Digital Dividend Green Paper

Submission

ARC Centre of Excellence for Creative Industries and Innovation (CCI)

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The ARC Centre of Excellence for Creative Industries and Innovation contributes to building a creative economy and society suited to conditions for content production and distribution, business sustainability, workforce requirements, citizenship, and legal and regulatory regimes emerging across the globe in the 21st century. It draws on a broad multi-disciplinary base, with contributions from research and industry leaders in the creative industries, media and communications, arts, cultural studies, law, information technology, education and business. It produces cutting-edge research of relevance to industry needs and fosters excellent and innovative research training at the intersection of these fields.

Introduction

The ARC Centre of Excellence for Creative Industries and Innovation (CCI) welcomes the call by The Hon Stephen Conroy, Minister for Broadband, Communications and the Digital Economy, for submissions on the potential uses and benefits of the digital dividend associated with the switchover to digital television in Australia.

In summary, this submission supports the framework for spectrum re-allocation advanced in the Digital Dividend Green Paper. In particular, we support

- ‘re-stacking’ to achieve a contiguous block of freed spectrum
- harmonization of Australia’s spectrum use with major developed countries
- use of market mechanisms for spectrum allocation, after public interest considerations have been addressed
- a flexible policy and regulatory environment that reflects a shift from static to dynamic spectrum use and the increasingly convergent nature of digital technology.

In our view, the Green Paper's proposals are necessary if Australia is to derive maximum economic and social benefit from freed-up spectrum. But we also argue that consideration of new models of spectrum access is also required.

A prime public interest consideration is whether the entire freed spectrum should be offered for licensed commercial use, or whether a portion should be set aside for class licensed, or 'open' use. In this submission we argue the case for ensuring that some portion of freed spectrum is available for open, 'unlicensed', or 'class-licensed' use. Earlier decisions on spectrum allocation, notably the decision to regulate the use of low-power devices through class licences, have yielded enormous economic, social and community benefits, notably through the development and use of wi-fi technologies. These benefits far exceed the utility associated with class-licensed technologies. We recommend a similar stance on the broad and flexible use of spectrum in the broadcasting services band. We argue that the economic and community benefits of ‘open spectrum’ can be summarized as:

- the innovation and productivity gains in the development of new technologies and applications
- the advancement of equity objectives through the spread of accessible communication technologies, especially in rural and remote areas
- the enhancement of digital literacy and future workforce training through the experimental and educational use of unlicensed spectrum
- the social and civic values associated with community uses of unlicensed spectrum

- the option value for future policy development that accrues from the retention of the spectrum resource in public hands.

Maximising the benefits of the digital dividend requires flexible policy and regulatory settings that do not lock in assumptions about future technological development or spectrum use. The emergence of increasingly sophisticated devices and a better understanding of spectrum properties have brought a reconceptualisation of spectrum as an abundant rather than a scarce resource. This dramatically alters the parameters of spectrum policy. We argue that the best policy response to the technological changes that undoubtedly lie ahead is to shift from a medium-specific allocation model towards a dynamic-use approach.

This submission principally addresses Chapter 3 of the Digital Dividend Green Paper. The submission briefly outlines the changing technological and policy environments shaping spectrum policy. It then details each of these benefits noted above, with supporting evidence and links to innovative developments.

Moving beyond the 'scarcity' model of spectrum allocation

The current model for allocating spectrum has its roots in the early radio era, a time when broadcasters demanded exclusive access to frequencies and bands of 'empty' space needed to be maintained as buffer zones between signals. This model is based on the presumption that spectrum is a scarce resource and is best managed by granting exclusive access to a small number of service providers – a presumption which has been at the core of communications and media policy in Australia ever since.

However, this is a dated and inefficient model of spectrum management. Under this model, much spectrum is effectively wasted, as it is reserved for non-broadcasting services or sealed off to create buffer zones (Werbach 2003). The present system is also based on medium-specific allocations, with a certain amount of spectrum going to radio, a different amount to free-to-air TV, and so on. As digital convergence continues to reshape the technological landscape, this approach is increasingly anachronistic.

Fortunately, the 'scarcity' model is neither the only nor the best way of managing our airwaves. Technology has advanced exponentially since the 1920s, and receiving devices today make much more efficient use of spectrum. Spread spectrum, mesh networking, time-sharing, ultra-wide band, space-time coding – these are all innovations which enable spectrum to be shared by potentially thousands of different services. The policy implication is that spectrum use can now be regulated at the point of reception, as well as transmission.

We support **reserving a portion of 'digital dividend' spectrum for open, class licensed use**. Users of class licensed devices do not need specific permission to operate at the specified frequencies, nor do they have regulatory protection from other users operating at the same frequencies. However, open spectrum use is not a ‘free for all’. Many different users can profitably and safely use the same frequencies, as today’s new generation of wireless devices are able to distinguish between competing signals through a variety of technological innovations. In the same way that the human ear is able to distinguish between potentially significant sounds and background noise, today’s smart receivers are also able to distinguish between simultaneous transmissions by a large number of transmitters.

One way of describing this phenomenon is by analogy to sea transport. As Werbach (2003, pp. 20-21) explains,

> [T]he ocean is not unlimited in size, but it is large enough that ships can be trusted to navigate around one another. The ships, like dynamic wireless devices, can intelligently alter their routes to avoid collisions. There is no need to give companies exclusive shipping lanes, and prohibit other ships from using those routes unless they pay a toll. Such exclusivity would significantly reduce the level of shipping traffic, with no corresponding benefits. Technology is making the wireless world look more and more like the ocean.

In the same way that safe sea transport does not require the ocean to be divided into exclusive territories, so too can spectrum be efficiently and effectively regulated through an open, class licensing model.

While a spectrum commons approach asserts the value of ‘freely accesible spectrum’, it is not a non-market or anti-commercial solution. In fact, the idea involves replacing an infrastructure market, based on ownership of parts of the spectrum, with a market in end-user equipment. The difference is something like the difference between the industry structures of pay television or mobile telephony and that of personal computing. In the former case, competition occurs between a small number of large players who invest large sums in securing control over entire distribution networks. These firms then seek a return through subscription services or access charges levied on end-users. In the latter case of personal computing, end users themselves make the capital investment in equipment designed around open networking protocols.

Spectrum allocations for broadcasting

Limited allocations of 'digital dividend' spectrum may be necessary in specific circumstances to ensure enhancements in existing broadcast services, including the conversion of some 'self-help' retransmission facilities. In our view, however, a platform-neutral approach should be taken to the problem of extending and improving television network coverage, and we support the use of more efficient solutions where they are practicable, such as satellite services or future managed services delivered over the National Broadband Network (NBN).

We do not support the allocation of digital dividend spectrum to facilitate the conversion to new digital television transmission technologies. Such an approach, in the absence of more far-reaching policy reform, would run the risk of reproducing the failures that have led to the extended prolongation of the current digital switch-over. A preferable approach would be to ensure that market mechanisms are in place which would give all spectrum licensees, including broadcasters, an incentive to adopt and promote the use of more efficient transmission technologies.

The Economic and Community Benefits of Open Spectrum

1. Open spectrum fosters innovation and productivity gains in the development of new technologies and applications

Werbach (2003) and others argue a powerful case that the combination of receiver technologies and statutory assumptions hindered innovation and efficient use of spectrum for much of the twentieth century. Expanding computational power, miniaturisation and investment in mobile technologies has revolutionized the communication and information landscape in the past few decades. The freedom to experiment with short range devices in unlicensed spectrum has produced some remarkable developments, including wi-fi, Bluetooth and ZigBee.

License-exempt spectrum has historically been used by technology enthusiasts, such as ham radio operators and, more recently, Wide Area Network (WAN) innovators such as Air-Stream in Adelaide. By providing a space for skill-sharing, building and testing technologies, these bands have been important in stimulating technological advancement through non-commercial endeavour and creating markets for a range of radio devices. For instance, the release of spectrum in the 5GHz bands enabled entertainment networking in the home, carrying more data at faster speeds than the 2.4GHz band. Providing further opportunities for class-licensed spectrum use would similarly stimulate new markets and uses, as well as enabling communications solutions in areas of market failure (see below). Alternative spectrum arrangements, including the benefits of unlicensed spectrum, are currently being considered by the Federal Communications Commission (FCC) through a Notice of Inquiry into Wireless innovation: ‘We seek comment on whether new developments are changing the way innovators access spectrum either on a licensed or unlicensed basis, and whether new models of spectrum access would further support and encourage innovation in wireless services.’ (FCC 2009: NOI 09-666, para 29). In 2009, Ofcom (the UK communications regulator) flagged the possibility of spectrum in the 800MHz band for short range devices as licensed exempt (or lightly licensed) use. Although the full benefits of unlicensed spectrum are unknown and cannot be known at this time, the burgeoning industries that are using existing unlicensed bands are an indicator of possible economic and social benefits.

Today's wi-fi technology is the most striking example of innovative spectrum use. Wi-fi is the leading platform for wireless local area networking (WLAN), and is rapidly becoming a part of everyday life in Australia. Based in part on technology developed by the CSIRO, wi-fi has revolutionized the way we access information. By 2009, one billion wi-fi chipsets had been sold, and more than 5000 wi-fi-enabled products had been developed (Wi-Fi Alliance 2010). Thousands of wi-fi'hotspots'have appeared in schools, universities, cafes, town squares and other public places around the country. Many Australians can now check their email or access information from their laptop, mobile, or other wireless device, usually at no cost. This innovation has had considerable economic benefits not only for CSIRO but for the entire nation, in terms of boosted productivity and increasing levels of innovation. However, none of this would be possible without unlicensed spectrum: wi-fi devices operate on what is sometimes referred to as 'the junk band', an unlicensed frequency range in which many services operate concurrently. In demonstrating the innovative potential of an under-utilized resource, wi-fi is an example of the productivity gains and innovation that can result from a dynamic spectrum allocation model.

2. Open wireless networks can advance equity objectives through the spread of accessible communication technologies, especially in rural and remote areas

Market failure in telecommunications is inevitable given the size of Australia and a population that is concentrated along the east coast. Many remote Indigenous households remain without residential phone lines, let alone internet access. This has serious consequences for economic participation and government service delivery. Past programs aimed at addressing disparities in access to telecommunications have not been fully effective (see Department of Communications, Information Technology and the Arts 2002).

The NBN is expected to deliver speeds of around 100mbps to city households via fibre-to-the-home technology. Although the government is committed to providing speeds of 12mpbs to communities with less than 1000 people, the technological and economic model for small communities is yet to be fully outlined. The danger is that the current digital divide between city and regional/remote areas will widen.

There is a strong argument for assigning a portion of spectrum for open, class licensed use across all bands in order to encourage innovation in densely populated areas. However, another approach would be to allow secondary use by cognitive devices where spectrum is not assigned to a licensee in a particular geographic area, or where a licensee is not making use of that spectrum. Areas of low congestion – in particular, rural and remote areas – could utilize spectrum for community networks, provided backbone infrastructure was within reach.

This approach would overcome a major obstacle in telecommunications delivery, whereby in order to guarantee economic viability, providers require a minimum number of households/businesses to sign up to fixed contracts. Even where a critical number of households exist in a remote community, the standard telecommunications business model can fail on the demand side due to social factors such as household economics and maintenance issues. Providing low-cost solutions that enable a community to retain control over infrastructure could potentially resolve such problems.

The social enterprise business model for broadband delivery and community ownership already exists in Canada with the K-Net initiative. K-Net began in 1998 by providing ethernet LAN/wireless MAN solutions in Keewaytinook communities, where the typical market-based approach was considered unviable. Since then, the community ownership model has been adopted by nine other First Nations. K-Net also provides training and technical support for communities in the network.

Cognitive radio devices could provide a range of high-speed communications services in remote communities, including internet access, VoIP telephony and local or regional television networks for the distribution of cultural and community content to the home. As the ‘digital switchover’ will effectively remove local control over television in remote communities, community broadband networks are perhaps the only realistic option for retaining (or regaining) Indigenous ownership and control of media distribution post 2013. As cognitive technologies are rapidly advancing – with the potential to cover vast areas as high speeds – the digital dividend policy should avoid ‘locking away’ spectrum in places that that the telecommunications industry has traditionally neglected.

A number of existing wireless internet projects are providing relatively high speeds to communities in areas of market failure. The Djursland Network in Denmark covers an area of 60 x 50km and provides internet access at 4—10mbps. Access is provided to approximately 7000 households (one quarter of the population) for one third of the cost of the average city commercial price. The project is, in part, an R&D exercise intended to resolve broadband access for poor or rural areas of the world via low-cost, community-owned wireless networks. The wireless nodes utilize the 2.4GHz and 5GHz bands and the group is pioneering cheap radio, antennae and net gear. One of the future goals of the group is to provide ‘triple play’ services (internet, television and telephony) across the network, including the establishment of local television networks. In Australia, where communities are spread across vast distances, there is a case for allowing ‘unlicensed’, or class-licensed, services in the Broadcasting Service Bands (‘waterfront property’) as it would mean fewer ‘nodes’ (with higher power radio transmitters) and therefore the ability to reach areas that are otherwise too far from the backbone.

3. Open wireless networks enhance digital literacy and future workforce training

The concept of digital literacy is firmly established in educational research and policyas one of the suite of multi-literacies required for effective intellectual and social development, workforce participation, and civic engagement. Wi-fi access is now a basic educational resource. This has been supported by the free or subsidized provision of laptops to students by Australian governments and schools. However, bandwidth restrictions and coverage limitations place limits onthe capability and accessibility of this resource. Beyond classroom walls, participation in the informal education sector – for example, the use of libraries and museums – has been transformed not only by on-line access, but by re-imagining visitors to those institutions as contributors to and co-managers of institutional knowledge. The use by libraries of volunteers to correct errors in digitized texts, and the gathering of information on museum and library photographic collections through placement on open source platforms, are two examples. Access to geo-sensitive information through mobile devices is also enriching our experience of urban spaces through the provision of educational, entertainment or service related information.

Clearly, the internet, wi-fi and mobile communications underpin these developments. However, non-commercial use of spectrum can yield substantial educational, civic and economic benefits. Community media has, from its beginnings in the early 1970s, been closely associated with re-engaging young people in education and training. In developing workforce skills and fostering new media markets, community media transcends notions of remedial education to be a leader in innovative Australian broadcasting. Similarly, the decision taken in the late 1990s to equip the new National Museum of Australia with a fully functioning broadcast studio – one of the few cultural institutions in the world with such a facility – has paid significant dividends through the production and wide transmission of innovative and participative programs.

4. Open wireless fosters social and civic values through community-oriented applications

The uses of the internet, wi-fi and mobile computing to enable new forms of social networking and civic participation has been well documented. In contrast to well-publicised fears of digital communication technologies eroding a commitment to face-to-face community, recent research has shown a significant inter-relationship between virtual networks and interaction in the physical realm (Dechief et al 2008). The emergence of community wireless networks (CWNs) in North America and Europe a decade ago indicates the level of civic activism surrounding new media. Initially connected to wireless hobbyists and hacker culture, the standardisation of wi-fi protocols saw the broadening and proliferation of CWNs. CWN structures and aims are diverse, and their business models are sometimes precarious. However, they are increasingly seen around the globe as an essential part of civic infrastructure. CWNs have been at the forefront of articulating connections between virtual and physical resources, from providing ‘hyperlocal’ information and publicizing volunteer opportunities and civic initiatives, to creating wi-fi hotspots in parks and other public places.

Again, while this example points to the foresight - or fortuitousness - of the regulatory regime in this part of the wireless spectrum, it also points to how much more might be afforded by opening further parts of the spectrum to unlicensed use. The web has brought to the Australian local government sector the capability to broadcast meetings and conduct deliberative fora, but this welcome move towards open government is restricted by bandwidth. The aggregation of local authorities and emerging interest in regional-level policy indicates a shift away from a truly 'local' government and calls into question conventional participative processes. Flexible spectrum access can underpin innovations in civic participation and governance in response to such changes.

5. Diversity in spectrum allocation is critical for innovation and experimentation

A substantial literature argues in favour of diverse and decentralised models of resource management. At a macro-level, diversity reduces the risk of systemic failure. At a micro-level, diverse systems are less constrained by path-dependent decision-making, more open to innovation and tolerant of experimentation. The reservation of a portion of wireless spectrum for open, class licensed use will add to institutional diversity in the use and management of this critical public resource and provide a locus for cooperation, adaptation and innovation.

Events such as the 2009 Victorian bushfires emphasise the importance of flexible and accessible communications media, and the vital role of citizens in assisting with emergency management. Subsequent analysis of the events of that day has pointed to major problems with the flow of communications, with centralised communications structures and inflexible agency protocols unable to adequately respond to the fast-moving situation. Furthermore, lack of clarity about the nature and availability of public sector information (such as geo-spatial imagery) limited decision-making inputs. By contrast, the use of mobile media such as Twitter enabled members of fire-affected communities to give and receive real time-and-place information to others in critical areas and to radio stations for re-broadcast. Such findings build on earlier analysis of systemic failure of communications systems in events such as 9/11. Open spectrum can make a significant contribution to the development of tools and protocols for community information, and provide a vital backup in the event of systemic communications failure by emergency services.

Conclusion

The first telecommunications legislation passed by the Australian Parliament, the *Wireless Telegraphy Act 1905*, made explicit provision for experimentation in this arena. A century later, the reallocation of wireless spectrum through the digital dividend provides an opportunity to make a new commitment to innovation, while supporting the Government's economic and social policy objectives.

The real digital dividend is not the freed-up spectrum, or the funds that may be raised through the sale of spectrum licenses. This submission has argued that the dividend is better conceived as the economic and social benefits of the wireless communications made possible by the switch-off of analogue television. In order to realise those benefits, it may be necessary for government to first consider more flexible and diverse models of spectrum access.

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