekom bought Voicestream in the US. France Telecom bought Orange in the UK. By September 2001, the Financial Times reported that a large telecoms operator was going bust every 6 days and that 300,000 telecoms jobs had been lost. Why had share prices gone up so much? What had been the evidence for growth? Between 1985 and 2000, telecoms as a % of GDP had risen from 1.5% to 2.8%. World telecoms revenue in the same period rose from $300 billion to $850 billion. Plenty of growth. At the same time, IT was transforming the global economy. Rapid falls in the cost of basic technologies fed through to falls in the cost of IT to users. This stimulated short term demand, increasing volumes and reducing costs further. The low cost of IT led to a structural increase in demand for IT and telecoms. The scale economies are substantial. NTL announced that in 2002, for an increase in 3% of the capital cost of their network, they were able to double capacity. But for regulatory barriers, London and New York could easily be a single local calling area. Companies re-organised to take advantage of these changes. Ford, for example, developed global centres of specialised activity.

The results have been astonishing. In one day in 1999; all the world's trade from 1949 took place, all the world's scientific projects from 1960 took place, all the world's telephone calls from 1983 took place and all the emails from 1990 were sent. Despite this level of growth in activity, there are signs of a slowdown in the growth of telecoms revenues. Year on year revenue growth was 13% in 2000, 10% in 2001 but only 5% in 2002 when revenues were $236 billion. The growth slowdown is marked in the mobile market. After year on year growth in European subscriber numbers of 67% in 1999 and 69% in

2000, growth fell to 37% in 2001 and was a mere 7% in 2002. Mobile subscriber penetration in Europe was 75% at the end of 2002. The strong growth in 1999 and 2000 was caused by the advent of prepay mobile phones. The number of telcos in Europe has fallen. The number of public network operators fell to 1561 in August 2002 from 1583 a year earlier. The number of voice operators fell to 1231 in August 2002 from 1352 a year earlier. A private Analysys survey (which was being unveiled for the first time today) in late 2002 showed that whilst operations costs continued to fall, activity rose. Increased competition from October 2002 onwards, probably from bankrupt operators such as Worldcom, caused revenues to fall. Despite this, traffic volumes continue to rise. The question is whether prices will fall faster.

WHAT WILL DRIVE A RETURN TO HEALTH?

After the overinvestment up to 1999 and then the collapse in share prices in 2000, revenue growth has slowed over the past 18 months. Consolidation is now taking place on the supply side enabling supply to match demand. David believes this is occurring at the moment. He foresees revenues starting to increase and investment re-starting in 2004.

Over 25,000 broadband connections are being added each week in the UK; about 2-3m per month worldwide. There are now 1m UK broadband subscribers. China, Japan and Korea are large broadband markets. Japan has 0.5m homes with optical fibre. Broadband prices are falling. Annual Revenue Per User ("ARPU") is now £280 for fixed residential in the UK and £3,600 for fixed business users. Both have been growing very slowly. Mobile ARPU has fallen fast to now be under £200. How does one sustain investment with falling ARPU caused by substitution of packet voice over broadband for fixed voice? Broadband has low variable costs.

Underlying profitability for some carriers has been very good. Vodafone has margins almost as good as Microsoft. Broadband however changes communications into connectivity. It supports multiple services and applications and has huge economies of scale. It opens up new tariff structures and destroys existing business models. It will however open up co-constructed markets. One problem is that business models for the future are not yet clear. There will be cannibalisation of revenues, flat tariffs, peer to peer networking and disruptive technologies. An example is Stokab in Stockholm. It's a municipal duct utility which sells duct or dark fibre to telecoms operators at a long run cost-based price. This has enabled a company called B2 to offer unlimited local calling at 5 euros per month.

WHAT'S HOT IN THE INDUSTRY?

Disruptive technologies can transform an industry. David gave the example of hydraulic machines, invented by a Birmingham company in 1948, bankrupting 22 out of 25 manufacturers of steam shovels 20 years later despite the fact that they all had hydraulic machine development programmes under way. SIP (session protocol) could change telecoms by removing the need for an intermediate telco. Wireless LANs are very cheap and could disrupt 3G business models. Where will it all lead?

You can use your mobile phone as a key but you cannot use your key as a mobile phone. The new PACE set top box is an active TV. Call centres are now centralised. We expect there will be ubiquitous networks with many competing players. With Moore's law doubling performance every year, we are only now into the second half of the chessboard; David mentioned the Chinese story of doubling a grain of rice for every square on the chess board. We have the second half of the chess board still to come. There are plenty of examples of good future predictions. An Economist article from 13 May 1954 was good at predicting the growth in the use of computers. David's predictions:

Telecoms is not one market. There are ducts, cables, network transmission, services and content. One goes from economies of density at the duct level to economies of scale at the content level. There are 2 possible industry structures. Vertical integration or horizontal players. IP still has yet to really change things. Telecommunications will vanish from view and be taken for granted. The content layer will be huge. The infrastructure layer less important. Hence telecommunications as we presently know it will wither but IT will be ubiquitous. There may be duct utilities and content competition.

David made a fascinating observation that his children's access to content had got more local over time. In other words, access to content becomes more about access to the content of one's local human contacts.

David concluded by saying that people over estimate change in the short run but under estimate change in the long run. This suggests to me that change has only just begun.

We then had many questions. Derek McAuley on how the PTTs can be stopped from vertical integration. David Cleevely, giving examples, said he did not think that vertical integration would work. Ian Leslie asked about 3G operator strategies; whether they would go low cost/high volume or the reverse. David predicted that "3" would go for the former. Norwich is building a duct utility. DG 4 in the European Commission has supported subsidies for duct utilities. Now what is needed is to solve the coordination problem on how to get joint usage of the capacity that has been built.

Crucible

The Crucible network has been created to encourage research in interdisciplinary design and involves representatives from more than 20 academic disciplines in addition to a range of applied and commercial areas, including representatives of most major traditions in HCI research.

The Crucible programme aims to create a new mode of engagement between the academic community and its social context, such that academics are more broadly engaged in the exercise of designing for society.

Crucible projects have been funded by an extremely diverse range of national and international funding bodies, and the results have included educational and public policy outputs as well as conventional academic research.

There are several ways in which Ring members can become involved with Crucible:

- Guest lectures on engineering and design
- Adopt a group project, either:
  - as technology provider, or
  - as realistic client
- Training and consultancy
- Interdisciplinary research collaboration.

For more information, contact Alan Blackwell at the Computer Lab or see www.crucible.cl.cam.ac.uk.

COMPUTING CAREERS PROJECT UPDATE

by Stephen Allott

The Ring has been set up to help Laboratory graduates achieve more of their career potential. We have been working since December 2002 on a project to identify the issues in this area and then to make changes which directly help members in their careers. This work is central to the goal of the Ring. It is also an important gap in the market. Cambridge University now provides plenty of help for people who want to set up companies, is well set up to partner with industry and has the Development Office ready and waiting to ask successful graduates for donations. What has been missing is help for people to succeed in their careers and become successful. The Cambridge way has always been to assume that people can and should take care of themselves. Survival of the fittest has many virtues. Many Cambridge people achieve great success. We reasoned however that making a small improvement to everyone's career would have a major pay-off.

Hence the Ring's Careers Project which covers 3 phases: student summer placements, finding the first job on graduation and third, subsequent career progression after Cambridge. An early initiative was to invite successful graduates to come back to the Laboratory to talk about their careers. At the Building Opening on 1 May 2002, 6 graduates formed a Panel to talk about the lessons learnt in their careers. The group was selected to cover different parts of the computer industry (applications software, middleware and operating systems, chips, services, networking and telecoms) and different roles (CEO, research, marketing, consultancy and development). David Colver from Operis, Andrew Herbert from Microsoft, Mike Muller from ARM, Nick Rule from Logica, Robert Sansom from FORE and Stephen Thomas from Geneva were the panelists and talked to a large audience of faculty, graduates and students. In November 2002, a separate careers talk for current students was held. Steve Harrison from Logica talked about careers in a computer consultancy and Mike Muller returned to talk about hardware careers. In January 2003, the Computer Laboratory Supporters Club held its annual recruiting fair. Although the number of companies attending was well down on the peak of the bubble, all the companies attending told me it had been one of their best ever. The scarcity of jobs seems to have turned the tables making students much keener and attractive to recruiters.

As well as organising events, we have been doing detailed research to find out where the issues currently lie with computing careers in the UK and to find out what changes are needed. We started our research by talking to the University Careers Service. The new Deputy Director, David Ainscough, is an experienced IT industry executive and is the Computer Laboratory specialist. We have been impressed by the quality of the services the Careers Service offers to current students. As well circulating vacancies, they provide counselling on career choices and coaching on essential job hunting skills. Almost too good to be true is that Cambridge graduates can continue to use their services for the rest of their careers for a very modest fee. If you want help, do contact David direct. We continue to work very closely with the Careers Service to develop careers for Cambridge computer scientists.

We have been conducting face to face and telephone research amongst Ring members over the past few months. The results of this research are synthesised for presentation to the Head of Department and will form the basis for change in the Department going forward as well as setting the agenda for Ring activities. If you have strong views on careers or important information to share, please get in touch. We have found that student summer placements were rare in the 1980's but became common place in the 1990's. People particularly liked doing summer placements in Cambridge itself because they could live in College. Please consider whether your company could offer a summer placement to a current Laboratory student.

People have followed a very broad number of careers. I am sure that entropy causes people to disperse over time into wider and wider ranges of careers. Whilst many have pursued mainstream computer related careers and a substantial number still live in Cambridge, many are in London, around the UK, in Europe or the Far East and the USA. As well as geographical dispersion, members work in many industries covering computer company in-house research departments, all types of computer company from IBM to Sun, from Microsoft to Intel, from Logica to Cambridge Consultants, the City, local government, venture capital and many others. A large number appear to work in software companies both large and small. We would like to know where people are now, why they got there and what lessons they would pass on to successive generations.

Some recent trends for recent graduates are that around 2/3rds of graduates take a first job in the UK (most of the rest continue in academic careers). Over half of those taking jobs in the UK, take jobs in computer companies. The IT recession has depressed the numbers going into computer companies in the past 2 years whilst more have gone into end user industries and the City. As well as doing summer placements, 3rd year Cambridge undergraduates are postponing the milk round until after graduation to enable them to focus on their degree. Overall the number of students in the Lab has risen strongly over the past 10 years.

We shall continue this research and plan to conduct a systematic survey of Laboratory graduates to find out where you are working, why you are there and what help you would have valued in the past.

In the meantime, the Ring has a growing list of members who have volunteered to provide informal careers advice to other members. You can volunteer by making the appropriate selection in the online Ring directory. To find the list of careers advisers, simply select "Yes" under careers advice when

making a directory search. Please advertise any jobs you have on the Ring jobs bulletin board. It's free and only accessible by members. Vacancies for raw graduates should still go to the Supporters Club or to the University Careers Service. The Ring helpline has also been busy. After several questions on work permits for foreign students, we attended a briefing organised by the University Careers Service. It is now pretty easy to get a work permit for a foreign employee. The key is that the company has to make a job offer and then apply for the permit. Although one may still have to advertise the role to show that no comparable EU candidate can be found, in practice this is not likely to be a barrier to obtaining a permit. Many companies may not realise this and may rule out foreign job applicants without permits. We suggest that you choose the best qualified candidate regardless of permit status and then obtain the best quality legal help to obtain a permit. The Careers Service can recommend qualified immigration lawyers to help with this.

In the immediate future, therefore, we shall be continuing our research to identify your key career issues. Please let us know what they are. We are also making changes to help current students get more information on career prospects.

We have formed a Careers Committee to supervise this work. If you would like to volunteer to serve on this Committee, please contact me.

Entrepreneurship Courses at Cambridge

We have found over 70 businesses founded by Computer Lab graduates; a very impressive number. Now help in at hand from the University's Entrepreneurship Centre.

Find out how to be an entrepreneur in a week over the summer. Entrepreneurship is a growing industry in Cambridge and the Cambridge Entrepreneurship Centre at Cambridge University is a great source of help to people starting companies. With 1,500 technology companies in Cambridge employing some 45,000 people, it's a buzzing place to learn about entrepreneurship.

The week long Summer School is being held this year from 7 to 12 July 2003. For anyone with a technology related business idea, the Summer School is an intensive one week course that will give you the tools, contacts and confidence to transform your idea into a successful business venture. As well as meeting useful contacts, you will be able to test and develop your idea in a high calibre environment.

For more information on the course, contact Jo Mills on summerschool@cec.cam.ac.uk or see www.cec.cam.ac.uk/teaching/summerschool.html

Cambridge University Careers Service

The Careers Service offers careers advice and information to all Cambridge graduates throughout their career. They have 11 full time careers advisers and a great deal of information on companies actively recruiting now. David Ainscough, the Deputy Director of the Careers Service, is assigned as a specialist for the Computer Laboratory. A history graduate from Oxford, he took a diploma in IT before working for Glaxo for 5 years. He then moved to Cambridge to work for Generics Group plc and has now lived and worked in Cambridge for many years.
To book an appointment with David phone the Careers Service on 01223 338283.

Business Hall of Fame

Thank you to all those who contacted us to add a company to the list. They are as follows. The full list - which currently stands at 73 (and is the largest number of any of the University's departments) - can be found on www.camring.ucam.org.

Nat Billington
Lorenzo Wood
KBW Consulting (f.1992)
Delivers innovative interactive solutions. Merged with Oyster in 1998

Rob Campbell
Kavanagh
The second largest Hewlett-Packard UNIX reseller in the UK

John Collins
Xi Software (f.1986)
Specialists in Unix and Linux software, developing high performance system management tools

Tim Coote
Duncan Grisby
Tideway (f.2002)
Develops systems to enhance the operations of IT departments

Nick Garnett
Jonathan Larmour
Ecocentric Ltd (f.2002)
Provides open source software for eCos operating system

Andrew Gower
Jagex Ltd (f.2001)
Specialises in producing Java games for webpages and is resonpsible for online titles such as RuneScape

Jan Hruska
Sophos Plc (f.1987)
A world leader in anti-virus protection, focused on defending businesses of all sizes from virus attack

Rex Hughes
Center for Internet Studies, University of Washington (f. 1999)
Established as the world's first university Internet Studies centre, it is an interdisciplinary research and teaching unit for the student of the Internet's global impact on society

Jong-Hyeon Lee
FiloSafe Corporation – formerly Filonet Corporation (f.2000)
Provider of secure online collaboration solutions

Filonet Korea Incorporated (f.2000)
Provider of information security consulting and collaboration solutions

SoftForum (f.1995)
Provider of public key infrastructure solutions and security consulting. IPO on KOSDAQ (Seoul) in 2001

Alex Shipp
MessageLabs (f.1999)
E-mail filtering company, removing unwanted items from SMTP e-mail. Messagelabs is currently the only company in the world to use Internet level virus scanning technology.

Adam Twiss
CacheLogic Ltd (f.2002)

Justin Wise
Curious Software Company Ltd (f.1999)
Develops ground breaking animation and visual content creation software for the broadcast television, video production, and presentation industries.

Computer Laboratory News

Building update

With new tenants on the second floor, the occupation of the building is finally complete.

Intel Research Cambridge, Intel's fourth lab in the Intel Research Network of labs, can be found on the South corridor. It is staffed by about 20 Intel researchers and an equal number of university researchers, graduate students, and visiting faculty. Its director, Derek McAuley, is an affiliated lecturer at the Computer Laboratory and founding member of the Marconi and Microsoft research labs in Cambridge.

The Engineering Department's Optics group and Laboratory for Communication Engineering are situated on the East and North corridor respectively.

Finally, the Cambridge Entrepreneurship Centre (CEC) is situated on the Central corridor.

Institutional Audit of the University by the Quality Assurance Agency for Higher Education

The Computer Laboratory is one of six departments selected for the audit. It will take place during the week beginning April 28th 003 by a team of academic auditors acting on behalf of the QAA. The resultant report will include an overall view of the strengths and weaknesses in the ways that quality and standards are set and maintained. All higher education institutions in England will have been audited by the end of 2005.

Cambridge Evening News announces the recruitment of Cambridge Computer Lab Ring's 100th member

Since the Cambridge Evening News' article at the beginning of March, another 67 lab grads have joined the 'Ring'. If you are in contact with any lab grads, please let them know about the association.

Obituaries

Professor Roger Needham

(originally published in 'The Independent' of March 8th 2003)

Roger Michael Needham, computer scientist: born Sheffield 9 February 1935; Senior Assistant in Research, Computer Laboratory, Cambridge University 1963-64, Assistant Director of Research 1964-73, Reader in Computer Systems 1973-81, head of Computer Laboratory 1980-95, Professor Computer Systems 1981-98 (Emeritus), Pro-Vice-Chancellor 1996-98; Fellow of Wolfson College, Cambridge 1967-2003; FRS 1985; managing director, Microsoft Research Ltd 1997-2003; CBE 2001; married 1958 Karen Spark-Jones; died Cambridge 28 February 2003.

Roger Needham will be remembered both for his work on early computer operating systems and for his more recent work on computer security. He was Head of the Computer Laboratory at Cambridge University for 15 years before running Microsoft's UK research laboratory based in the city.

Needham was brought up in Sheffield and educated at Doncaster Grammar School. In 1953 he went up to Cambridge and spent two years studying pure and applied mathematics, switching to philosophy in his third year. The benefits of the training in marshalling and presenting arguments received during that year were apparent in his later life.

Needham took a PhD in 1961, his thesis being on the classification of data. He then started working on computer systems at the Computer Laboratory (of which I was then Head), becoming a Senior Assistant in Research in 1963. The laboratory was engaged in a major project to develop an operating system for a special computer built for it by ICT (later ICL) and eventually marketed under the name Atlas 2.

This was originally intended to be a batch-processing system. However, in 1963 time sharing broke on the world, and I took the decision to reorient the project so as to develop a time-sharing system (one that allows multiple users to access a single computer at the same time). This presented a huge challenge to the team. Needham made a major contribution to the work and helped to carry the project through to a very successful conclusion. In particular, he invented a system of password scrambling that has become generally adopted in the industry.

Needham served with equal success as leader for a number of succeeding projects. The last of these in my time as head of the laboratory was the Cambridge Model Distributed Computing System, which was based on the Cambridge Ring, a pioneering wide band local area network. The Cambridge Model Distributed System was a very early client-server system, and foreshadowed thin client computing.

Needham was appointed head of the Computer Laboratory in 1980 on my retirement. I had come to rely greatly on him, not only as a project leader, but also for the help he gave me with strategic research planning for the whole laboratory. The handover took place in a seamless manner.

Soon after Needham took over the laboratory, the British Government decided to put extra money into computing, or IT, as they called it. Not only did this make significant staff increases possible, but it also

made more money available for research. The laboratory also grew on the teaching side, and became one of the major teaching departments in the university.

In addition to his work on laboratory projects, Needham found time to engage in other activities. He was a non-executive director of Computer Technology Ltd, a British minicomputer company. He was also a member of the Real Time dining club composed mostly of people in industry who were interested in real time applications.

He also established a close relationship with the Xerox Palo Alto Research Center (Parc), on the West Coast of the United States, working as a visiting consultant from 1977 to 1984. This gave him an opportunity to observe and participate in work with the Alto and Dorado personal computers, giving him a taste of what it would be like at a time in the future when personal computers of great power had become generally available at low cost. When a number of research workers at Xerox moved over to the Systems Research Center of Digital Equipment Corporation, also in Palo Alto, Needham went with them.

At Palo Alto, Needham met Mike Schroeder and others who shared his interest in encryption as an aid to computer security. Needham and Schroeder jointly published an important paper on encryption and authentication in 1978. He also worked with Mike Burrows and Martin Abadi on a formal logic of authentication. This could be applied to the authentication of security protocols, a matter to which Needham devoted much attention.

Needham became interested in administration at the university level. He was a member of an important committee whose deliberations led to far-reaching changes in the way Cambridge University was run. These included changes in the role of the Vice-Chancellor, and the way in which he was appointed. It also provided for the establishment of two Pro Vice-Chancellorships. These changes took effect in 1992. In 1996, when the new system was well established, Needham was appointed a Pro Vice-Chancellor with special responsibility for research, and was thus enabled to play an important part in the management of the university at the highest level.

Needham enjoyed these activities but he always liked new challenges. Moreover, a time was approaching when he would reach the age limit for employment within the university. Therefore in 1997, when he was invited to set up and run a new research laboratory for Microsoft in Cambridge – the first research centre outside America – he seized the opportunity with alacrity.

The object of establishing the Microsoft Research Laboratory was to undertake long-term research, and Needham concentrated on the appointment of first class people with the intention of giving them a free hand. Under Needham's vigorous leadership, the laboratory made rapid progress. It is now in its sixth year and has 60 research workers on its staff, many of them leading people in their respective fields.

Needham was made a professor in 1981 shortly after he had taken over the headship of the Computer Laboratory. In 1965 he was elected a Fellow of Wolfson College. In 1985 he became a Fellow of the Royal Society, and in 1993 a Fellow of the Royal Academy of Engineering. The latter distinction gave him great pleasure, since he regarded himself as an engineer rather than a scientist. He was appointed CBE in 2001.

In 1958 Needham married Karen Spärck-Jones whom he had met when they were both research students. They developed the habit of discussing their work together and of reading each other's drafts. They continued to do this until the end. She is now Professor of Computers and Information in the Computer Laboratory.

Maurice Wilkes

Just two weeks before he died, Roger Needham attended an event at Microsoft Research to celebrate his 50 years in Cambridge and five years with Microsoft Research. The highlight of the event was a presentation of a book written in his honour by dozens of the world's top computer scientists.

Graduates in the News

We would welcome news of any appointments, distinctions gained or honours and awards made to graduates of the Laboratory. Please contact the Cambridge Computer Lab Ring office.

News of Members

U=undergraduate, G=postgraduate, year= year of graduation

Fred Roberts, U02, decided to take a gap year traveling through Africa. Nevertheless, he has still been putting his comsci skills to good use from a café in Accra, reactivating his mother's email and sorting out various other problems. His experience fixing bicycles could come in handy on his return though whether he'll have much cause to dig his way out of a desert remains to be seen. Fred will return to normality when he takes up a job on his return this summer.

Paul Menage, U96/ G02, is currently working in Sunnyvale, California for Ensim. He has been working on server virtualization to provide QoS and isolation for shared hosting servers, and mass hosting server management systems.

Roger Marlow, U92, is currently Head of IT Enablement UK for Thoughtworks, a software consultancy specializing in Agile software development.

Masahiro Abe, is moving back to Japan where he will be General Manager of Hitachi's Global R&D Operation Office in the R&D Group. Dr Abe will support the President in making global R&D strategy and controlling overseas laboratories in the US and China as well as Europe.

By the time The Ring goes to print, **David Hooper**, U00, will have run the London Marathon for the Leukemia Research Fund – the adopted charity of David's car club. David and his club have raised £150,000 since 1991 and David has so far raised over £1000 in sponsorship pledges for the London marathon.