The National Broadband Network (NBN) is a national digital infrastructure project being constructed over the next decade to deliver high-speed broadband services to all Australian premises. Much of the discussion on the NBN to date has been on the physical construction ramp and rollout progress of the project. Thousands of engineering and construction people are building the physical network; there are equally thousands of people developing the applications and new services that will run over the NBN. This article on the NBN Broadband Applications Canvas explores the investment and activity in Australia happening around the NBN in research, broadband application development and case studies of people using the national broadband network and future possibilities to exploit the full potential of the NBN.

The NBN Broadband Applications Environment

Digital Highway - New Digital Boundaries, New Service Delivery Models

The national broadband network is an investment by the government in national infrastructure to support a wide variety of digital services. Like the construction of the road network, the NBN “digital superhighway” will serve many purposes and be used for much more than just single purpose Internet access. The underlying network will serve all industry and public sectors, delivering health, education, business, communities, government services, consumer entertainment and communications services.

Digital services models are disrupting existing businesses as already being seen in the transition to electronic media delivery – books, music, newspapers, mail, shopping and entertainment. The first wave of digital services simply replaced physical media with the download of files containing the desired content: email, eBooks, MP3s, video on demand download. Further cost reduction in pervasive high-speed broadband and the proliferation of many low-cost connected devices will create new business opportunities and the potential for digital displacement of other services. The second wave of digital delivery will occur with online cloud services and through two-way high definition video conferencing. Digital services are not constrained by physical boundaries and can be delivered anywhere across the network through high-speed broadband communications.

Additional Ports – Independent Services

The NBN high-speed broadband architecture has the capability to deliver multiple independent services into premises, opening up opportunities for new business models. Service providers, governments or businesses can use a dedicated second port to deliver health, education, business or government access. Cost savings attained through digital
delivery allow for service expansion across a ubiquitous network. Several potential examples are listed below:

**Running a business at home** —
A small home business can order a second independent service at home, separate from the family broadband plan. No more conflict or contention in terms of broadband performance, monthly allocation, home network security or weighing up a decision between the business and family plans. Larger businesses could allow flexible works arrangements and teleworking through a dedicated broadband service for business use, separate from the home network access plan.

**Health care at home** —
Private or public health providers could deliver services into the home over a dedicated broadband connection as a health service, not offered specifically as an Internet service.

*Chronic Disease Care:*
High speed broadband can deliver in home technology assisted living and in home consultation through video conferencing, reducing health care cost through better health management. Support “home + health service” where it makes sense in terms of health care and economic models.

*Home Rehabilitation:*
In home services could be provided on a short-term basis as part of a recovery process. Temporary service may only be provided for a 2-3 month period. Instead of additional visits to the hospital or doctor’s office for follow-up, the additional consultations can be administered or monitored remotely.

**Aged Care** —
Home aged care providers could create ageing in place solutions through high speed broadband and technology assisted living to address the challenge of the ageing Australian population. Investment in ageing in place can offset the need for more facilities and help address the predicted skill shortages in the aged care industry. Elderly people will be able to stay in their home longer, living independently and safely.

**Education** —
An Australian national digital curriculum could be provided and delivered to every home in Australia. Students can watch lectures and lessons online as homework, head into the classroom to complete their lessons and interactive educational activities. Online, self-paced learning can be used to track the progress of individuals rather than depending on one speed in the classroom. Improve access to education content, communication and opportunities for remote collaboration.

Universities could extend access to the campus network to home. Every student and university professor can access the universities remotely. Course selection is no longer limited to what is offered on the physical campus. Access to high speed broadband is a critical component of tertiary education.

**Broadband Application Innovation**

The real value of the national broadband network will be unlocked through the applications and services running across the network. Australian universities, businesses and research institutions are leading the innovation and development of broadband applications. New research centres in Australia have been created around the investment in the national infrastructure; this section will provide a sample cross section of local activity.
IBES – Institute for a Broadband Enabled Society

The Institute for a Broadband Enabled Society (IBES) was formed by the University of Melbourne in July 2009 supporting broadband research projects across education, health and ageing, social infrastructure and service transformation.

IBES Mission Statement: “To align research and industry interest to drive innovation in broadband applications to deliver seamless experiences for the benefit of society.”

The Institute has provided a plethora of broadband applications development activity, supporting 36 separate projects, involving 111 researchers and 73 external collaborators. IBES established an industry partner program to better align the interests of industry and academia. The platinum and gold partners include Alcatel-Lucent, Cisco, Google, Microsoft, Juniper Networks, Huawei, Ericsson and Optus. Total funding for IBES from all partners has totalled $21M, a significant investment in broadband applications research. (Institute for a Broadband Enable Society 2010)

As part of IBES, the Australian Broadband Applications Laboratory (ABAL) was established to help drive broadband innovation by providing facilities for application development and testing. The test environment can be used for a range of technologies including virtual collaboration, immersive 3D environments, augmented reality, smart sensors and web 2.0 over a high-speed broadband network. There is no need for developers to wait; tomorrow’s applications are being created today in the ABAL environment.

ACBI – Australia Centre for Broadband Innovation

“The Australia Centre for Broadband Innovation (ACBI) is a collaborative national research initiative which connects people and businesses to the benefits of game-changing services and applications enabled by next generation broadband technologies.” (Australia Centre for Broadband Innovation 2011)

ACBI has adopted a very hands-on approach, getting the research and technology out of the lab and into the real world with real user deployments on the national broadband network. Early collaboration projects include a Smart Farm in Armidale with the University of New England, building Smarter Safer Homes for aged care in Armidale and a social TV platform creating a new interactive viewing experience. ACBI is also supporting a broadband applications competition to encourage industry application innovation in the broadband connected home.

Nominated broadband application focus areas of research include media/entertainment, health/ageing, education/learning, government/business services, smart infrastructure, and social/economic analysis.

ACBI is supported by CSIRO in partnership with National ICT Australia (NICTA) and also received matching foundation funding from the NSW government. The Tasmanian Government has also become a supporting partner of ACBI through the SenseT research initiative, exploring pervasive sensor networks across the state.

CSIRO – Digital Productivity Flagship

On January 29th, CSIRO launched the $40M Digital Productivity and Services Flagship research initiative to address the challenge of Australia’s productivity. The goal of the research is to create $4 billion per annum in additional value by developing and delivering more efficient and innovative digital services. A ubiquitous, high-speed national broadband network provides the transit platform for digital productivity.

The Digital Productivity Flagship’s research is focused on large challenges: Government and commercial services, health services and smart secure infrastructure. To achieve the productivity challenge, CSIRO has set some high level guidance to solving complex problems - Do things more efficiently, do old things in new ways, and do new things by changing the
way people engage with technology. (CSIRO Digital Productivity and Services Flagship 2012)

**University Research**

Many universities and academics are seizing the research opportunity in anticipation of the national broadband rollout. The examples sighted below are just a snapshot of some of the activity happening across Australia, by no means is it a comprehensive representation of university research.

Armidale was one of the first release sites for the NBN and home to the University of New England. In 2011, the University of New England (UNE) organised an NBN Seminar Series to start the discussion on the potential impact of the NBN. (University of New England 2011). Vice Chancellor Professor Jim Barber has been an avid NBN broadband advocate and believes the NBN will help transform the way distance education is delivered (Barber 2013). UNE created a connected Smart Farm combining sensors, monitoring, broadband connections and data analytics to improve agricultural management (University of New England 2012). UNE has also demonstrated the capability to deliver remote medical education training over a broadband link with a collaboration project with University of California Irvine.

The University of Wollongong has created an IT innovation ecosystem called iAccelerate to build on the digital economy by matching IT graduates out of UoW with the NBN rollout. iAccelerate will help transition the Illawarra manufacturing based economy into a high tech cluster and double the pipeline of successful start-ups in the region on the back of the NBN rollout. (University of Wollongong 2012)

University of Technology Sydney (UTS) and Alcatel-Lucent established joint postgraduate courses for advanced carrier grade IP networks, developing additional technical expertise required for Australia’s NBN (University of Technology Sydney 2012a). Professor Doan Hoang is the Director of iNEXT – UTS Centre for innovation in IT services and applications for next generation networks. Areas of research include Internet-enabled business applications, high-end visualisation, image processing, cloud computing and advanced video surveillance systems. This research will provide the broadband application building blocks to deliver new services on the NBN. (University of Technology Sydney 2012b)

Australia universities and researchers have had the privilege of experiencing high speed broadband on campus for a couple decades through AARNET. Research is a collaborative and global process, no longer practiced in the isolated confines of the university laboratory. In the US, Gig.U was established to accelerate the deployment of ultra high-speed networks to leading universities and their surrounding communities to create the environment for next generation applications and services. The rollout of the NBN will surround universities with high-speed connections and will move research off of the campus and into the communities across Australia.

**Early NBN Application Case Studies**

In the NBN first release site areas there has been a flurry of broadband application pilots and communities organising at the local level to take advantage of the rollout of the NBN.

**Communities**

Many of the first release sites are leveraging the rollout of the NBN for community benefits by organising local digital taskforces. In 2012, the Coffs Harbour City Council held the second T.H.E. Exchange focused on Technology, Health and Education. T.H.E Exchange was developed by Regional Development Australia – Mid North Coast to showcase the benefits of higher broadband speeds and the use of technology to businesses, individuals and the entire community. The Coffs Harbour City Council published a digital strategy “Switched
on Coffs”, created by Dr. Tim Williams in consultation with local businesses, council, educators, health industry, creative industry and the broader community.

The former Mayor of Kiama Council, Sandra McCarthy, drafted a community Broadband Strategy, created a Community NBN Committee and formed partnerships with the University of Wollongong and CSIRO for broadband application development. The Kiama Council is piloting “Kiama TV”, a local broadband channel with council's meetings, food and health workshops, leisure classes and youth concerts. In March 2012, Kiama hosted an NBN Futures Expo to educate the community and businesses on how to get the most out of the national broadband network rollout. Through local initiatives, organisation and community communication, Kiama is leading the way with one of the highest uptake of NBN services in Australia. (Kiama Municipal Council 2012)

Aged Care – Ageing Well At Home

In Brunswick, the National Ageing Research Institute and Moreland City Council received funding through the Victorian Government’s Broadband Enabled Innovation Program to trial a virtual exercise program from home to promote health and wellbeing among older people. The virtual gym class will use the Microsoft Kinect platform for an interactive group exercise session over broadband to help older people improve their physical, mental and social connectedness. The Ageing Well at Home project is an early example of a new service model, broadband innovation and future possibilities for aged care.

Building on their LifeLinkResponse capabilities (Feros Care 2010), Feros Care has received a grant to implement telehealth solutions for extended aged care at home for the benefits of the client and cares. Specific goals of the Feros Telehealth trial include:

- Defer residential aged care admission
- Prevent unplanned hospital admissions
- Reduce routine GP visits and allow better utilisation of medical services
- Allow improved self-management of chronic conditions
- Allow better care management by Feros Care staff and Care Managers
- Reduce Client and Carer anxiety

Health Care – Tackling the Big Challenges

There are also a number of health trials taking place in the NBN first release site areas, designed to address the big challenges in health care.

Diabetes is the fastest growing chronic disease worldwide and in Australia it is estimated to affect in excess of 1.7M people.

“By 2023, type 2 diabetes is projected to become the leading specific cause of disease burden for men and the second leading cause for women. The number of Australians diagnosed with diabetes is expected to grow to 3.5 million by 2033.” (Diabetes Australia 2012)

In Townsville, the Townsville-Mackay Medicare Local is conducting a clinical trial looking at the use of technology can care coordination to better manage Type 2 diabetes in the home. The intervention will include in-home monitors, video conferencing and support from the diabetes coordinator to complement the care for their GP and other health professionals. The Townsville Health Service District has a 36% higher diabetes mortality rate and a 37% higher hospital rate compared to the Queensland average. This broadband health trial is focused on delivering to the health needs of the community.

The NBN first release sites in Kiama and Armidale are trialling a Telehealth to the Home focusing on older Australians with chronic conditions. The project includes in home
monitoring of patient health through measuring blood pressure, glucose levels and lung functions, relating to heart disease, diabetes and chronic obstructive pulmonary disease (COPD). High definition video consultations will allow patients to communicate more regularly with health service providers from home. Preventative care and healthy living support provide coaching and information to promote a healthier lifestyle. This project is funded under the Digital Regions initiative and is being delivered through the Hunter New-England Local Health District, the Illawarra Shoalhaven Local Health District and Illawarra Shoalhaven Medicare Local in collaboration with the NSW Ministry of Health.

In November, Medibank Health Solutions launched <Anywhere Healthcare> to deliver live video consultations with medical specialist people living in rural and remote areas or for consumer convenience, saving time and travel. Initial medical services include dermatology, paediatrics, psychiatry and general medicine.

Building Smarter Cities – Townsville and Geraldton

IBM selected the two NBN sites of Geraldton and Townsville as recipients of the global Smarter Cities Challenge in Australia. The goal of the program is to build a better planet through the implementation technology on smart systems. Townsville has a focus on building a sustainable community (Townsville City Council 2012) and Geraldton is exploring smart energy and economic development through digital services (City of Greater Geraldton 2012). The national broadband network is playing a supporting role in the smarter cities projects through the deployment of a ubiquitous high-speed broadband network for communications and information flow.

NBN Government Initiatives/Programs

The Department of Broadband, Communications and the Digital Economy (DBCDE) is investing in NBN pilot projects and programs in the early stages of the broadband rollout as part of the National Digital Economy Strategy. The projects cover a range of initiatives including regional communities, business, teleworking, local government, health, education and aged care. These projects will serve as early demonstrations to deliver key findings that can be scaled as the build progresses.

Digital Enterprise Program

Approximately half of Australian small businesses still do not transact business online. Getting Australian business online can improve business productivity, increase market reach and enable future job growth. The NBN network infrastructure is acting as a catalyst for business rethinking their online and business strategies. The Digital Enterprise Program will provide $10M in grant funding to assist small businesses and not-for-profit organisations in 40 NBN connected communities across the nation. (Department of Broadband, Communications and the Digital Economy 2012a). This program supports the Digital Economy Strategy objective of ranking in the top five OECD countries in terms of percentage of businesses and not-for-profit organisations online.

NBN-enabled Education and Skills Services Program

This program is a four-year investment of $27M to demonstrate the benefits of high-speed broadband connectivity on innovative education delivery. Overall, more than 150 applications were received showing the breadth of interest and potential to deliver a better education experience on the NBN. (Department of Broadband, Communications and the Digital Economy 2012b).

On August 8, 2012 Peter Garrett announced funding for 12 education projects across schools, TAFEs, universities, workplaces and homes via the NBN. The Sydney Opera House project
From Bennelong Point to the Nation will use the NBN to deliver drama, dance and music classes to remote and rural parts of Australia. UNE Asia ConneXions will connect Australia students with Korean classrooms through high definition video conferencing. The Australian Youth Orchestra Digital Connection Trial will demonstrate video connections between cities, rural and remote for live auditions and master level classes. The NBN-enabled Education and Skills Services will expand the knowledge base and help shape best practices of delivering education over broadband. (Department of Education, Employment and Workplace Relations 2012)

NBN-enabled Telehealth Pilots Program

The Department of Health and Ageing (DoHA) and DBCDE released program guidelines for the $20.6M NBN-enabled Telehealth Pilots program with a specific focus on aged care, palliative care and cancer care services into the home. The program will investigate opportunities for telehealth services in the future and the supporting business cases, tackling large expenditures of the health care system. Possible outcomes of the trials will include improved access in regional/rural/remote areas, reduced cost in health transportation, a reduction in unnecessary hospitalisation, mitigating health workforce skills shortages, reducing social isolation and improved communications during health emergencies. (Department of Health and Ageing 2012)

Future Application Trends

The fibre to the home (FTTH) network NBN Co is building delivers wholesale download speeds of up to 100Mbs to service providers and has the potential to deliver even faster speeds in the future. Many people have asked or are still actually debating “What are we going to do with all that bandwidth?” Where do we begin?...

The demand for bandwidth is not slowing down. There will be many consumer use trends, new technology developments, higher definition screens and smart infrastructure devices will continue to drive more demand on the network. Cisco Visual Networking Index predicts that Australia’s consumer and business Internet (IP) traffic will grow six-fold by 2015, a compound annual grow rate of 41% over the period.

Video – IPTV, Video on Demand, Video Conferencing

Internet traffic is becoming dominated by video delivery. By 2015, video will make up 81% of all consumer Internet traffic, up from 50% in 2010. Consumers will increasingly adopt video streaming and on-demand models as an option for entertainment, communications, education and training. Digital video distribution will create a long tail of video content and narrow cast opportunities supporting local content creation and delivery.

Higher Definition Screens

Technology companies are continuing to push the visual boundaries with higher definition devices and screen resolutions. The Apple “retina display” for the third generation iPAD(tm) has a screen resolution of 2048x1536, achieving a higher definition than the current 1080p high definition televisions.

At the 2013 Consumer Electronics Show in Las Vegas, Samsung demonstrated the world’s largest commercial Ultra HD LCD TV with an 85-inch screen. The Ultra High Definition picture contains more than 8 million pixels, creating an image size 4 times the resolution of existing 1080p HD screens.
Internet of Things – More and More Devices

Another trend driving the demand for more bandwidth is the number of physical devices connecting to the Internet. The proliferation of Internet connected computers, smart phones, tablets, TVs, gaming consoles, Internet audio systems, storage, appliances, smart meters, video conferencing systems, scales, health monitoring, security systems... will continue. The Cisco Visual Networking Index predicts by 2016 Australia will have an average of 5.7 connected devices per person. (Cisco 2011)

The rise of machine-to-machine communications and smart systems will create demand for additional bandwidth beyond just human interaction and consumption. Low cost monitoring electronics, mesh networks and “infinite” data storage will drive the capability to capture mountains of information for big data analytics and real time processing.

Ubiquitous broadband = Health/Education/Government

Much of the discussion on the NBN has focused on the vastly improved speed of the network, equally important is the aspect of network ubiquity – the NBN is connecting all of Australia. A national broadband network will provide a common platform for federal, state and local government to deliver digital services over broadband reaching all Australians.

Conclusion

Some people believe in building a high-speed network and the applications will follow. As demonstrated, this belief is clearly not the case in Australia. Researchers, universities, businesses and all levels of government are already thinking about and developing the next generation of applications and services to take advantage of a national broadband network infrastructure. The NBN Broadband Applications Canvas provides an early overview of activities and projects to date and only begins to paint a picture of what the applications landscape of an NBN connected country could look like.

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Endnotes

1. The initiatives and programs described in this article are examples of how government, communities and organisations are taking advantage of high-speed broadband services over the NBN. End user experience including the speeds actually achieved over the NBN depends on some factors outside NBN Co’s control like equipment quality, software, the broadband plan chosen and how the end user’s service provider designs its network.

2. The NBN is designed to provide these speeds to its wholesale customers, telephone and Internet service providers. End user experience including the speeds actually achieved over the NBN depends on some factors outside NBN Co’s control like equipment quality, software, broadband plans and how the end user’s service provider designs its network.

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