Curriculum Vitae

Ian Malcolm Leslie

January 2010

Date of birth	11 February 1955
Citizenship	Canadian and British
Work address	The Computer Laboratory University of Cambridge JJ Thomson Avenue Cambridge CB3 OFD
Current Position	Robert Sansom Professor of Computer Science (previously Pro-Vice-Chancellor for Research to December 2009)
Research Interests	Computer communications, multiservice networks, distributed computing, operating systems, energy monitoring
College Appointments	Fellow, Christ's College, Cambridge
Email:	Ian.Leslie@cl.cam.ac.uk

Career Overview

Pre-Faculty Career (to 1983)

May – Aug, 1975 and 1976	Flight test analysis, Aerodynamics and Aeroelastics Departments, DeHavilland Aircraft of Canada
June 1977 – Sept 1978	Software designer, Quartic Systems, Toronto
July – Sept 1980	Intern, IBM Research Laboratory, Zurich
Oct 1981	Research Assistant, Computer Laboratory, University of Cambridge

Early University Career (1983-99)

Oct 1983	University Assistant Lecturer, Computer Laboratory, University of Cambridge
Oct 1986	University Lecturer, Computer Laboratory, University of Cambridge
Oct 1998	Robert Sansom Professor of Computer Science, University of Cambridge

My research focus has been in the area of networks and operating systems in which I have supervised 25 successful PhD students. My area of research has provided me with commercial opportunities: I have co-founded two companies and have had a significant consulting career.

By its nature, my work is collaborative, requiring teams that are large by computer science standards to take work from conception to implementation. My group has always had a culture in which working systems are the deliverable; publications on concept are followed up by publications on experience with prototype.

Arguably the main output of this work is a collection of PhD students who help shape the operating system and networking communities in the research labs of Microsoft, Citrix, AT&T, Google, other companies and universities. Technical contributions include early work with limited address space networks which produced an early version of Network Address Translation; the partitioning of network resources in an operating system-like fashion to allow resource-backed virtual networks (switchlets) which has become a standard feature in modern switches; and the leading in the early 1990s of a major EU funded initiative in operating system design, called Pegasus. The Nemesis operating system produced in Pegasus is the precursor — both technically and in personnel — to the Xen hypervisor whose commercial implementation is now the basis of many cloud computing platforms.

A major effort throughout the 1990s was to demonstrate that flexibility and simplicity in Asynchronous Transfer Mode networks — particular in the systems used to establish connections — were both possible and necessary for user level adoption. While producing some interesting technical outputs and the "OpenSig" community, the resistance from the traditional telecommunication community was not to be overcome. Ironically, some of the connection protocols for Voice over IP were first aired in OpenSig meetings.

Head of Department (1999-2004)

Oct 1999 – Sept 2004	Head of the Computer Laboratory, University of Cambridge
Jan 2001 – Dec 2004	Member University Council
2001-	Planning and Resources Committee
2001-2004	Executive Committee of the Council
2001-2002	Finance Committee
2003	Audit Committee (Chair)
2001-2002	Governance Committee
2002	Financial Working Party
2003	Working Group on Intellectual Property Rights

In 1999 I became head of Computer Science at Cambridge. I inherited a department with a strong reputation, but one that had flat research funding (I had the largest research portfolio) and which had entered into a relationship with Microsoft, who had just placed their first research facility outside Redmond in Cambridge. The department was also in the midst of planning a move from central Cambridge to the west campus. These were all causing disquiet in the department. I led the department through all these difficulties. When I stepped down as head in 2004 to take on the PVC role, I left a department with a buoyant research income (almost doubled over the five year period to approximately £2m per annum) and an overall expenditure of around £4m per annum. I argued for a gradual increase in resources to the Department which has continued to this day. The relationship with Microsoft is valued by (nearly) all and causes (almost) no disquiet within the University. The Department obtained a 5* (top) rating in the UK's 2001 Research Assessment Exercise, and came out on top, by a very considerable margin, in the 2008 exercise.

In 2000 I came to the view that the impediments to greater success for the Department lay within the University as a whole. At the end of 2000 I was elected to the University Council and served on many of the main Committees of the University. I was also involved in two significant working parties.

The first, the Financial Working Group, comprised Malcolm Grant (now Provost of UCL), Tony Minson (PVC Planning and Resources at Cambridge until July 2009) and me, supported by senior administrative officers. The Group was charged with producing recommendations to bring the University into financial balance. This led to a number of changes in financial policy — including the tightening up of loopholes — but most profoundly to devolution of budgets to the constituent Schools of the University. The University surplus/deficit has been tightly managed since this time.

The second working party was on intellectual property rights (IPR) policy. This group of four was charged with rewriting an IPR policy document that had been put forth but badly received by parts of the University.

Pro-Vice-Chancellor (2004 -2009)

Jan 2004 - Dec 2009	Pro-Vice-Chancellor for Research, University of Cambridge
2005 - Dec 2009	Member Science and Industry Council for the East of England
2004-	Board member of Greater Cambridge Partnership (Subregional body)
2004- Dec 2009	Board member of Cambridgeshire Horizons (Infrastructure delivery for Cambridgeshire)
2004-	Board member of Cambridge Network

In 2004 I became Pro-Vice-Chancellor. It was clear to me that I had to lead a number of important changes, and I knew of, both the reluctance within the University for change, and the mechanisms that could be used to oppose change.

A major task was clearly ensuring that submission to the 2008 Research Assessment Exercise (RAE) was made to optimise benefit to the institution. The RAE drives our research block grant from Government and accounts for approximately 20% of our income. When official results were released in December 2008, most league tables put Cambridge at the top. I have contributed significantly to the national debate on the Research Excellence Framework (the successor to the RAE) both in my role as PVC and as a member of the High Education Funding Council for England's (HEFCE's) Strategic Committee on Research and Innovation. I am currently also serving on HEFCE's REF Impact Pilot Steering Group.

Another major task was putting in place appropriate administrative support for research and commercialisation. I reviewed the Research Services Division of the adminstration as one of my first tasks. This had grown to be too broad; there was a lack of focus on mission. By combining research adminstration with commercialisation, including the establishment of new companies, the University had put what ought to have been the safest pairs of hands administering the largest revenue stream of the University together with the most financially speculative part of the operation: seed capital. Not surprisingly it was not a happy situation. The review recommended a split of these tasks and there has been a steady improvement in service (despite the enormous volume increases).

Administrative support for research has continued to improve despite an substantial growth in research activity — from £176m in 2003/4 to £260m in 2008/9 — as well as more a more complex regulatory environment.

Entangled somewhat with the administration of commericialisation process was the IPR policy. I believed strongly in the policy that the working group mentioned above had developed. I was able to rally opinion against a small but vociferous group who opposed it — during the height of the campaign the issue was reported in the national press — and

succeeded in getting the policy adopted by a vote in the University with both the largest turnout and largest majority ever (in 800 years!).

Moreover, I saw that the University's technology transfer office, while successful when simply viewed as a revenue generator, was underperforming. I took two further actions: setting up Cambridge Enterprise as a wholly owned company (completed in December 2006) and searching outside the UK for a new Director. Teri Willey, a former President of AUTM, formerly in the University of Chicago technology transfer office, and most recently a venture fund manager in the Midwest, took up the Directorship in August 2006, an appointment which has been welcomed with great enthusiasm within Cambridge and across the UK.

My international activies have been centred around research relationships, (for example building up the Low Carbon Energy University Alliance amongst Tsinghau, MIT and Cambridge) with a small number of institution-to-institution level arrangements. I represented Cambridge on the Rectors Group of the League of European Research Universities (LERU), which has given me considerable insight into the diversity of systems of higher education across Europe. I chaired LERU's Working Group on Post-Doctoral Researchers which examined the treatment and career paths of post-docs across Europe and made a series of recommendations for LERU institutions which are being followed up, including a soon to be published LERU policy document.

Another important international effort is in maintaining and widening our relations with Japanese corporations, both to assure industrial research funding, and to attract more Japanese companies to establish research laboratories in the Cambridge subregion. I have made many visits to China and am actively involved in building a broad relationship with China Mobile for the support of graduate students, executive education and research programmes.

The considerable efforts in China, Singapore and most recently continental Europe, to create "world class" research universities has caused me to focus on the long-term sustainability of Cambridge's position as a world leading university. I have paid particular attention to the innovation environment around Cambridge, engaging with local government and putting effort into attracting the research laboratories of large multinationals to Cambridge. Genzyme, Nokia and Philips have established research labs in Cambridge in the past three years, with the express aim of interacting with the University and the cluster surrounding it. My remit has included interaction with the Cambridge Cluster and I served on the Cambridge Network, the Greater Cambridge Partnership, and Cambridgeshire Horizons (the local infrastructure delivery vehicle). I believe that the future of the University and Cluster are intertwined and that by moving forward together they can continue to produce something that is greater than the sum of the parts.

I have also became convinced of the need to communicate the impact that the University has on the UK economy to stakeholders, particularly UK government. I commissioned

an impact study in 2005 — very much an initial step, but an important step that has been well received. The challenge of measuring impact is now being taken up by others, including the UK Research Councils, and we have recently embarked on a study of the impact of our activities in the Arts and Humanities, cofunded with the AHRC so that we might better inform discussion about the upcoming Research Excellence Framework. In 2009, I commissioned a brochure *A Tale of Two Innovations: Making an Impact*, which examines the paths from research to impact for two important innovations that have come from the University. This not only communicates that we have an impact but shows that simple-minded assessment of short-term impact is unlikely to capture the value that we create.

I have taken actions to strengthen the University's ability to link across disparate areas, realising that this has to be done with patience and by encouraging academic leadership. We have had three successful EPSRC Science and Innovation Awards (which provide capacity building resources) and have developed large collaborations in Neuroscience, in Infectious Disease and in Cancer.

One current project (which I am carrying forward)is an initiative to create a Conservation Campus to bring together many of the conservation organisations based around Cambridge together with the conservation activities (research and education) of the University with the aim of bringing education, research, policy, and practice together. This initiative includes a new Masters course in conservation leadership with the involvement of the conversation organisations and departments of the University including the Judge Business School. In this effort I liaise with academics, conservation organisations and donors.

I co-chaired the University's Review of Graduate Education which was a root and branch examination of our organisation of Graduate Education — motivated by our continued expansion of graduate numbers. Conducted in 2006-7, this Review has recommended major structural changes to provide greater consistency while preserving the role of academics in making the key academic decisions, and the rationalisation of the complexities of admission and funding decisions which arise in a collegiate university. Implementation of many of the recommendations is now underway, albeit at a pace which can be frustratingly slow — however, the adoption of Graduate Schools across the University now seems inevitable.

Most recently I was charged with planning the University's strategy for reducing its environmental impact, not just to meet medium term emissions targets, but to think about what the University estate and operations should look like in 2050 to meet 80-90% reduction targets.

I have contributed more broadly to the strategic thinking of the leadership of the University. It has been a privilege to belong to the Cambridge team; in collaboration with my colleagues I have been able to lead change, to make the institution less suspicious of the outside world, and have learned how to do so without creating unnecessary angst within the institution.

Education

1977	Bachelor of Applied Science (Honours) Computer Science Option, Division of Engineering Science, University of Toronto
1978	Master of Applied Science Department of Electrical Engineering, University of Toronto
1983	Doctor of Philosophy University of Cambridge Computer Laboratory

Non University Activities

1993	Co-founder Nemesys Research Limited (Acquired by FORE Systems in 1996)
1996-99	OFTEL Technical Expert
1998	Co-founder CPlane Inc
2001- 2004	Director of Cambridge 3G (A not for profit association)
2001- 2004	Member of UK e-Science Technical Advisory Group
2003- 2004	Advisory Panel of the NATO Computer Networking Sub-Programme
2007	UK Office of Science and Innovation Ad-hoc Working Group on Business-University Collaboration
2008 -	Council of Advisors for Research and Innovation Strategy, National University of Singapore
2008 -	Member HEFCE Strategic Research and Innovation Committee

Patents

Leslie, Burren, Tennenhouse, Adams, and Pitura,
"Variable Data Rate Channel for Digital Network", United States Patent 4,805,167 14 Feb 1989

Leslie, and van der Merwe,
"Switching System", US Patent 6,097,807

Bjoerkman, Crosby, Latour-Henner, Leslie, Lewis, Toomey, and Russell,
"Controlling Networks", First Filing 19/2/97, British Patent Application 9703425.0

Keynote Address

Universities and Innovation: Diversity and Critical Mass to the 3rd Chinese-Foreign Uni-

versity Presidents Forum, Shanghai, July 2006

Refereed Publications

Leslie, I.M.,
"A Master Clock Repeater for the Cambridge Ring", *Proceedings of the IEE*, Vol 128 Part E, No 2, March 1981

Leslie, I.M.,
"A High Performance Gateway for the Local Connection of Cambridge Rings", *Local Computer Networks*, North Holland, 1982, Ravasio, Hopkins and Naffah (editors)

Adams, C.J., Adams, G.C., Waters, A.G., Leslie, I.M., and Kirk, P.,
"The Architecture of the Universe Project", *Proceedings of the Sixth International Conference of Computer Communications*, September 1982

Cole, R., Adams, C.J., Celandroni, N., Ferro, E., Lenzini, L., and Leslie, I.M.,
"An Interworking Architecture for STELLA and Universe", *Proceedings of the International Symposium on Satellite and Computer Communications*, Versailles, France, 1983

Leslie, I.M., and Burren, J.W.,
"Experience with a High Capacity, Satellite Based, Packet Switched Network", *First African Conference on Computer Communications*, Tunis, May 1984

Leslie, I.M., Needham, R.M., Burren J.W., and Adams, G.C.,
"The Architecture of the Universe Network", *ACM Computer Communication Review*, Vol 14, No 2, June 1984

Waters, A.G., Adams, C.J., Leslie, I.M., and Needham, R.M.,
"The Use of Broadcast Techniques in the Universe Network", *ACM Computer Communication Review*, Vol 14, No 2, June 1984

Leslie, I.M., and Tennenhouse, D.L.,
"Cambridge Networks and Distributed Systems", *COMPINT 85 Conference Proceedings*, Montreal, September 1985

Tennenhouse, D.L., Leslie I.M., Needham R.M., Adams C.A., Burren, J.W., and Cooper, C.S.
"Exploiting Wideband ISDN: The UNISON Exchange", *INFOCOM Conference Proceedings*, April 1987

Bacon, J.M., Leslie, I.M., and Needham, R.M.
"Distributed Computing with a Processor Bank", in *Progress in Distributed Operating Systems and Distributed Systems Management*,
Springer Verlag LNCS 433, April 1989

Harita, B.R., and Leslie I.M.
"Dynamic Bandwidth Management of Primary Rate ISDN to Support ATM Access", *ACM Computer Communication Review*, Vol 19, No 4, September 1989

Tennenhouse, D.L., and Leslie, I.M.
"A Testbed for Wide Area ATM Research", *ACM Computer Communication Review*, Vol 19, No 4, September 1989

Leslie I.M., and McAuley D.R.
"Fairisle : An ATM Network for the Local Area", *ACM Computer Communication Review*, Vol 21, No 4 September 1991

Chen X., and Leslie I.M.
"A neural network approach towards adaptive congestion control in broadband ATM networks," in *GLOBECOM'91*, Phoenix, Arizona, December 2-5 1991.

Chen X., and Leslie I.M.
"Neural adaptive congestion control for broadband ATM networks", *IEE Proceedings-I, Commun., Speech and Vision*, vol. 139, no. 3, June 1992

Chen X., and Leslie I.M.
"Queueing Analysis of Input Traffic Control in Broadband ATM Networks" *INFOCOM Conference Proceedings*, Florence, Italy May 1992

Doar J.M.S. and Leslie I.M.
"How bad is naive multicast?", *INFOCOM Conference Proceedings*, March 1993.

Leslie I.M., Mullender S.J. and McAuley D.R.
"Pegasus — Operating System Support for Distributed Multimedia Systems", *Operating Systems Review* January 1993.

Mullender S.J., Leslie I.M., and McAuley D.R.
"Operating-System Support for Distributed Multimedia", *USENIX* June 1994.

Black R.J., Leslie I.M., and McAuley D.R.
"Experiences of Building an ATM Switch for the Local Area" *ACM Computer Communication Review*, Vol 24, No 4, October 1994

Crosby S.A., Leslie I.M., van der Merwe K., Atkinson A., Griffiths R., and Key P.
"CDV in ATM Networks — Performance Results from the Fairisle ATM Testbed", *Proceedings of the RACE EXPLOIT Traffic Workshop*, Basel, Switzerland, September 1994.

Crosby S.A., Leslie I.M., Lewis J.T., O'Connel N., Russell, R. and Toomey F.
"Bypassing Modelling: an Investigation of Entropy as a Traffic Descriptor in The Fairisle ATM Network", in *UK Teletraffic Symposium* Windsor, UK, 1995.

Curson P., and Leslie I.M.
"A Case Study on Design for Provability" in *The Proceedings of the First International Conference on Engineering of Complex Systems*, Nov 1995.

Crosby S.A., Huggard M., Leslie I.M., Lewis J.T., Toomey F., and Walsh C.
"Bypassing Modelling: Further Investigations of Entropy as a Traffic Descriptor in the Fairisle ATM Network", *Proceedings WATM'95 First Workshop on ATM Traffic Management*, IFIP W.G. 6.2, Ecole Nationale Superieure des Telecommunications, Paris, December 1995.

Crosby S., Leslie I., Huggard M., Lewis J., McGurk R., and Russell R.
"Predicting bandwidth requirements of ATM and Ethernet traffic" *Proceedings Thirteenth UK Teletraffic Symposium* Glasgow, March 1996.

Bjorkman N., Latour-Henner A., Miah A., Crosby S.A., Leslie I.M., Davey M. Russell R., and Toomey F.
" Exploring the Queueing Behaviour of ATM Switches" *Performance 96, International Conference on Performance Theory, Measurement and Evaluation of Computer and Communication Systems*, Lausanne, Oct 7-11, 1996

Leslie I.M., McAuley D.R., Black R.J., Roscoe T., Barham P.R., Evers D.M., Fairbairns R., and Hyden E.A.
"The Design and Implementation of an Operating System to Support Distributed Multimedia Applications", *IEEE Journal in Selected Areas of Communications* special issue on Distributed Multimedia Systems and Technology, Vol 14, No 7, pp 1280-1297, Sept 1996.

Hall J., Sabatino R., Crosby S.A., Leslie I.M., and Black R.J.
"A Comparative Study of High Speed Networks", *Proceedings of the 1996 UK Performance Workshop*, Edinburgh UK, Sept 1996

van der Merwe J.E.,and Leslie I.M.
"Switchlets and Dynamic Virtual ATM Networks", *Proceedings of IM '97, Fifth IFIP/IEEE International Symposium on Integrated Network Management* San Diego,pp. 355-368. May 1997.

Crosby S., Leslie I., Lewis J., Russell R., and McGurk R.
"Statistical Properties of a Near-Optimal Measurement-based CAC Algorithm", *Proceedings of IEEE ATM97*, May 1997.

Hall J., Sabatino R., Crosby S.A., Leslie I.M., and Black R.J.
"A Comparative Study of NFS Performance over High Speed Networks", *Proceedings of The Annual IEEE Conference on Computer Networks (LCN)*, November 1997.

Lewis J.T., Russell R., and Toomey F., McGuirk B., Crosby S., and Leslie I.
Practical Connection Admission Control for ATM Networks Based on On-line Measure-

ments. *Computer Communications*, (Invited Paper) Special Issue on Stochastic Analysis and Optimisation of Communication Systems, Vol 21, 1998, pp 1585-1596.

Hall J., Sabatino R., Crosby S.A., Leslie I.M., and Black R.J.
"A Comparative Study of High Speed Networks", *Proceedings of INFOCOM 98*, San Francisco, March 1998.

van der Merwe J.E.,and Leslie I.M.
"Service Specific Control Architectures for ATM", *IEEE Journal on Selected Areas in Communication*, Special Issue on Protocol Architectures for 21st Century Applications, Vol 16, No 3, pp 424-436, April 1998.

van der Merwe J.E., Rooney, S., Leslie I.M. and Crosby S.A.
"The Tempest: A Practical Framework for Network Programmability" in *IEEE Network, 1998*

Isaacs R. and Leslie I.M."
"Support for Resource-Assured and Dynamic Virtual Private Networks" in *IEEE Journal on Selected Areas in Communications*, vol 19, number 3, March 2001, pages 460–472, (Special Issue on Active and Programmable Networks)

Hall J., Pratt I.A., and Leslie I.M.
"Non-Intrusive Estimation of Web Server Delays" in *Proceedings of IEEE LCN2001, November 2001*

Hall J., Pratt I.A., Leslie I.M. and Moore A.W.
"The Effect of Early Packet Loss on Web Page Download Times" in *Passive and Active Measurement Workshop Proceedings, April 2003*

Hall J., Moore A.W., Pratt I.A., and Leslie I.M.
Multi-Protocol Visualisation - A Tool Demonstration in *Proceedings of the ACM SIGCOMM 2003 MoMeTools Workshop*

Completed PhD Students

1989
Derek McAuley *Protocol Design for High Speed Networks*

1990
Cosmos Nicolaou *A Distributed Architecture for Multimedia Systems*

1991
Baskar Harita *Dynamic Bandwidth Management*
Peter Dickman *Distributed Object Management in a Non-small Graph of Autonomous Net-*

works with Few Failures

1992
Glenford Mapp *An Object Oriented Approach to Virtual Memory Management*
Xiao Qiang Chen *Congestion Control and Routing in Integrated Broadband Networks*

1993
Matthew Doar *Multicast in the Asynchronous Transfer Mode Environment*
Simon Kelley *Congestion Control for Unreserved Traffic in ATM Networks*
Xiaobao Chen *An End-to-end Communication Support Architecture for Distributed Applications*

1994
Eoin Hyden *Operating System Support for Quality of Service*

1995
Timothy Roscoe *The Structure of a Multi Service Operating System*
Simon Crosby *Performance Management in ATM Networks*

1998
Jacobus van der Merwe *Open Service Support for ATM*
Sean Rooney *The Structure of Open ATM Control Architectures*

1999
Steven Hand *Memory Management in Support of Multimedia Applications*
Herbert Bos *Elastic Network Control*
Daniel Gordon *Analysis of Optically Based ATM Switching Fabrics*

2000
Don Oparah *Adaptive Resource Management in a Multimedia Operating System*
Shaw Chaung *Security Management in ATM Networks*

2001
Ioannis Papaefstathiou *Increasing Packet Network Bandwidth Through Low Level Compression*
Dickon Reed *The Effects of Code Layout on Performance*
Rebecca Isaacs *Dynamic Provisioning of Resource Assured and Programmable Virtual Private Networks*

2002
Andrew Moore *Measurement-Based Management of Network Resources*

2003
James Hall *Multilayer Network Modelling and Analysis*

2004