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A wannabe worldbeater

07.02.2007 - Science professors ain't what they used to be. As he takes his seat in his orderly Office within the Lloyd Institute at the Westland Row end of the Trinity College Dublin (TCD) campus, Professor Donal O'Mahony (*pictured*), director of the Centre for Telecommunications Value-Chain Research (CTVR), is disappointingly devoid of the usual mad scientist trademarks of wispy beard, bow tie and flyaway hair.

Bedecked in a spotless suit and clean-shaven, O'Mahony could in fact be mistaken for a businessman or entrepreneur about to go through his business plan with a group of investors.

The comparison might not be too wide of the mark because bringing a strong commercial focus to bear on selected areas of telecoms research is what O'Mahony and the CTVR are all about.

Established in June 2004, the CTVR works alongside Bell Labs — the R&D arm of Lucent Technologies — and a growing number of other industrial partners, including semiconductor maker Xilinx and Airbus parent, the European Aeronautic Defence and Space Company. By closely associating with industry it is hoped that the research done by the centre won't simply disappear into a black hole, as can happen, but will be taken up by industry partners and find its way into their product development pipelines.

To understand what the CTVR actually does, it is first necessary to define the term 'value chain'. It was first coined in the Eighties by US management thinker ME Porter, who defined it as a "tool for diagnosing competitive advantage" and stated that a value chain "divides a firm into the discrete activities it performs in designing, producing, marketing and distributing its product".

The quality or otherwise of a company's value chain is what ultimately determines what the product will look like, how efficiently it can be produced and, ultimately, how cheap it will be to buy. Telecommunications technology is a classic example of this. State-of-the-art manufacturing techniques and processes allow the production of highly complex devices such as mobile phones, base-stations and high-speed optical backbone networks at prices that would not have been possible five years ago. The stark difference between Motorola's Razr series of mobile handsets of today and its original 'mobile brick' back in the Seventies is a case of value-chain optimisation in league with technological innovation.

Blue sky is the limit

While in-company R&D departments will always have the value chain at the forefront of their minds, the same cannot be said of university-based research which has traditionally been more 'blue sky'. Changing this mindset has been one of the early challenges facing O'Mahony and his colleagues at the CTVR.



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The logo consists of the text "e-THURSDAY" in a white, serif font, centered on a solid black rectangular background.

"We try to instill the concept of the value chain into all the researchers working here," he says. "Let's say someone is working on a new laser source for a fibre-optic network. We ask them to think a little beyond the physics of it and say to them: 'If you do make a big innovation there, what difference is that going to make to products? What effect is that going to have on the complex value chains of Lucent and others like it?'"

He adds: "Part of the recipe of the CTVR is to be working on the right problems to begin with. For any academic working in a particular field there are hundreds of areas they could be focusing on so we specially picked the ones that are likely to be of interest to industry or that are likely to make an impact."

The CTVR directly funds the work of about 80 researchers. Roughly 20 of these are based at TCD, the remainder in research groups at seven other third-level institutions around the country — Dublin City University, National University of Ireland (NUI) Maynooth, University of Limerick, University College Cork, Tyndall National Institute, Dublin Institute of Technology and Sligo Institute of Technology. Between them these research groups are working on approximately 25 projects currently.

The larger projects are split into a number of sub-projects, with each team working away on its piece of the bigger puzzle. In so doing, it can be very easy for individual teams to lose sight of the bigger picture. So, as O'Mahony acknowledges, another of the challenges facing the CTVR is getting all the research teams 'singing from the same hymn sheet'. "Every now and then we remind them of the larger picture. It's the team leader's job to knit all those small pieces together into something coherent," he says.

It is also challenging to get colleges working together. Traditionally they have competed for funding, which came mainly from the EU. Now the Government, through Science Foundation Ireland (SFI) and other funding instruments, has put a pot of money on the table for collaborative projects between several Irish universities. And it's been a big culture shock for all concerned.

"Getting people not to fly their own institutional flag the whole time has been kind of interesting," O'Mahony laughs. "It's taken a while for people to adjust but they're much more used to it than they were."

The issue of intellectual property (IP) ownership has traditionally been a major bone of contention between universities. The CTVR decided to tackle this head on by getting all of the participants to sign up to a single IP agreement along with Bell Labs. The thrust of it is anything that is solely developed by a university or Bell Labs is fully owned by that party but anything that is created jointly is jointly owned and either side can exploit it without having to get the approval of their partner. "It's completely free of any sort of complicated IP accounting. It allows any company that's working with us to exploit it and it also gives universities equal right to do that. It maximises the chances of something getting out of the universities and getting deployed," states O'Mahony.

Patents pipeline

So far the IP agreement seems to be working reasonably well. One of the targets the CTVR had set itself was that it would have filed two patents by the end of its second year. It actually filed four patents and has several more in the pipeline.

The next crucial step is to translate those patents — as well as other research — into commercial products. While some of the research that comes out of the CTVR will be commercialised by its industrial partners, it is also intended that a cluster of Irish tech firms will evolve around the research generated by the institute. Some of these firms will be spun off the centre itself, in classic Silicon Valley style, and some will be existing companies that see the benefit of collaborating with CTVR researchers. Although it may be a few years before a discernible cluster emerges, several ideas have already been identified as having market potential. So far four CTVR projects have received proof-of-concept grants from Enterprise Ireland totalling around €500,000, with several more approved to do so.

While the CTVR may so far be hitting its targets, O'Mahony has no doubt the long-term viability of the institute will depend on the success or otherwise of these projects and others like them.

"There are two things we're charged with: to do brilliant research and bring Ireland to the top of the heap on that; and to do effective technology transfer. So if we don't generate the downstream activity we'll have been a failure."

WORK IN PROGRESS

**The CTVR works on 25 projects at any one time.
Here are some of them:**

1. Reconfigurability

Wireless radio frequency is one of the five main research strands under way at the CTVR and reconfigurable radio is a key focus within this. Reconfigurable radio, also known as software radio, is one of the holy grails of the mobile telephony industry. A reconfigurable radio is one that can change its characteristics to suit different radio environments, meaning that a single radio and single antenna can now do the job where multiple ones were needed before, with obvious cost benefits for handset manufacturers and, ultimately, users.

A second aspect of reconfigurability relates to spectrum allocation, an area in which CTVR is building a global reputation. Radio spectrum is allocated statically, in other words particular chunks are licensed to different operators/ users for them to have exclusive use of for the licence period. It is a very inefficient way of allocating spectrum however, as much of it lies unused. The CTVR is researching ways in which spectrum can be allocated dynamically so that operators/users can trade or rent spectrum space as needed, thus increasing the overall efficiency of its use.

Technically this is achieved through reconfigurable radio. The Commission for Communications Regulation has issued the CTVR with a special licence allowing it to experiment with reconfigurable radio — the first time that such a licence has been issued anywhere in the world.

2. Reliability

Finding ways to make telecoms equipment more robust and reliable is another major research track at the CTVR, led by the Stokes Research Institute at the University of Limerick. What is driving the research at the moment is the growth of the Asian market where atmospheric conditions are very different to those of Western countries and factors such as humidity and pollution can play havoc with telecoms equipment such as base stations. The CTVR is conducting research into why components fail and is developing a test that can be done during manufacture to screen out components that will fail in particular types of environments.

3. Thermal management

A CTVR project team split between University of Limerick and TCD is working with Bell Labs on more efficient ways to cool electronic equipment such as laptops. The research is based on Bell Labs' patented 'Nanograss' technology. This is a highly water-resistant microscopic textured surface that is applied on to electronic components and which allows the flow of the cooling fluid to be controlled such that the coolant moves quickly to the hottest sites within the computer circuitry.

4. Wireless antennas

A research team led by DIT is developing wireless antennas for use in people's living rooms. The technology in question involves low-cost high-performance antennas for ultra wide band (UWB) systems. UWB technology uses existing radio- frequency spectrum to allow large amounts of data to be sent wirelessly over short distances. In much the same way as Bluetooth technology connects devices like mobile phones to earpieces and PCs to printers, UWB technology would allow devices like DVD players, games consoles and video recorders to be connected to TV sets without the need for cables. If successful, it is expected the technology could have a major impact on the market for popular consumer electronics devices like TVs, DVD players, games consoles and even mobile phones. The DIT team under Max Ammann recently received a €90,000 proof-of-concept grant from Enterprise Ireland to take the research to prototype stage.

What is the CTVR?

The CTVR is a cross-university telecommunications research facility based at TCD. Funded by Science Foundation Ireland as part of its ambitious Centre for Science Engineering and Technology programme, the CTVR was part of a five-year €69m investment package announced by the Government in June 2004 that also saw the creation of the first R&D facility in Ireland by Bell Labs, the R&D arm of US telecoms equipment giant Lucent Technologies. The Bell Labs facility accounted for more than €43m of the total investment and secured joint funding from Bell Labs and IDA Ireland.

The CTVR employs 80 researchers working across five inter-related research strands. These are:

Emerging Networks — focuses on the form of future networks in terms of protocols, control, management, mobility handling, routing and other architectural issues

Photonics — works on key issues in the realisation of an all-optical network including transparency and intelligence

RF — aims at realising the next generation of fully reconfigurable radio transceivers and associated intelligent antenna systems

Test & Reliability — looks at test strategies and field-monitoring of telecoms systems in order to optimise the value-related balance between test effort and field-reliability

Optimisation & Management — develops new techniques to acquire, model and optimise value chains in the presence of hierarchy, distribution, uncertainty and change.

While each partner university within the CTVR has its own area of expertise — for example TCD takes the lead in network architecture, NUI Maynooth in radio frequency and UCC in value chain research — each strand typically draws on the expertise of a number of third-level partners, thus ensuring true cross-institute collaboration on each project.

By Brian Skelly

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