THE UNIVERSITY OF MELBOURNE

IBES
Institute for a
Broadband-Enabled Society

Submission to the Regional Telecommunications Independent Review Committee

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www.broadband.unimelb.edu.au

Contents

1. Introduction

This paper is the Institute for a Broadband-Enabled Society's (IBES) submission to the Regional Telecommunications Review 2011-12. The Institute is actively involved in the research and development of broadband services and applications that deliver tangible benefits to society. Access to high-speed broadband has the capacity to transform business, service delivery and communities across rural and regional Australia. IBES is currently undertaking research to develop new applications and services that leverage the potential of high-speed broadband to make a positive impact for society.

1.1 About IBES

The Institute for a Broadband-Enabled Society (IBES) 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. One hundred and sixty-nine researchers from the University of Melbourne's research community along with 46 external collaborators contribute to the research program at IBES. The University of Melbourne, the Victorian State Government and Industry Partners support the activities of the Institute.

In September 2011 the Prime Minister launched the Australian Broadband Applications Laboratory (ABAL) at IBES. The Laboratory provides a sand-pit environment for innovative businesses and organisations to develop and test new broadband ideas and service offerings. ABAL supports a range of organisations to foster innovation no matter where they are located in Australia, from small to medium enterprises and not-for-profits through to multinational corporations.

2. The Digital Economy

High-speed broadband offers many opportunities to grow the digital economy, especially in rural and regional Australia. The enhanced data transfer capacity made available by high-speed broadband supports a range of applications including video conferencing, transmission of large files, accessing secure private networks, interactive gaming, immersive environments and video-on-demand offered through Internet Protocol TV. These technologies provide the basis for teleworking, amongst other applications, and will enable new business opportunities as well as provide societal benefits to people living across Australia, including in rural and regional areas. Investments in telecommunications infrastructure and information technologies are enablers of the digital economy and will enable rural and regional Australia to compete in national and international markets.

IBES encourages the Review Committee to consider recommendations to Government that would see the continuation of support programs that drive innovation, for example the Digital Regions Initiative. However, we note that it would be possible to support a much larger number of activities through the provision of smaller grants, to make these sorts of programs available to a broader number of SMEs, including in regional Australia.

The Government should support innovation in the interim period while the NBN is rolled out across Australia. For example, teleworking may not be available for a lot of people until they are connected, which may not occur for several years. However, programs could be put in place to support communities to develop interim solutions, such as establishing teleworking facilities in regional hubs that would provide access to a range of services and encourage a culture of teleworking and collaboration via technology in the regions.

Additionally, IBES has undertaken some research in the Digital Economy area that demonstrates the benefits of broadband in agriculture, as well as provide an understanding to barriers to broadband adoption. These are outlined below.

2.1 Smart sensors for crop irrigation

Agriculture is an essential component of the Australian economy but faces new challenges arising from climate change and pressures on resources. Sustainable management of the environment, especially the use of water, is essential to maintain productivity levels. Many research centres, including NICTA, have demonstrated that advanced sensor technologies enable farmers to better manage water usage throughout their farms, minimising consumption while maximising yield.

Automated plant sensing is a crucial part of online decision support system for optimal crop irrigation. Research at IBES has developed techniques to enable a distributed online decision support system to help farmers better understand and control their water usage. Advanced communications network infrastructure is required to support the volume of data produced and transmitted by the sensors. This is both within the local context of the farm and potential beyond the farm gates, for example to customers. This technology has been trialed in vineyards.

The use of sensor technology is expected to increase into the future, as the demand for quality produce is high while the cost, both economic and environmental, to produce increases. IBES views that assisting

farmers to understand the benefits of sensor technology to support the production of crops, as well as other applications that assist them to reach their target market, will be essential in the future as pressure on the produce supply chain intensifies.

2.2. Barriers to the adoption of high-speed broadband by small business

IBES has explored some of the barriers that small businesses face in the adoption of broadband services. 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 more rural locations, there is often no competition and businesses have no choice of the type of service they can access. 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, the research found 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.

3. Broadband supporting Health

The Institute for a Broadband-Enabled Society has an active research program using broadband technologies to assist in the treatment, management and monitoring of patients and their health.

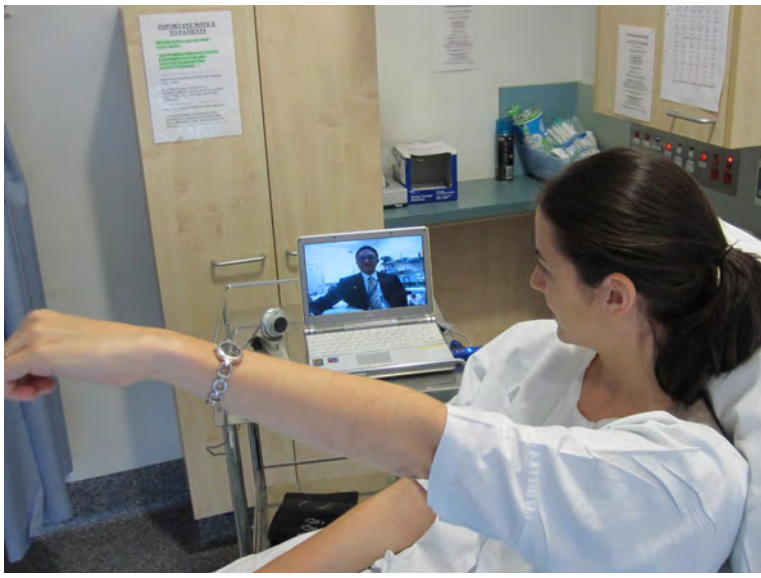
3.1 Telemedicine

Telemedicine has the potential to support the delivery of medical services, supported by telecommunications infrastructure throughout Australia. 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 involving different technologies, such as three-dimensional video applications and haptic technologies that provide force feedback via a broadband connection. The solutions being developed will provide patients with access to a diverse variety of healthcare services. A short summary of IBES telemedicine projects appears below.

3.1.1 Telestroke for rural thrombolysis

Stroke is the second leading cause of mortality in Australia, with approximately 60,000 strokes occurring annually resulting in 1,000 deaths. For many patients this leads to physical dependence on others and prevents them from working. Disability from stroke arises from impairment 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.



Demonstration of telestroke consultation

The treatment of acute stroke has been revolutionised over the past fifteen years through the use of early intravenous thrombolysis treatment. 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 at IBES 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. Either way, this system has resulted in better patient care for people living in regional areas.

3.1.2 Haptic stroke tele-rehabilitation

Eighty-five percent of people who suffer from stroke 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.

Broadband technologies can enable alternative rehabilitation methods for stroke survivors significantly improving health care services and health outcomes in Australia. IBES researchers have developed a haptic tele- rehabilitation system to address these issues.

The prototype system involves a 'rehabilitation robot' that 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 and connected via video conference to understand how patients are exercising without being physically present in the same room.

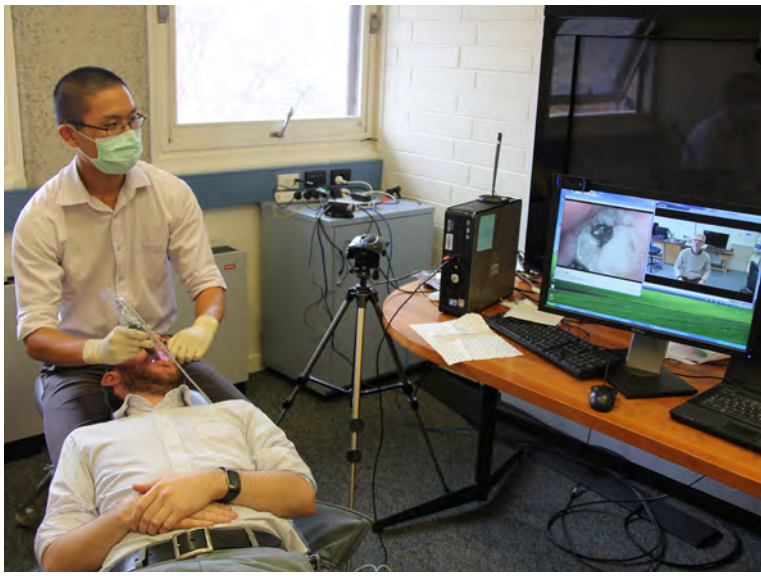
The patient connects to their clinician via a broadband connection. The clinician can dial up a number of different exercises for the patient on the rehabilitation robot. The clinician can also control the level of the exercises, adjusting the assistance or resistance of the robot to fit the patient's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

3.1.3 Tele-dentistry

There is a serious dental workforce shortage in Australia. Broadband-enabled 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. The most effective method for correct oral health diagnosis is a face-to-face examination. However, with limited dentists available many patients are left untreated.

This tele-dentistry program that has been developed by IBES researchers has tested the feasibility and

reliability of delivering oral health checkups remotely. 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. Patients benefit by saving time from making trips to the dentist for check-ups, and only need to travel to see a dentist when an intervention is required, for example to receive a filling.



Teledentisty check-up

3.1.4 3D telehealth applications

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. IBES and its research partners supported by the Victorian Government are developing telemedicine technology to reverse the negative impact of inequality in the provision of medical experts across the country by providing health consultations via a broadband connection.

One component of this project is the trialing of 3D High Definition technologies to deliver teleheath consultation providing specialist care to patients in the Wimmera. The trial involves connecting oncologists based at the Ballarat Oncology and Haematology Services and radiotherapists at the Ballarat Hospital with Nhill and Horsham Hospitals. The links will enable private practitioners to provide essential specialist cancer care to patients in Horsham and Nhill.

3.2 Broadband supporting health and wellbeing

Technology can greatly assist in supporting the wellbeing of young people throughout regional Australia. Some young people may be socially isolated, or required ongoing or specialist medical care that is not readily available in their community.

3.2.1 Virtual visits: webcam consultations for young adult's sexual health

Access to healthcare is one of the key factors in reducing the incidence of sexually transmitted infections. Many barriers exist to young people accessing sexual health care, including limited options in medical providers, lack of confidentiality, limited bulk billing and lack of transportation. Research at IBES is examining the acceptability of video conferencing to deliver sexual health consultations to increase access to sexual healthcare for young people in Australia. This research has found that distance to doctor impacts upon the willingness to use a telemedicine service. 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).

Additionally, most of the sample population (88 percent) were willing to receive testing kits and treatment by mail.

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, especially those living in rural and regional areas. To increase acceptability of the technology, privacy and security concerns need to be minimised to facilitate greater acceptability of webcam consultations.

3.2.2 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. IBES research on youth mental health aims to identify, alleviate and support affected youth.

Broadband-enabled technologies can support decision-making by patients and health care professionals through the availability of online tools. IBES research is testing the effectiveness of Internet based resources for young people who experience depression and is providing evidence to inform their carers and clinicians of their state by providing a first decision support tool and methods for monitoring depressive symptoms and adverse events. IBES is also investigating how social network technology can help overcome isolation providing a positive impact through collaboration with key stakeholders. IBES researchers have used social networking technology to provide opportunities for young people to develop online network and activities that connect them with peers, carers, case workers and the broader community.

IBES researchers have also been investigating how broadband applications can help support people with first-episode psychosis. The risk of relapse after a first episode of psychosis is high, and is a factor in young people disconnecting from their school, work and friends while dramatically increasing the risk of developing chronic psychosis, a permanent disability. 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. The HORYZONS project supported by IBES is first to use broadband technology in the early treatment of psychosis through the use of an advanced web-based and mobile interactive psychosocial tool for relapse prevention and promotion of social recovery for young psychosis sufferers.

3.3 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. 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 an active programming the provision of broadband-enabled aged care services. By using items that are readily available, older adults are able to benefit from broadband connectivity. One research project is exploring the use of domestic technologies in addressing social isolation among older people. The active use of iPads can enable older adults to share and connect with family and friends through images. Additionally the system can be used to increase social support. The research has developed a framework to support the future development of systems for older people.

Another IBES project is developing a broadband-enabled exercise program that will promote health and wellbeing among older people, enabling them to stay in their homes longer and promote social inclusion. The technology will be developed for the Microsoft Kinect platform with the initial trial to connect 20 older residents via the National Broadband Network. Outcomes from this trial will provide the basis for interactive gaming technology to assist older people to maintain independence in their home through improved social connectedness, and physical and mental wellbeing.

4. Broadband supporting Education

IBES has supported a number of research projects that demonstrate the benefits of broadband applications in education, including primary school aged children through to university students and beyond. Some of the projects are outlined below.

4.1 Uni TV

Uni TV provides a platform for innovation in the delivery of tertiary education across a wide range of fields such as medicine, chemistry and engineering, as well as providing a means for the Australian community to access content developed at the University such as public lectures. The project brings together both existing and newly created content from across the University of Melbourne, combines them with interactive applications such as shared learning and virtual workspaces transmitting them via broadband through a commercial-grade Internet Protocol (IPTV) system.

Uni TV

As high-speed broadband is rolled out across Australia, Uni TV will provide a basis for the development of the delivery of immersive educational services to communities across Australia. IPTV has the potential to deliver a wide range of educational services, such as professional development and life long learning, enabling increased access throughout the community.

4.2 Connecting learners across diverse communities

Collaboration between students is highly beneficial to learning in informal and formal settings. Broadband-enabled platforms provide an opportunity to bring learners together and increase the breadth of educational experiences available to students. IBES researchers are developing an innovative system to facilitate the pairing of students in order for them to work on collaborative tasks or projects. 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 technology has been designed for use among three cohorts connecting: primary schools in remote and rural locations with urban students, Aboriginal students in Fitzroy Crossing WA with students in Melbourne and secondary schools across Victoria with sister schools in Asia.

4.3 Being in school but not at school

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.

Student with an ambient orb

Creating a presence in the classroom for chronically ill children that are absent from school is important for the continuity of their education, as well as for the patient's mental health and wellbeing. 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. IBES research has explored the impact of creating a presence of the hospitalised child in the classroom through the use of an 'ambient orb'. 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 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.

5. Broadband supporting Indigenous communities

Indigenous research at IBES is focusing on the preservation and conservation of indigenous knowledge through the capturing of language information and exploring how end users use technology. The information gained from these projects will inform future approaches that make use of broadband-enabled technologies to support the development of indigenous communities and preservation of cultural traditions across Australia.

5.1 Victorian Aboriginal Youth and their use of technology

Aboriginal youth can experience limited educational, health and social outcomes with many of these relating 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.

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.

IBES researchers are studying the patterns of use of social network technologies among Victorian Aboriginal youth 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. Mapping online social network use among Indigenous youth and will result in a plain language community report highlighting the use of social network technology that will provide the basis for improving Aboriginal educational outcomes.

5.2 Technology for endangered languages in Australasia

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. IBES is researching new techniques to increase the amount of indigenous language materials on the Internet by developing scalable methods for recording and annotating large quantities of oral literature along with deploying crowdsourcing techniques to assist the translation of videos, ascribing metadata and annotations to make the materials interpretable.

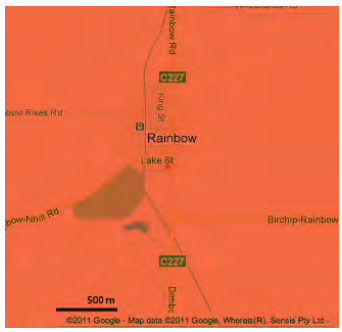
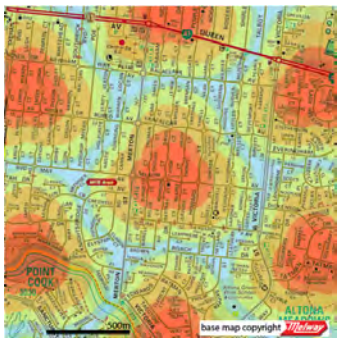
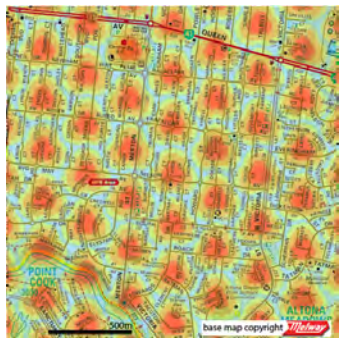
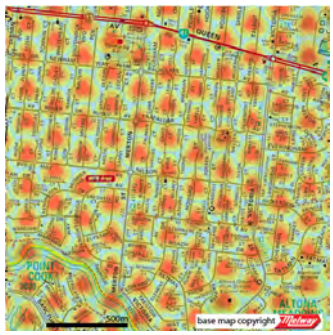
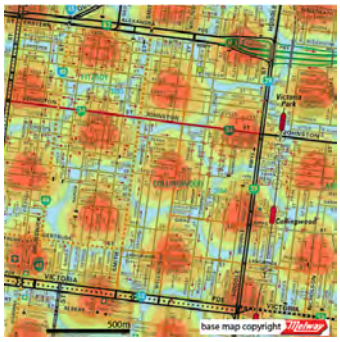
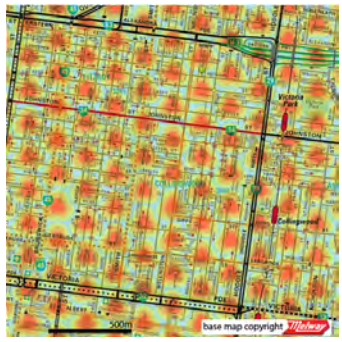
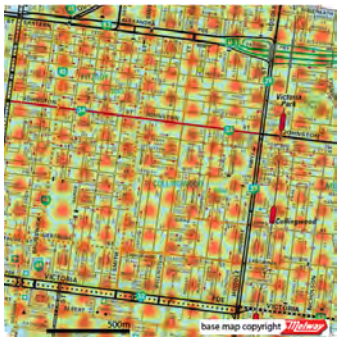
6. Mobile phone coverage in regional Australia

Mobile phone coverage is an important form of connectivity for people throughout Australia, including in the regions. The advent of new phone technologies, such as smart phones, and accompanying increased demand for data on mobile handsets means that communities across Australia are demanding better mobile coverage. While some communities are requesting better mobile coverage to ensure they have access to mobile telecommunications, and the associated benefits, in addition to the NBN, others have suggested that mobile communications are a suitable replacement for the NBN.

6.1 Where Wireless Makes Sense

Wireless technologies can, in some cases, provide a viable alternative to fixed telecommunications infrastructure such as in the National Broadband Network. IBES has investigated the capabilities, advantages and disadvantages of fixed wireless broadband technologies, with the findings produced in a report titled Where Wireless Makes Sense. The report 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 yet this results in increased interference as the spacing between base stations decreases. The image presented on the next page presents a summary of the key findings of the report.

Location	Download volume per user per month		
	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

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.

Legend

7. Conclusion

This submission demonstrates the potential benefits available to rural and regional Australia through enhanced connectivity. High-speed broadband has the capacity to transform service delivery increasing access to health, education and new business opportunities. The Institute for a Broadband-Enabled Society, along with the Australian Broadband Applications Laboratory are well placed to drive the innovation process to leverage these new opportunities. Continued investment by government to support the transition to a digital economy will have benefits not just for rural and regional Australia but the country as a whole.

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