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Matrix of UCT talent unbundles connectivity problems

When they met some 15 years ago, neither Professor Mqhele Dlodlo nor Emeritus Professor Gerhard de Jager – both from the University of Cape Town – could have foreseen that their academic relationship would result in a friendship. It was this friendship that led to them collaborate on a project that promises to revolutionise the way in which people connect to the Internet in low bandwidth areas in Southern Africa.

It is for this very achievement that Professor Dlodlo and Emeritus Professor De Jager – from UCT's Communications Research Group and Image Processing Group respectively - walked away with the 2012/13 NSTF-BHP Billiton Award for *An Individual or a Team who delivered an Outstanding Contribution to SETI through Research Leading to Innovation*. They received this award together with colleagues from the Council for Scientific and Industrial Research (CSIR) and East Coast Access in Durban for their stellar work on the project, "Adaptive Real-Time Internet Streaming Technology" (ARTIST). ARTIST has developed solutions for Internet congestion in areas where low bandwidth is experienced.

While technological advancements are inspiring more and more people to use the Internet, limited bandwidth, particularly in developing countries such as South Africa, is impeding the way in which people access or experience the Internet. It causes slow and difficult downloading of online content, especially videos which are becoming a popular learning tool across the world, e.g. Massive Open Online Courses (MOOCs) and open-source learning. MOOCs enable leading universities worldwide to offer highly interactive online coursework free of charge, on a large scale, to anyone with access to the Internet.

With the help of Dr Keith Ferguson from the Meraka Institute at the CSIR in Midrand, Gauteng, the joint team effort saw UCT providing the student training and patentable research; CSIR providing a platform to apply the research commercially; and East Coast Access – as a media partner – providing the required marketing knowledge and technology. Dr Ferguson originated the conceptual IP for the platform and organised funding for the resulting ARTIST project through the Technological Innovation Agency.

Connecting the dots

The research covers a cluster of applications in the areas of broadband networks, wireless

communications, real-time video streaming and digital image processing. Focusing on video streaming over low bandwidth networks, ARTIST makes use of the most appropriate media pipeline plug-in architecture while reducing overheads to transmit less data. All of this led to achieving the same goal: optimising video processing and using bandwidth more effectively. Because high-definition quality video is becoming the norm these days, even more bandwidth is required to access this content, says Emeritus Professor De Jager. By slightly degrading the picture but retaining the quality in sufficient amounts, so as to not negatively affect the user experience, the ARTIST project solves the problem. "Our aim was to find the balance between complete blockage due to congestion and acceptable picture/video quality, in order to lessen the disruption to the viewing experience of the user," he explains.

The project was piloted on YFM, a commercial radio station in Johannesburg with a strong youth listenership. "We chose a radio station because it only uses voice broadcasts and therefore operates on a low bandwidth channel. We tested our video compression techniques by adding a TV channel to the offering which proved to be very successful," explains Professor Dlodlo.

He acknowledges that the ARTIST project could not have been completed successfully without the invaluable input and dedication of a number of postgraduate students whose masters and PhD research contributed to the project. "The NSTF-BHP Billiton Award was a platform for launching the careers of these students. Our focus was to come up with solutions for problems in communities. More importantly, the funding received to start the project, enabled us to share knowledge and broaden our links across the continent. This is in line with UCT's Afropolitan focus."

Looking to the future

The final outcome of the ARTIST project is the creation of Tuluntulu (Pty) Ltd, an Internet-based media company which focuses on marketing user content on the platform. ARTIST is a perfect example of how an idea led to research, then implementation and now commercialisation. Professor Dlodlo explains: "Usually, as a researcher you produce papers on various concepts and issues, and you don't always know what happens with the work once you've published. But this project validates our work in that we've been part of this project from conception right to the end, and that's a coup for us, thanks to Keith and his keen interest in academic research coupled with business savvy."

The project may be complete, but the two friends' journey is far from over. "Once ARTIST has been commercialised, CSIR will run the company and we will continue doing what we do – educate the next generation of researchers," concludes Emeritus Professor De Jager.

About Professor Mqhele Dlodlo

On his return to Africa following a 12-year stint as a postgraduate maintenance engineer in the USA, Zimbabwean-born Professor Mqhele Dlodlo first joined a polytechnic institute. Here he taught artisans and technicians about telecommunication technology. Thereafter, he earned a masters' degree in electrical engineering and joined the founders of the National University of Science and Technology (NUST), which offers professional degrees such as the Bachelor of Engineering degree. Between 1994 and 1996 he studied land-mobile satellite communication systems at the Delft University of Technology in terms of comparative performance analysis and applications to communities in developing countries for his PhD studies. On his return to NUST, in 1997, he chaired the Department of Electronic Engineering.

Emeritus Professor Gerhard de Jager acted as his external examiner for a year and this is

where the journey began, developing a friendship that eventually resulted in Professor Dlodlo joining UCT in 2005. It is Professor Dlodlo's love for unity that has motivated him to focus on communication system research. "In telecommunications, as it is in life, there's been so much convergence in all directions. The challenge is to optimise the ways in which different elements of technology converge." It was this unifying nature and expertise that saw Professor Dlodlo join the team that worked on the Zimbabwean constitution in 1999 as well as sit on the boards of various non-governmental organisations.

About Emeritus Professor Gerhard de Jager

His name wasn't listed as the credits rolled down the screen at the end of the television episode. Nor was it mentioned as the doctors of "Grey's Anatomy" became excited over the Lodox machine – an X-ray device that can scan a full-length body in just 13 seconds. But, Emeritus Professor Gerhard de Jager, part of the team that designed and built the original machine, wasn't bothered. "We were very excited when 'Grey's' featured our Lodox machine." Under the leadership of Herman Potgieter, Emeritus Professor De Jager was part of the team that originally designed such an x-ray scanner for the De Beers mining company to help detect diamond theft. Potgieter later suggested that they worked on a medical version of the machine. "We installed it at Groote Schuur Hospital for a year, after which they said, take it away, it's not up to the standard we expect. And so we did, but when we brought it back a year later, they loved it."

A specialist in image processing, Emeritus Professor De Jager, a Senior Scholar at UCT, started his academic career as a physicist and then spent 25 years as a radio astronomer at Jodrell Bank in the UK and South Africa before becoming a professor of electronics.

His television experience is not just limited to "Grey's Anatomy". Together with a Stellenbosch University colleague, the late Professor Johan Lourens, Emeritus Professor De Jager helped M-Net develop digital television broadcasting and offered workshops to the company that today is known as DSTV. His knowledge of and expertise in video compression was useful then, and today, it contributes to enhancing the user experience of the Internet in low bandwidth areas.

A man of many talents Emeritus Professor De Jager is also an Intellectual Property scout for electrical and mechanical engineering at UCT – assisting, advising and identifying opportunities to patent the work of students before they publish their research. He says this is an area with which South Africa still struggles. "Much commercial and economic opportunity is lost to international markets because we don't patent enough of our ideas locally," he says. "The country (and continent) loses out as innovative ideas originating from our shores become commercialised and patented elsewhere."

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