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UK ICT: a long tradition of ICT innovation

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Glance around a modern home and you will find myriad gadgets designed to make life easier, entertaining, efficient and more connected. Much of the research that makes these innovations possible - from interactive digital TV and mobile phones to the World Wide Web - can trace its origins to the UK, a country with a long tradition in ICT innovation.

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In 1873, Willoughby Smith, for example, was selecting cables to be used for telegraph wires. He chose a selenium alloy, thinking it would fit the bill, only to discover that its conductivity decreased when exposed to light. Further investigations, which produced a paper in the respected journal Nature, eventually led to the development of the photoelectric cells used in early televisions.

The 20th century brought further world-changing ICT innovation from the UK. In 1948, Tom Kilburn developed the first stored programme computer, and less that 50 years later Tim Berners-Lee began connecting the descendants of Kilburn's machine through 'Hypertext transfer protocol' (http) to servers, heralding the advent of the World Wide Web.

The UK continues to invest heavily in ICT research and pioneer ICT advances, particularly through involvement in the EU’s Seventh Framework Programme (FP7) specific programme for 'Information and communication technologies' (ICT). The country's scientists, universities and companies have particular strengths in the fields of information processing, information media, telecommunications, and electronics and microelectronics. UK organisations - mostly universities - coordinate around 10 % of all the FP7 ICT projects.

Multidimensional media research

The area of "new media" is one where the UK combines its historical expertise in both television and computer media through the development and application of the very latest networking and 'Future Internet' technologies.

Researchers at the University of Lancaster are examining the possibility of using peer-to-peer applications, a technology more commonly associated with internet piracy, through its involvement in the project P2P-Next [2] (1). The project aims to help content providers stream videos to millions of users simultaneously. A total of 19 institutions are collaborating on the project, with efforts coordinated by the VTT Technical Research Centre of Finland.

The largest trial to validate the Next P2P broadcasting system was conducted at Lancaster, looking at the bandwidth saved compared to other technologies and the quality and stability of the video streamed. The team showcased the NextP2P set-top-box at several conferences and events, including IBC 2011, where they streamed a live BBC broadcast from London.

Future Internet technologies will soon make it possible to create highly interactive, immersive and virtual-reality experiences over networks. Now that TV is an everyday technology, broadcasters need to find new ways to astonish and entertain their audiences. Researchers at the University of Reading are working in collaboration with 12 other partners on the FP7-funded project 20-20 3D Media [3] (2). The aim of the project is to research and develop technologies to support 3D stereoscopic and immersive audiovisual content which could be used to create compelling entertainment experiences at home or in public spaces.

Elsewhere, other UK academic institutions are working in collaborative projects which could soon change the way we consume media and communicate. Goldsmiths College of the University of London is involved in TA2 [4] (3), a project looking to improve the capabilities of group communication. Meanwhile, My-e-Director 2012 [4] (4), supported by Queen Mary College, University of London, is developing technologies that will make it possible for broadcasters to offer real-time, context-aware, personalised media streaming. Viewers will be able to select specific actors, perspectives, image angles or points of interest within live broadcasts and receive a highly personalised viewing experience.

The EMIME [5] (5) project, coordinated by the University of Edinburgh, looked at another aspect of personalisation, this time a mobile device for speech-to-speech translation. When a user speaks a sentence in their own language into the prototype device, the unit will utter the translated sentence, but spoken in the voice of the user! The technology behind the device uses hidden Markov models - the same technology used for automatic speech recognition. The device analyses the characteristics of a user's voice and adds these to the output speech to make it more personalised and help make multilingual exchanges more natural between users.

Intelligent systems like these, using artificial intelligence and computer learning, appear in numerous projects, for example the Recognition [6] (6) project, coordinated by Cardiff University. The project is trying to endow ICT with self-awareness by mimicking related cognitive processes in humans. The project aims to develop machine intelligence that, when faced with partial information and a range of very different inputs, can assert their relevance (or irrelevance), extract knowledge and take appropriate decisions. The Recognition algorithms are being tested on internet content to see how well they can discern between different types of content and work out what can be displayed and where on different devices.

Little and large

The presence of large media organisations such as the BBC, a respected, world-leading broadcaster and multimedia content producer, places the UK at the leading edge of developments in new networked media R&D. The size and reputation of the BBC means it can contribute significant resources and expertise to projects and be an excellent vehicle for trialling and piloting new technologies and techniques. The BBC is involved in a total of 13 projects within the ICT area of FP7area.

However, the UK's strengths in ICT R&D do not rest solely in universities and large corporations such as the BBC and British Telecom. The experience of these bodies in previous FP6 or FP7 projects often helps them to form strong consortia for successful projects, but their expertise is enhanced by a plethora of innovative, hi-tech SMEs.

The electronics firm Rapita, for example, is involved in four projects, Parmerasa [7] (7), Merasa [8] (8), Proartis [9] (9), and All-Times [10] (10), all based around similar technologies and working with the same partners.

Rapita Systems Ltd started in 2004 as a spin-out from the University of York, providing a system that checks the software inside planes and cars. The company grew from a small team of four to a team of 16, and has hopes of further expansion.

Speaking about his company's success, Company Director Ian Broster recognises that 'FP7 has been instrumental in the growth of Rapita. (….). Without FP7 we would not be able to develop any of our products as quickly as we have been.'

The example of Rapita highlights the important role FP7 plays in bringing resources and Europe's best experts in specific areas of R&D together to complement each other, creating critical mass and achieving significant, commercially relevant progress. Peter Walters, the UK's National Contact Point for FP7 ICT puts is like this: 'FP7 is about innovation, it's about research collaboration and building networks across Europe to develop better lifestyles and systems to citizens of Europe and the wider world.'

The microelectronics firm ARM is perhaps one of the best examples of how a UK company has achieved success and had worldwide impact, through EU-funded research. ARM's participation in earlier Framework Programmes led to its development of the mobile microchip technology that is found in every single mobile device.

Today ARM continues to make the most of the opportunities to collaborate and access top-quality research through FP7. The company is involved in nine FP7 ICT projects (seven still in execution), all pushing the boundaries of microelectronics and preparing for a low-power, high-processing future.

ICT-EMUCO [11] (11), for example, addresses the platform architecture of future mobile devices. The number of mobile applications steadily grows and consumers continue to expect more performance from their mobile devices; the computational performance must continue to improve. Multi-core architecture is needed to get the best balance of power and performance support for new features. ARM, along with the University of York, is providing UK-based expertise in this high-level project.

One project that sees ARM taking a coordinating role is EuroCloud [12] (12). With server power consumption and cost becoming an increasing concern, a solution is needed to provide a dense, low power server solution. EuroCloud is a 3D server-on-chip solution, built from many ARM cores with integrated 3D DRAM providing high memory bandwidth with less power consumption, paving the way for scalable, green servers.

As European Commission Vice-President Neelie Kroes has said: 'Today's power-hungry cloud data centres are not sustainable in the long run. The Eurocloud chip addresses the core of this energy consumption problem. I hope further development of the Eurocloud chip will boost the position of European businesses in a sector currently dominated by non-Europeans.'

Power struggle

The UK is heavily involved in projects related to ICT and energy saving. Around half of the 84 projects currently funded in this area involve a UK partner.

Dehems [13] (13), for example, is exploring ways in which the energy meters which typically measure the amount of electricity we use could also track how that energy is being consumed. The DEHEMS smart meter brings together sensor data on a house's heat loss, along with data on appliance performance, to give real-time information on emissions and energy performance. Work is being carried out by a number of UK institutions, with efforts coordinated by Manchester City Council and with UK academic input from Coventry University.

'We took smart meters into peoples' home,' explains the project team, 'but instead of a meter that just told you some basic facts about energy use, we have linked that information to a clever way of visualising data. So you can look on your smartphone, PC or laptop and immediately see what is happening in your home in terms of energy use.

'And if people have easy access to information and it is user friendly, they do start turning things off and realise that 20 % of their energy bill could be coming from equipment left on standby. Having facts at your fingertips can be a real stimulus for behaviour change. Small projects like this aggregate up to make a big change.'

In just the same way, the UK's involvement in so many projects through FP7 will aggregate up to make a big change to European business, society and its sustainable growth. The legacy of Smith, Kilburn and Berners-Lee lives on.

The projects featured in this article have been supported by the Competitive and Innovation Programme’s (CIP) ICT-Policy Support scheme or the Seventh Framework Programme (FP7) for research.

(1) P2P-Next: Next generation peer-to-peer content delivery platform
(2) 20-20 3D Media: Spatial sound and vision
(3) TA2: together anywhere, together anytime % (4) 2020 3D Media Spatial Sounds and Vision
(4) EMIME: Effective Multilingual Interaction in Mobile Environments
(5) Recognition: Relevance and cognition for self-awareness in a content-centric Internet
(6) Parmerasa: Multi-Core Execution of Parallelised Hard Real-Time Applications Supporting Analysability
(7) Merasa: Multi-Core Execution of Hard Real Time Applications Supporting Analysability
(8) Proartis: Probabilistically Analyzable Real-Time Systems
(9) All-Times: Integrating European Timing Analysis Technology
(10) ICT-EMUCO: Embedded multi-core processing for mobile communication systems
(11) EuroCloud: Energy-conscious 3D Server-on-Chip for Green Cloud Services
(12) Dehems: Digital Environment Home Energy Management System

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