# Institute for a Broadband-Enabled Society

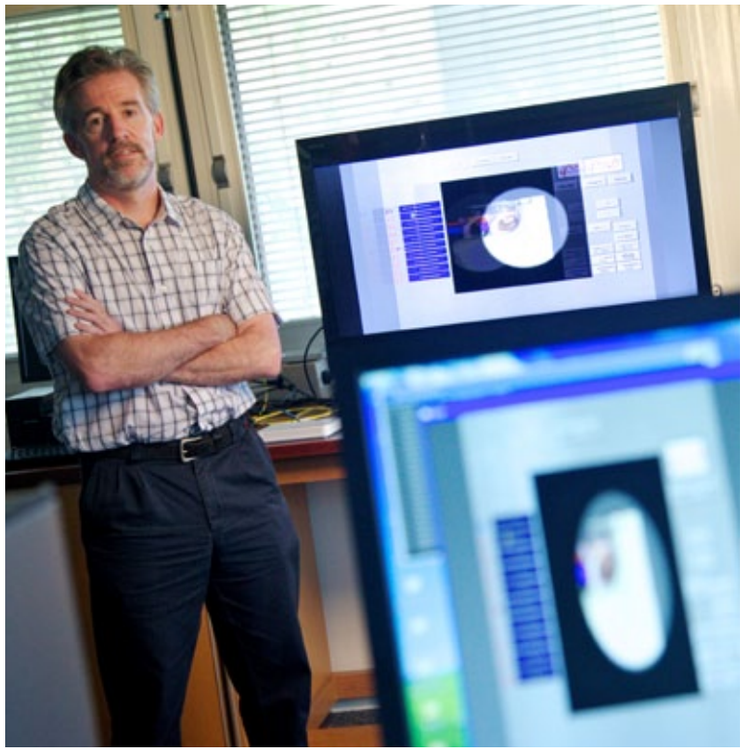
## Annual Report 2011


State Government Victoria

The University of Melbourne

IBES
Institute for a
Broadband-Enabled Society

www.broadband.unimelb.edu.au



Welcome to the second annual report of the Institute for a Broadband-Enabled Society – an interdisciplinary research institute based at the University of Melbourne dedicated to broadband technologies, applications and end-user experiences.

In our second year of operation we have built upon our impressive research program, supporting 53 interdisciplinary projects across a range of disciplines. IBES researchers come from 38 departments across the University of Melbourne. Our projects address issues relating to policy, digital literacy as well as innovation into new applications using high-speed broadband. Our research program has continued to attract support from both government and industry sectors, including $10 million for the establishment of the Centre for Energy-Efficient Telecommunications.

Development of applications at the IBES Broadband Applications Laboratory has led to new innovations, including demonstrating the use of technology that can save lives. As noted in this report many of our projects have been highlighted in media articles, and one project has received a Global Telecommunications Business Award for Innovation.

IBES' success is heavily dependent on the support we have and continue to receive from our Industry Partners in the Industry Partner Program (IPP). We are very grateful for this support. This year we welcome a number of companies to the IPP including Google, Juniper and Microsoft as platinum members, as well as Anue, TestTelecom and Comms Force.

The Institute's profile has grown through active engagement with industry and government.

Through our events program, we have attracted a number of high profile speakers to the Institute and hosted national and international delegations. IBES has achieved a high profile through active leadership in the Australian broadband debate, with Executive Director, Kate Cornick receiving recognition as a Young Achiever at the Australian Communications Awards.

IBES' success is a direct consequence of the enthusiasm and support of the people who help shape the activities of the Institute. This includes the dedicated staff, postgraduate students, researchers and Executive Committee members, in addition to industry partners and the members of the IBES Advisory Board. We also acknowledge the ongoing support of the Victorian State Government and University of Melbourne, without which the Institute would not function.

This annual report provides greater detail on the activities of IBES, but most of all we hope it provides an insight into the possibilities offered by high-speed broadband for the benefit of society.

**Rod Tucker**
Director IBES

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# About the Institute for a Broadband-Enabled Society

The Institute for a Broadband-Enabled Society is an interdisciplinary research institute dedicated to innovations in broadband technologies, applications and end user experiences. Founded in July 2009, the Institute currently supports 53 research projects across four research themes: education and learning, health and wellbeing, social communities and infrastructure, and business and service transformation.

169 researchers from the University of Melbourne's research community, and 46 external collaborators have contributed to the research program at IBES in the past year. A full list of researchers and collaborators is available on pages 126–8.

IBES is supported by its Industry Partner Program, which provides an opportunity to foster research collaborations between industry and academia. In 2010/11 IBES received $2.16 million in cash and in-kind donations from its partners, which is used to support the activities of the Institute. A full list of partners is included on page 5.

The IBES Broadband Applications Laboratory includes equipment donated by Industry Partners, and provides an environment for researchers to test and develop broadband innovations in a real world environment. More details on the applications laboratory are included on page 8.

IBES also provides an environment to discuss and develop ideas relating to broadband, through a program of events, workshops, symposia and public lectures. Details of the events in the past year are highlighted on pages 10 through to 12.

## Mission

**Aligning research and industry interests to drive innovation in broadband applications to deliver seamless experiences for the benefit of society.**

### Goals

- Become a leader in the development of broadband services and innovations for the benefit of Australian society
- Drive interdisciplinary research on technologies, applications and end user experiences of high-speed broadband
- Foster research collaborations, with linkages to other universities and research institutions
- Develop strong partnerships with industry
- Raise awareness of broadband technologies and applications in the community
- Provide a laboratory environment that facilitates the development of new ideas

In its second year of operations IBES invested $839,000 in direct grants to research projects into broadband technologies, applications and end user experiences. The Institute received $2 million in cash from the Victorian State Government and the University of Melbourne, in addition to the support received from industry. Additionally, IBES research attracted $400,000 from external funding sources and consultancies.

In June 2011 IBES received an additional 3 years funding from the Victorian State Government and the University of Melbourne, totalling $6 million in cash investments and $15 million in-kind. We look forward to growing the work of the Institute in the years ahead.

# Industry Partner Program

The IBES Industry Partner Program provides IBES researchers with a direct link to industry and assists in fostering research was established to drive greater collaborations between industry and academia. Recognising the benefit of researching real world problems that industries face, and that many of these problems can be solved by broadband innovations, enables collaborations between industry and academia mutually beneficial.

The Industry Partner Program provides partners and researchers with the opportunity to interact and collaborate. The program provides a neutral ground to discuss issues, shape outcomes relating to broadband in Australia and to develop the next generation of broadband applications and technologies.

Benefits of the Industry Partner Program include providing industry with access to IBES' research and researchers, invitations to events and workshops and the ability to shape future research that will underpin a broadband-enabled society.

Outcomes of the Industry Partner Program include research that has resulted in collaborations as well as internationally awarded work; the development of new broadband applications; usability testing of applications; showcasing of technologies in the Broadband Applications Laboratory; the sharing of expertise between industry and academia; research outputs including publications of white papers; as well as driving broadband debates.

Our partners include a diverse range of organisations from telecommunications equipment vendors, ICT companies and telecommunications service providers, through to local small and medium enterprises. Partners contribute in a variety of ways, from cash contributions to fund research through to the provision of equipment and in-kind support to turn ideas into reality. IBES' success is largely due to this support.

IBES invites industry to connect with us. To get involved or to find out more about the program contact us on ipp@broadband.unimelb.edu.au.

**Jeong Kim** | President Bell Labs, Alcatel-Lucent at the launch of the Centre for Energy-Efficient Telecommunications (CEET)

## Platinum Partners

Alcatel·Lucent

CISCO

Google

HUAWEI

JUNIPER NETWORKS

Microsoft

## Gold Partners

ERICSSON

'yes' OPTUS

## Partners

aarnet

anue SYSTEMS

Allied Telesis

Clarity Simplifying Operations

CommsForce Leaders in Technology Solutions

Haliplex

Empowered by Innovation NEC

NETGEAR Connect with innovation

NICTA

OptiComm fibre connected communities

PBN Pacific Broadband Networks

telecom test solutions

WB

# Industry Partner Case Study – Ericsson

**Colin Goodwin**
Broadband Strategy Manager | Ericsson

Ericsson Australia has been involved with IBES since its inception; indeed we are proud to have been able to lend our voice to the creation of the organisation, as well as contribute to the success of IBES in its first year of operation.

As an early participant we have now had the experience of working with IBES researchers on several projects.

The first to be completed was UniTV – a demonstration in the IBES Broadband Applications Laboratory of utilising a commercial IPTV system and adapting it for educational purposes. This was very much a joint project involving local Ericsson IPTV engineers who customised the standard Ericsson IPTV solution and Melbourne University researchers who provided video content, haptic workstations, and portal structure.

While the demonstration was held in December 2010, the equipment was reinstated several times to show visiting teams of politicians and media. It even had a moment of glory appearing on the ABC's "Four Corners" NBN documentary in April 2011.

The project has been discussed all over the world, and was the winner in June of the 2011 Global Telecoms Business Innovation Award in London, as well as being short-listed for the 2011 ATUG Broadband Award in Australia.

Ericsson has subsequently continued to work with the IBES team on extending the concept outside the lab into more elaborate proof-of-concept projects for health and education.

A second project is the novel use of wireless devices to monitor the position and movement of knee joints in real-time to assist in the diagnosis and treatment of Osteo-Arthritis (OA). With the ageing populations in developed countries around the globe, OA has become one of the major chronic diseases of our time, yet existing diagnostic processes require expensive specialised laboratories seldom found outside of teaching hospitals in major cities.


**Colin Goodwin**, **Natalie Hollier** & **Kursten Leins** | Ericsson in front of Uni TV

Working with the research team, Ericsson's engineers have developed an Android App that runs on a smartphone, collecting data from movement sensors and relaying it over an NBN connection, or a 3G mobile connection, to a server for real-time display and analysis.

The tool is now being used to collect real world data and the researchers are beginning the process of manipulating the aggregated data, looking for the analytical techniques that will identify the presence of OA, and help towards its treatment.

Using this tool, the Ericsson team has been able to contribute to what we hope will be a breakthrough diagnostic approach, and in the process we have learnt a great deal about the complexities of collecting high-volumes of sensor data across wireless networks.

With both projects, the contribution of Ericsson as an industry partner has been to "jump start" the research through a carefully scoped project, either through a demonstration that helps secure funding for a more comprehensive proof-of-concept, or by developing a tool needed for longer-term research.

In the case of the OA project, Ericsson also acted as a supporter of the original concept and helped the researchers gain their initial funding with the IBES project selection panel.

The needs and culture of industry and academia are quite different. Academic research marches to the tune of protracted funding approval cycles, and the rhythm of the academic year with its lectures, exams, and conferences. Industry is driven by an intense focus on fast product development, marketing promotions, and sales deliverables. So working across the two domains is challenging.

I have found that all the members of the IBES team are sympathetic to the needs of both groups. They have been enormously helpful in helping bridge the gap with the researchers, and ensuring that both Ericsson and the researchers have been successful.

From Ericsson's point of view, we have found the experience of working with IBES commercially rewarding, and enormously satisfying for our engineers … myself included.

# Broadband Applications Laboratory

The Institute for a Broadband-Enabled Society (IBES) Broadband Applications Laboratory provides a sandpit environment for the development of new broadband ideas and service offerings.

The laboratory includes a state-of-the-art broadband network that supports the development and testing of new ideas in a real-life environment, ranging from configuring applications vertically through the technology stack through to assessing end user reactions to new services and applications.

## Equipment

- Access network that replicates a similar network to the NBN
- Aggregation and transport components replicating core network functionality
- Interconnect with typical retail service provider equipment
- End user devices such as customer premises equipment along with a range of devices found in homes and offices.
- State-of-the-art test gear to emulate real world network characteristics in a closed and controlled environment

## Services

The laboratory provides:

- Access to the test facility and its equipment, including end user devices and test gear
- Testing of applications in a real world environment
- Advice on the best use of technology for different applications
- Hosting of applications
- Limited software resources to assist with application development

Over the past year the Broadband Applications Laboratory has been used by a diverse range of researchers as well as IBES Industry Partners that have access to the facility. A number of applications have been tested and developed in the laboratory including:

- sensing applications
- virtual collaboration spaces
- interactive 'serious' gaming technology
- immersive 3D environments
- haptic tools that provide force-feedback over the internet

The Broadband Applications Laboratory has been a focal point for visitors to IBES and has been used to showcase the benefit of high-speed broadband to Australian society and beyond. IBES has hosted a number of visitors, including international delegations from industry, research, and government. In March 2011, the Institute hosted the House of Representatives Standing Committee on Infrastructure and Communications at the Broadband Applications Laboratory during their inquiry into high-speed broadband. Other visitors to the Broadband Applications Laboratory include senior executives from multinational ICT companies, international delegations and well as a number of media crews including from Parliament House, the Victorian State Government, the ABC and NBN Co.

Members of the House of Representatives Infrastructure and Communications Committee at a technology demonstration

# Events and Engagement

## Events

In its second year of operations IBES has hosted a number of high profile events and visits.

The Inaugural IBES Annual Symposium, held in September 2010, brought together researchers, industry and government representatives as well as the general public at a showcase of IBES' research. The day-long event attracted over 300 people, and provided a fruitful opportunity to explore research collaborations between industry and academia, from which successful partnerships have been developed. An evening cocktail function for Industry Partners included keynote speakers Jaala Pulford, Victorian Parliamentary Secretary Industry and Trade, Steve Wood, CEO Tennis Australia and Chair of IBES Advisory Board, and Glyn Davis, Vice Chancellor of the University of Melbourne (picture below).

In March 2011 IBES launched the $10 million Centre for Energy-Efficient Telecommunications, a collaboration between the University of Melbourne, Victorian State Government and Alcatel-Lucent, which leveraged network technologies research underway at IBES. The launch attracted 80 visitors and included keynote speeches from the Hon Gordon Rich-Phillips, Minister for ICT in the Victorian Parliament; Jeong Kim, President of Bell Labs; Rod Alferness, Chief Scientist of Alcatel-Lucent; Andrew Butterworth, Managing Director of Alcatel-Lucent Australia and David Tudehope, CEO of Macquarie Telecom.

IBES has hosted a number of public lectures given by guest speakers from all around the world, with topics ranging across the research areas of focus at IBES. Industry speakers included Craig Mundie, Microsoft's Chief Research and Strategy Officer. Speakers from academia included Laura Czerniewicz, Director of the Centre for Educational Technology at University of Cape Town; Peter Boon, from the Freudenthal Institute at Utrecht University; Anthony Maeder, Professor of Health Informatics at University of Western Sydney; and Cathy Bailey and Glenda Cook from Northumbria University in the UK.


**Glyn Davis** | University of Melbourne, **Jaala Pulford** | Parliament of Victoria & **Steve Wood** | Tennis Australia, speaking at the Symposium

IBES Annual Symposium

IBES staff have also represented the Institute at a wide variety of external events including to the Department of Business and Innovation in the Victorian State Government, the Department of Broadband, Communications and the Digital Economy in the Australian Government, and the Australian Communications and Media Authority. Presentations have been made to academic and industry focused conferences including CeBIT Australia 2011; the Korea-Australia-New Zealand Summit (KANZ); the Communications Alliance Broadband and Beyond 2011 conference; the Comms Day Summit 2011; and the Ultra-Fast Broadband Technology Summit 2010, New Zealand. Presentations have been made at a number of forums and workshops including to the Australian Telecommunications Users Group, and the UK Broadband Stakeholders Group.

## Kinecting with people

IBES hosted a public lecture by Craig Mundie, Microsoft Chief Research and Strategy Officer who demonstrated the Avatar Kinect capabilities of the Microsoft Kinect platform. The demonstration involved Craig Mundie conducting part of the presentation remotely by having a conversation with the Avatar of Liz Sonenberg, Pro Vice-Chancellor Industry Engagement who was in another location at the University.

The presentation highlighted the power of the Microsoft Kinect platform to the 350 people in attendance.

**Craig Mundie** | Microsoft, presenting at public lecture

## Workshops

In the past year IBES has hosted a number of workshops and symposia that have brought together leading minds from industry and research to explore issues of importance. Three key events included the Content Futures Forum, Bushfire Workshop and the ICT Forum.

The Content Futures Forum was held on 25 October 2010 and mapped out the challenges faced by media and advertising industries as the digital economy becomes more prevalent. The workshop explored issues arising between across content creation and distribution industries and the ICT sector, including ICT platforms for the future, issues around content creation and explore how future markets could operate. The workshop was attended by over 60 invited guests, including eminent academics and IBES Industry Partners.

The Bushfire Workshop, held in November 2010, drew heavily on expertise developed in the IBES project 'Data assimilation and bushfire modelling for early and rapid bushfire detection using broadband technology'. The workshop brought together leading experts from government, industry and academia to explore research opportunities in bushfire modelling.

On 28 March 2011, IBES co-hosted an ICT Forum with Asialink and the Asia Society. The forum was sponsored by Industry Partner, Huawei and brought together 400 ICT experts from industry and academia to explore how broadband and the digital economy can help to shape Australia's role in the global economy. Keynote speakers included the Honourable Senator Stephen Conroy, Minister for Broadband, Communications and the Digital Economy; David Thodey, CEO Telstra Corporation; and Mike Quigley, CEO of NBN Co (pictured below). The forum also included a session exploring the different approaches to broadband in Asia, and included speakers Hiroki Kuriyama from NTT Japan and Datuk Badlisham Ghazali from the Malaysian Development Corporation. A talk by Dr Tim Williams emphasised the importance of broadband technology to drive the development of new services and applications in health, education and business.


**David Thodey** | Telstra, **Mike Quigley** | NBN Co & The Hon. **Stephen Conroy** | Minster for Broadband, Communications and the Digital Economy presenting at the National ICT Forum

## Engagement

The output from IBES' research program has resulted in the publication of a number of academic journal articles, conference presentations and white papers. In addition to this IBES actively engages with public debate on broadband, and researchers regularly contribute to the debate through opinion pieces and articles that have been published in print and online media outlets.

IBES has responded to Government reviews including the House of Representatives Standing Committee on Infrastructure and Communications and the Convergence Review.

IBES Connect is the Institute's newsletter that provides up-to-date information to researchers, industry, government and the general public. The e-newsletter provides IBES an effective communications channel for those wanting to stay abreast of the latest development. Sign up online: go.unimelb.edu.au/8vu

IBES is engaging with our audiences via a range of social media channels. These outlets provide a way for IBES to contribute to contemporary debate, gather and source information and connect people.



twitter

IBES has an active presence on Twitter and uses this communications channel to actively disseminate information to our followers. Twitter also allows IBES to keep abreast of the latest news and developments of our partners, industry and the wider community.

www.twitter.com/ibesunimelb

YouTube

Video provides a useful medium to engage audiences about the research occurring at IBES. The IBES YouTube channel features videos highlighting research projects as well as providing a central point of contact to access this and related information.

www.youtube.com/user/ibesunimelb

LinkedIn

IBES has a large number of stakeholders including: researchers, partners, industry and government and the wider community. Through Linkedin IBES is able to connect with these people to build a strong network around broadband innovation.

www.linkedin.com/groups?gid=3945696

## Future broadband

The Australian communications sector is undergoing a transformation. The rollout of the National Broadband Network is changing the fixed telecommunications landscape and is enabling a wide range of innovations in broadband service delivery and applications. The rollout of next generation mobile wireless networks, including Long Term Evolution, are also shaping the telecommunications sector and are providing opportunities for innovation. These infrastructures are driving the convergence of the media and communications landscapes, as boundaries between television, radio and telecommunications become blurred as more content becomes accessible online. This raises a range of research issues relating to broadband technologies and their regulation. IBES researchers have been investigating issues relevant to this, including where different technologies should be deployed, the benefits of broadband to the economy and how the media and communications industry should be regulated in the future.

# Where wireless makes sense

Rod Tucker, Rob Ayre, Jeff Chong, David Fateas, Kerry Hinton

Electrical and Electronic Engineering

Kate Cornick, Brad Gathercole, Adam Lodders

Institute for a Broadband-Enabled Society

In recent times there has been much focus on wireless technologies as a viable alternative to fixed telecommunications infrastructure including the National Broadband Network. IBES was commissioned to investigate the capabilities, advantages and disadvantages of fixed wireless broadband technologies. A report titled *Where Wireless Makes Sense* describes, in simple terms, how wireless networks operate and examines where it is and is not appropriate, from a technical perspective, to roll out wireless broadband networks as a substitute for fixed cabled networks.

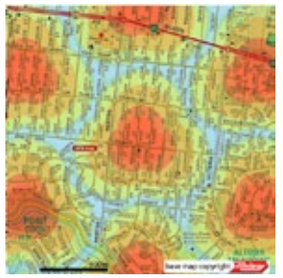
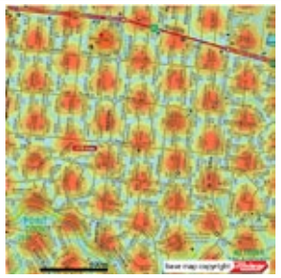
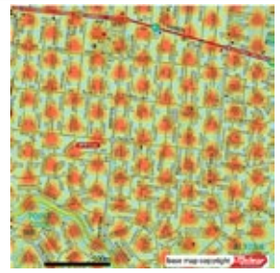
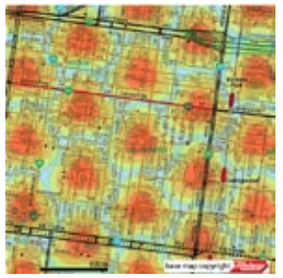
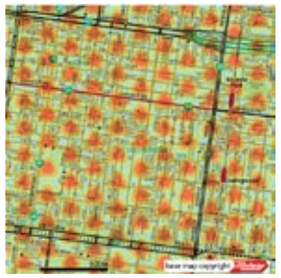
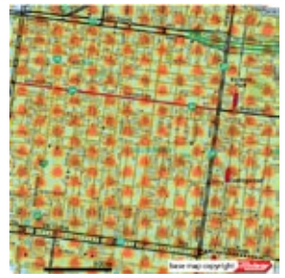
The findings of the research found that fixed wireless networks are a good substitute for fixed cabled networks in rural areas where there are few broadband users. Rural broadband users can use wireless technologies to download large volumes of data and experience a good level of performance without overloading the network as the number of users is small.

However, fixed wireless networks are not a good substitute for fixed networks in suburban and inner urban areas where future capacity demands for broadband can overload networks. To overcome this many more base stations are needed for example to deliver a service with an average download volume of 200 GB per month a base station spacing as low as 200 meters in suburban areas and 150 metres in inner urban areas is required.

The reason for this is that fixed wireless networks in suburban and inner urban areas are limited by interference as the spacing between base stations decreases. The achievable speed by any one user will depend on several factors, especially their location.

To overcome this, a fixed wireless network that meets future user broadband demands needs more spectrum than is currently available. Wireless networks use the radio spectrum, a scarce resource that must be shared between a number of uses and users, limiting overall capacity. While it is technically possible to achieve high speeds on wireless networks when only a single user accesses the network, the reality is that many people access a wireless network simultaneously resulting in slow speeds and low volumes of data downloads.

The image opposite presents a summary of the key findings of the report, that was released in June 2011.

| | Download volume per user per month | | |
|---|---|---|---|
| **Location** | **10 GB per month** | **50 GB per month** | **200 GB per month** |
| **Rural** (Rainbow) |  |  |  |
| | 1 base station | 1 base station | 1 base station (3 cells) |
| **Suburban** (Point Cook) |  |  |  |
| | 1000m base station spacing | 300m base station spacing | 200m base station spacing |
| **Inner Urban** (Collingwood) |  |  |  |
| | 500m base station spacing | 200m base station spacing | 150m base station spacing |

**Legend**

Red = Above 90 Mbit/s
Orange = 75-90 Mbit/s
Mustard = 50-75 Mbit/s
Green = 25-50 Mbit/s
Teal = 12-25 Mbit/s
Blue = 6-12 Mbit/s
500m

Distribution of base stations in a typical rural, suburban and inner urban region for monthly download volumes per user of 10 GB per month, 50 GB per month and 200 GB per month. The Figure shows the minimum number of base stations that are needed to provide the specified monthly download volume per user to all users in each region. One base station is located in the centre of each red area in the figure. In the rural region, only one base station is required for all monthly download volumes to all users, but in the suburban and inner urban areas, the number of base stations increases rapidly as the monthly download volumes increase. For the purpose of this study, the base stations are distributed uniformly across the region and locations are indicative. Overlaid on each map are speed contours for each base station, under the best-case scenario where there is only one user in each cell. The average download speed experienced under ideal conditions by one user in each cell is colour coded on the contour maps. The red areas, centred on the base stations, indicate where the speed experienced by a single user is fastest. The blue regions show where speeds are slowest. The single user in each cell receives maximum speed if that user happens to be located close to the base station and receives minimum speed if they are located near the edge of the cell. In reality, the number of users per cell will be greater than one, so the actual speeds will be lower.

# Valuing broadband benefits: *A selective report on issues and options*

Richard Hayes, Joshua Gans, Racheal Meager
Melbourne Business School

Cost-benefit analyses for the National Broadband Network have received much attention as people question the value of the project to society. The reality is that high-speed broadband will impact on many aspects of Australian society and any cost-benefit analysis needs to take social benefits into account. However methodologies to capture social benefits of high-speed broadband are complex.

*Valuing Broadband Benefits* examined what criteria a social cost-benefit analysis could use to accurately capture the range of benefits delivered via high-speed broadband. The research was presented in a report that highlighted the difficulty in deriving benefits of a range of services likely to be delivered via high-speed broadband by examining the previous attempts to model broadband benefits and the methodological techniques future analysts would have to consider.

Traditional approaches to cost-benefit analyses attempt to calculate consumers willingness to pay for high-speed broadband. These approaches must be very carefully constructed to ensure accurate calculations can be made. Pricing models can also be used, however, these models suffer from a lack of reliable data.

The research highlighted the issues of these approaches, including identifying the difficulty of creating in advance the exact experience of a future world with the NBN. Some applications can be demonstrated such as high-definition videoconferencing, IPTV and cloud computing, however, many other future applications are possible and likely but are currently unknown.

Furthermore, the benefits of some applications may not be realised until a critical mass of high-speed broadband users exist. To the extent that these future services are valued, the current demand for high-speed broadband and the implied demand calculated from willingness to pay studies will produce conservative estimates of the value.

According to a 2008 consumer study by the United Kingdom's communications regulatory agency OfCom, "It is not reasonable to expect today's consumers to demonstrate a willingness to pay for tomorrow's services when they can barely envisage the scope and nature of those services. Ten years ago, they would not have shown a willingness to pay what they currently do for broadband; twenty years ago, they would not have shown a willingness to pay for what they now do on mobiles." For example the initial subscribers to broadband access similar services that were available on dial-up such as email and web browsing. Sites such as YouTube, and on-demand television services such as ABC iView did not exist.

As high-speed broadband is an experience good, the ubiquity needed for application development and persuasive uptake makes it difficult for any valuation to include some of the likely future benefits. This affects current demand models based on current consumer purchases of broadband as they fail to capture future demand. On the other hand, a social cost-benefit analysis contains uncertainty about the future adding greater complexity to any analysis.

The research findings were presented in a white paper titled *Valuing Broadband Benefits* that was released in February 2011.

# Regulation for the digital economy

Thomas Apperley, Scott McQuire
Culture and Communication
John Stanton, Helen Bailey
Communications Alliance

The Australian media and communications industries are converging as boundaries between television, radio and telecommunications blur. Traditionally the three technologies have been regulated separately, however, recognising the blurring boundaries the Commonwealth Government commissioned the Convergence Review to examine the policy and regulatory frameworks for the converged media landscape in Australia. In responding to the review IBES is collaborating with the Communications Alliance to assess industry views on the future of the converged environment.

The outcomes of the research were presented in a report that found while there is a strong consensus that such a review is timely and appropriate, there is also a common concern that any resulting policy framework should be based on principles that are both appropriate for the convergent environment and sufficiently flexible to cope with its dynamism.

The important themes are summarised in the executive summary of the report and are reproduced. These include that:

- The Review is an opportunity for legacy regulation to be reconsidered in light of the dynamic changes occurring in the converging communications and media sectors, and for implementing a transparent regulatory framework that will encourage investment in the Digital Economy.
- A platform-specific regulatory approach appears to be implied in the final Terms of Reference for the Review. The Committee is urged to ensure that this setting does not curtail or limit it from taking a holistic review of the convergent environment.
- The Committee is encouraged to develop over arching principles that inform the regulatory framework and maximise the potential for many-to-many convergent communications channels.
- The informants overwhelmingly recognise 'technology neutrality' as a core principle that the Committee is urged to consider when developing regulatory frameworks for the convergent environment. It creates parity between services based on end user experience, rather than on the regulation of particular distribution paths.
- Regulatory forbearance should also be a guiding principle for the Review, given the risks inherent in applying prescriptive regulation to a fast-changing environment.
- The Terms of Reference tend to reflect a 'passive,' twentieth-century model of consumer behaviour. Any new framework should recognise the emerging role of consumers as "Digital Citizens" who generate content and can themselves be a key component a dynamic regulatory construct.
- The committee is urged to take the opportunity to broaden the definition of 'Australian content'—e.g. by recognising user-generated content alongside professional productions— in order to maximise opportunities for fostering economic as well as cultural outcomes by encouraging competition, investment, and innovation in Australia.
- Cross-border regulations must take account of what is happening in other regions. If Australian regulations are significantly more stringent than elsewhere, investment may be discouraged and there is a risk that some investment and/or existing business operations may be driven offshore.
- The rationale and principles behind spectrum allocation should be closely considered by the Committee, in a manner that is consistent with the policy goals of the rest of the Convergence Review.

The Convergence Review provides an important opportunity to rethink contemporary media regulation. With this submission, IBES and the Communications Alliance are collaborating to provide leadership in driving the future of the digital economy.

COMMUNICATIONS ALLIANCE LTD

## Managing networks

Over the past decade the demand for broadband services has grown exponentially with the average monthly download volume increasing by a factor of 3.6 over the past four years. This growth comes from a greater number of services being made available online that require higher download, and increasingly upload, capacities.

In order to cope with this demand broadband telecommunications networks are becoming more complex. The increasing complexity means that more effort must be focused on how networks are managed. The management of networks impact on all aspects of the supply chain, from vendors whose equipment is deployed in networks, through to the telecommunications providers who manage traffic on the network and offer services to end users, as well as end users who access a wide range of services. Research at IBES is focusing on two aspects of managing telecommunications networks: energy efficiency and empowering consumers to understand the telecommunications supply chain.

# Centre for Energy-Efficient Telecommunications

In 2010, the Internet consumed about 1 percent of the world's electricity supply. This is a relatively small fraction of the world's electricity, but there is a real danger that this fraction will increase rapidly. Fuelled by an ever-increasing range of applications and services, the quantity of data per user on the Internet is growing at around 40 percent per annum. The only way to control the growth of energy consumption of the Internet is to develop technologies, protocols, design methodologies, and architectures that increase the energy efficiency of the network.

The $10 million Centre for Energy-Efficient Telecommunications (CEET) leveraged work underway at IBES, and was established in 2010 to carry out research that aims to improve the energy efficiency of the Internet and keep the total energy of the Internet under control as the amount of data on the network increases and as the number of users expands.

CEET is a partnership between the University of Melbourne, Alcatel-Lucent and the Victorian State Government. It is an autonomous research centre within IBES and is based in the Department of Electrical and Electronic Engineering at the University of Melbourne. Governance of the centre is shared between Alcatel-Lucent, through its research arm Bell Labs, and the University of Melbourne. CEET was launched in March 2011 and has already established a research program in three key areas.

## Modelling

The Modelling Program aims to drive a deeper understanding of the energy consumption of telecommunications networks enabling the development of more sophisticated models.

The CEET Modelling research projects include:

- Cloud Computing, Content Distribution and Information Logistics
- Energy Efficiency of Next Generation Networks
- Internet Services Energy Star Rating
- Energy and Carbon Footprint of Universal Broadband

## Transmission

The Transmission Program explores techniques to reduce the energy consumption of the transmission equipment in telecommunications networks.

The CEET Transmission research projects include:

- Energy Efficient Future Modulation Formats
- Low-Energy Fibre Access Networks
- Energy Efficient of Analogue-to-Digital Converters
- Video Coding for Energy-Efficient Telecommunications

## Fundamentals

The Fundamentals Program explores the physical and mathematical properties of photons and electrons to enable the design and development of energy-efficient telecommunications equipment.

The CEET Fundamentals research projects include:

- Fundamental Limits of Switching and Information Transfer
- Router Power Measurements

For more information visit: www.ceet.unimelb.edu.au


**The Hon. Gordon Rich-Phillips** | Minister for Technology launching the Centre for Energy-Efficient Telecommunications

# Scalable and energy-efficient deployment of video services

**Elaine Wong, Chien Aun Chan, Thas Nirmalathas**
Electrical and Electronic Engineering

**Chris Leckie, Aaron Harwood**
Computer Science and Software Engineering

**André F. Gygax**
Finance

Ubiquitous high-speed broadband will transform the way that people access video services in their home. One mechanism for delivery that is becoming increasingly popular is Internet Protocol Television (IPTV) that provides a scalable delivery method for video on demand services. However the growth and traffic of IPTV is expected to grow exponentially. This growth will place greater demands on the energy required to power telecommunications networks.

This project is developing new techniques to increase the energy-efficiency of IPTV services over current and next generation broadband networks through the investigation of peer-assisted patching with mulitcast and localised hybrid peer-to-peer delivery methods for Video on Demand services and into content sharing.

The Video on Demand service is an important element of IPTV services that allow users to choose any on demand video content at any time from a central video server with a high level of interactivity.

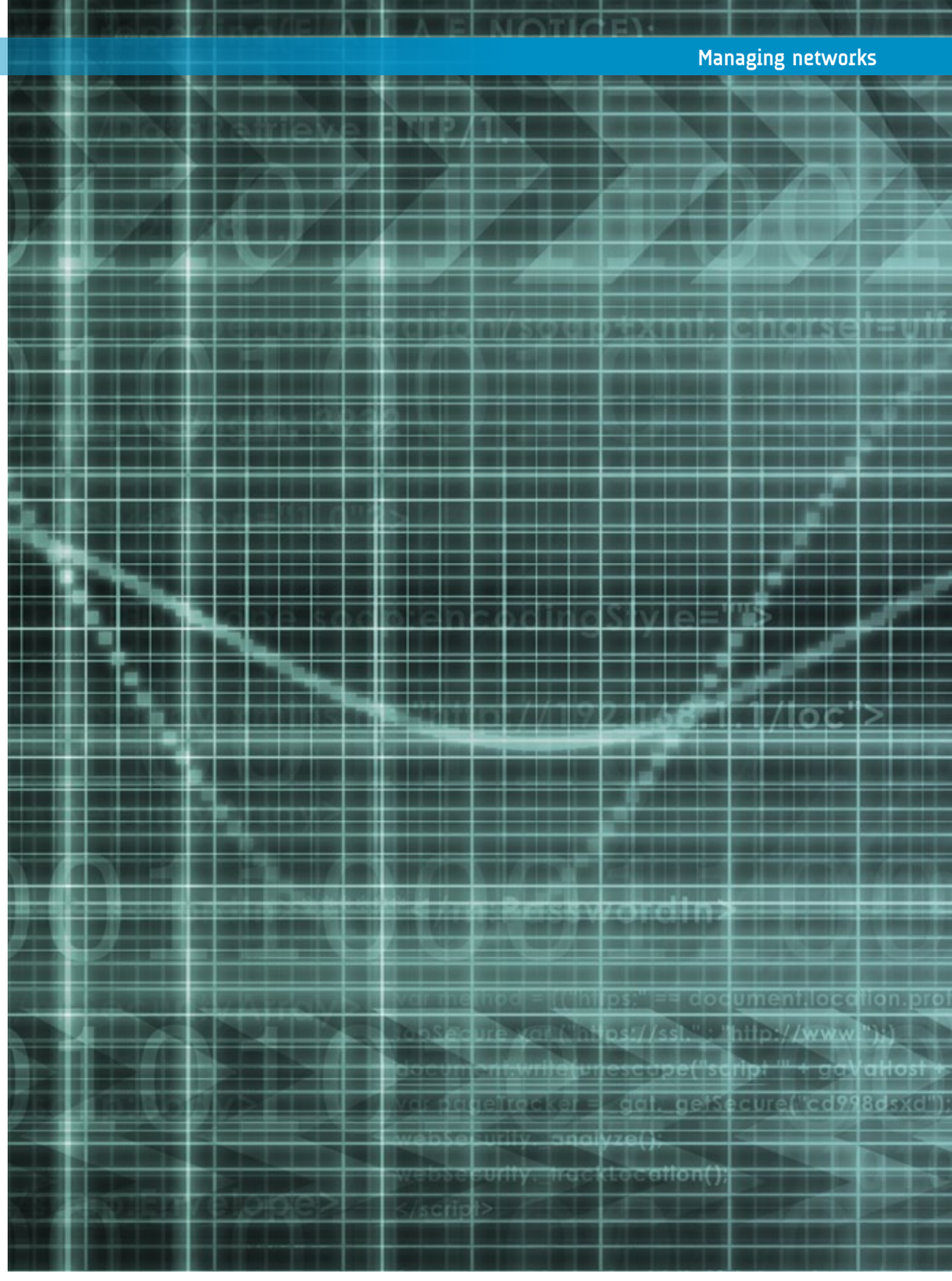
Video content sharing within local communities could potentially overwhelm the access network with large volumes of peer-to-peer traffic during peak times since full length, high definition content needs to be transferred between local uses. This issue is exacerbated for popular content with thousands of concurrent viewers.

Localised peer-assisted patching with multicast video delivery allows a large number of views to share the same multicast sessions while receiving patching of the initial parts of the video content from local neighbouring users. The research findings showed that the use of this technique will reduce the overall network energy consumption for popular multicast channels.

On next generation fibre-to-the-home networks, the localised peer-assisted patching scheme selects the most under-utilised and closest set top box to supply patching streams reducing the energy consumption. Further improvements to the scalability and sustainability of the technique involve the implementation of dynamic patching lengths set in relation to the content popularity and the impact video quality has on energy consumption.

This work was started by IBES and is now incorporated into the research program at CEET.

The outcomes of this research were presented at the IEEE Photonics Society Annual Meeting, in November 2010.



# Building a digital user guardian

**Julien Ridoux, Darryl Veitch, Lele Zhang, Paul Tune, Matthew Davis**
Electrical and Electronic Engineering
**Josh Gans**
Melbourne Business School

The Internet  is now considered by many to be a utility infrastructure that is as essential to modern society and the economy as other utilities such as the electricity grid and national transport systems. However, in contrast to these traditional networks the evolution of the Internet is not under any one person's or organisation's control. Furthermore, the telecommunications infrastructure that enables the Internet is a complex web of different inter-operating equipment, which belong to many different service providers. The resulting complexity means that behaviour or use of the Internet cannot be reliably predicted.

The decentralised nature of the Internet is a key reason for its success, but also the cause of significant problems. Because the telecommunications network offers basic connectivity between two points it is hard to predict what is happening in the network. As a result the responsibility falls to network users via their software applications to determine how the network is performing. This becomes more complicated as the number of service providers needed to transmit signals between two points increases.

High-speed broadband accelerates opportunities offered by the Internet but also compounds the seriousness of problems arising from incomplete information about how the network is performing. These issues will not only be technical but will also impact on regulatory, legal, policy and privacy concerns.

For example a network fault may have serious consequences raising many questions including how end users can independently verify that the service received by their Internet service provider is meeting their contractual obligations with the end user.

This project is developing a prototype 'User Guardian' that is a modular software application that runs on a computer attached to a home network. The software provides protection and services to users, enabling them to assess the quality of their connection, and ensuring that privacy and regulatory requirements are met, allowing legal bodies to collect accurate evidence about disputes.

The outcomes of this project have resulted in four conference presentations and two submissions to international academic journals.


# Peer-to-peer software service for monitoring NBN quality

**Yang Liao** | PhD Candidate
Computer Science and Software Engineering

The National Broadband Network provides an Ethernet bitstream service between premises and access seekers. End users will not receive a service directly from NBN Co, rather they will contract with an Internet (or retail) service provider who form part of a supply chain that make use of the National Broadband Network infrastructure. As a result there are a large number of components that are needed to provide services to end users. The quality of the service received by each end user is determined by these components, with end users receiving a good service when all components operate effectively. This leads to complexities in the delivery of end-to-end broadband services and a dynamic and clear understanding of service quality of network components is essential for all stakeholders, including end users, to understand, control and efficiently use the NBN.

This project is using Peer-to-Peer technologies to develop and deploy cost-effective network monitoring sensors. Each sensor, working as a software agent, will collect information about the connectivity of the network. By aggregating the information received from these sensors, a big picture of network performance is generating, providing valuable data to those involved in managing the network. The development of this technology provides the seed for a larger monitoring public service that would assist all stakeholders, including end users, to understand, control and efficiently use the NBN.

## Broadband and business

High-speed broadband is a utility infrastructure, as important to our economy as gas, electricity, water and transport networks. A recent report commissioned by Google, *The Connected Continent*, found that the Internet contributed 3.6 percent of Australia's GDP in 2010, equivalent to the value of iron-ore exports. Australia's Internet economy is expected to grow by $20 billion over the next five years.

Broadband has the potential to transform business and organisations across our economy through the development of innovative broadband applications that will help to drive efficiencies, and new service delivery models to reach customers.

Nevertheless, many businesses are not making use of high-speed broadband, and it has been reported that less than half of Australia's small and medium businesses have a website. IBES researchers are investigating barriers to broadband services by Australian businesses and not-for-profit organisations, and exploring how high-speed broadband impacts on countries' roles in the global digital economy.

# Assessing the potential barriers to the adoption of high-speed broadband by Australian business

**Pat Auger, Hafizul Islam**
Melbourne Business School

**Catherine Middleton**
Ryerson University

**Rens Scheepers**
Deakin University

This project is exploring the key barriers to the adoption of broadband from the perspective of small and large businesses in Australia. The research has found that barriers include: availability, cost concerns, resistance to change, lack of applications and support services, real or perceived security concerns, uncertainty about regulatory policies, and concerns about digital literacy.

The lack of basic, widespread broadband availability is a barrier for the broader uptake of broadband. While basic broadband services are available even in smaller locations, there is often no competition and businesses have no choice of the type of service they can access. However, even in urban locations, some businesses find that existing broadband services do not meet their needs. Additionally, the lack of availability of high quality broadband services for the general public also inhibits business use of broadband, as business customers are not able to access services delivered over broadband networks.

Adoption of broadband networks to support and enable business activities requires change. Some changes are minor, but often they involve significant process redesign and may change the nature of employment and individual job tasks, which may create a barrier to adoption among business owners and their employees. Additionally, businesses tend to adopt technologies when they can identify a clear benefit however; there is a lack of compelling applications and support services to encourage further investment. In particular, it was noted that despite a number of new initiatives, there are currently few e-government or e-commerce applications and support services.

Other barriers to update include: security concerns surrounding undesirable content on the Internet and an uncertain regulatory environment. A lack of funding to support the adoption of high-speed in broadband in small-to-medium enterprises, not-for-profit and community organisations is a barrier preventing organisations from developing the services and applications that leverage the technology. Finally, digital literacy is a concern on two fronts, first among businesses as many do not have the expertise to determine how to benefit from incorporating broadband communications, and secondly that a lack of digital literacy in the general population means that businesses that are using broadband to deliver goods and services to Australian consumers do not have a receptive marketplace.

While exploring the barriers, the research also examined the benefits of broadband with businesses recognising that broadband connectivity can allow them to engage with a national and international clientele, reduce geographic barriers, operate more efficiently, and that the NBN would have the ability to change service delivery models. Findings from this research were submitted to the House of Representatives Standing Committee on Infrastructure and Communications NBN inquiry.

# Returns on ICT investment in the third sector

**Michael Arnold**
Historical and Philosophical Studies
**Tom Denison, Graeme Johanson, Larry Stillman**
Monash University

There are about 380,000 community-based organisations in Australia with ten percent employing staff. The 890,000 people they employ contribute $34 billion to the Australian economy. Community-based organisations are keen to take advantage of new technologies. While the National Broadband Network offers potential for these organisations, many already experience significant problems exploiting information and communications technology such as integrating it into daily business practices.

There is significant potential for ICT innovation for the delivery of human services by the third sector. Government has made investment in technical infrastructure for community-based organisations but there has been a weak response from the sector to develop vision, drive, and capacity to take advantage of ICT to connect communities. Through an understanding of the value being created by organisations, in both social and economic outcomes and the impact that ICT can have on those outcomes provides the basis for enhancing the capacity of community-based organisations to take control of ICT. This will lead to better service delivery for clients, reduced costs and helping the organisations focus on their core business.

This project is developing models that measure both the social and economic outcomes of ICT choices, enabling organisations to develop ICT strategies that align with their core businesses. The development of models that are able to assess return on investment in new technology, in ways that are robust, transparent, flexible and incorporate both social and financial elements will provide community-based organisations tools to drive investment in ICT. The community partners involved in this project are keen to take advantage of the opportunities offered by technology and applications supported by high-speed broadband.

This project will provide community organisations a better understanding of the issues involved in implementing and adapting technology in their organisations, techniques for measuring impact, the development of a shared model and language to discuss their experiences and support new practice and planning models.

# Digital China

**Ian Lang**
Victorian College of the Arts

**Ken Clarke**
Electrical and Electronic Engineering

**Du Liping, Yuxing Zhou**
Asia Institute

**Josko Petkovic**
Murdoch University

Countries around the globe use public diplomacy to project themselves as respectable, internationally responsible members of the global community. Increasingly public knowledge-sharing takes place through online content and media outlets that are enabled by high-speed broadband. However, there are often lags between different nations' abilities to adapt local knowledge into compelling online narratives capable of winning audiences' attention. This affects each country's ability to communicate online and participate in cultural exchanges.

The differences between countries is particularly true for Australia and China. China currently has around 300 universities teaching digital media production and factual communication in China. This is coupled with 4.5 million users online at any time. Australia has far fewer universities and a population of just 21 million. This raises interesting research issues relating to how the two countries can communicate online and participate in cultural exchanges, and in particular, the role of Australia as China modernises.

Collaboration between the Victorian College of the Arts (VCA) at the University of Melbourne and selected Chinese screen education institutions is enhancing online communication models and increasing cross-cultural understanding. This project is using these relationships and is exploring the gaps in knowledge of Chinese broadband-enabled narrative productions, transmissions and interactions.

The research recognises that collaborations between Australia and China are slowed by traditional media or text-only online media. By evaluating existing and proposed digital media application developments by Chinese universities, this project is developing innovative models to enhance collaborations between Australia and China in the arts, sciences and commerce that move beyond text-only media.

The outcomes from digital China are scheduled to commence in 2012 and will include: the facilitation of Australian short, intensive courses for professionals and graduates in science, education, health and digital communication; a book and e-book for the Chinese market targeted to policy makers; and a book and e-book for western markets.

## Education

High-speed broadband offers incredible opportunities to transform educational outcomes in kindergartens, primary and secondary schools, higher education, vocational and workplace training as well as life-long learning opportunities.

Students no longer have to travel to particular settings to undertake education. Rather, broadband provides a mechanism by which education can be delivered to anyone, no matter where they live or work. Applications including virtual collaboration spaces, interactive 'serious' gaming technology, immersive 3D environments and haptic tools that provide force-feedback over the Internet can enhance learner experiences.

However, the use of technologies in educational settings are not yet widely adopted. While technology exists to support distance and online education, the impact of technology on teaching pedagogy needs to be properly understood if online learning is to be widely adopted across different communities.

IBES researchers are developing and investigating a range of broadband-enabled applications with the goal of adding to our understanding and exploring the opportunities presented by online education.

# I would be IN school but not AT school

**Julie Green, Amy Nisselle, Glenda Strong, Xuan Thu Dang**
Royal Children's Hospital
**Frank Vetere, Paul Peng Deng**
Information Systems

Approximately 11,000 school-aged children are admitted to Melbourne's Royal Children's Hospital each year. Many of these children are absent from school for prolonged periods and experience barriers to their education. Risks include disengagement from the school, academic failure and compromised social wellbeing due to an 'out of sight, out of mind' attitude from their peers.

Creating a presence in the classroom for chronically ill children that are absent from school is important for the continuity of their education. Broadband-enabled technologies provide a mechanism to connect remotely located students, however the technologies must be deployed in a way that they do not lead to adverse effects, for example disrupting the physical classroom or enabling contact between the unwell child and their peers when they are unwell.

This project explored the impact of creating a presence of the hospitalised child in the classroom through the use of an 'ambient orb', pictured right. The orb was used to alert teachers and schoolmates to the absent child's desire to connect with their classroom and peers, without requiring the need to establish communication. The child in the hospital was given an orb, and a second orb was placed in the classroom. A wireless sensor is connected to a laptop to enable the hospitalised child to control the orb that was located in the classroom via a web application.

Children in both the hospital and the classroom had positive experiences with the orb. Responses from classroom children include: "It's cool how it lights up and stuff and you know that Jerry's there."

Hospitalised children said "I reckon it was good… some of my friends said when it changed colours it reminded them of me and I liked it 'cause everyone would think of me." And "I think [the orb]'s a smart idea because… they can know I'm thinking of them, and they can think of me.  And that's good."

The benefits of this research included demonstrating how broadband-enabled technology can help connect children with their schools contributing to a culture of learning across hospital and school settings. This research has provided a template for the development of educational policies that support continued engagement for hospitalised children.

Outcomes of the research included five publications including in international conference proceedings and a feature article in the Department of Education and Early Childhood Development (DEECD) monthly magazine. The research is now being extended to include other technologies including video applications.


**Amy Nisselle** with a patient holding an Orb

# Uni TV


**Ken Clarke**
Electrical and Electronic Engineering

**Eric Reynolds, David Manton, Chau Nguyen, Matt Hopcraft, Michael McCullough, Roy Judge**
Melbourne Dental School

**Gregor Kennedy, Lynda Ball**
Melbourne Graduate School of Education

**Peter Tregoloan**
Chemistry

**Steven O'Leary**
Otolaryngology

**Ramaswami Harindranath**
Culture and Communication

**Brad Gathercole, Adam Lodders**
Institute for a Broadband-Enabled Society

**Colin Goodwin, Todd Clark, Natalie Hollier, Ravi Jayalath, Lydia Lye**
Ericsson

**Doug Farmer**
AARNet

**Bernard Meade, Scott Middleton**
Information Technology Services

**Rob Myers**
Panasonic

**Ben Loveridge, Ian Shiel**
Scholarly Information

**Diane Squires, Pat Freeland-Small**
Marketing and Communications


Uni TV provides a platform for innovation in the delivery in education across the world. It enables educators, technologists and vendors to work together to deliver educational services across a number of fields such as medicine, chemistry and engineering by developing 3D content to assist learners engage with complex subject matter. As Australia rolls out the NBN, Uni TV will provide the basis for other educational services, such as professional development of doctors in remote locations.

Ubiquitous high-speed broadband services offer an exciting opportunity for new types of service providers to enter a media landscape that is traditionally dominated by large corporations. Potentially, organisations that produce content will be able to offer their services and products and contract directly to the end user.

The Uni TV project brings together a huge variety of both existing and newly created customised content from numerous sources at the University of Melbourne and combines them with interactive applications such as shared learning and virtual workspaces.

Uni TV has used 3D technology to broadcast virtual reality surgical operations via 3DTV. The technology enables tomorrow's surgeons to experience their teachers' surgical expertise first-hand in the classroom or their own homes.

The Uni TV platform has been built in conjunction with IBES' Industry Partner, Ericsson. The platform is based on Ericsson's commercial-grade Internet Protocol (IPTV) system, enabling the delivery of a premium service over a managed network connection. Uni TV takes Ericsson's standard IPTV product that deliveres video entertainment to TV sets around the world and customises it for education use.

## Award winning research

The Institute for a Broadband-Enabled Society and Ericsson received the 2011 Global Telecoms Business Innovation Award for remote education. The award recognises the collaboration between IBES and Ericsson in developing Uni TV.


**Sally Capp** | Agent General Victoria, London collects the award on behalf of IBES

# Connecting learners across diverse communities

**Jon Pearce, Shanton Chang, Suelette Dreyfus**
Information Systems

**Mary Ainley**
Psychological Sciences

**Gregor Kennedy**
Melbourne Graduate School of Education

**Lindy Joubert**
Architecture, Building and Planning

**Chris Platania-Phung**
Melbourne Law School

**Lenin Mehedy**
Electrical and Electronic Engineering

Collaboration between students is highly beneficial to learning in informal and formal settings. Broadband-enabled platforms provide an opportunity to bring together learners from different cultural and social contexts to collaborate using right media connections.

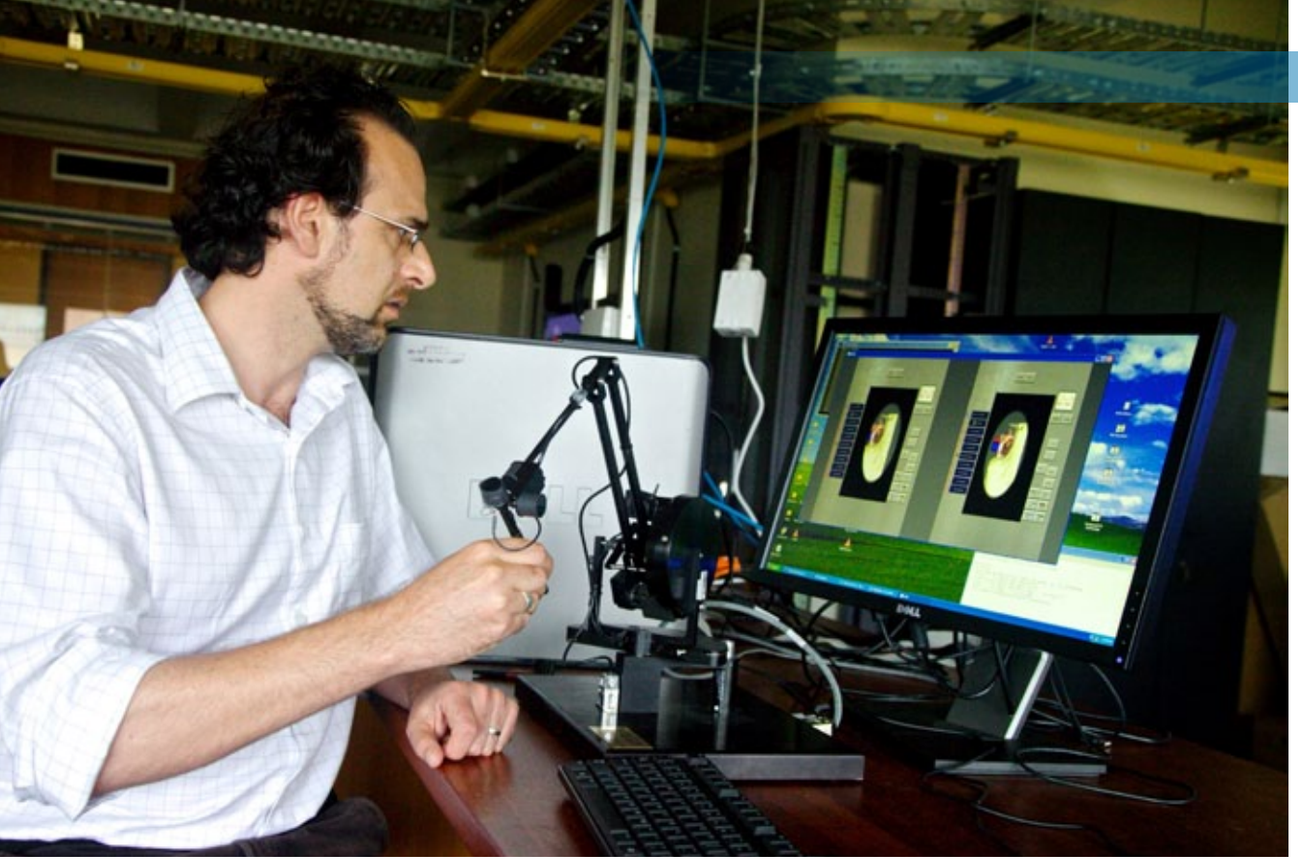
This project is developing an innovative system to facilitate the pairing of students in order for them to work on a collaborative task or project. The system allows students to enter information such as personal preferences about what they like, be it school subjects, tastes, attributes of other people, into the system and then explore the attributes of other students - represented anonymously as graphic icons - in an environment that is designed to encourage exploration.

The project has been designed for use amongst three different student cohorts including:

- Primary schools in remote and rural locations with urban school children
- Aboriginal students in Fitzroy Crossing (WA) with students in Melbourne; and
- Teachers and students from primary schools in Victoria with sister schools in Japan, Indonesia, Korea and China

However, the initial application of this system is aimed at primary school children. They enter the program submitting some personal information and set four sliders representing preferences for their on-screen school subjects. This information determines the design of unique fish, an iconic representation of them in an aquarium. When all students have completed this data entry stage, they move on to an 'aquarium' screen in which they see all the other fish from their class. By moving the four sliders that represent their preferences they see the fish swim around, dynamically ranked by their slider settings. They select three fish of interest and then await the system to tell them who will be allocated as their partner. They then carry out their allocated task together.

This research is refining the pairing process and understanding in both local and remote settings. Further research aims to gain an understanding of how different pairing criteria impact on the students' performance in the tasks that follow. The final goal of this project is to use the system to pair collaborators located in remote places.



# 3D virtual reality training


**Ioanna Ioannou, Min Li**
Health and Biomedical Informatics

**James Bailey, Ed Kazmierczak**
Computer Science and Software Engineering

**Gregor Kennedy**
Melbourne Graduate School of Education

**Terry Judd**
Melbourne Medical School

**Stephen O'Leary**
Otolaryngology


Lack of surgical experience is a major factor contributing to surgical errors. In order to improve decision-making skills, novice surgeons need additional experience as well as timely and appropriate feedback. Fully immersive 3D virtual reality environments have great value in education and training. New delivery platforms like IPTV, high-speed broadband and reduced 3D development costs will result in the wider rollout of this technology.

3D virtual reality environments can enable the development and refinement of a number of skills, while broadband allows the training to occur in the comfort of the home or office.

This research project is developing a feedback system that uses data mining techniques to model performance in 3D virtual reality surgery. The system provides individualised advice to operators about the performance. An example of the system in action is pictured opposite below. Based upon historical surgical data the simulator provides real-time feedback and evaluation of drilling techniques before delivering a final overall assessment.





# Developing decision-making skills using immersive virtual reality

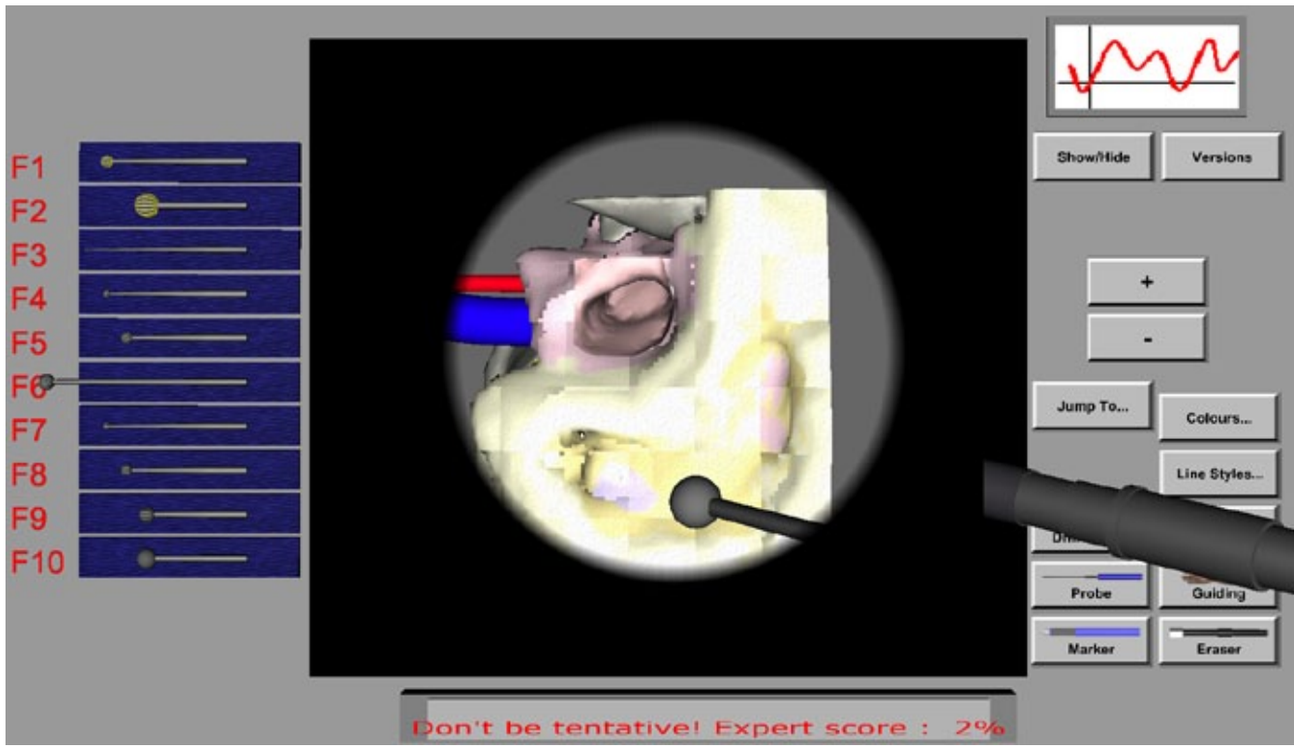

**Yun Zhou** | PhD Candidate
Computer Science and Software Engineering


Reducing the incidence of surgical errors is a major concern for hospitals. A major factor contributing to errors is a lack of surgical experience. This PhD research project is exploring the relationship between surgical experience and surgical error rate.

Computer-based immersive virtual reality systems, coupled with haptic (force-feedback) capabilities are useful tools to assist surgical training. Connecting these systems via broadband will enable collaboration that will improve surgical decision-making skills.

Through data-mining, the project will be able to recognise the difference between experts and trainees as they use a surgical simulator (pictured below).

Given this understanding the program will be able to provide timely and appropriate feedback to users about their performance. The simulator will enable trainee surgeons to refine their skills resulting in less surgical errors improving patient safety.



## Don't forget to be awesome: *Young adult literature, heterotopia and adolescent civic engagement online*

**Lili Wilkinson** | PhD Candidate
Melbourne Graduate School of Education

Adolescents occupy socially and politically restricted spaces – living under near-constant surveillance. Young Adult literature provides a fictional space where teenagers can, by proxy, step outside the real-world confines of adolescence and act with power and agency.

Reading is no longer a solitary activity. Communities of readers are being created using social networking technologies, and literary engagement is becoming social, creative and socially productive. For example, the Harry Potter Alliance is an online Harry Potter fan club, which seeks to identify the "real world Dark Arts" – issues such as genocide, homophobia and illiteracy. Teenagers and young adults from all over the world then engage in projects to combat these "Dark Arts" In 2010, the Harry Potter Alliance raised over $250,000 for a global literacy project, in addition to sending five planes full of food and medical supplies to earthquake victims in Haiti.

This project is investigating the use of online social networks – specifically literary fandoms and exploring how they extend and develop the transformative spaces offered by Young Adult literature, creating new spaces where teenagers can be genuine participants in the civic process.

The outcomes of the project will include the writing of *The Wild Kindness,* a Young Adult fiction novel about a young Australian who flees a Junior UN Summit in New York and embarks on a transformational road trip during a time of global political uncertainty. The novel will interrogate the role of young Australians in local, national and global political engagement, and explore ways in which online participation can allow teenagers to be civically motivated and active.

## Unpacking the Ultranet: *Home-school uses*

**Veronica Fitzgerald** | PhD Candidate
Melbourne Graduate School of Education

The Victorian Government's Ultranet connects urban, rural and remote users from kindergarten to year 12 in government schools and homes. The Ultranet is an innovative, secure, online portal where 50,000 teachers, 500,000 students and one million parents across Victoria can create, access and use teaching and learning materials from within personalised learning spaces.

Unpacking the Ultranet is exploring the social and technological impact of broadband technology in homes and classrooms. The project analyses home-school communication and new media technologies to provide insight into relationships between home and school and patterns of computer use. Empirical research will seek to draw out the first-hand experiences children, parents and teachers to qualitatively analyse how the Ultranet connects education and home media spaces. The data for this project will be collected through an 18-month ethnographic study in three comparative, urban grade 5 and 6 classrooms and a small number of homes.

Broadband-enabled technologies have value for 'new millennium' learners as they build their social and technologies identities in a rapidly changing environment. Understanding how end users engage with and connect with other government school users in the twenty-first century through Ultranet will unpack some of the attitudes, values and perceptions of ICT use in schools and homes. This research provides opportunities to analyse interactivity and participation contributing to a growing dialogue on current and future digital media and learning needs of Victorians.

## Monitoring health

The health care system is complex, with many stakeholders including general practitioners, specialists and allied health professionals, Government, patients and their carers.

Ubiquitous and high-speed broadband has the potential to dramatically transform the health care sector. Broadband technologies and services can help to improve communications between patients and clinicians, and through inter- and intra-organisational entities, resulting in better health outcomes. The application of video-conferencing, sensor networks and enhanced information management systems can drive efficiencies and productivity growth in hospitals, general practice and support patients in their home.

Research underway at IBES is investigating the use of broadband-enabled technologies to address issues of national importance, including the increase in youth mental health disorders, the introduction of the Personally Controlled Electronic Health Record and the remote monitoring of chronic disease.

Additionally, IBES is supporting research leadership in the emerging field of personalised or precision medicine, where advanced diagnosis and therapy in complex diseases such as cancer can benefit from specialists' and researchers' ability to rapidly process large volumes of human genomic data.

# Health and biomedical informatics research

Fernando Martin-Sanchez, Kathleen Gray
Health and Biomedical Informatics

In February 2011, Fernando Martin-Sanchez (pictured below with Kathleen Gray) was appointed as the Professor and Chair of Health Informatics at the University of Melbourne, supported by IBES. Professor Martin-Sanchez's role includes driving health and biomedical research at IBES.

Health and biomedical informatics is the science and practice around information in health that leads to informed and assisted healthcare (Health Informatics Society of Australia, 2010). It is the body of knowledge that concerns the acquisition, storage, retrieval and use of information in, about and for human health, and the design and management of related information systems to advance the understanding and practice of healthcare.

Health and biomedical informatics is underpinned by the availability of ultra-high-speed, high-capacity, ubiquitous, 'always-on' broadband connectivity that enables the transmission of health information between different points in the healthcare system.

The electronic transmission of health information, including everything from a pathology result or hospital stay record to a computed tomography (CT) scan or real-time data from physiological monitoring devices, will transform healthcare outcomes.

It enables improved access, equity, safety, quality, sustainability and innovation.

Those who will be affected by new ways of using health information include patients and their carers, clinicians from all health professions, managers of healthcare services and facilities of all types, their commercial partners and providers, healthy citizens, public health authorities, health policy-makers, and health and biomedical researchers.

The discipline of health and biomedical informatics integrates four fields of research:

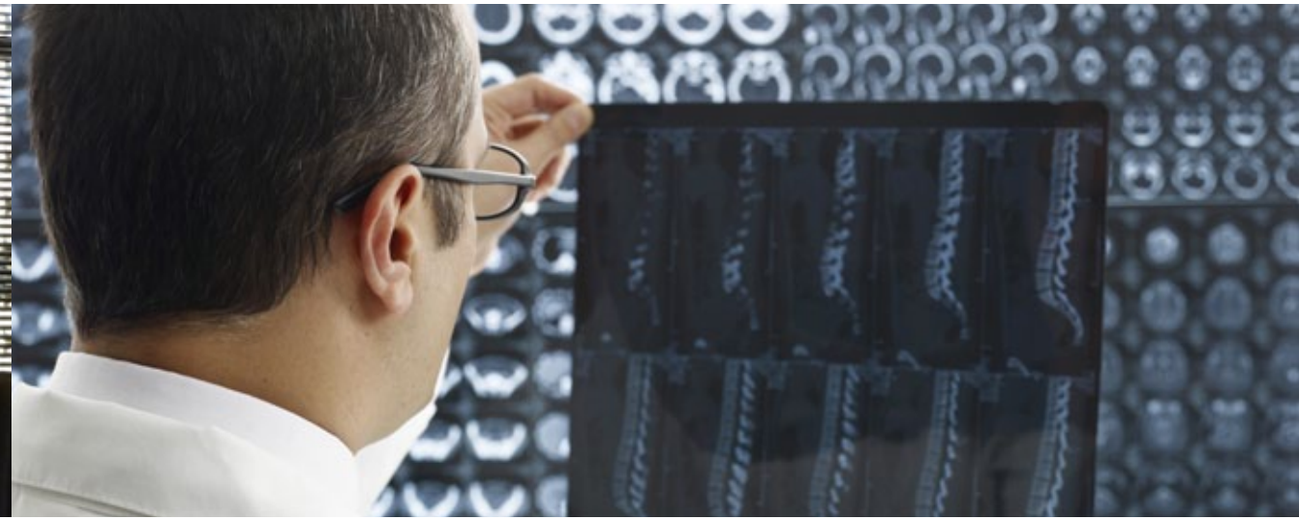
- health science
- computer science
- information science and
- knowledge management

Health and biomedical informaticians have an important role ensuring that strategies, technologies, accountability and usability are properly integrated in the design and implementation of broadband enabled healthcare solutions. Research areas include:

- data standards to facilitate the exchange of health data types, including controlled vocabularies and technical standards
- databases, such as those that underpin electronic health records, clinical decision support systems, health registries and biobanks
- networks and devices for information and communication, for example in health provision, governance and research, and
- human-computer interactions among health information custodians, users and other stakeholders

Through the work of Professor Martin-Sanchez, IBES is also supporting research leadership in the emerging field of personalised medicine. Personalised medicine refers to the tailoring of medical treatment to groups of patients with similar genetic or molecular profiles. This paradigm is based on the availability of several enabling technologies including personal genome sequencing, integrated personal health records and sensor technology.

Personalised medicine will drive enormous volumes of health information, including human genomic data. Ultra high-speed broadband networks will be required to transmit data and knowledge from patients' homes to health practitioners and vice versa in a timely manner, and to enable the processing of this deluge of data. Personalised medicine offers enormous opportunities for improving preventive, diagnostic and therapeutic solutions, and therefore has a potential impact on improving healthcare outcomes, reducing costs and increasing patient safety.



# Youth mental health

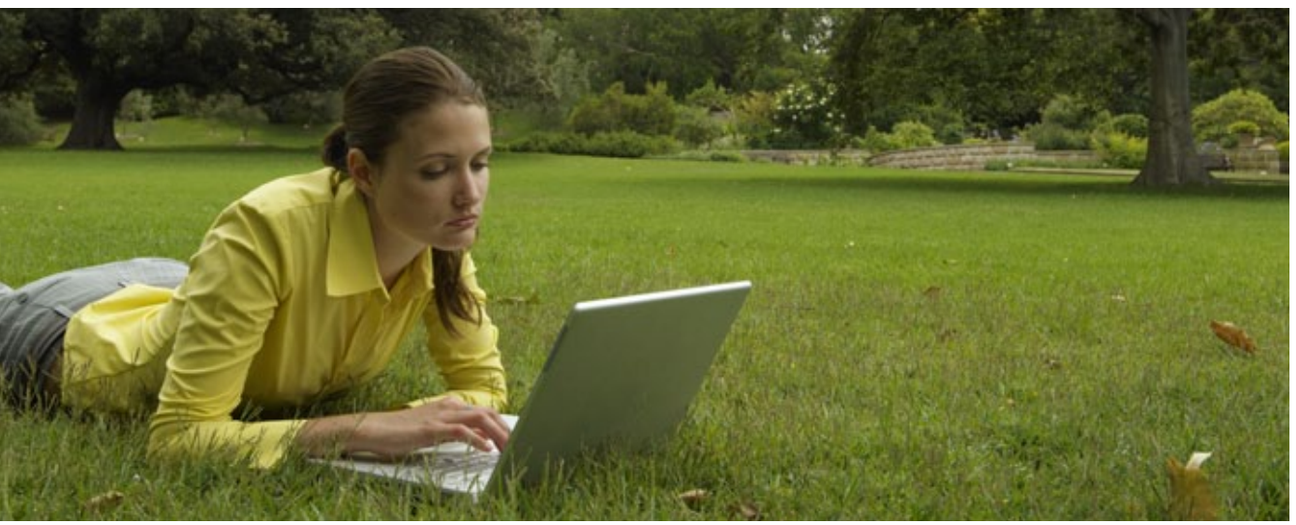
Mental disorders, led by depression, account for more than 50 percent of the total disease burden of young people in Australia. Broadband technologies have the potential to tackle this pressing concern by providing opportunities for young people who are socially isolated to develop online networks and activities that connect them with peers, carers, clinicians and the broader social community.

Youth mental health is a research cluster at IBES that has brought together researchers working on three interrelated projects aiming to identify, alleviate and support affected youth.

## Promoting guideline concordant care for young people with depressive disorders

Sarah Hetrick, Magenta Simmons
Centre for Youth Mental Health
Jane Gunn, Lena Sanci
General Practice
Kristina Dellosa
Psychological Sciences

Broadband-enabled technologies can support decision-making by patients and health care professionals through the availability of online tools. This project is testing the effectiveness Internet based resources for young people who experience depression and is providing evidence to inform their carers and clinicians of their state. Researchers have created a website containing relevant and informative resources for young people that enable them to improve the management and treatment of depression. In addition to youth specific interactive information resources, the website houses the first decision support tool made internationally available to clinicians and carers that supports and assists this population by providing methods for monitoring depressive symptoms and adverse events.



## Social networking applications for young people with sisabilities from ethnic communities

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Information Systems
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Young people with disabilities from ethnic communities are often physically and emotionally isolated due to language barriers and stigma associated with the disability. This isolation can prevent them from participating in social activities.

Social networking technology can provide opportunities for such young people to develop online network and activities that connect them with peers, carers, case workers and the broader community.

This research project is investigating how social network technology can help overcome isolation providing a positive impact through collaboration with key stakeholders.

The findings from this project have enabled a detailed understanding of how social networking technologies can support general satisfaction and wellbeing among young people with disabilities from ethnic communities and provide a toolkit to support caseworkers engage their clients.

## HORYZONS: *Broadband for first episode psychosis*

**Mario Alvarez-Jimenez, Eoin Killackey**
Centre for Youth Mental Health

**Reeva Lederman, Greg Wadley**
Information Systems

**John Gleeson**
Australian Catholic University

First-episode psychosis is a major issue in the lives of patients and their families. While clinical remission is obtained by 90 percent of patients within the first twelve months of treatment. However, 80 percent of patients will experience a relapse within five years of the initial episode.

Relapse means that young people disconnect from their school, work and friends. It also dramatically increases the risk of developing chronic psychosis, permanent disability and homelessness.

The economic and social costs of psychosis place it among the world's top ten causes of disability, costing the Australian economy $1.85 billion annually.

Clinical trials have demonstrated that specifically designed relapse prevention therapy has been effective in dramatically reducing the rate of relapse. However, the implementation of this therapy is costly, limiting its availability. There is an additional stigma associated with mental health treatment that adversely affects those seeking help and compliance among young sufferers.

Broadband-enabled technologies enable novel psychological interventions, addressing accessibility and compliance issues at a low cost.

The HORYZONS project is first to use broadband technology in the early treatment of psychosis.

One focus of the project is to test the effectiveness of an advanced web-based and mobile interactive psychosocial tool for relapse prevention and promotion of social recovery for young psychosis sufferers.

The project team has developed an interactive and flexible tool comprising moderated social networking, online relapse prevention therapy and intervention via mobile devices that are highly customisable to end user needs. The welcome page is shown opposite.

Patients interact with the tool by regularly recording their experiences, joining and contributing to groups and sharing their activities with peers. Through this information, the system detects young people at high-risk of relapse, alerting moderators and case-managers who can then devise an appropriate intervention.

This project is supported by the Telematics Trust, the Helen McPherson Trust and Telstra.

## Electronic health records

The Commonwealth Government is in the process of exploring the rollout of a Personally Controlled Electronic Health Record enabling all Australians to have access to their health information.

The Personally Controlled Electronic Health Records will transform healthcare, altering doctor-patient relationships and empowering individuals to take a more proactive approach towards their health. However a number of issues surrounding their implementation remain unanswered.

A research cluster at IBES is exploring a number of issues surrounding electronic health records from how to make them easier to read, to how they can be adopted to assist in treating health issues, through to ethical and social issues. Each of these projects is outlined in the following pages.





### Multi-site electronic health record, clinical viewer and personal patient record to improve clinical outcomes for immigrants and refugees requiring specialist care

Beverley-Ann Biggs, Marienne Hibbert, Georgie Paxton, Thomas Schulz

Medicine – Royal Melbourne Hospital

Jason Lohrey

Arcitecta

Refugee patients usually have multiple and complex health conditions requiring lengthy medical follow-up. Typically they may see both a General Practitioner (GP) and a specialist multiple times over the course of months to years. This presents issues relating to continuity of health records for individuals who may visit multiple clinicians during the course of their treatment.

This project is developing a pilot web-based electronic health record system to overcome this issues. The system is being deployed in specialist refugee health clinic at the Royal Melbourne Hospital, and Dandenong and Geelong hospitals. The system links to hospital pathology systems and provides data for monitoring health to clinicians.

The system makes use of cloud computing facilities, providing an interface to generate care plans and specialist summaries. The research team is also exploring the use of videoconferencing to provide real-time specialist support for GPs by enabling them to virtually consult with specialists, as well as interpreters, via video conferencing.

By connecting GPs and specialists across different hospitals and clinics, patient care will be optimised through the facilitation, coordination and specialist management of patients with complex health issues. Real-time engagement will avoid delays and duplication leading to better health outcomes. Providing support to GPs in regional areas will allow for the efficient use of limited specialist resources.

The project team are seeking to extend this project and have applied for additional funding from the Victorian State Government through the Broadband Lead Adoption Program.

## Making pathology reports smarter

**Reeva Lederman, Suelette Dreyfus**
Information Systems

**Paul Monagle**
Royal Children's Hospital

**Stephen Smith**
Monash University

Pathology reports are currently designed as a concise record of test results. Unfortunately, the technical emphasis of these reports makes them difficult to understand for many patients, representing a communication barrier between patient and physician. A more user-friendly report design that helps patients more easily understand their pathology results would enable greater engagement by patients in achieving positive health outcomes.

This project is developing a new type of pathology report that will enable a patient with a chronic disease to better understand, monitor and manage their condition through a customised health tool. The smarter pathology reports developed by the project team use message matching to connect the health message, the pathology results, with the patients preferred manner of delivery, to drive health-behaviour outcomes from the presented information.

The smarter pathology reports are activated via a small questionnaire to illicit patients' presentation preference, with tailored messages sent from a centralised server to mobile phones. Patients also have the ability to log into the system and view their reports any time.

The research from this project will be continued through support from the Commonwealth Department of Health and Ageing.


**Steven Smith** | IBES Annual Symposium 2010

## Ethical and social issues

**Craig Fry, Michael Arnold, Merle Spriggs**
Historical and Philosophical Studies

**Chris Pearce**
General Practice

The Australian Government is currently designing a system that will make everybody's key medical information and history available through a single access point. The system is called the Personally Controlled Electronic Health Record and its implementation raises a number of ethical and social issues.

Some of the challenges arising from the implementation of Personally Controlled Electronic Health Records include: how responsibilities change among stakeholders such as patients and clinicians; how conflict is resolved; how privacy and confidentiality is managed, and how patients accessing their own health information affects their relationship with health providers.

The researchers on this project are exploring the views and practices of stakeholders to identify key ethical challenges. Along with cultural concerns, these exploration challenges are leading to the development of resources to inform policy making around electronic health records.

The project is developing practical ethical guidelines and decision-making resources to address current needs in relation to electronic health records that will inform policy and consultation by the National E-Health Transition Authority (NEHTA) and other government bodies as Personally Controlled Electronic Health Records are progressively rolled out across Australia.

# Wireless broadband monitoring of knee osteoarthritis

**Tim Wrigley, Kim Bennell**
Physiotherapy

**Daniel Lai**
Victoria University

**Marimuthu Palaniswami**
Electrical and Electronic Engineering

**Colin Goodwin**
Ericsson

Osteoarthritis is one of the main chronic diseases in developed countries alongside cardiac and pulmonary diseases. Knee osteoarthritis affects approximately 8 percent of the Australian population. With no cure, treatment is limited to the alleviation of symptomatic pain, physiotherapy, and ultimately joint replacement.

Diagnosing and monitoring the progress of the disease requires the close monitoring of knee joint loading. This measurement typically requires complex laboratory equipment. The cost and size of the equipment means that it is not possible to examine patients' movements frequently.

Working in partnership with IBES' Industry Partner Ericsson, this project team is developing a prototype device to enable the remote monitoring of patients as they undertake typical daily activities.

The device consists of small accelerometers that is attached to a patient's body and an Android smartphone that the patient must carry alongside the sensor. The accelerometers collect data as the patient moves as they undertake their typical daily activities. The data is then transmitted via a WiFi network to a home router or alternatively the phone can connect over a 3G mobile network allowing the patient to move around outside their home. The data can then be accessed by the patient and the physiotherapist through a web application.

The device enables real time monitoring of joint movement over extended periods, enabling the development of more accurate assessments of knee joint usage patterns and disease progression.

The outcomes of this research are expected to contribute to more effective interventions to alleviate the pain caused by knee osteoarthritis.

## Telemedicine

High-speed broadband is transforming the delivery of services, including in the healthcare sector. One use of broadband is telemedicine that makes use of video conferencing to connect remotely located patients and healthcare professionals.

The use of telemedicine can assist and enhance medical outcomes. This is particularly true for patients who have difficulty accessing specialist medical care, for example those with mobility issues or those that live in rural and regional areas.

The potential offered by telemedicine has been recognised by the Australian Federal Government, who recently introduced Medicare rebates to encourage the use of medical consultations via video-conferencing.

Research underway at IBES is exploring different uses of telemedicine including in specialist and GP consultations as well as in physiotherapy. Researchers are employing different technologies, including three dimensional video applications, as well as haptic technologies that provide force feedback through a broadband connection.

# The Telestroke solution to rural Thrombolysis

**Bernard Yan, Stephen Davis**
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**Les Bolitho**
Rural Clinical School

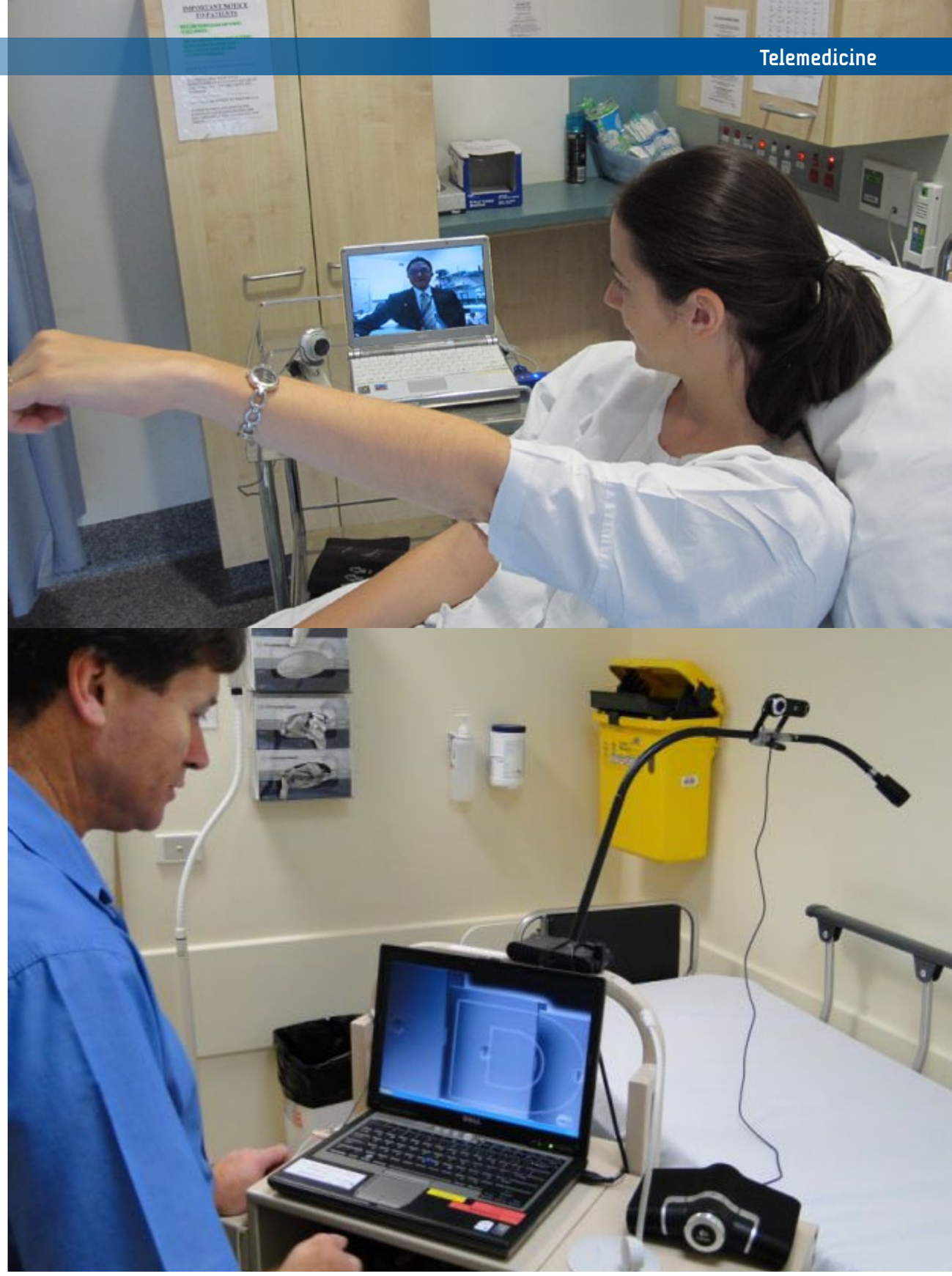
Stroke is the second leading cause of mortality in Australia resulting 11,000 deaths annually. There are approximately 60,000 strokes annually. For many patients this leads to physical dependence on others and prevents them from working. Disability from stroke arises from impartment of neurons that control language, movement, sensation and higher level functioning. Importantly, the duration of time for which blood flow is compromised during the stroke affects the level of disability.

The treatment of acute stroke has been revolutionised over the past fifteen years through the use of early intravenous thrombolysis treatment known as rt-PA. However, a shortage of stroke specialists required to administer the treatment means that this treatment is poorly utilised in rural areas. The long travel times from rural hospitals to stroke centres often result in patients presenting after the four and a half hour treatment eligibility window. Treatment is time critical with delay associated with greater disability.

The application of telemedicine in assessment and management of acute stroke patients is one solution to combat the rural-metropolitan stroke care divide. Telestroke systems are already in place overseas and have demonstrated safety, diagnostic accuracy and improvement in long-term functional outcomes.

The telestroke system developed by the research team uses real-time videoconferencing technology to provide specialist stroke advice to rural clinicians inexperienced in acute stroke care, enabling them to administer the thrombolysis treatment. The telestroke system connects Wangarratta Base Hospital with stroke specialists in Melbourne. In its first year of operation 119 acute stroke patients were seen with 8 receiving treatment through facilitated consultation with a Royal Melbourne Hospital neurologist.

Facilitating thrombolysis is only one aspect of enhancing stroke care. Telestroke can aid in other domains including subacute care, secondary prevention and rehabilitation. By facilitating a clinical review of stroke patients and their radiology by specialist neurologists, unnecessary patient transfers can be avoided. On the other hand, the telestroke system can assist with the early identification and transfer of patients appropriate for interventions. An additional benefit of the telestroke system is that it raises the opportunity to recruit rural patients into acute stroke treatment trials and entice young physicians to rural hospitals with the opportunity for telestroke consultation.



# Haptic tele-rehabilitation:
## *Latency implications for system stability and clinical communication*

**Denny Oetomo, David Watt**
Mechanical Engineering

**Ioanna Ioannou**
Health and Biomedical Informatics

**Ed Kazmierczak**
Computer Science and Software Engineering

**Mary Galea**
Physiotherapy

**Dragan Nesic**
Electrical and Electronic Engineering

**Gregor Kennedy**
Melbourne Graduate School of Education

Stroke is a major public health problem in Australia. Approximately 60,000 people per year have a stroke. It is also the fifth highest cause of life span reduction due to disability. The cost of strokes in Australia is $2.14 billion annually.

Of those who suffer from strokes, eighty-five percent have an initial deficit in arm function and there is clear evidence that early rehabilitation of the arm and hand after the stroke is highly effective.

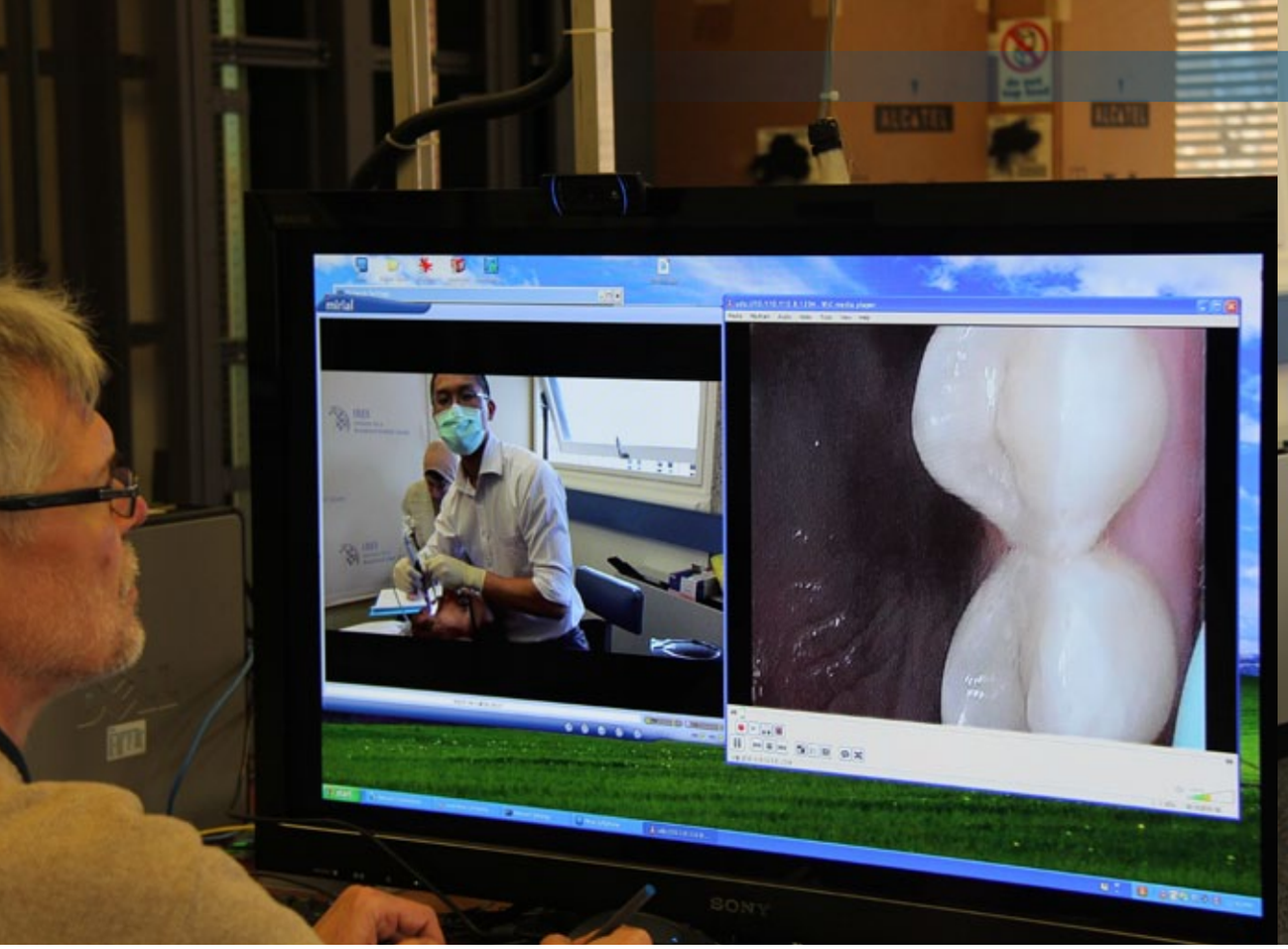
However, for a number of reasons, arm training is frequently given a lower priority than walking training in hospitals and clinics, with a recent study finding that only 6 percent of rehabilitation time is allocated to the affected upper limb. Nevertheless, the loss of hand function impacts greatly on the ability of a person to lead an independent life.

Given this, the application of broadband technologies in the provision of alternative rehabilitation methods for stroke survivors has the potential to significantly improve health care services and health outcomes in Australia. The research team have developed a haptic tele-rehabilitation system to address these issues.

The prototype system involves a 'rehabilitation robot', pictured opposite, which is placed in the patient's home. The robot makes use of haptic technology that provides force feedback over a broadband connection. The force feedback enables physiotherapists located remotely from patient to understand how patients are exercising without being physically present in the same room.

The patient connects to their clinician via a broadband connection. The clinician can dial up a number of different exercises for the patient on the rehabilitation robot. The clinician can also control the level of the exercises, adjusting the assistance or resistance of the robot to fit the patient's rehabilitation regime.

The robot's performance was tested in the IBES Broadband Applications Laboratory to understand how it will function on real world networks that contain various levels of delay. This is important in considering what, if any, implications the network has for the clinical efficacy of the rehabilitation robot.



# Concordance between real-time teledentistry assessments and face-to-face examination

**Rodrigo Mariño, Matt Hopcraft, David Manton, Michael McCullough**
Melbourne Dental School

**Elizabeth Ozanne**
Social Work

**Irene Blackberry**
National Ageing Research Institute

**Ken Clarke**
Electrical and Electronic Engineering

There is a serious dental workforce shortage in Australia. Information and communications technologies provide an opportunity to increase the accessibility of oral health services and screen for oral disease, especially in communities that lack adequate access such as in rural and regional areas, and older people living in residential aged care facilities.

Older people living in residential aged care facilities are a significant risk group for dental diseases in Australia. There are more than 41,000 Victorians living in a residential facility. Residents generally have poor oral health and face barriers accessing dental services due to physical or psychological barriers making them dependent on other for their oral health needs.

The most effective method for correct oral health diagnosis is a face-to-face examination. However few dentists service residential aged care facilities resulting in only 11 percent of residents seeing a dentist in a twelve month period.

Broadband-enabled technologies provide the opportunity to dramatically increase this number extending oral health care to those most in need.

This project has tested the feasibility and reliability of delivering oral health checkups remotely via a teledentistry system. A teledentistry assistant at the patient end operates an intraoral camera to relay high-definition oral imagery to a dentist connected via a videoconferening facility. The dentist can then screen patients for oral diseases and conditions, and develop treatment plans in real-time that are analogous to traditional face-to-face examinations.

Results from this research indicate that the use of teledentistry for oral health screens is feasible, being a reliable alternative to traditional examinations. Patient trials conducted in the IBES Broadband Applications Laboratory revealed high levels of satisfaction with the service and provide a promising beginning for the delivery of remote oral health care. The next phase of this research is to extend the trial and training into aged care facilities in Melbourne.

The project team have applied for additional funding to support this research through the Victorian State Government's Broadband Lead Adoption Program.

# Virtual visits: *Investigating the acceptability of webcam consultations for young adults' sexual health*

**Cameryn Garrett** | PhD Candidate
Population Health

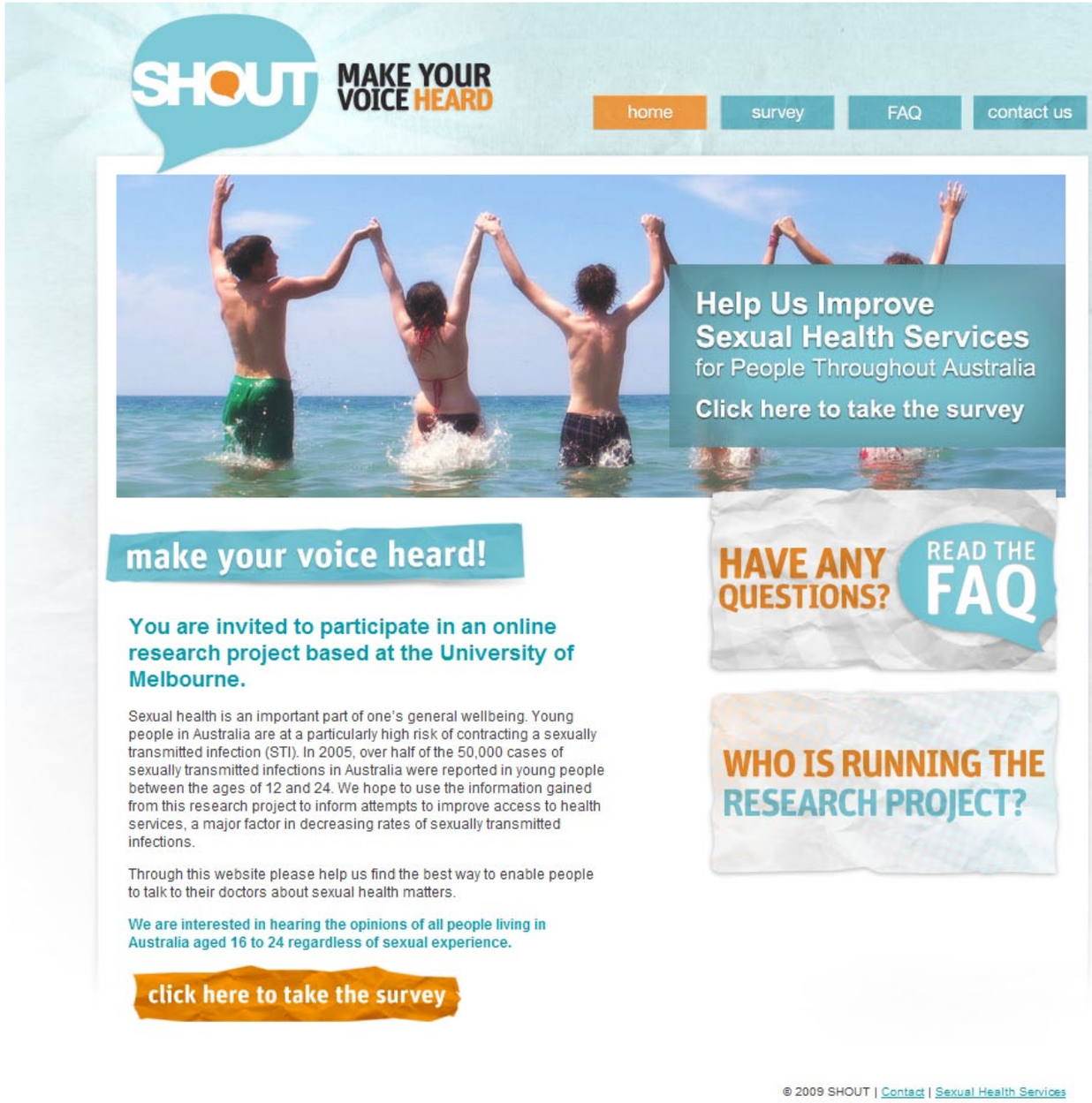
High-speed broadband networks enables the roll out of medical webcam consultations which may become a viable option to address a variety of health concerns. This project is examining the need, usability, and acceptability of conducting telemedicine sexual health consultations with a goal of increasing access to sexual healthcare for young people in Australia.

The pre-use views of young people aged 16 to 24 were examined via a national online questionnaire. The data gained from the 662 respondents showed that 85 percent were willing to have an asymptomatic in-person consultation with a doctor, 63 percent a telephone consultation, and 29 percent a webcam consultation. There was greater willingness to have a webcam consultation among men (36 percent compared to 26 percent of women), those with same-sex partners (45 percent against 27 percent), and those with three or more partners in the prior year (38 percent versus 27 percent). Most (88 percent) of the sample were willing to receive testing kits and treatment by mail.

Distance to a doctor makes a difference to the preferred consultation method. Given the option between an in-person, telephone, or webcam consultation, those living 20 minutes from a doctor had an in-person consultation (83 percent) as their top preference, however, those living 2 hours from a doctor had telephone as their top preference (51 percent).

While it was hypothesized that webcam consultations would decrease privacy and confidentiality concerns by preventing people from having to attend a sexual health clinic, preliminary results suggest that webcam consultations may instead augment such concerns. Free text responses indicate that this may be because online consultations can be recorded, stored and, potentially, if security measures are breached, be retrievable and searchable online. This violates the contextual integrity of the medical consultation, by breaching social norms of appropriateness and distribution.

This is the first investigation of the use of telemedicine consultations between healthcare providers and clients for sexually transmitted disease care. While only about one third of respondents were willing to have webcam consultations, the service may benefit a minority of high-risk youth who would not otherwise access a sexual health service. Privacy and security concerns need to be minimised to fascinate greater acceptability of webcam consultations.




Project website

# Overcoming geographical barriers for community health through 3D

**Ian Everall, Ramon Mocellin**
Psychiatry

**Ken Clarke**
Electrical and Electronic Engineering

**Andrew Stranieri**
University of Ballarat

**Ann Borda, Chris Myers**
VeRSI

**David Ryan**
Grampians Health

**Dirk van der Knijff, Brett Rosolen**
Information Technology Services

There is acknowledged geographical and social inequality in the provision of high-expertise medical knowledge around the nation. These include: too few highly trained specialists, unequal distribution of expertise and patient location between metropolitan and rural and regional areas, ageing demographics and disparities in economic distribution.

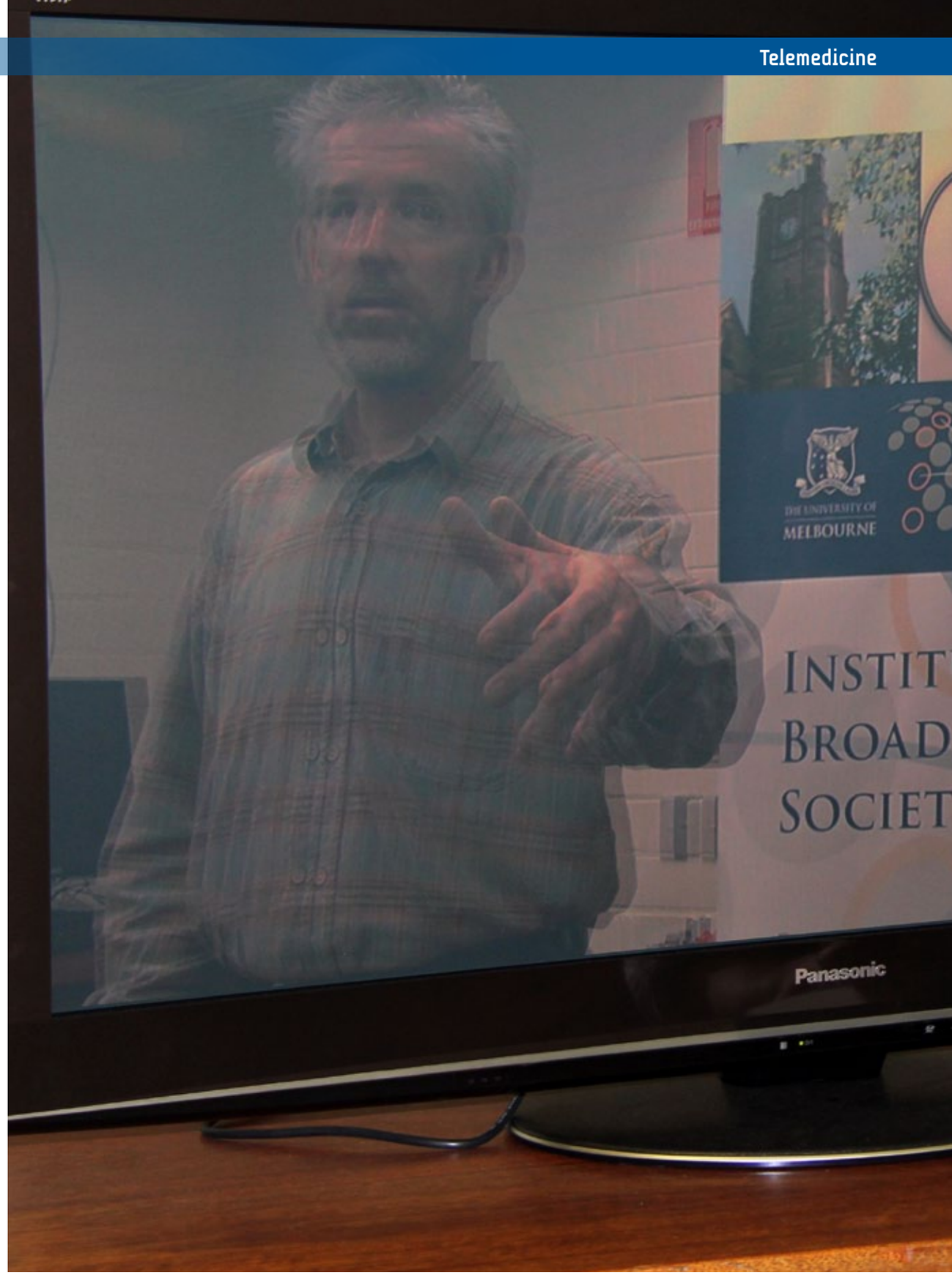
Telemedicine offers an opportunity to reverse the negative impact of inequality in the provision of medical experts around the nation by providing health consultation via a broadband connection, no matter where the patient and clinician is located.

Typical telemedicine consultations rely on two dimensional video. However some applications will be enhanced by the provision of three dimensional (3D) video conferencing facilities. 3D high-definition technology enables the clinician to improve their observation of small muscle movements, such as dilation of the pupil, and depth perception, for example in wound management. The additional information provided by 3D high definition video conferencing enables more accurate monitoring of patients.

This project is developing tools that allow the provision of specialist medical services to patients who cannot access specialist medical practitioners. The platform is being integrated with existing wireless physiological telemetry providing real-time measurements of heart rate, body temperature and blood pressure. The use of high definition and 3D in combination, will improve the clinician's ability to diagnose and assess the progress of a disorder, or response to treatment.

The expected outcome of the project is to develop a small-scale solution for tele-assessment and diagnosis of patients in geographically remote areas. Based in the IBES Broadband Application Laboratory, this facility will model 3D stereo video technology including high-quality audio within the context of controlled simulation of a variety of real-world communications networks. The project is validating the use of advanced 3D telediagnosis techniques in clinical situations through partnership with teaching hospitals.

The research team have applied for additional funding to support this research through the Victorian State Government's Broadband Lead Adoption Program.



## Ageing well

Australia, like many other countries around the world, has a looming aged care crisis. Over the next 45 years the number of Australians aged over 65 is expected to double.

At the same time, social isolation amongst our elderly population is becoming more prevalent. A 2008 report by the State Government of Victoria showed there are currently over 50,000 socially isolated Victorians over the age of 65 years, and this number is expected to increase to 75,000 by 2020 – a growth rate of 46 percent.

Broadband technologies can help to address these problems by enabling people to retain their independence in their old age, and live in their own homes for longer. Broadband technologies also provide opportunities for people to engage socially, utilise their skills, and continue lifelong learning opportunities. They also help people to have easier access to the health care system – for example video conferencing from home to local GPs and specialists.

IBES has been driving an agenda in the provision of broadband-enabled aged care services. Researchers are focused on how technologies can be designed to encourage uptake and use, as well as exploring technology-enabled aged care in other countries.

# Mobile and broadband technologies for ameliorating social isolation in older people

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**Elizabeth Ozanne**
Social Work

**Lars Kulik, Daniel Grosche**
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**Alan Gruner**
Benetas

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**Roland Naufal**
4clivingwell

Despite the increasing use of information and communications technologies, social isolation remains an issue among older people. Assistive technologies exist to address important health needs, but there is a lack of social technologies that adequately deal with social isolation. This project is exploring the role of domestic technologies for addressing social isolation of older people.

In order to develop an appropriate system to tackle social isolation, knowledge about the everyday life of older people is required. This project gathered information from three sources. Firstly, a survey of leading industry and research experts was undertaken to explore current practices and emergent trends in the use of technology to address social isolation. Secondly, a cultural study exploring older adults' experiences of social isolation and how it is mediated was conducted. Finally, a workshop was held to develop guiding principals for technological interventions to address social isolation.

Six core areas of need were identified guiding the technology development process. These include:

1. The maintenance of existing social connections as older people require support for maintaining existing connections, such as when they are admitted to hospital.
2. Any solution must be integrated with existing technologies. Technologies for connection already exists but are poorly coordinated.
3. Education and life long learning is important to ensure that older people can access the Internet and other information and communications technologies.
4. Older adults require systems that not only allow them to receive help and information but also to contribute and reciprocate.
5. Reminiscing is important, therefore any solution that gives the opportunity to reminisce in ways that are sensitive to individuals is highly valued.
6. Independence is an integral value as older adults require systems that allow them to express their autonomy and individuality.

The framework developed from this project provides significant foundation for a prototype system based on a touchscreen tablet that is currently in development. This technology will be trialled with a group of isolated older people increasing their social support from care managers, family and friends. The findings of this trial will inform future developments that leverage information and communications technologies to support the ageing process.

# Smart homes for the elderly

**Sung Jun Kim** | PhD Candidate
Architecture, Building and Planning

South Korea is at the forefront of the rollout of broadband technologies and is a world leader in the rollout of optical fibre to support high-speed, high-bandwidth applications. Along with many countries, it is facing a demographic dilemma with a rapidly ageing population and a lack of aged care facilities.

Assistive technologies can support people as they age, and smart living environments, called silver towns have been built in South Korea to housing an aging population. Five towns were built between 1998 and 2007 making use of embedded information and communications technologies to support elderly Koreans in their own homes.

This research project is investigating the how smart technologies integrate with the spatial elements of the silver towns.

Silver towns also provide a wealth of information gained by exploring how elderly residents engage and adapt to embedded communications technology compared to those in other towns.

The insights of this research will shape and inform future policy directions about how best to integrate technology to support ageing well.

## Environmental Monitoring

Broadband technologies have an increasingly important role to play in the protection of built and natural resources, and to transform how we interact with the environment.

The use of broadband-enabled sensor networks to monitor the environment can provide useful feedback to ensure scarce resources are managed in the most efficient way possible. Additionally, high-speed broadband has the capacity to empower consumers to manage their impact in their local environment. The use of sensor networks and broadband technologies are increasingly important in the protection of both built and natural resources, including during disastrous events.

Over time all of these monitoring uses produce vast amounts of data that must be aggregated using broadband and processed to provide information about resource allocation or warnings of unpredictable events.

IBES research projects in environmental monitoring are exploring how to harness broadband networks to enable better management of limited resources, and to protect people and property from disastrous events.

# Gardens of tomorrow in broadband-enabled neighbourhoods

**Jon Pearce, Wally Smith**
Information Systems

**Adrian Pearce**
Computer Science and Software Engineering

**Nigel Stork**
Resource Management and Geography

The adaptation of technology that monitors local micro-climate information, such as soil moisture and temperature measurement, ambient temperature and humidity, is very low in urban environments but has the potential to significantly impact on garden yields, as well as to protect precious water resources.

The Gardens of Tomorrow project is designing decision aids for scheduling garden activities such as watering, fertilising, mulching, planting and the application of insecticides.

The aim of this project is to help gardeners better utilise precious resources, such as water, as well as assist them in planning to ensure that get optimum yields in their gardens.

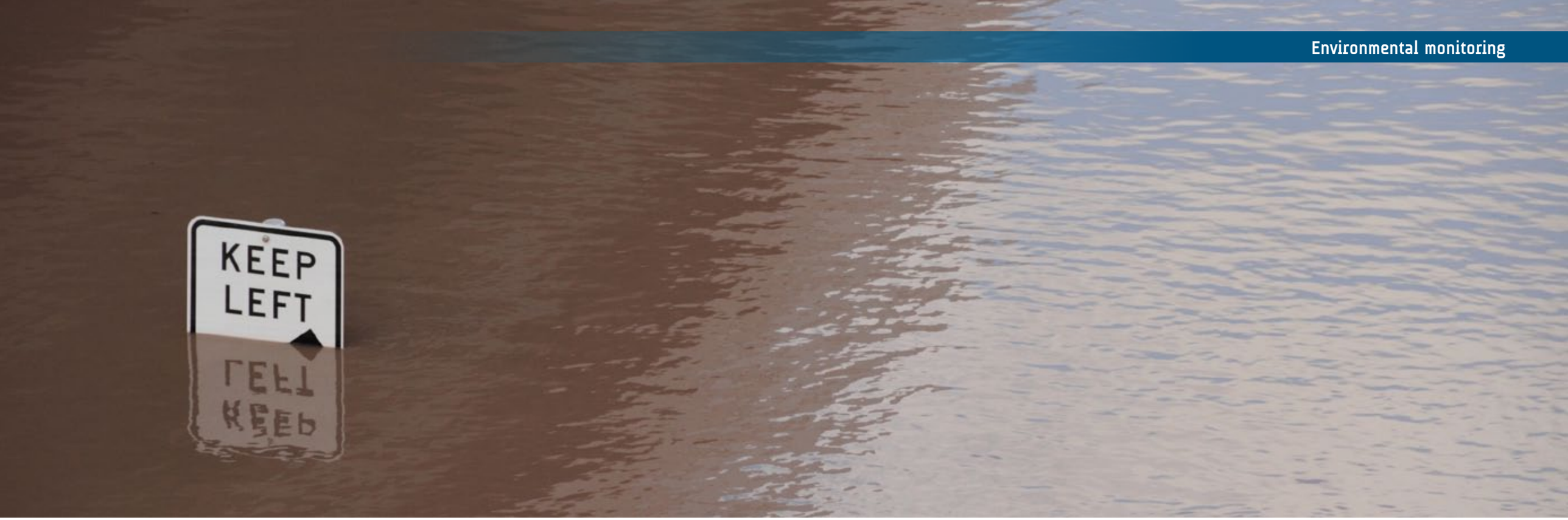
The technology developed by the research team offers advice about an individual's garden based on not only what occurs in their garden but also what happens in the gardens of others.

Broadband-enabled sensors are deployed in gardens and surrounding areas. Data is gathered from these sensors and processed to identify trends providing information that the gardener can use in guiding decision-making.

The project team has developed a physical garden module that records this data and transmits them to a central server. From there they can be displayed to gardeners in several ways including: as tables on an online Google Docs spreadsheet; online plots and other visual representations; and via an app running on an iPhone.

The app links to the www.SmartGardenWatering.org.au web site and displays sensor data as well as an individual gardener's watering schedule and recent weather events in his or her local area.

The long term goal is to aggregate sensor data from many gardens, present these to gardeners in a meaningful and useful manner, so they can better manage resources in their garden.




# Early detection and mitigation of disastrous events with broadband-enabled social interaction technologies

**Shanika Karunasekera, Rao Kotagiri, Aaron Harwood, Tim Baldwin, Masud Moshtaghi, Yang Liao, Bo Han**

Computer Science and Software Engineering

**Philippa Pattison**

Psychological Sciences

**Alex Skvortsov, Ajith Gunatilaka, Chris Woodruff, Ralph Gailis**

Defence Science and Technology Organisation

Micro-blogging services such as Twitter and Tumblr have become popular means of communication with most of today's popular social network sites like Google Plus, supporting these features.

The main factor differentiating these micro-blogging from traditional blogging is the limited message size with most limited to 140 characters.

These services have evolved to include rich social network features such as the ability to "follow" other users and thereby receive all the messages posted by them. Through this social networking feature, information propagation in micro-blogs resembles epidemic propagation in social communities. The highly connected nature of these dynamic networks can lead to rapid and efficient data dissemination.

While these technologies were originally designed for communication between people they have increasingly found an important role as an emergency alert system. For example during the recent Australian floods many people found Twitter a useful source for accessing the latest information.

This project is investigating how messages on micro-blogging technologies such as Twitter can be harnessed to obtain valuable information.

The interesting characteristics of micro-blogging services, such as being user oriented, provide opportunities for different applications to use the content of these sites to their advantage. However, this is also a problem as the sites contain a large amount of unstructured data that increases the difficulty of data mining required to identify important characteristics.

The techniques being developed by the research team are helping to identify and provide rapid response from social networking data.

# Online decision support for crop irrigation

**Bill Moran, Xuezhi Wang, Peter Farrell**
Electrical and Electronic Engineering
**Snow Barlow, Nicola Cooley, Ashley Wheaton, Kate Howell**
Melbourne School of Land and Environment

The National Farmers Federation has calculated that agriculture and closely related sectors contribute twelve percent to Australia's Gross Domestic Product (GDP).

Although it is a key part of the Australian economy, the sector is facing new challenges arising from climate change and pressures on resources.

Sustainable management of the environment especially the use of water is essential to ensure continual productive output.

Water is a key input to agricultural processes. Advanced sensor technologies enable farmers to better manage water use throughout their farms, minimising consumption while maximising yield.

Automated plant sensing is a crucial part of online decision support system for optimal crop irrigation. This project has developed two major automated plant-sensing techniques to detect plant water stress level.

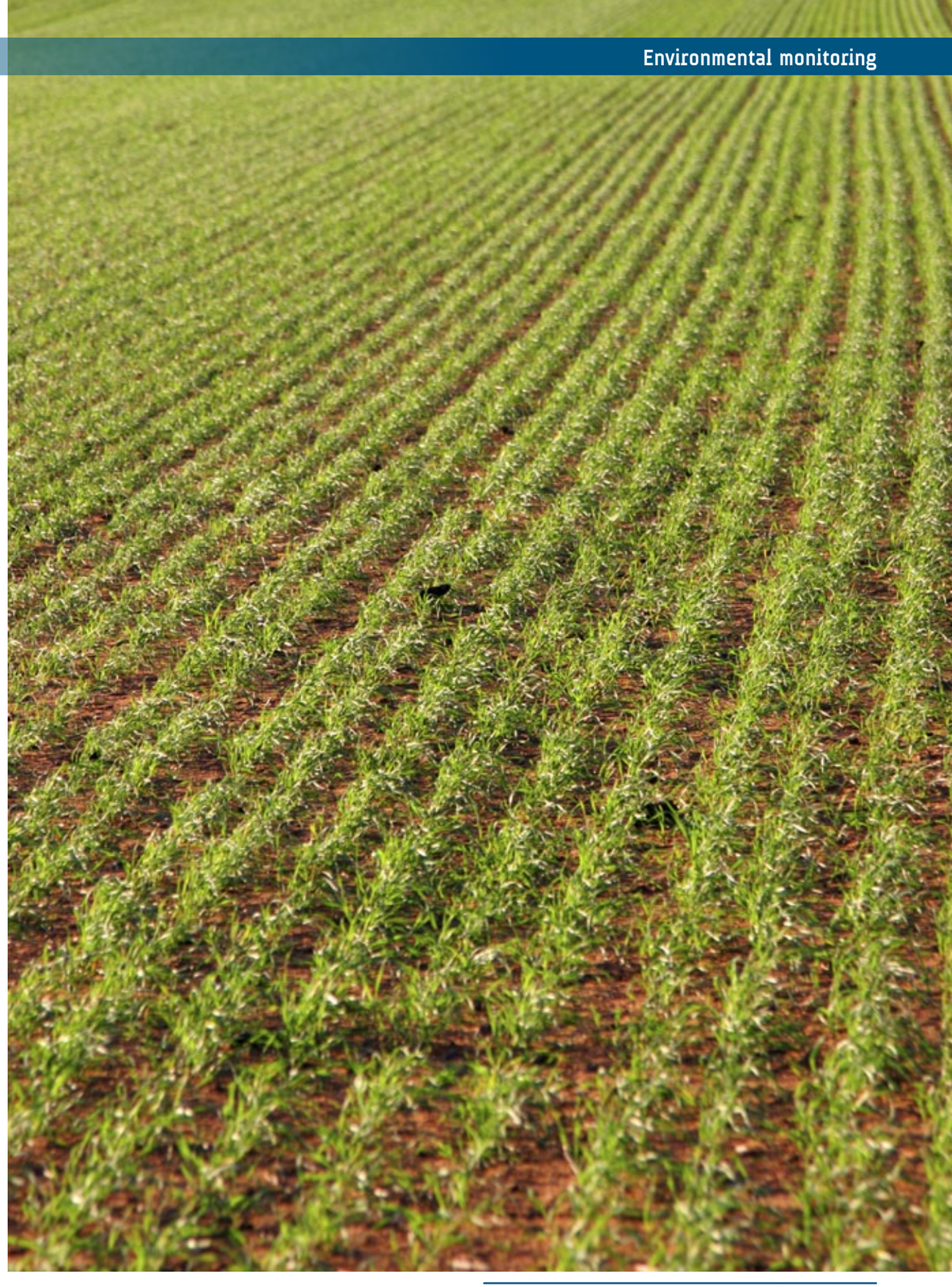
The first technique is automated canopy temperature estimation that uses infrared and optical imaging to measure canopy and reference temperatures to calculate a Crop Water Stress Index.

The second technique is investigating the morphological detection of leaf surfaces via coherent laser speckle statistics. This technology will provide an alternative, nondestructive method to detect plant water stress levels via wireless broadband infrastructure.

This research is developing a proof of concept through the deployment of experimental methods and data analysis techniques. A key element includes the investigation of distributed data processing strategies, information sharing and communication network structure.

The infrastructure is being designed for the implementation of a distributed online decision support system that connects field data with a knowledge database and system control before being integrated to the plant-sensing environment.

The outcomes of this project have resulted in three academic journal publications and two conference presentations.



# High resolution monitoring of atmospheric pollutants to identify their impact on population health

Shanika Karunasekera, Chris Leckie
Computer Science and Software Engineering
Marimuthu Palaniswami, Bill Moran, Peter Farrell
Electrical and Electronic Engineering
Shyamali Dharmage
Population Health

Air pollution is a major cause for many respiratory conditions such as asthma, bronchitis and chronic obstructive pulmonary disease.

Environmental protection agencies take an active role in monitoring air quality. However, due to high costs, present monitoring activities are limited. Measurements from a small number of monitoring stations are used to extrapolate pollution levels across a region. Due to the chaotic nature of pollutants such sparse measurements are inadequate to fully capture the effects in specific geographic areas.

The rollout of smart metering technology in Victoria coupled with the National Broadband Network (NBN) provides the basis for building an urban environmental monitoring system by plugging in suitable environmental sensors.

Wireless sensor networks have the potential to enable automated environmental monitoring with high spatial and temporal resolutions.

This project is developing a generic communication platform to allow sensors to communicate over existing networks, along with designing sensor network applications to gather high-resolution environmental pollution data.

The research is determining the type, number and sensitivity of the sensors, and the sensing and communication frequencies. The resultant network will inform communities about levels of pollutants in their neighbourhoods, provide data for examining the impact of pollutants on population health, and enable monitoring of hazardous pollutants.

# Demand response in smart grids

Marimuthu Palaniswami, Slaven Marusic, Yee Wei Law
Electrical and Electronic Engineering
Bharat Dave, Peter Raisbeck
Architecture, Building and Planning
Jeremy Moss
Historical and Philosophical Studies

Power grids around the world are operating ever close to operational limits due to factors such as climate change and population growth. Energy rationing is one way to ensure the supply of electricity to consumers without interruption during critical peak times. The project explores a practical energy-rationing scheme with positive socioeconomic outcomes.

Energy rationing is a way to ensure the supply of electricity to consumers without interruption during peak times. Dynamic pricing schemes have the potential to be implemented with the deployment of smart meters, which enables load shedding. A load shedding policy compensates those who pay a critical peak price if their load is shed. The load shedding policy addresses the possibility of unabated system congestion even when rationing energy. This technique can operate through a Persuasive Energy-Conscious Network, a network of energy consuming devices that collaborate to optimise their own energy footprint.

The stability of the power system must be maintained under an energy rationing system. The two parameters that must be controlled are voltage and frequency. Frequency control is particularly important, being responsible for a large blackout in Europe in 2006.

While energy rationing has tremendous potential, it relies on social acceptance from the consumers on the premise of economical viability. In partnership with the National Consumers' Roundtable on Energy and the St Vincent de Paul Society of Victoria a report focusing on the economic, health and social impacts of Advanced Metering Infrastructure on low-income and disadvantaged groups has provided input to the policy debate.

# Data assimilation and bushfire modelling for early and rapid bushfire detection using broadband technology

**Bill Moran, Peter Farrell, Parisa Saeedian**
Electrical and Electronic Engineering

**Malka Halgamuge, Muditha Dissanayake**
Infrastructure Engineering

**Kevin Tolhurst**
Forest and Ecosystem Science

**Mark Garvey**
Country Fire Authority

**Jessica Block**
University of California in San Diego

Bushfires are a significant threat to many communities throughout Australia. New broadband-enabled technologies can assist in detecting, tracking and predicting bushfires, a critical factor in keeping the environment and the community safe. A real time, spatially explicit fire model exists to predict the spread of bushfires that predicts likely fire behaviour patterns.

This project is improving the fire model by allowing the real-time inclusion of satellite data to be combined with information from fire spotters and the public.

A small sensor network, connected via wireless broadband, has been deployed in the Melbourne suburb of Olinda to feed data to the model providing estimation of possible fire events. The results from this trial are promising, allowing for the inclusion of new statistical techniques to further enhance the fire model.

A collaborative workshop with University of California in San Diego to discuss and refine fire prediction techniques in Victoria and Southern California was held in November 2010, paving the way for future collaborative research. The workshop brought together leading experts from Government, industry and academia to explore research opportunities in bushfire modelling. Academics from the University of California in San Diego joined the workshop remotely via a broadband connection.

The outcome of this research has resulted in publications, including at the International Conference on Information and Automation for Sustainability.

Bushfire Workshop with University of California – San Diego, November 2010

## Data assimilation of bushfire

**Parisa Saeedian** | PhD Candidate
Electrical and Electronic Engineering

Ubiquitous high-speed broadband networks can facilitate the transmission of high-resolution, on-demand video and images between remotely located places during fires providing important information to coordinators, first responders and the public.

Access to this data, updated in real time, improves the capacity of central coordination.

This project aims to design an information collection and processing system to feed data into existing bushfire models, increasing their accuracy, detecting bushfires before they become a major threat.

Developing techniques for accommodating real-time data from all sources including telephone, satellite and mobile phone images, sensor networks, and wind data, will improve the bushfire models real-time modelling and predictive capacity.

## Mitigating human elephant conflict through an engineering approach

**Chinthaka Dissanayake** | PhD Candidate
Electrical and Electronic Engineering

Elephants and people have a long history of interdependence in Sri Lanka, featuring in work, warfare and culture. The colonisation of Sri Lanka five centuries ago altered the ecological landscape of the nation by clearing vast areas for the plantation of crops such as tea and rubber. Coupled with rapid population growth there is continuing pressure on the forest environments that is the elephants' natural habitats.

It is estimated that there are approximately 5,000 wild elephants in Sri Lanka. One elephant needs at least five square kilometres to survive. Supporting this population requires 38 percent of the overall land area. With national parks covering only 12.5 percent of the land almost 70 percent of elephants share the land with people. Human elephant conflict is common in Sri Lanka as people try to protect the crops from elephant damage.

This project is aiming to reduce the occurrences of human elephant conflict through the use of sensor networks to detect, localise and track elephants before they move into rural communities.

The Sri Lankan environment presents many challenges that must be overcome to ensure sensors operate effectively.

The sensors will capture the noise made be elephants as they travel through forests providing the basis for an early warning system to alert villages and law enforcement officials.

## Making data more accessible

Ubiquitous high-speed broadband facilitates access to large amounts of data, including valuable databases, through the public Internet or private intranets.

While it must be recognised that some data sets are simply too large to regularly move around on the Internet, there are many others that can be made available that will seed new opportunities, in research, enterprise or otherwise.

There are many databases of valuable information that are not currently easily accessible, either because they are not online, or searching is too cumbersome. The roll out of ubiquitous high-speed broadband, as well as the increase in cloud computing services, provides platforms to make databases that are traditionally hard to access easily accessible no matter where the user is located.

Researchers at IBES are investigating ways to make particular datasets more easily accessible to a variety of end users. Beneficiaries include researchers, educators, family historians, linguistics and policy makers to name a few.

# The digital Panopticon: *Convict founders and survivors of Tasmania*

Janet McCalman
Population Health
Hamish Maxwell-Stewart
University of Tasmania

At least 72,500 convicts were transported to Tasmania from 1803 to 1853. From their arrest in Britain to their release in Australia, they were the subject of intense documentation: their eye colour, their height, their birthplaces, where they were sent to work, how many days they spent labouring on the roads or in penal stations, who was sick on the voyage to Australia and who died under sentence.

The records are the most detailed nineteenth-century source anywhere in the world for family history, bodies and the behaviour of ordinary men and women. In 2007 the Australian convict records were inscribed onto the UNESCO Memory of the World Register in recognition of their 'world significance and outstanding universal value'.

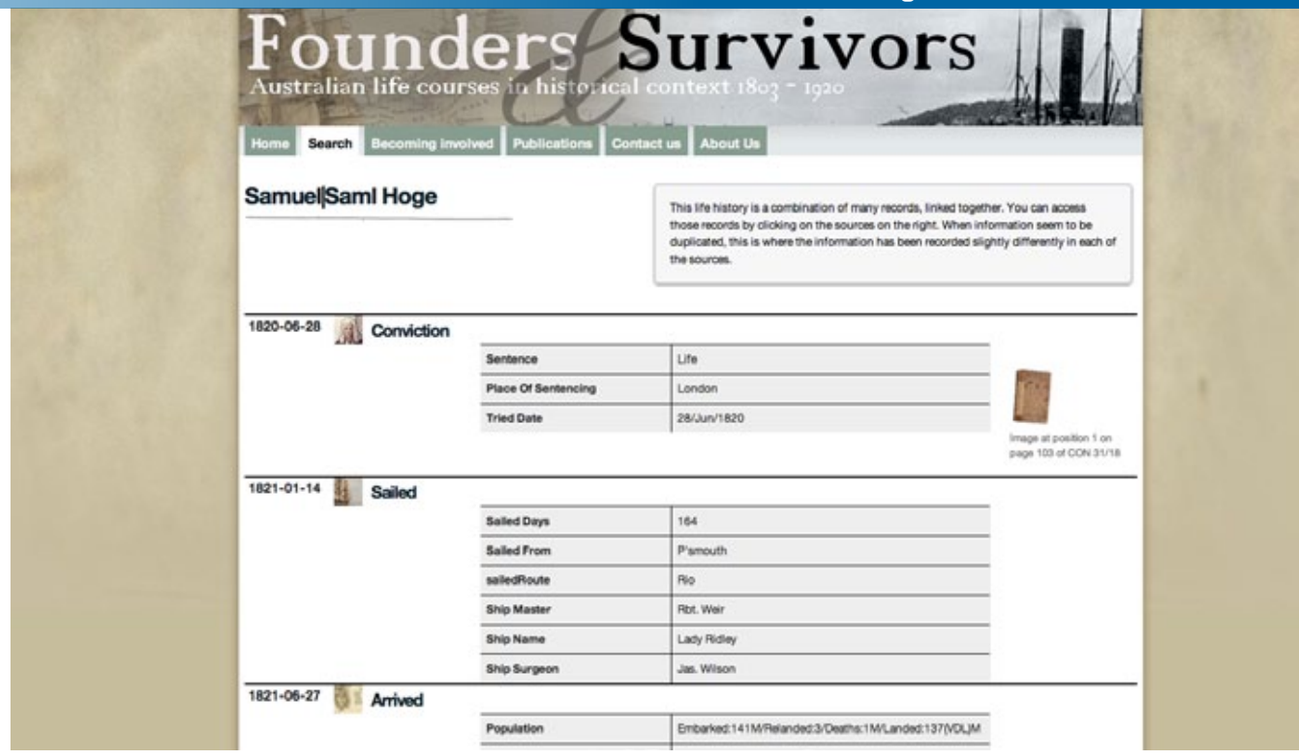
The Founders and Survivors project team have used this data and have created a multi-purpose database that stores the convict information in an easily accessible form that can be accessed using high-speed broadband. The database syntheses data from a variety of sources such as births, deaths and marriages, ships records, court proceedings, muster records and government notifications.

The database is reconstructing the convict founding population of Tasmania. This data is then linked to subsequent generations, to discover the intergenerational impact of transportation on the population's health.

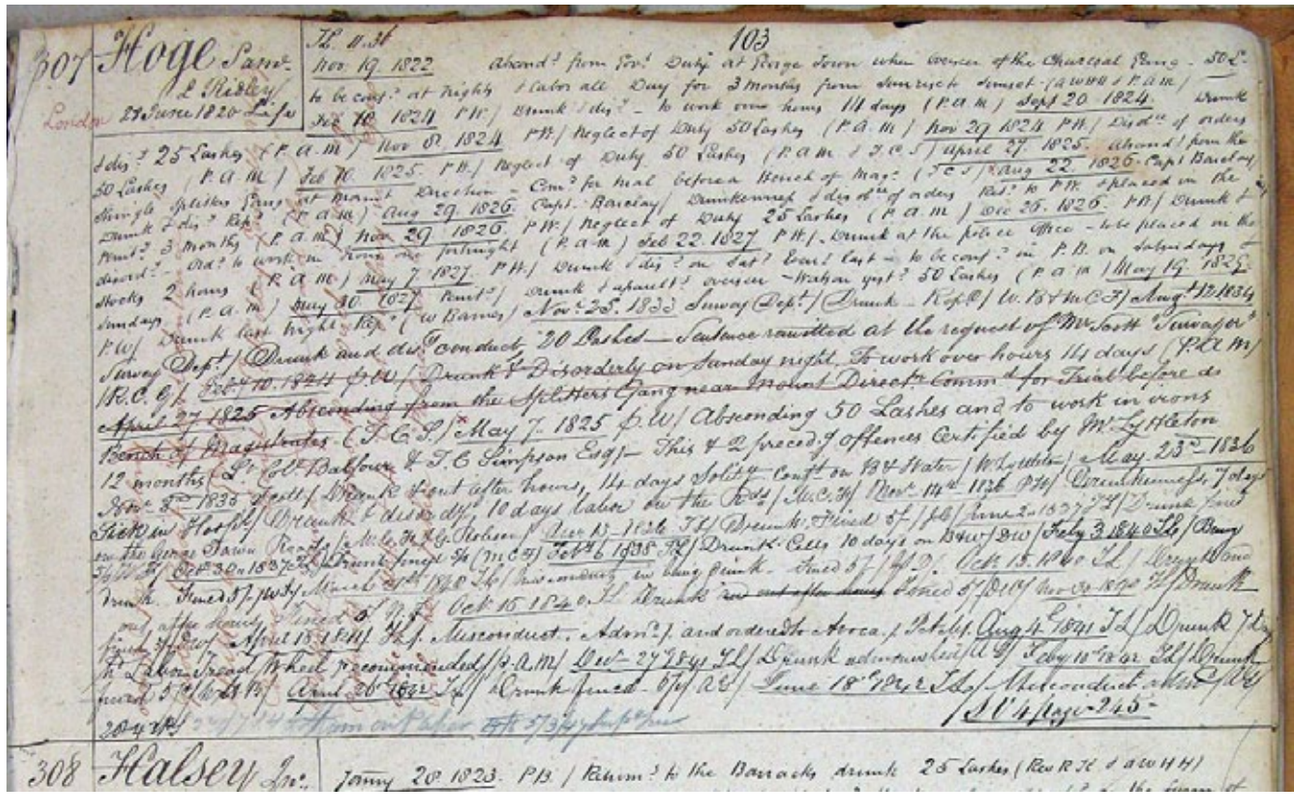
Crowd sourcing through community engagement and public participation has been central to this project, with over 400 volunteers aiding the work of tracing convicts and their decedents and inputting this data into the system.

The data is made searchable and accessible through the Founders and Survivors website that also links to the original data source, as pictured opposite. The database is designed to be used by professional historians and demographers, as well as the general public to enable demographic and historical analysis of the Tasmanian convicts, their origins, their experiences and their descendants. The database has proven to be a useful tool for a range of researchers across a number of disciplines to explore issues relating socioeconomic status and population health in early Australia.

The research has resulted in a journal article published in a leading European journal of historical demography History of the Family. The research has also been featured in a YouTube video produced by IBES that has been made available on the Institute's YouTube channel.




Founders and Survivors entry for Samuel Hoge



Original convict record for Samuel Hoge

# Streaming Australian research data to the world:
## *Towards a distributed international ethnographic museum*


**Nick Thieberger, Rachel Nordlinger**
Linguistics and Applied Linguistics

**Cathy Falk**
Melbourne Conservatorium of Music

**Steven Bird**
Computer Science and Software Engineering

**Linda Barwick**
University of Sydney


The Internet provides access to a vast amount of information however, media representing small and endangered languages is not always very accessible. The Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC) collection currently contains 2,500 hours of digital audio files. Making this data accessible via online databases. This is allowing a number of previously unavailable language collections to be made public and will provide a valuable research database.

The collaboration between researchers at the University of Melbourne, the University of Sydney and the Australian National University has built an exemplary open-source system that takes advantage of HTML5 technologies for linking media and text. The products from ordinary fieldwork methods are uploaded, validated against a classification schema, and then transformed into a HTML presentation. Media is also uploaded and transcoded to a format suitable for streaming. The working system is available at: www.eopas.org. This system not only provides an example of the reuse of research data that conforms to web standards, but the collection data also provides a glimpse into another language and can be used as part of an online language museum.





# TELIA: *Technology for endangered languages in Australasia*


**Steven Bird**
Computer Science and Software Engineering

**David Grayden**
Electrical and Electronic Engineering

**Steve Howard**
Information Systems

**Daniel Little**
Psychological Sciences

**Nick Thieberger**
Linguistics and Applied Linguistics

**Sally Treloyn**
Melbourne Conservatorium of Music

**Sarah Cutfield**
Australian Institute of Aboriginal and Torres Strait Islander Studies

**Mark Liberman**
University of Pennsylvania


Australia and its region are home to about 2,000 languages, many of which are endangered. As the largest economy in the region, Australia has the opportunity to safeguard this irreplaceable heritage for the benefit of future generations.

The Australian Government is supporting the use of new technology to assist in the maintenance of Australia's 110 critically endangered languages by collecting the content of these languages and disseminating them through the Internet.

Language preservation has cultural and economic impacts, for example, access to indigenous language materials on the web helps speakers of those languages cross the digital divide.

This project is increasing the amount of indigenous language materials on the Internet by developing scalable methods for recording and annotating large quantities of oral literature. Crowdsourcing techniques will assist the translation of videos, ascribing metadata and annotations to make the materials interpretable.

The project team is also developing semi-automatic methods for segmenting speech and song to enable the efficient creation of media transcriptions and translations.

Existing solutions for media segmentation and annotation make no attempt to bridge the digital divide. The sensitivities inherent in indigenous language materials and the reduced opportunity for western-style formal education create a qualitatively different situation for content creation and management that is addressed by this project

# Political issues analysis system

**Craig Bellamy, Conal Tuohy, Jaan Kotli**
VeRSI
**Martin Gibbs, Mitchell Harrop**
Information Systems

The Internet is recognised as a vital component of our political information systems. Governments and civil society groups use the Internet to campaign, deliver key messages and engage with the public as part of the political process. However, its effects upon political processes remains relatively unknown, particularly how users use this information in their political deliberations.

Emerging research suggests that the Internet's capacity to easily produce information has also led to data overload, undermining its deliberative potential. With the advent of the National Broadband Network the 'data deluge' promises to intensify increasing the need for political information—in its various guises—to be delivered in much more meaningful ways. This is especially important for younger audiences who are increasingly abandoning broadcast media in favour of online political information.

This project is undertaking an iterative study and design of an online Political Issues Analysis System to assist users' research and analyse broad political issues. The system delivered information about political issues, such as health, the environment, or the economy, using selective data sources within a coherent framework.

Evaluating the needs of users to comprehend political issues will refine the design of software tools that filter and visualise online political information from various datasets.

The knowledge obtained through the design workshops and testing provides the basis for a unique model for making sense of online political data.

Technologies that are being investigated as a part of this work include search engines, websites, and generally available social-software systems. Through a series of tasks and search-scenarios the researchers test users' ability to find information about and make sense of important political issues. 'Deliberative' tools that are commonly available such as online forums as well as innovative government, research, and NGO initiatives are also being tested.

The combination of theory, empirical research and design and implementation makes an important contribution to the understanding of political information on the Internet. This is achieved through the opening up of the information, allowing it to be used in a deliberative manner, and providing a pathway towards greater online political engagement. The project findings will be presented in a report in late 2011.

## Broadband in public spaces

High-speed broadband is a vital component of contemporary social infrastructure comparable to roads, water and electricity. Broadband availability drives changes in patterns of social interaction across a wide spectrum of activities, ranging from established media platforms such as television to emergent forms of social networking and user-generated content creation.

Additionally, high-speed broadband services can assist to address contemporary issues such as social inclusion and social diversity as well as improving service delivery to urban, regional and remote communities.

Understanding the ways people use existing broadband technologies in community settings is important to Australia's future from a social, technological and economic perspective.

Broadband technologies can effectively promote social interaction in public places, empower community initiatives and bridge the gap between the online world and the urban environment.

IBES researchers are examining how universal broadband access in urban public spaces can develop new forms of social interaction and community initiatives through a combination of mobile broadband, Internet-enabled devices, locative media and user-friendly social networking tools.

# Crowdsourcing human knowledge on spatial semantics of place names

**Stephan Winter, Allison Kealy, Matt Duckam, Abbas Rajabifard**
Infrastructure Engineering

**Tim Baldwin, Hai Rue Xie**
Computer Science and Software Engineering

**Lawrence Cavedon**
NICTA

**Lesley Stirling**
Linguistics and Applied Linguistics

People communicate about geographic locations through language using place names like "Forum Theatre" and spatial relations between places, like "near the University". Place descriptions facilitate easy communication between people but are surprisingly difficult to interpret by computers. To build smarter information services capable of using place descriptions rich resource of human knowledge about place names and their relationships is needed.

The lack of techniques for automatically generating data about human place descriptions is a barrier to building services that incorporate this functionality. This project developed a new technique that enables the automated capture of human knowledge, in order to collect a large volume of geo-tagged place descriptions. The resultant data set will provide an important tool enabling the development of services that incorporate human place descriptions.

The technology underpinning this project is a mobile, location-based game that can be played anywhere in Victoria. The game collects human place descriptions from the players, wherever they are and whenever they can spare a minute. The descriptions are stored together with the position of the mobile device. The game has an optimised interface for Android phones and iPhone with players who submit a location, entering the running to win an iTunes gift card. The game *Tell Us Where* collected over 2000 georeferenced human place descriptions.

This project is now being supported by an Australian Research Council Grant.


**Hai Rue Xie & Stephan Winter** | Infrastructure Engineering in front of project poster at 2010 IBES Annual Symposium

# Broadband-enabled public screens: *From display to interaction*

**Scott McQuire, Nikos Papastergiadis**
Culture and Communication

**Matt Jones**
Federation Square

**Frank Vetere, Martin Gibbs, Sonja Pedell, John Downs**
Information Systems

Video screens are becoming increasingly common in urban spaces. Traditionally these screens have primarily been used for advertising, impacting negatively on the civic values of public space, but also meaning that alternative uses have not been explored.

The roll out of a new generation of large screens in traditional public spaces, such as Melbourne's Federation Square, challenges traditional assumptions. These screens have begun to develop new forms of community engagement through the live broadcast of sporting, cultural and social events.

Understanding how people currently engage with screens is important to supporting future development of interactive systems.

Observations of participants playing public games using the X-Box platform have provided useful insights into engagement. This project will further extend this research through an ethnographic study of public use of the Microsoft Kinect platform on Federation Square's Big Screen.

Federation Square is an active participant in this project contributing their screening facilities and staff to support the public interactions. The findings from this research project will inform Federation Square's development of future public gaming events. It will also provide the basis for further investigation into participatory public space. Finally this project is looking to support live gaming activities in the lead up to the London Olympics in 2012.





# New forms of social interaction through universal broadband access in public spaces

**Marcus Dias** | PhD Candidate
Culture and Communications

Connectivity is increasing in public spaces with access to mobile broadband complimenting other networking practices such as mobile phone calls and SMS generating new forms of social interaction. This enables new possibilities for community in public spaces by combining the benefits of Internet access, mobile connectivity, the physical world, and face-to-face interaction.

Groundbreaking digital performances by artistic collectives such as Blast Theory (www.blasttheory.co.uk) in public spaces have highlighted the technical, usability and spatial constraints.

These digital performances have also raised social issues surrounding the use of broadband in public spaces. These include privacy management and the willingness, or not, of strangers to interact with each other.

This project is researching digital performances and installations in public spaces through empirical and theoretical analysis of social interaction and user collaboration.

This research is developing a framework for new technologies and applications promoting the social benefits of universal broadband access in public spaces.


Conducting empirical research on Blast Theory's "A Machine to See With" - Brighton, UK

## Understanding end users

High-speed broadband has the potential to transform the delivery of services enabling all Australians – no matter where they live – to have access to a wide range of opportunities including in health care, education and employment. However, the successful adoption of broadband by Australians is critical to achieving this vision.

The introduction of broadband applications to workplaces must take into account individual workflows, if adoption is to be widespread. Likewise, for consumers must be intuitive and easy to use if people are to continue to use high-speed broadband on a regular basis. Issues relating to digital literacy must also be considered. All of these issues point to a need to better understand what different end users groups need and want from high-speed broadband.

IBES researchers are undertaking a range of studies and are adding to a body of knowledge in this area. Research projects have focused on broadband use in domestic settings including among low socioeconomic groups, people with speech impairments, aboriginal and new migrant communities.


# Broadband in the home: *A longitudinal study*

**Michael Arnold**
Historical and Philosophical Studies

**Bjorn Nansen**
McCaughey Centre

**Rowan Wilken**
Swinburne University

Information and communications technology have become more prevalent in Australian homes. However, the rollout of high-speed broadband provides opportunities to deliver new services and applications that will impact daily domestic life. Therefore domestic homes are a key site for mapping the present and possible future uses of broadband technology and its use in daily life.

Understanding the early stages and evolving dynamics of broadband introduction, appropriation and experience is critical to: map shifting arrangements for education and employment; inform policy development, implementation and regulatory responses; explore implications for domestic leisure and patterns of media usage in the context of family life.

The project team undertook a longitudinal study to investigate the social, technological and economic dynamics that shape domestic broadband use, the relationship of broadband to other patterns of media use, and the expected future use of high-speed broadband.

Building on previous research that considers the interplay of multiple technologies and practices in the home, the researchers considered the complementary and disruptive relation of fibre-to-the-premises technologies compare to other broadband technologies, including the shift from dial-up to high-speed broadband. The relation of newer services and devices in relation to legacy systems was also considered. Additionally, this research project explored the way that new technologies that are brought into the home are domesticated over time, by being integrated into routines of use.

The findings from this study suggest that the changes to the performance of family life in the early stages of broadband adoption are limited. The varying degrees of use observed by the participants in this project showed that the meanings and uses of new technologies often adhere to familiar, routine, or past modes of use, with more significant changes in behaviour developing slowly.

The broadband in the home research revealed that increased bandwidth correlates to increased participation in the digital economy through online activities and the use of entertainment and communication services and technologies. The research also showed that participant interest in ancillary broadband services, such as Video on Demand, supports investment in downstream businesses that will benefit from new technology.

The project team have recently received a research grant from the Australian Communications Consumer Action Network.

# Migrant youth and the cultural dynamics of transnational connectivity

**Fazal Rizvi**
Melbourne Graduate School of Education

**Frank Vetere**
Information Systems

**Nikos Papastergiadis**
Culture and Communication

Globalisation and the developments in communications technologies have changed the way connections are experienced across national borders. These developments are particularly important to the experiences of migrant youth.

New technologies and social media have enabled youth to maintain ongoing, everyday connections that were once impossible, transforming the notion of emigration.

The experiences of migrant youth are deeply shaped by these shifts, enabling them to think about their identities in new ways.

Experiences of migration are no longer shaped by static memories and cultural nostalgia but also involve everyday processes of identity formation and cultural production.

This project is exploring how migrant youth in Australia use new technologies and social media to remain connected to their counties of origins.

Through interviews with migrants from Indian, Vietnamese and Afghan backgrounds this project is developing an understanding of the ways that migrant youth use this knowledge to make sense of their engagement with Australian schools and society.

The outcomes from this research will enable education policy makers to develop contemporary views of multicultural education and internationalisation.

# Understanding the role of broadband technologies in periodically reunited families with pre-teen children

**Kostas Kazakos** | PhD Candidate
Information Systems

Families increasingly experience recurring transitions between collocation and separation, often due to employment, such as defence personal being separated from their family for extended periods. Those families that are separated experience regular reunions. A reunion is not only a ritualised gathering of extended kin, but is deeply connected with family routines influencing interactions between all family members.

Broadband technology can facilitate healthy family reunions enabling younger and older family members to exchange experiences. For example, the advances in broadband technologies provide family members with opportunities to enrich their sense of togetherness and connectedness while physically distant. Broadband technologies can be embedded into the modern family lifestyle as tools of interaction between parents and children.

Families have different access to these technologies. A defence family might not engage in interactions while separated in the same manner as a business family due to many reasons including those due to the sensitive professional setting to the absence of communication technologies.

This project is examining the lives of different families that are periodically separated by employment, such as defence forces personnel, academics and miners, in order to design new broadband technologies that can enrich parent-child interactions during reunion.

The research is using the Microsoft Kinect technology to enhance reunion in physical and virtual spaces.

# Victorian aboriginal youth and their use of technology:
## *Exploring online social networks to enhance educational outcomes*

**Phillip Morrissey**
Culture and Communication

Studies have shown that Aboriginal youth can experience limited educational, health and social outcomes. Many of these relate to the impact of colonisation, where the effects of stolen generations, high levels of incarceration and dispossession of land impact on Aboriginal social and emotional wellbeing.

Education is a key factor in determining economic and social outcomes for the Aboriginal community.

Developing and maintaining social networks and contacts within Aboriginal communities is important for sustaining cultural connections and a strong cultural identity. Maintaining these networks means that the Aboriginal community is amongst the highest users of mobile phones and associated technologies, including Facebook.

This project is studying the patterns of use of social network technologies among Victorian Aboriginal youth in order to better understand the capacity for social network technologies to enhance community and cultural connections.

Investigating how and why Aboriginal youth use new technologies will assist in developing the potential of these technologies to improve educational and social equity outcomes.

The project is mapping online social network use among Indigenous youth and will result in a plain language community report highlighting the use of social network technology to improve Aboriginal educational outcomes.

# Exploring technology-mediated unstructured play

**John Downs** | PhD Candidate
Information Systems

We all know what it means to play, but, when we think about playing through technology, video gaming is what usually comes to mind. However, play itself is broader than just gaming, which is often formal with rules and procedures.

Unstructured play is informal. It is the type of play that does not have strict rules and procedures, but unfolds more naturally and organically. Unstructured play is a critical part of human development and is important to strengthening social bonds between friends and family.

When properly applied, technologies can enable and mediate play between people who are distant. Technology can augment play by integrating the physical and the virtual into a single play space.

Elements of these ideas appear in recent physical console gaming technologies such as the Kinect for Xbox 360, PlayStation Move and the Nintendo Wii. These game technologies encourage physical and social interaction in both the game world and the real world.

This research project is examining unstructured play and the different ways in which it can occur.

Research into how physical console gaming technologies enhance social gaming by enabling playful interactions between players will reveal knowledge about unstructured play itself.

# Screen stories and community connections

**Lisa Gibbs, Kabita Chakraborty, Bjorn Nansen, Elise Davis**
McCaughey Centre

**Frank Vetere**
Information Systems

**Colin MacDougall**
Flinders University

Low-cost, convenient computing technologies and Internet access facilities have appeared in a number of low socioeconomic status communities across Australia. Early indications are that these initiatives have the potential to be a cost effective way of reducing inequality and marginalisation as well as promoting social inclusion.

However, there remain gaps in the production of knowledge surrounding these initiatives, such as their impact on the wellbeing of young people in public housing as well as those living and working in new suburban developments on city fringes.

This project explored the way that new media technologies are used in different geographical settings. The research involved collecting qualitative data that enables the construction of usage patterns of people from different socioeconomic settings.

The project revealed that for children and families in outer suburban areas technology plays an important role enabling social inclusion in adults, but also for children. Ensuring access to technology is important to prevent increasing social isolation.

A key finding was that social networking has the potential to support social connectedness in new suburban areas. However, there is limited access to information and communications technologies for children outside of school and this is especially prevalent among families from low socioeconomic backgrounds. Parents do not have sufficient knowledge to support their children in using technology in a safe and positive manner.

The research also warned of risks to younger children that are associated with the engagement with interpersonal relationships as opposed to commercial content.

The project has provided effective knowledge that can assist policy makers to formulating policy that can promote social inclusion in a safe and responsible way.

Through engagement across a number of disciplines, the project provides a basis of knowledge and understanding about the ways that young people use technology and some of the challenges surrounding these issues.

The findings of this report have informed cyber- safety developments targeted at younger people along with supporting documentation for teachers and parents.

The team also had support from partners Vic Health and Vic Urban along with the Alannah and Madeline Foundation (AMF), a national charity whose mission is keeping children safe from violence.

# The role of high-speed broadband in communication between people with little or no speech and GPs

Louise Greenstock, Peter Brooks
Australian Health Workforce Institute

Brendon Wickham
General Practice Victoria

Jan Ashford
Communications Rights Australia

Evidence shows that internet-based technologies enable people with communication impairments to make themselves heard and to interact with others. This has been seen in the introduction of the National Relay Service (NRS) which provides, among other things, an internet-based medium for conversational interaction for people with hearing impairment and/or little or no speech (communication impairment). However, the NRS has identified challenges arising from unreliable, inconsistent and 'slower than optimal' Internet connections.

This research addressed the communication needs of people with communication impairment in health care and explored the potential role of high-speed broadband in facilitating communication between GPs and this patient group. Without making assumptions about the role of Internet technologies, this research focused on the needs of these two populations when communicating with each other in everyday scenarios.

An examination of the relevant literature revealed that patients with disabilities experience substandard care and those with communication disabilities are at risk of not having their medical, and other more basic needs met. Additionally, there has been limited research exploring the use of Internet technologies to facilitate communication between patients with disabilities and health professionals.

Researchers explored the communication experiences of patients, who identify as having little or no speech, and GPs ascertaining the challenges faced in these interactions. The participants where questioned about the role of the Internet and other technologies in facilitating their communication.

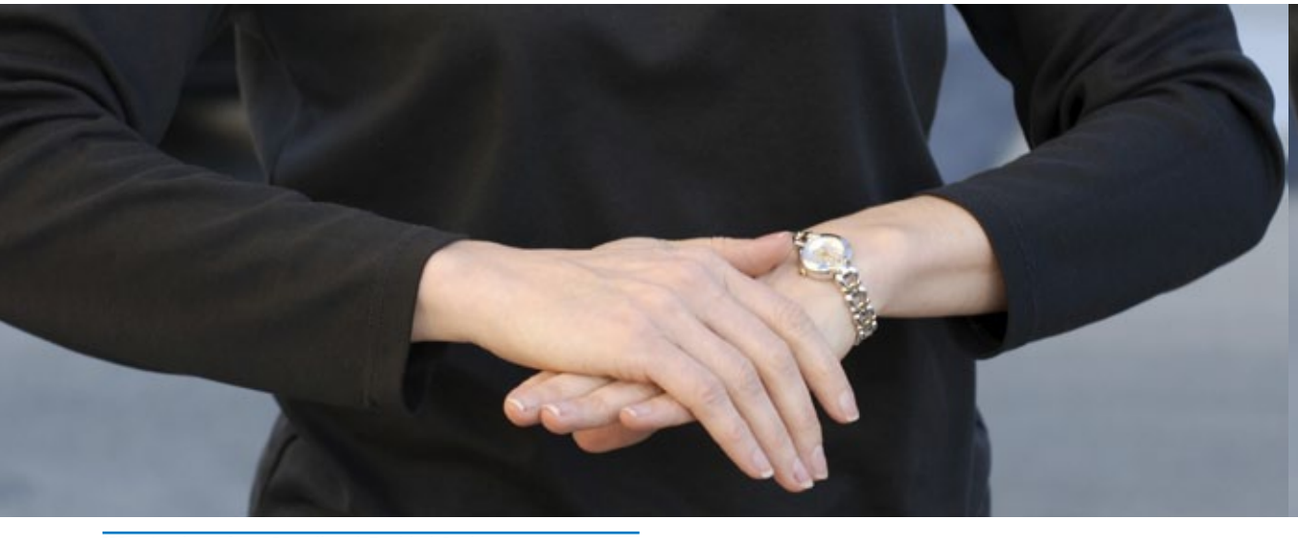
Four themes emerged from the analysis: the importance of communication in healthcare, the need for disability awareness and training, the relationship between health, the Internet and email, and the need for patient centered care and continuity of care.

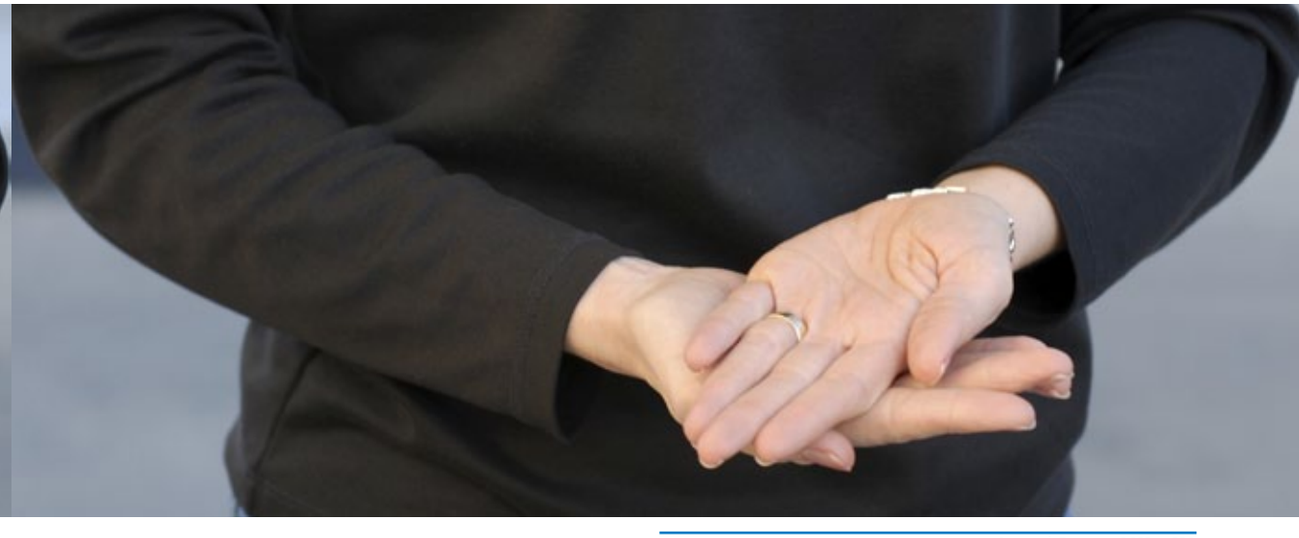
The Internet and related technologies were believed to offer some potential for enabling communication between patients with little or no speech and GPs; however, a number of concerns were raised. These include: secure transmission of sensitive data, broadband affordability, and the possibility of online consultations being a 'band aid' response to complicated communications barriers.

Patients desired a simple way of sending information to their GP that minimised the stress of communicating solely in speech. Email was the patients' preferred method but GPs raised a number of concerns. GPs were flexible in meeting the needs of the patient with all participants agreeing that there were benefits in having a regular ongoing GP- patient relationship.

This research found that the enablers of preferred methods of communication are: training for GPs in disability awareness and the use of technology; systems to determine the urgency of messages being sent by asynchronous media and delivering an appropriate response; an ongoing relationship between patient and GP to facilitate continuity of care; negotiation of communication method; increased time allowances for consultations where communication may be more complex; and a system to manage the workload for health professionals related to Internet technologies.

The research findings were published in a white paper released in June 2011.





# Death grieving and memorialisation

**Michael Arnold, Tamara Kohn**
Historical and Philosophical Studies

**Martin Gibbs, Joji Mori**
Information Systems

**Connor Graham**
National University of Singapore

The advent of broadband-enabled technologies have transformed people's experience of death and related practices. There are two distinct trends. Firstly, communities tied to a notion of place are eroded along with supporting social structures. Secondly, the rise of network individualism is supporting new connections and support.

This project is examining the contradictions about death, grieving and memorialisation in a digital landscape.

While offline practices around death are relatively settled and based on established practices, there is still uncertainty about how best to deploy and engage in online practices such as using social networks sites as memorials.

The interpretation of death through technology and cultural production reveals a growing culturing of death and life online. Shifts in the practices, rituals and cultural values associated with death and dying are occurring as our social life is increasingly played out through digital media that are still seen to be novel and strange rather than familiar and taken-for-granted.

The research is revealing that analysis of online practices associated with death provides a unique insight into current and emerging social infrastructures and communities within broadband-enabled societies. The experience of death online can provide insights into the experience of life online.

# Designing digital technologies for global memorialisation:
## *A 'Black Saturday' bushfire case study*

**Joji Mori** | PhD Candidate
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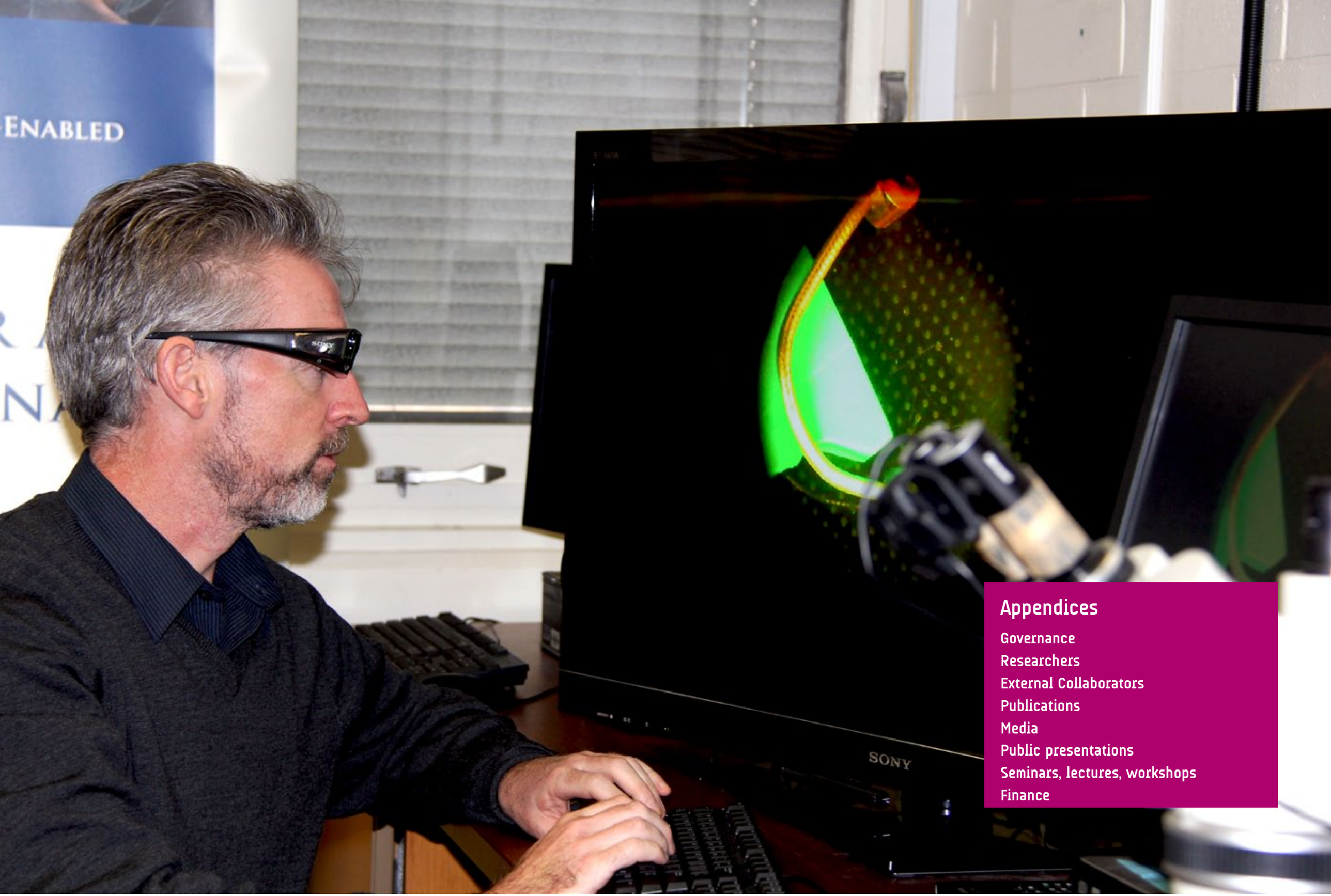
We witness tragic events unfold as a global audience on news websites and online social networks. Examples include the recent earthquakes in New Zealand and Japan. In the aftermath of such tragedy, there is a need to rebuild lives and livelihoods. Memorialisation provides an avenue for grieving, remembering, and honouring the resilience of the survivors. At a local neighbourhood level, this may take the form of commemorative events, rituals and special places. Online approaches that support global participation may be limited to posting messages on bespoke websites or social networks. This project is looking at designing meaningful memorials by bridging the gap between the types of memorials seen at a local level versus those available online by installing physically situated, broadband-enabled digital memorials.

To support the development process the commemorative activities relating to the Victorian 2009 Black Saturday were explored. One commemorative device was the *Poetry Tree* (pictured opposite) located on the side of the road in Strathewen. All residents pass this tree as they drive into town. Days after the fire, a surviving resident posted a poem on the tree. Touched by the gesture, other residents, some of whom lost homes or loved ones wrote their own poems and stuck them to the same tree. The Poetry Tree is an evolving memorial and provides a key input to support the design of global digital memorialisation technologies.




## Appendices

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| **Daniel Lai** |
| Victoria University |



# Publications

## White papers and submissions

*Response to the House of Representatives Standing Committee on Infrastructure and Communications Inquiry into the National Broadband Network*
Institute for a Broadband-Enabled Society, February 2011

*Valuing Broadband Benefits: A selective report on issues and options*
R Hayes, February 2011

*Regulation in the Digital Economy: Convergent regulation for the digital economy*
T Apperley, May 2011

*Where Wireless Makes Sense: Where wireless networks can be rolled out as a substitute for fixed broadband networks*
R Tucker, R Ayre, K Cornick, J Chong, D Fateas, B Gathercole, K Hinton, A Lodders, June 2011

*The role of high-speed broadband in communication between people with little or no speech and GPs*
L Greenstock, B Wickham 2011

*'Screen Stories and Community Connection' Report to VicHealth and The Jack Brockhoff Foundation*
K Chakraborty, B Nansen, L Gibbs 2011

## Journal Articles

M Arnold,T Kohn, C Graham, M Gibbs, 'Gravesites and Websites: a comparative typology of memorialisation' *Cultural Politics,* in press 2011

K Cornick 'The Broadband Revolution: Why Australia needs a National Broadband Network', *The Australian Quarterly*, 2011

S Dreyfus, R Lederman, S Smith, P Monagle 'Customising Pathology Report Design for Patient Use' *electronic Journal of Health Informatics* 6(2) 2011

M Feng, K Hinton, R Ayre, R Tucker, 'Reducing NGN Energy Consumption with IP/SDH/WDM', *E-energy 2010*, 2010

C Garrett, M Kirkman, MY Chen, R Cummings, C Fuller, J Hocking, J Tomnay, CK Fairley, 'Clients' views on a piloted telemedicine sexual health service for rural youth'. *Sexual Health*, 20 June 2011.

SE Hetrick, M Simmons, A Thompson, AG Parker 'What are specialist mental health clinician attitudes to guideline recommendations for the treatment of depression in young people?' *Australian and New Zealand Journal of Psychiatry* in press 2011

S McQuire, 'The dilemma of public space in cities on the move: control space and ludic space', *Aether: The Journal of Media Geography*, 5b, 2010.

S McQuire, 'Sun work: mathematics as media - interview with Rafael Lozano-Hemmer', *Real Time*, 97, Jul 2010

S McQuire, N Radywyl, 'From Object to Platform: Digital Technology and Temporality', *Time and Society*, 19(1), 5–27, 2010

J Mori, S Howard, M Gibbs, 'Poets and Blacksmiths: Implications for Global Memorialisation using Digital Technology'. *Interactions*, in press 2011

N Papastergiadis, 'Wars of Mobility', *European Journal of Social Theory*, 13(3): 343–63, 2010

N Papastergiadis, 'Vulture and its …', *Performance Paradigm*, 6 (June):30–35, 2010

N Papastergiadis, 'Aesthetics and politics in the age of ambient spectacles', *Broadsheet*, 39(1): 32–9, 2010

G Paxton, J Rice, G Davie and S Skull, 'East African immigrant children in Australia have poor immunisation coverage'. *Journal of Paediatric Child Health*, Jan 2011

J Ridoux, D Veitch, T Broomhead 'The Case for Feed-Forward Clock Synchronization' *IEEE/ACM Transactions on Networking*, in press 2011

MB Simmons, SE Hetrick, AF Jorm 'Shared decision making: benefits, barriers and current opportunities for application' *Australasian Psychiatry*. 18(5) 2010

MB Simmons, SE Hetrick, AF Jorm 'Experiences of treatment decision making for young people diagnosed with depressive disorders: A qualitative study in primary care and specialist mental health settings' *BMC Psychiatry,* 2011

P Tune, D Veitch 'Fisher information in flow size distribution' *IEEE Transactions on Information Theory,* in press 2011

X Wang, W Yang, A Wheaton, N Cooley, B Moran, 'Automated Canopy Temperature Estimation via Infrared Thermography: A First Step Towards Automated Plant Water Stress Monitoring'. *Journal of Computers and Electronic in Agriculture*, 73(1), 74–83, Jul 2010

X Wang, W Yang, A Wheaton, N Cooley, B Moran, 'Efficient registration of optical and IR images for automatic plant water stress assessment'. *Journal of Computers and Electronic in Agriculture*, 74(2), 230–7, Nov 2010

AD Wheaton, NC Cooley, GM Dunn, I Goodwin, X Wang, W Yang, B Moran, 'Use of Thermal Imagery to Detect Water Stress during Berry Ripening in Vitis vinifera (L. cv. Cabernet Sauvignon)' *Acta Hort*, 2010.

R Wilken, B Nansen, M Arnold, 'Broadband in the Home Pilot Study: Suburban Hobart' , *Telecommunications Journal of Australia*, 2011

L Woodland , D Burgner, G Paxton, K Zwi, 'Health service delivery for newly arrived refugee children: a framework for good practice'. *Journal of Paediatric Child Health*, 46(10), 560–7, Oct 2010

## Book chapters

D Lai, R Begg, M Palaniswami, (eds) *Healthcare Sensor Networks: Challenges to Practical Implementation,* Taylor and Francis, in press

N Thieberger 'Anxious respect for linguistic data: the Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC) and the Resource Network for Linguistic Diversity (RNLD)' in Margaret Florey (ed) *Endangered languages of Austronesia* Oxford: Oxford University Press,141–58, 2010

N Thieberger 'Linguistic preservation and linguistic responsibility: examples from the Pacific' in Gunter Senft (ed) *Endangered languages in the Pacific: Essays on their Documentation, Archiving, and Revitalization* Canberra: Pacific Linguistics, 93–103, 2010

N Thieberger, M Jacobson. 2010. 'Sharing data in small and endangered languages: cataloging and metadata, formats and encodings' in Lenore Grenoble and Louanna Furbee (eds) *Language Documentation. Practice and values*. Amsterdam: Benjamins. 147–58, 2010

TV Wrigley 'Motion sensors in osteoarthritis – prospects and issues' in D Lai, et al, (eds), *Healthcare Sensor Networks: Challenges to Practical Implementation*. Taylor and Francis, in press

T Schulz, G Paxton, B Biggs, 'Infectious diseases: considerations in refugee populations', in S Loue, M Sajatovic (eds) *Encyclopedia of immigrant health*, , Springer, 2010

SJ Kim, B Dave, 'Health Telematics: Towards useful services for elderly and people with disabilities' in *Lecture Notes in Computer Science*, Volume 6719/2011, 129–36, 2011

N Papastergiadis, 'Collaboration in Art and Society', in N Montmann (ed) *New Communities*, Toronto: Public Books, 2010

N Papastergiadis, 'Identity on the Move and Place of Integration' in N Tsoutas (ed) *Australian*, Sydney: Casula Powerhouse, 82–95, 2010

Y Liao, M Moshtaghi, B Han, S Karunasekera, R Kotagiri, T Baldwin, A Harwood, P Pattison. 'Mining Micro-Blogs: Opportunities and Challenges', *Social Networks: Computational Aspects and Mining*, Springer- Verlag, 2011.

## Conference Papers

T Broomhead, L Cremean, J Ridoux, D Veitch 'Virtualize Everything But Time' *Usenix Symposium on Operating Systems Design and Implementation*, Vancouver, Canada, 4–6 Oct 2010.

K Chakraborty, L Gibbs, B Nansen, 'Negotiating culture, space and identity: how innovative methods can support interviews with children'. *Association of Social Anthropologists of the UK and the Commonwealth Annual Conference*, Belfast, 13–16 Apr 2010.

K Chakraborty, L Gibbs, B Nansen, 'Young People's Play Negotiations in a South Asian Cultural Context'. *Institute of Australian Geographers and New Zealand Geography Society*, Christchurch, New Zealand, Jul 2010

CA Chan, E Wong, C Jayasundara, A Nirmalathas, 'Energy Efficient Solution for Video-rich Services over Next Generation Broadband Access Networks' *Proceedings IEEE Photonic Society Annual Meeting*, Denver, CO, USA, November 2010

CA Chan, E Wong, C Jayasundara, A Nirmalathas, "Energy-Efficient Video Distribution Schemes for Next Generation Passive Optical Networks," *IEEE Int. Conf. Communications*, Kyoto, Japan, June 2011.

T Denison, M Arnold, G Johanson, L Stillman, 'Assessing Returns on ICT Investment in the Third Sector'. accepted to the *CIRN Community Informatics Conference*. Prato, Italy, 9–11 Nov 2011

MP Dias, 'Digital Performance in Networked Public Spaces: Situating the Posthuman Subject'. Accepted to *Inter-Society of Electronic Arts Conference*, Turkey, 14–21 Sep 2011

CM Dissanayake, MN Halgamuge, K Ramamohanarao, B Moran and P Farrell, 'The Signal Propagation Effects on IEEE 802.15.4 Radio Link in Fire Environment', *5th International Conference on Information and Automation for Sustainability* Sri Lanka, 17–19 Dec 2010

MZ Feng, K Hinton, R Ayre and RS Tucker, 'Energy consumption in intelligent optical networks'. *Annual Conference on Green IT*, Singapore, Oct 2010

MZ Feng, K Hinton, R Ayre and RS Tucker, 'Energy efficiency in optical IP networks with multi-layer switching'. *Optical Fibre Communication Conference*, USA, Mar 2011

J Green, F Vetere, A Nisselle, XT Dang, PP Deng, G Strong '"Lucy's always with us": Overcoming absence from school through ambient orb technology' *Association for the Advancement of Computing in Education (AACE) for the Global Conference on Learning and Technology*, Melbourne, 28 Mar – 1 Apr 2011.

J Green, F Vetere, A Nisselle, XT Dang, PP Deng S Hanns 'Ambient orb technology: fostering presence and awareness of children absent from school' *Australian Association for Research in Education conference*, Melbourne, 30 November 2010

SE Hetrick, A Thompson, M Willet (eds), 'How does real world clinical practice compare with 'gold standard' treatment for young people with depression?' *International Youth Mental Health Conference*, Melbourne, 29–30 Jul 2010

K Hinton, R Ayre, R Tucker 'Technology and upgrade options for broadband networks' *Proceedings 35th Australian Conference on Optical Fibre Technology*, Paper 415, 2010

SJ Kim, B Dave, 'Smart silver towns: prospects and challenges' . *Proceedings of 9th International Conference on Smart Homes and Heath Telematics*, Canada 21–22 Jun 2011

R Lederman, G Wadley, J Gleeson, M Alvarez-Jiminez, A Spiteri-Staines, 'Supporting young people with psychosis in the community: An ICT-enabled relapse prevention tool'. *Pacific Asia Conference on Information Systems*, Brisbane, Jul 2011

S McQuire 'Networked urban screens: from display to distributed response', Keynote address at *SEAM 2010: Agency and action*, Sydney, 16 Oct 2010

S McQuire 'INTERACT: Community engagement and city branding'. *UNESCO Creative Cities Network Shenzhen International Conference*, China, 6–9 Dec 2010.

J Mori, 'Memorialising Digital Content: Bushfire Affected Communities'. *22nd conference of the computer-human interaction special interest group (CHISIG) of Australia on Computer-human interaction* 2010

R Naufal, F Vetere, 'Successfully Connecting Socially Isolated People'. *International Federation on Ageing*, Melbourne, May 2010

B Nansen, K Chakraborty, L Gibbs, 'Mathletics: Profit, Pedagogy, Play'. *Affective Fabrics of Digital Cultures Conference*, Manchester, UK, 3–4 Jun 2010

B Nansen, K Chakraborty, L Gibbs, 'Children, ICT and negotiating a Rights-Based Approach to Research within Australian Academia: Ethics, Methods, Strategies'. *E-youth: Balancing between Opportunities and Risks Conference*, Belgium, 27–28 May 2010

B Gopalakrishna Pillai et. al., 'Automated Path Identification for Node Aggregation in Backhaul Networks'. *OptoElectronics Communications Conference*, 5–9 Jul 2010

A Nisselle, J Green, S Hanns, XT Dang, A Jones, F Vetere '"They're hard to break": using netbooks to support learning and social connections in a children's hospital' *Australian Association for Research in Education conference*, Melbourne, 30 Nov 2010

S Pedell, F Vetere, L Kulik, E Ozanne, A Gruner 'Social Isolation in Older People: the Role of Domestic Technologies' *OZCHI '10: Proceedings of the 22nd Australian Conference on Computer-Human Interaction*, Brisbane, Australia 22–24 Nov 2010

P Saeedian, B Moran, K Tolhust, MN Halgamuge, 'Prediction of high-risk areas in wildland'. *5th International Conference on Information and Automation for Sustainability*, Sri Lanka, Dec 2010

N Thieberger, 'EOPAS - streaming linguistic data arising from fieldwork'. Australian Linguistic Society Conference, Brisbane, 7–9 Jul 2010

N Thieberger, 'Reuse and responsibility: records and recordings of speakers of Indigenous languages'. *Australian Institute of Aboriginal and Torres Strait Islander Studies Symposium on Technology*, Canberra, 12–14 Jul 2010.

N Thieberger 'Spoken language corpora: Applications for small languages.' *TELDAP International Conference 2010 Proceedings*. Taipei: Academia Sinica.

P Tune, D Veitch 'Sampling vs Sketching: An Information Theoretic Comparison' IEEE International Conference on Computer Communications, Shanghai, China, 10–15 April 2011

F Vetere, S Pedell, 'The challenges of developing appropriate research methods with seniors'. *Australasian Conference on Computer-Human Interaction*, Sydney, November 2010

X Wang, B Moran and S Challa, 'Efficient Feature Aided Multi-object Tracking in Video Surveillance'. *Proceedings of the 3rd International Conference on Image Processing and Signal Processing* (CISP'10), 1, 114–8, China, 16–18 Oct 2010

L Zhang, D Veitch 'Learning Entropy' *IFIP Networking 2011*, Valencia, Spain 9–13 May 2011

L Zhang, D Veitch, R Kotagiri 'The Role of KL Divergence in Anomaly Detection' *ACM Sigmetrics 2011 International Conference on the Measurement and Modeling of Computer Systems*, San Jose, 7–11 Jun 2011

IBES researchers afternoon tea | August 2010

# Media

## Contributions

Tao of Business: Australia - A broadband-enabled Society | K Cornick, *WIn-Win*, October 2010

Only a broadband network will get us up to speed | R Tucker *The Age*, 10 August 2010

Back on the Superhighway | R Tucker *The Age*, 9 September 2010

When privacy can be a life or death call | M Spriggs, *The Age*, 11 November 2010

Exploring the real-value of high-speed connections | K Cornick & A Lodders, *Ericsson Business Review* No. 1 2011

NBN vs 4G: the contest is already over | RTucker, *ABC The Drum*, 17 February 2011

Every detail of your ills at the touch of a button | M Spriggs & C Fry, *The Age* 15 April 2011

Getting Alan Jones up to speed on the NBN | R Tucker, *The Conversation* 30 May 2011

## Coverage

Tony Abbott defends broadband policy stumble
*Herald Sun* | 11 August 2010

How do we talk about our town?
*Physorg.com* | 16 August 2010

Professor Rod Tucker on access technologies in the broadband policies
*Computeworld* | 16 August 2010

University of Melbourne's IBES signs contract with Clarity
*Telecom Paper* | 10 September 2010

Clarity joins industry program at IBES
*Communications Day* | 10 September 2010

Powerlan joins IBES partner program
*CFO world* | 10 September 2010

IBES project to provide costing scenarios for NBN
*Communications Day* | 21 September 2010

Why a credible cost benefit analysis would help NBN policy
*Communications Day* | 10 October 2010

Turnbull's revamped broadband policy still a "bandaid solution": IBES' Tucker
*Computerworld* | 29 October 2010

Driven by the need for speed
*The Australian* | 6 November 2010

Melbourne Uni seeking funds to further develop academic IPTV system
*Communications Day* | 13 December 2010

IBES signs up new industry partner for broadband testing
*Communications Day* | 20 January 2011

NBN cost benefit analysis would be real challenge, says IBES study
*ITWire* | 1 February 2011

Telstra has announced a new high-speed wireless technology
*Drive* ABC Southern Queensland | 15 February 2011

It's on: NBN vs Wireless
*National Interest* Radio National | 18 February 2011

Wireless camp uninformed about cable, says NBN boss
*Sydney Morning Herald* | 23 Feb ruary 2011

Melbourne uni floats IPTV for international students
*Computerworld* | 18 March 2011

Melbourne uni floats IPTV for international students
*Rapid TV news* | 18 March 2011

Comms Alliance, Melbourne uni explore digital economy rules
*Telecom Paper* | 22 March 2011

CA, IBES to research converged regulatory issues
*Communications Day* | 23 March 2011

Comms Alliance teams with IBES to research comms regulation
*Exchange Daily* | 23 March 2011

Microsoft funds broadband research at Melbourne Uni
*IT Wire* | 28 March 2011

Microsoft's Craig Mundie talks Kinect and demos Avatar Kinect in Melbourne
*I started something* | 28 March 2011

Australia launches biggest effort to "green" internet
*International Business Times* | 28 March 2011

Alcatel, Melbourne university, Victoria govt launch CEET
*TelecomPaper* | 28 March 2011

Bell Labs inaugura Centro Tecnológico de Eficiência Energética
*Computerworld Brasil* | 28 March 2011

Melbourne Uni & Bell Labs set up 'green telecoms' R&D centre
*ITWire* | 28 March 2011

University of Melbourne brings GreenTouch efforts down under
*CIO* | 28 March 2011

Alcatel-Lucent Bell Labs, University of Melbourne and Victoria State Government open Centre for Energy-Efficient Telecommunications
*Smart Grid* | 28 March 2011

One of the world's largest green telecommunications research efforts launched in Melbourne
*BuddeBlog* | 28 March 2011

Alcatel-Lucent Bell Labs, University of Melbourne and Victoria State Government open Centre for Energy-Efficient Telecommunications
*Satellite Spotlight* | 28 March 2011

Green telecommunications research centre opens in Melbourne
*The IndoAus Times* | 28 March 2011

CEET aims to introduce energy rating system for telecom services
*Communications Day* | 29 March 2011

Minister Opens Research Centre
*The Southern Thunderer* | 29 March 2011

The National Broadband Network
*Four Corners* ABC |11 April 2011

Aus to host Microsoft's Imagine Cup 2012
*ZD Net* | 5 May 2011

Google sponsors research into NBN applications, via IBES
*IT Wire* | 12 May 2011

Google seeds Australian broadband research
*IT News* | 12 May 2011

Invest Victoria Announces Partnership Between Melbourne's Globally Renowned Institute for a Broadband Enabled Society and Google for Research into Powerful Broadband Applications
*Red Orbit* | 13 May 2011

Google seeds Australian broadband research
*CRN* | 13 May 2011

Comms Alliance report identifies convergence issues
*TelecomPaper* | 15 June 2011

Convergence Review may be doomed to failure, says IBES
*IT Wire* | 15 June 2011

Melbourne Uni scores award for IPTV platform
Computerworld | 9 June 2011

Global Telecoms Business awards winners named
*Biztech Africa* | 8 June 2011

IBES highlights NBN benefits
*Government News* | 13 May 2011

NBN to raise local vision
*Herald Sun* | 22 June 2011

## Media Releases

Clarity to enable Australian industry innovation with the Institute for a Broadband-Enabled Society
10 September 2010

IBES Inaugural Annual Symposium
4 October 2010

IBES and AIMIA charting the future of creative content in a converged world
25 October 2010

Delivering 3D education through high-speed broadband
10 December 2010

Anue Systems partners with IBES
19 January 2011

Xena Networks Helps IBES Test Next-Generation Gigabit Ethernet Networks
18 February 2011

Comms Alliance supports IBES to research the future of regulation in the digital economy
22 March 2011

One of the world's largest green telecommunications research efforts launched in Melbourne
28 March 2011

Microsoft contributes $400,000 for research into broadband applications
28 March 2011

CommsForce supports research at IBES
18 April 2011

Google joins the IBES Industry Partner Program to fund collaborative research
12 May 2011

IBES and Ericsson win Global Telecoms Business Innovation Award
8 June 2011

IBES report identifies key issues for Convergence Review
16 June 2011

# Presentations by executives on behalf of IBES

## Rod Tucker

Australian American Leadership Dialogue Forum
12–16 July 2010

IEEE Photonics Society Summer Topical Conference, Mexico
19–23 July 2010

The Committee for Economic Development of Australia (CEDA) | 27 July 2010

Australian Economic Forum, Sydney | 5 August 2010

Federal Election ICT Policy Forum, Canberra | 10 August 2010

Bullseye Business Leaders Round Table, Melbourne | 12 August 2010

Athenaeum Club, Melbourne | 16 August 2010

The Future of Cities in the Low Carbon Economy: A Melbourne Energy Institute Public Seminar
18 August 2010

National Policy Advisory Council, Sydney
1 September 2010

Polycom Launch: Bridging the Divide through transformative and collaborative technology solutions
4 October 2010

Content Futures Workshop
25 October 2010

Keynote speaker at Endeavour Awards Ceremony
28 October 2010

CloudS'10 Workshop, Sydney
5 November 2010

Greentouch Annual meeting, Amsterdam
15–19 November 2010

IEEE Victorian Section and ANZSCON Congress
25 November 2010

Australian American Leadership Dialogue, West Coast Leadership Dialogue
11–14 January 2011

GreenTouch Press Conference, London
31 January 2011

Broadband and Beyond 2011 – Driving Australia's Digital Productivity, Sydney
22 February 2011

Ericsson Internal Conference, Broadbeach
3 March 2011

Optical Fibre Conference, Los Angeles
6–10 March 2011

Launch of the Centre for Energy-Efficient Telecommunications
28 March 2011

Industry Innovation Council
31 March 2011

GreenTouch Meeting, Seoul
6 April 2011

CeBIT Australia
31 May 2011

## Kate Cornick

Victorian Government's cIIF Projects Collaborative Workshop
22 July 2010

**Kate Cornick** | Presenting at UKTI Infrastructure Seminar, Australia House, London

The Victorian e-Health Network Breakfast at HIC 2010 Conference and Exhibition
24 August 2010

Ultra-Fast Broadband Technology Summit 2010, New Zealand
17 September 2010

Comms Day Summit
12 October 2010

Content Futures Workshop
25 October 2010

ATUG 2010 October Forum - NBN Update and Digital Economy Developments
26 October 2010

Go Girl, Go for IT 2010, Deakin University
27 October 2010

Broadband for Society Summit, Hobart
6 February 2011

UKTI Infrastructure Seminar, Australia House, London
4 February 2011

Broadband and Beyond 2011 – Driving Australia's Digital Productivity, Sydney
22 February 2011

Strategies for growth in regional Australia
23 February 2011

Presentation to the House of Representatives Standing Committee on Infrastructure and Communications
17 March 2011

Australian Communications and Media Authority (ACMA) internal staff forum
30 March 2011

KANZ Broadband Summit 2011: Digital Futures, Hobart
28 April 2011

Intel Capital Technology Forum presented by the Victorian Government and KPMG
20 June 2011

## Scott McQuire & Tom Apperley

Convergence Review Committee Briefing
30 May 2011

# Seminars, Lectures, Workshops

When we see it change colour we think, 'Oh, Lucy's here'": using ambient technologies to create a classroom presence for children absent due to health condition
Amy Nisselle, Royal Children's Hospital
17 September 2010

Inaugural IBES Annual Symposium
29 September 2010

Content Futures Workshop co-hosted with the Australian Interactive Media Industry Association (AIMIA)
25 October 2010

Bushfire Intelligence & Communication Workshop
5 November 2010

The future is un/evenly distributed
Laura Czerniewicz, University of Cape Town
23 November 2010

Aspects of educational software design
Peter Boon, Freudenthal Institute, Utrecht University,
6 December 2010

ICT Forum: Australia's role in a global environment: Broadband and the Digital economy, co-hosted with Asialink
10 March 2011

Visit by House of Representatives Standing Committee on Infrastructure and Communications
17 March 2011

Launch of the Centre for Energy-Efficient Telecommunications
28 March 2011

Public Lecture, More Like Us: Computing Transformed
Craig Mundie, Microsoft, 28 March 2011

Collaborative Health Informatics Research Seminar
Fernando Martin-Sanchez, Health and Biomedical Informatics Research, 14 April 2011

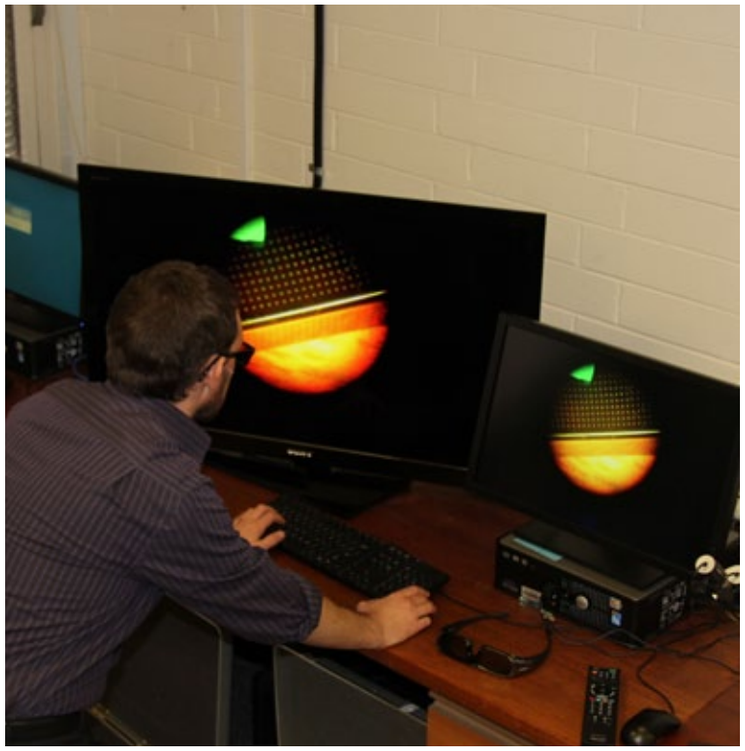
'Models for ageing and technological solutions for improving and enhancing the quality of life'
Cathy Bailey & Glenda Cook, Northumbria University
2 June 2011

'FutureHealth' Lab at University of Western Sydney
Anthony Maeder, University of Western Sydney
23 June 2011

# Finance

| Contributions (cash and in-kind) | |
|---|---|
| University of Melbourne (cash and in-kind) | 4,121,000.00 |
| Industry (cash and In-kind) | 2,156,123.00 |
| Consultancy (cash) | 412,460.36 |
| Victorian Government | 1,000,000.00 |
| **Total** | **7,689,583.36** |

| Cash Expenditure | |
|---|---|
| IBES staff salaries | 964,036.35 |
| Research seed funding | 838,755.33 |
| PhD top-up scholarships | 51,666.67 |
| Broadband Application Lab set up and operations | 109,972.75 |
| Office operating | 8,366.29 |
| Marketing and events | 66,394.25 |
| Travel | 29,808.16 |
| Legal services | 3,310.00 |
| **Total** | **2,072,309.80** |



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