

Draft Computer Science and Engineering Timeline 1955 – 2007

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1955

New staff in the School of Electrical Engineering included C Gilbert and R Smart (computation area and significant as they were soon heavily involved in working with University's first computer).

1956

11 September - The School's and the University's first computer system, UTECOM (University of Technology Electronic Computer) was officially switched on by the Premier of New South Wales Mr JJ Cahill. Deane, J (*UTECOM: A Turing Engine for the University of New South Wales (NSW)*, History compiled by the Australian Computer Museum Society, (no date)), p29.¹ *See also Vignettes below.*

1961

Staff crisis in the Digital Computer Section of Electrical Engineering when Mr Smart, Dr Thornton and Mr Parks accepted offers from Remington Rand Pty Ltd. 'Catastrophy (sic) was averted when Mr Smart agreed to stay on temporarily'. [Engineering Yearbook 1961, UNSW Archives, V 106, p82]

¹ 'The English Electric DEUCE was virtually identical in architecture to the Pilot ACE (Automatic Computing Engine) designed by Allan Turing in the late Forties. UNSW was far sighted in installing UTECOM in 1956. Computing systems were moved from the basements of buildings and changed their role from being a mathematical tool of scientists to being a commercial enterprise. They became highly centralised, usually within a single room having glass (observation) walls.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

'UTECOM was a separately created administration unit within the University, providing computing facilities for research within the University, and it remaining operational until December 1966. The only remains of this computer are photographs and some circuit hardware. The DEUCE magnetic drum was the only movable head drum ever built in the World and the UTECOM magnetic drum is now housed in the computer museum in Boston, USA. It appears that the development of GEORGE – (GENERAL ORDER GENERATOR) – at UNSW lead to the name GEORGE being used as the name of the operating system for all the ICL 1900 series. The operating system for the English Electric KDF9 computer was also based on GEORGE. A very significant feedback to the UK from the colonies.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

Purchase of an IBM 1620, becoming the University's second computer. 'UNSW purchased an IBM 1620 computer in 1961 for a million dollars. This was the second computer ever used on campus and it was fondly called DUCHESS. It was a second generation computer (it used transistors) and was used by the Traffic and Highway Engineering School for research, but the administration also used it for payroll calculations. This machine is almost complete and is still kept within CSE. There was a simple operating system to control the computer resources, and there was a FORTRAN II compiler. A similar computer was also purchased by the School of Chemical Engineering.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

1962

29 May – Head of School of Electrical Engineering, Professor Vowels proposes establishment of four Departments – Communications, Control Systems, Power Systems and Energy Conversion, and Computing.' [Electrical Engineering Advisory Panel, 29 May 1962, UNSW Archive CN913]

1966

April – Installation of IBM Computer series 360 / model 50. [Electrical Engineering Advisory Panel, April 1966, UNSW Archive CN913]

'An IBM 360 model 50 was installed in the School of Electrical Engineering in March 1966, becoming operational in the following October. It replaced UTECOM as being the University's main computer, a department of Computer Science was also created within the School of Electrical Engineering, which then owned the computer, providing computing facilities to all the University, as well as teaching computer science subjects within the newly formed school (sic). The IBM 360 was to form the third generation of computers, in that they were built from integrated circuits. Installation of the IBM 360/50 was typical of the technology and that of the era. The merging of the computer and communications industries has had a profound influence on the way computer systems are organised.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

1967-1968

In the Department of Electronic Computation, the main research activity continued to concentrate on the development of a graphics data system. This consisted of a special purpose computer (integraphic) coupled to a communications network and terminal sets based on television techniques. The system was designed to produce an order of magnitude reduction on the cost of general purpose graphic terminals and the project was supported by the Australian Research Grants Committee. Software projects were also conducted in related fields including operating systems, graphical languages, information retrieval and console mathematics. Other project areas included speech recognition, optimum job scheduling and digital instrumentation. [Electrical Engineering Advisory file, School of Electrical Engineering Annual Report, July 1967 to March 1968', p13/14, UNSW Archive CN913]

1972

2 August – Approval given for the name of the Department of Electronic Computation to be changed to the Department of Computer Science [UNSW Archives, 72/F510/27814, F-SRF- Electrical Engineering]

1973

New staff includes Dr John Lions in Department of Computer Science who went on to make the UNIX system accessible. *See Vignettes below.*

1974

Instillation of a Control Data Cyber 72 computer. Both the IBM 360/50 and the CDC Cyber 72 operated side by side until the CDC Cyber 72 moved to the 14th Floor of the Library Stage II building in January 1977.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

1976 (approx) The Give system for electronic submission and automatic marking of assignments was implemented by Ken Robinson with assistance from David Carrington. This was probably one of the first such systems in the world and continues to be used by CSE. Maintenance of the system was taken over by Geoff Whale in the mid 1980's. Also at this time, some courses used electronic submission of course results. This was expanded and made more accessible by the development of the

Student Management System (SMS) in the early 1980's by Michael Rourke. This development was taken over by Geoff Whale and later Mei-Cheng Whale.

1978

Significant revisions were made to computer training as a result of the development of computer technologies, the miniaturisation of electronics and rise in demand resulting from the proliferation of personal computers.

About one third of the Electrical Engineering students were now doing Computer Science, leading to a doubling of demand for laboratory facilities. A quota system was discussed to hold the numbers to the current level along with a possible upgrade of laboratory facilities for 1980. [School of Electrical Engineering Report to the Visiting Committee, June 1978 – July 1979, p1, UNSW Archives V484] The strain of what was becoming a student overload was accentuated by competition with industry for qualified teaching personnel and the expectation that students from other School's choosing computing subjects would be taught by the Department of Computer Science. A special university teaching grant for the School and a program whereby competent computer specialists from the Schools of Civil and Mechanical Engineering and Surveying also taught computer subjects within the Department assisted somewhat. The University also purchased a new VAX11/780 computer which completed an effective computer network within the School.

1980

A switching network was designed and began operation within the School of Electrical Engineering computer facilities. 'The dramatic development came when a switching network (Local Automatic Computer Exchange) was designed and began operation in 1980. The LACE – as it was called – was an asynchronous terminal switch using time division multiplexing. This enabled all of the terminals to be able to be connected to any of the ever expanding number of host computers via a star architecture of seven nodes (in computing centres) and over two hundred extensions throughout. It was finally switched off in 1997.' [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

1981

8 September - Council altered the name of the school to the School of Electrical Engineering & Computer Science, effective from 1981 (resolution 80/139).

Professor Murray Allen was elected to the Australian Academy of Technological Sciences for his services to Computer Science.

1983

In Computer Science, despite a heavy teaching load, with the support of a Dean's Special Project Grant and an Australian Research Grant, work was carried out on a backend relational database machine. The development of a high performance index for large database information retrieval and several computer-aided instruction projects were conducted under Professor Dunworth and projects concerned with maximizing workstation and computer network were carried out under Associate Professor John Lions. Developmental work was done on computer systems to aid children suffering from dyslexia. [*Report to Visiting Committee, 1983/84, UNSW Archives collection, V 313*].

1987 –

July - Professor Murray Allen retired after 21 years. 'The Department [Computer Science] is unique in being the only department of its kind in an Electrical Engineering school in Australia. Murray was always a great defender of this position and events we believe have certainly shown him to be correct. Not a great committee man or one to involve himself in University politics, Murray led his Department by scholarship.' [*School of Electrical Engineering Report to the Visiting Committee, 1986 – 1987, p3, UNSW Archives V484*]

1987-89 Ken Robinson became Acting Head of Department. During this time a new Computer Engineering program was developed. This was the first of a sequence of undergraduate engineering programs to be developed later by the School of Computer Science & Engineering.

1988: Apollo workstation laboratory opened in Electrical Engineering undercroft.

1989 – 1996 Professor John Hiller

Professor John Hiller became Head of the Department of Computer Science as the pressures of student numbers continued to mount placing enormous stresses on teaching.

Also, of the 704 students across all the years of the School of Electrical Engineering, those taking the Bachelor of Engineering in Computing Science and the Bachelor of Science and Computing totalled 490 students. [*Report to Visiting Committee*, 1988/1989, p62-3, UNSW Archives collection, V 313].²

10 December – University Council meeting resolved to create a School of Computer Science [Resolution: CL90/108 (v)]

Late 1980's research groups were established. Among those created were the *Artificial Intelligence Group*, *VAST group*, *Software Engineering Research Group (SERG)*. Many of these groups later became departments in CSE.

1990

Ken Robinson received a UNSW Vice-Chancellor's Award for Teaching Excellence

1991

1 January – The School of Computer Science and Engineering (CSE) was established, with John Hiller as Head of School, whilst the remainder of the School of Electrical Engineering once again became “Electrical Engineering”.

1996 – 1998 Associate Professor Paul Compton

1996

Associate Professor Paul Compton became Head of School.

1996

² This situation was untenable. ‘It was the case [that] this little Department with its tiny staff of 40, was number four in total teaching units [EFTSU] within the University. It was crazy, I mean the Department was bigger than the rest of the School [in terms of teaching units] and it just didn’t make a scrap of sense.’ [Hiller, interview 2002]

The undergraduate BE Software Engineering program was developed in collaboration with the Commerce School of Information Systems. The program took in its first students in 1997, jointly administered by CSE and Information Systems. Later, in 2006, CSE took over total administration of the program.

1997

The LACE network system was switched off and an optical fibre network was installed across the campus. [KW Titmuss, 'The History of Computing at UNSW', December 1997, SRF – Computing Science, UNSW Archives]

Professor Graham Hellestrand forms VaST Systems Technology Corporation, a company that provides electronic system design and real-time embedded software development tools. The company had an office initially in Sydney and then moved to Sunnyvale California. VaST tools have a strong, worldwide reputation.

1999 – 2002 Associate Professor Arun Sharma

1999

Associate Professor Arun Sharma became Head of School.

In Robotics, the abilities of the School's students were put to the test with the Sony-sponsored international RoboCup competition. Sony gave each university team identical AIBOs (legged robotic dogs). Each team has to program their AIBOs to play soccer. Once on the field, there can be no assistance. In its first year, UNSW team came a creditable second.

Initial Workshop for Primary school children with Anita Borg, was organised by Arcot Sowmya. Women PhD students and women staff (including Anne Ngu) were involved in the workshop

2000

The School relocated to a new facility in K17. Costing more than \$13.5 million, the facility contained refurbished teaching labs, 'study pods' for senior students, docking ports for network access and a new student office.

The School continued to research in widely diverse areas as such Distributing Operating Systems, Networks, Real-Time Computing, Visualisation, Multimedia Embedded Systems, Motion Detection, and Robotics.

UNSW RoboCup team beat Humboldt and Carnegie Mellon Universities to win the competition. [*UNSW Engineers*, Issue 3. November 2000, p.8/9.]

2001

UNSW Robocup team successfully defended their title.

A program involving Year Four students was established for research into Reconfigurable Algorithms, System, Compilers and Languages (RASCL). Led by Associate Professor Hossam El-Gindy and Dr Oliver Diessel, research concentrated on design, management and use of reconfigurable and FPGA-based (Field-Programmable Gate Arrays) systems, helping students to use these devices and develop cost-effective solutions. In its first year, three student papers were selected for presentation at various international conferences. [*UNSW Engineers*, Issue 6, May 2002, p.9]

From 2001, three different teams, all coached by Professor Hossam ElGindy, won the South-Pacific Regional Championship at the Annual ACM International Collegiate Programming Contest for three consecutive years and were ranked 11th, 11th and 21st in the world respectively. The ICPC is the premier programming competition in the world for university students in which over 2000 teams from 70 countries participate annually.

The new cross-faculty undergraduate BE program in Bionformatics is introduced. The first of its kind in Australia, this degree program was created in conjunction with the Schools of Biotechnology and Biomolecular Sciences in the Faculty of Science.

2000-2001

dot.com bubble burst. The period until then had been accompanied by extraordinary, and ultimately unsustainable, growth in attempted exploitation of internet commerce. See later for the effect of this on CSE.

2002

Professor Paul Compton becomes acting Head of School.

2003 – Professor Paul Compton

2003

Professor Compton is again Head of School.

UNSW team again won the RoboCup competition. ‘Over the tournament’s history, UNSW teams have won three times and come second twice.’ [*UNSW Engineers*, Issue 9, December 2003, p.14.]

2004

In the developing field of interdisciplinary research, the collaborative Interactive Cinema (iCinema) project between the School of Computer Science and Engineering and UNSW College of Fine Arts, was directed at creating digitally expanded cinema, using interactive and immersive environments to explore experimental narrative forms. This project was funded by an Australian Research Council Discovery Grant and developed in conjunction with the ZKM Centre for Art and Media in Karlsruhe Germany. [*UNSW Engineers*, Issue 10, Sept 2004, p.14]

Administrative Staff Excellence Award Brad Hall

Technical Staff Excellence Award Peter Linich

Teaching Staff Excellence Award Richard Buckland

Graham Hellestrand, CEO of VaST Systems Technology and formerly a professor in CSE is elected a fellow of the IEEE. Only one other Australian has previously been elected to this position.

2005

August – The iCinema Centre for Interactive Cinema Research was established in the Scientia Building. ‘The showpiece of iCinema is the Advanced Visualisation and Interaction Environment (AVIE), the World’s first stereoscopic panoramic cinematic environment. AVIE is 12 metres diameter by 4 metres high circular screen that surrounds the audience and provides the backdrop for a three-dimensional immersive cinema experience [UNSW Engineers, Issue 14, Dec 2006, p7]

Apple University Consortium Teaching Award given to Daniel Woo

Teaching Staff Excellence Award Sri Parameswaran

2006

Administrative Staff Excellence Award Cassandra Nock

Teaching Staff Excellence Award ENG1000 Team: (including Richard Buckland)

UNSW Vice-Chancellor's Award for Teaching Excellence awarded to Richard Buckland

2006-2007

Professional Staff Excellence Award Brenda Ford

UNSWAsia

CSE played a significant role in this ill-fated attempt to establish an off-shore campus in Singapore.

Arcot Sowmya took over as Prof and Head, Engineering, Science and Technology Division, UNSWAsia on July 1st 2006; continued until closure on Aug 10th 2007

Oliver Diessel- appointed Asst Professor in Oct 2006, continued up until closure on Aug 10th 2007.

2008

In 2003-2004 the School of Computer Science and Engineering was one of the largest Schools within the University and one of the largest of its kind in Australia. It then had 58 full-time academic staff and 45 support staff and employed a large number of part-time and casual teaching staff to support teaching and teaching administration.

The School had a student body of approximately 4000 undergraduate students, more than 2500 of these majoring in a computing degree, over 350 postgraduate coursework students, 140+ PhD and Masters by Research students.

The burst of the “dot.com bubble” in 2000-2001 led to a downturn of enrolments in IT programs around the world, and enrolments in CSE undergraduate programs have halved and sometimes more than that since 2003. This is a serious problem for schools like CSE and in contrast there is now a serious shortage of software engineers.

Currently the undergraduate student body is approximately 2000 students and about half of those are majoring in CSE programs.

The academic staff have research focus in Machine Learning and Knowledge Acquisition; Knowledge Representation and Reasoning; Database Systems; Network Research Laboratory; Operating Systems; Compilers and Distributed Computing; Computer Vision and Image Processing; Formal Methods in Software Engineering; Empirical Methods in Software Engineering; Human Computer Interaction; Reconfigurable Architectures and Algorithms and Embedded Systems.

The School offers four undergraduate degrees - BE (Computer Engineering) - a four-year degree offered in collaboration with the School of Electrical Engineering and Telecommunications (EE&T). BE (Software Engineering) - a four-year degree, BSc (Computer Science), a three-year degree with optional Honours year. BE (ormatics), a four-year degree offered in collaboration with the School of Biotechnology and Biomolecular Sciences.

The School offers coursework programs in Master of Information Technology , Master of Computing and Information Technology , Graduate Diploma in Computing and

Information Technology , Graduate Certificate in Computing and Graduate Certificate in Advanced Computing .

The School is the largest research partner in the Cooperative Research Centre for Smart Internet Technology, collaborating with partners such as Motorola, Hewlett-Packard and Telstra. It is also host to the [Centre for Advanced Software Engineering Research \(CAESER\)](#), formed from the expertise developed within the School of Computer Science and Engineering and the School of Information Systems, Technology and Management. CAESER is an internationally linked Centre of Excellence in the collaborative advancement and practice of software engineering and acts as a focus for software engineering research in Australia.

The School also continues to collaborate with UNSW [College of Fine Arts](#) in the [Centre for Interactive Cinema \(iCinema\)](#) to foster research in various aspects of entertainment technology.

There are specialist teaching laboratories including: the Microprocessor Projects Laboratory, the Advanced Systems Teaching Laboratory and the Human Computer Interaction Laboratory. There are also special research facilities including the Network Research Laboratory, the Distributed Operating Systems Laboratory, the Robotics Laboratory, the Visual Information Processing Laboratory, the PCB Prototyping Facility and the Human Computer Interaction Facility.

Carrick (Teaching) Award given to Richard Buckland

Vignettes:

Utecom

UTECOM (University of Technology Electronic Computer), UNSW's first computer was developed from the English 'Deuce' digital computer and was installed in the basement of the University's Old Main Building at Kensington. The implications for all engineering disciplines were enormous, but it was up to Electrical Engineering to keep ahead of this new technology. In 1955, the year prior to the arrival of UTECOM, Messrs RG[[name](#)] Smart and [[name](#)] Gilbert were appointed as Lecturers in the School to undertake research into and the development of this new system, with Mr Smart being sent to English Electric in Stafford, England, to train on the original 'Deuce' digital computer. In 1957, Mr Gilbert developed the 'UTAC' analogue computer

system, part of which had been installed in the Old Main Building at the Kensington campus as well. [*Technology*, December 1958, p71] Users of these new computers included University researchers in areas such as civil engineering, government agencies and private firms. Among the School's own research interests was the development of the digital computer to control complex electricity generating processes.

Time on the computer was at a premium and rosters (and bunk beds) were established to ensure that the computer was always manned, both to assist with problems in the system and to ensure that every minute was utilised fairly.

However, it was not all about the sombre and relatively slow grinding of numbers. One part of UTECOM's control register was amplified and gave a note, the frequency of which was controlled so that Christmas Carols could be played and that programs could be recognised by their 'tunes'. One PhD student became renowned for his ability to sing along with the unwieldy computer as it ground through his program. [UNSW Archives, lecture by Associate Professor Gareth Dewsnap, IEAust conference, 26 Nov 1981.]

The forming of the Digital Computing Laboratory in 1962 led to the rapid development of computing and its application in undergraduate and postgraduate teaching and research programs at UNSW. Early research in the Department of Electronic Computation focused primarily on computer graphic technologies. In 1966, an IBM 360/50 replaced UTECOM, providing faster calculations and better overall service. In a foretaste of things to come in this new world of rapidly accelerating technological change, in December 1966, with little ceremony and after 10 years of service, UTECOM was decommissioned and scrapped. All that was saved were a drum, some memory tubes and a few racks of electronics. [Deane, J *UTECOM: A Turing Engine for UNSW*, History compiled by the Australian Computer Museum Society, (no date), p29]

John Lions and UNIX

Also in the early seventies, the groundbreaking creation of the UNIX operating system and the C programming language by Bell Laboratories researchers Ken Thompson and Dennis Ritchie inspired programmers globally including Lecturers Ken Robinson (on staff from 1972) and John Lions (on staff from 1973). In 1973, Ken Robinson recognised the UNIX OS as "too good to be true" and acquired a copy of the system

from Bell Laboratories. John Lions took over the management of the installation of UNIX on the department's PDP 11/40 computer and, recognising the importance of the accessibility of this system immediately incorporated a study of UNIX in his teaching, making significant modifications to two of his courses. In addition, he wrote the 'Source Code and Commentary on Unix Level 6' and handed cardboard bound copies on computer printout paper to his astonished students. Containing the entire UNIX 6 operating system, the book proved an invaluable teaching resource and a technical bible for a whole generation of professionals.

Legally, the book was only supposed to be available to licensees of UNIX 6 and by the time of the release of UNIX 7 in 1979, intellectual property laws were invoked to ban its publication. One programming student recalled, 'because we couldn't legally discuss the book in the university's operating systems class, several of us would meet at night in an empty classroom to discuss the book. It was the only time in my life I was an active member of an underground.' [Mr Peter Reintjes (BE 'xx) quoted in the *Sydney Morning Herald*, 11 December 1999].

In the early 1980s multiple copies of the Lion's book were photocopied. (title) John Lions taught until 1991 and lived just long enough to see the ban on his book finally lifted in 1998. The importance of his work was recognised by the dedication on 26 June 2002 of the John Lions Garden outside the K17 building, with an annular placed around the largest tree bearing the inscription, 'Lions' books inspired a generation of operating systems designers.' [*UNSW Engineers*, Issue 7, November 2002, p10.] It the same time, a Lions Chair in Computer Science was established, funded partly through the University, but largely through the tremendous efforts of former students who he motivated and inspired with his teaching and research and who acknowledge his defining influence on their professional lives.

UNSW had the first installation of UNIX in Australia, and was one of the first places to be using that system outside of the USA. The School of Computer Science and Engineering has continued to base a significant amount of its teaching on UNIX-like systems, nowadays Linux.

Computing at UNSW and the Department/School

When established, the Department of Electronic Computation (as it was then called) had the responsibility for providing computing for the University. Initially this was provided by an IBM 360/50, extended by large core storage (LCS) of 1MB. The LCS was the first installed in Australia. It consisted of a massive column, about 30cm x 30cm x 1.5m high of hand threaded ferrite cores. The LCS can be viewed in the School of CSE.

Various other computers were installed to handle computing, including a Control Data Cyber 72, Digital Equipment Vax. For Department use there was a PDP 11/40 and 11/70. At that stage computing services were provided by “batch processing”, or by time-shared terminals. The manager of the Computer Services Unit (CSU), providing services to the campus was Peter Ivanov.

With the introduction of the Computer Engineering program in 1989 the Department chose to move to workstation laboratories, and the Apollo workstation laboratory was opened in 1988.

Since then the School has managed a large number of workstation laboratories and individual workstations to support undergraduate, postgraduate and staff computing. Computing for the School was based in the Computing Service Group (CSG) managed by Geoff Oakley.

Special Laboratories Established in School

1997 The Advanced Systems Teaching (ASysT) Lab was created. This lab was used for teaching Advanced Operating Systems. It was equipped with locally-developed MIPS R4600-based 64-bit computers called u4600, which students used to build operating systems (to our knowledge the only place in Australia where such a course is taught). In 2006 the u4600s were replaced by a slightly-modified NSLU2s, a commercial ARM-based embedded platform.

1992 (approx) Silicon Graphics workstation installed to provide advanced computer graphics capabilities. The facility was also used commercially to prepare graphics for advertising.

2001 HCI teaching laboratory - apparently the first lab deployment of Mac OS X in Australia, according to the higher education people at Apple.

Engineering Programs

Commencing with the Computer Engineering program introduced in 1989 the School has continued a line of full engineering programs, emphasising the need for software and hardware system development to be recognised as an engineering activity.

In 1996 Ken Robinson (in collaboration with Ross Jeffery (School of Information Systems) developed the Software Engineering program. One of the innovations in that program is a series of software engineering workshops that give students the experience of working in teams on a project.

In 2000 Bruno Gaëta developed a Bioinformatics program offered in collaboration with the School of Biotechnology and Biomolecular Sciences.

Robocup

Quote from Claude Sammut

In RoboCup, CSE we came 3 times, second 3 times, 3rd once and were quarterfinalists once. In 2000, we beat CMU in the semi-finals and LRP (Laboratoire de Robotique de Paris) in the finals. I think we beat Humboldt on the quarters. In 2001, we beat CMU again in the finals.

School Activities with Schools and School Children

1997 UNSW Schools Programming Competition

1999 The first Primary Schools Girls Workshop

(<http://www.cse.unsw.edu.au/~mancilla/myHome/workshops/>)

2005 Robotics Workshops established

Special Research and Research Centres

L4 microkernel research was initiated within CSE by Gernot Heiser in 1994 and transferred to NICTA in 2003. This research has led to the creation of the startup company Open Kernel Labs (OK Labs). Their OKL4 operating system is presently shipping on an estimated 10 million mobile phones a month, with other deployments in the pipeline.

Computational Bioacoustics (1996--) principally initiated by Andrew Taylor. Boards and software have been developed within CSE that can learn and classify sounds that could come from animals, such as cane toads. Since 1996 the group has been working with the federal Department of the Environment and Parks, Australia North, placing solar-powered boards mounted on poles to automatically monitor the calling activity of native frogs at 16 sites in the Roper River Valley and Kakadu National Park. The aim is determine the impact of the Cane Toad invasion on native frog communities. The work has found no indication of significant long-term impact of Cane Toads on the native frog communities

Ripple Down Rules (RDR) initially developed by Paul Compton. RDR enable knowledge-bases to be built over time while a system is in routine use and that the time taken to add a new rule is largely independent of knowledge base size. This enables very large knowledge bases to be built with minimal impact on the normal workflow and these knowledge bases can be constantly adapted to meet changing requirements. Multiple Classification Ripple-Down Rules (MCRDR) developed by Byeong Kang, supervised by Paul Compton, have been used by Pacific Knowledge Systems to develop systems for producing reports on pathology tests. RDR can also be used with business rules and is used in a system called Sonnetto used by Tesco.

Smart Internet Technology Cooperative Research Centre (2001-2007), proposed by Arun Sharma, Claude Sammut and Ron van der Meyden. Claude Sammut and Ron van der Meyden become program leaders in this centre.

ARC Centre of Excellence for Autonomous Systems (2003-2010), headed by Claude Sammut heads of CSE. The Centre is in partnership with The University of Sydney and The University of Technology.

The National ICT Australia Limited (NICTA), a Centre of Excellence, was commenced by the Australian Government in 2002 with \$50M per annum funding. NICTA was set up as a company with four members, UNSW, ANU, New South Wales State Government, Australian Capital Territory Government. The two School involved were Computer Science and Engineering and Electrical Engineering and Telecommunications. CSE provided the Sydney Node Director, (Arun Sharma) and five of the six program directors, Arun Sharma, Norman Fu, Ron van der Meyden, Ross Jeffrey, Gernot Heiser, with the sixth program director being Aruna Seneviratne from EE&T. Over 30 CSE staff provided in-kind contributions to help establish NICTA.

The Orion Search Engine developed by Ori Allon and Eric Martin in 2006 produced a patent, which was in turn sold to Google. The search strategy is incorporated in the Google search engine and Ori Allon is working within Google.