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CAN A WIRELESS FUTURE SAVE US FROM A REGULATORY SCHEMOZZLE?

The regulatory stand-off that Australia currently finds itself in on national broadband infrastructure investment is, ironically, to a large extent the unintended consequence of Telstra’s very effective lobbying in the mid-1990s to move telecommunications from a regime of industry-specific regulation to one of general competition law. This was timed to coincide with the legislation needed in 1997 to support the foreshadowed change from a duopoly fixed network market (with ‘triopoly’ mobile networks) to open-ended competition in the provision of most network-based services.

From 1991 to 1996 the incumbent telco was becoming thwarted by an increasingly knowledgeable industry regulator. AUSTEL was having success in systematically removing or diminishing technical barriers to fair competition, whether those barriers were the capacity limits of legacy systems or more recently 'optimised' processes. The change to broad economic regulation had a willing supporter in the then ACCC Chairman, Alan Fels, who conveyed a profound belief in the ability of economic principles alone, when suitably enforced by legislation, to better protect the long-term needs of telecommunications users. The change was even more strongly supported by Telstra's consultant, Henry Ergas – whose recent book 'Wrong Number?', highly relevant to the NBN debate, is critically reviewed in this TJA issue.

However Telstra's competitors, and the advocates for the business and consumer telecommunications user groups, did not accept those radical proposals for change of the regulatory regime lying down. The end result was an accompanying major extension of the Trade Practices Act, its Parts XIB and XIC, to ensure that the incumbent telco would not abuse its inherited monopoly ownership of key access infrastructure, on which any-to-any connectivity of public communication services continues to depend. However it took the ACCC, who regrettably retained very few of AUSTEL's staff and hence their accumulated expertise, several years to 'climb the learning curve' and become aware of the vast repertoire of techniques by which a technically savvy incumbent can postpone and diminish unwelcome competition. By then they perhaps realized that the former industry regulator's powers to arbitrate on unresolved issues of process as well as price would have come in handy.

A particularly lucid paper by Meena Chavan and Holly Raiche in this issue of TJA analyses the effectiveness of the post-1997 access regime, and finds it unsatisfactory from the points of view of both access providers and access seekers. The somewhat frustrated former regulator, Professor Fels, together with the current Productivity Commission chairman, Gary Banks, have pronounced themselves in favour of structural separation of any monopolistic infrastructure, in order to achieve a level playing field for retail competition, in the national interest. Not surprisingly, this is also supported by Telstra's competitors. Equally unsurprisingly Telstra, looking after the interests of its shareholders, is violently opposed, to the point at which it has recently issued an ultimatum to the Government: unless structural separation is ruled out for the proposed National Broadband Network (NBN), Telstra will not bid for it.

Within a few months of this November issue of TJA appearing, we will learn if the Australian Government has kept its nerve and put the national interest first. The Government will be very tempted to accept Telstra's condition, as the fastest path to implementation of the NBN, so that
it can tell a perhaps not too discerning public that it has kept its election promise to roll out a 12 Mbps access NBN. The fact that this decision would then entrench a monopoly on optical fibre-delivered broadband services for ten to twenty years, with consequent much higher retail prices and the likely lagging of advanced products behind those available overseas, would infuriate much of the business community but perhaps have less impact on the general electorate.

**BUT WHAT ABOUT THE WIRELESS (BROADBAND ACCESS) FUTURE?**

In our May 2008 issue, Unwired's CEO David Spence suggested that the end user's desire for 'personal broadband', rather than building-specific broadband, would favour the take-up of mobile broadband services to meet most communications, information and entertainment needs. Would the Federal Government's proposed spending of $4.7B on fixed network infrastructure prove to be a white elephant? The Minister for Communications had ridiculed the previous government's proposed roll-out of an optical fibre backbone network with wireless access, when cancelling that project; was this wise?

The steady worldwide roll-out of WiMAX provides evidence of its credibility as a platform for wireless broadband delivery. Furthermore Telstra itself has declared that its 3G mobile platform has the capability to provide a competing mobile NBN to the Federal Government's fixed NBN. These and other wireless technology platforms – including a revival of interest in high altitude platforms – are reviewed in three papers within this issue of TJA.

The availability of sufficient spectrum for these services becomes a crucial issue. Thanks to the efforts of fellow TJA Editor John Costa, this issue features five papers on worldwide progress towards spectrum reform.

Finally, the future of wireless surely depends most critically on the content delivered, especially to motivate end users to spend money to convert their radios, TVs, mobile phones and computers to new, more versatile technologies.

Our section on 'Digital radio and mobile content' contains Jock Given's revealing account of a second schemozzle – the halting process towards digital radio services – as well as a brilliant and authoritative paper on the 'new content services regime', by Monash University academics Sharon Rodrick, Melissa de Zwart and David Lindsay.

**AND BROADBAND FOR THE SUSTAINABLE ENVIRONMENT?**

I am pleased to report that the response to the 2008 Eckermann-TJA Prize, generously sponsored by Alcatel Lucent as the $10,000 Broadband Challenge for the Sustainable Environment, was so good that we received nine worthy candidate papers, of which the eight best will be published in a special issue of TJA in February 2009.

My thanks go to the members of the TJA Editorial Advisory Board for sourcing (and reviewing) so many excellent papers for this bumper November issue, and to our Executive Editor, Blair Feenanthy, for skilfully preparing them for publication. Special thanks also go to the Australian Computer Society's Telecommunications Board for supporting this venerable 75-year-old Journal in its modern, online format, thus enabling TJA to continue informing debate on the most critical public policy issues in both Australian and worldwide telecommunications.

*Peter Gerrand, Managing Editor*
Professor Christopher Newell, AM, was a pioneer in the field of telecommunications and consumers. In 1989, Christopher was awarded a Master's degree from the University of Wollongong from a thesis entitled *Australian Telecommunications and Disabled People*. He promptly followed this up in 1994 with a PhD thesis from Deakin University, entitled *The Social Construction of the Wheelchair and Cochlear Implant: A Study of the Definition and Regulation of Disability*. Many papers, talks, addresses, and scholarly articles followed on topics of disability, technology, and telecommunications.

Christopher was schooled in the traditions of science and technology studies, and various other critical disciplines, not least ethics, and the new disability studies. He saw technology as socially shaped, or even socially constructed – and as a ‘socio-political space’. Like many critical scholars of technology, Christopher opened up the ‘black box’ of technology’. In our 2004 book *Digital Disability*, we offered an account of how disability was time and time again built into new digital technologies.

The implication of such arguments that Christopher put elsewhere was that people actually did have a great deal of power to determine to what ends they put technology; to how technology was designed, and implemented. Christopher especially taught us to be aware and question the great, dominant myth of technology as the salvation of people with disabilities – while real, existing people with disabilities were actually experiencing new forms of exclusion, and, most ironically, from those important new technologies in which they should have a stake.
Not content with undertaking his luminous critical and scholarly work, Christopher engaged directly and over many years in telecommunications policy, in the interests of consumers. Christopher was at the table at the most fruitful initiatives in consumer, industry, and government partnership in the past two decades, including the Telstra Consultative Council, the Telecommunications Industry Ombudsman, various government policy exercises (not least the Broadband Services Expert Group), Standards Australia work, and the self-regulation represented by the Communications Alliances and its predecessor bodies.

While still relatively young, Christopher was an éminence grise of the consumer and disability movements. He was a central and pivotal figure in so many boards, committees and engagements in telecommunications and consumers – shaping consultative processes, standards, regulations, complaints handling, policy, and many other areas. To the everyday mundane proceedings of such organisations, Christopher reminded us, often with great humour, of the importance of activating consumer rights, of considering the ethical implications of what we do, of the vital role of governance. Christopher was deeply committed, in the most ethical and spiritual, as well as in professional, democratic, and intellectual dimensions, to conversations as constituting a truly civil society.

One of the things that most frustrated Christopher was the recurrent tendency of those who have the power to set the scene for deliberation on telecommunications policy in Australia to neglect dialogue and to forget lessons and insights (especially from the literature represented by *Telecommunications Journal of Australia*, and other indispensable chronicles). Time and time again, he observed, and spoke out against, the industry, government, regulatory, academic, and even consumer forums, in which no heed was paid to how to ensure a diversity of people could participate; that many voices could speak; that as many life experiences, desires and aspirations could figure in the envisioning of futures.

Christopher challenged the powerful to genuinely incorporate the interests of all in telecommunications policy, founding such a nationally beneficially communications environment, upon ongoing, real, and institutionalised dialogue, in which consumers were extended some modicum of resources to research, discuss, and determine their views. Christopher believed that such dialogue was especially critical in making self and co-regulation fair and effective, rather than just for lip-service and show.

When I remember him, it is vitally important to me that the quest for genuine dialogue in telecommunications not only continues, but is taken to new heights. Such conversations, and the actions that are bound up in them, are one important step to ensure that our telecommunications technology is imagined and realized with all us in mind. Christopher had a gift for such rich and potent dialogue, and for the extraordinary friendships he struck up with people across the telecommunications industry – and in all this, his example testified to the importance of relationships in all we do, even the great modern project of technology.
THE AUSTRALIAN TELECOMMUNICATIONS ACCESS REGIME – TEN YEARS ON

Dr Meena Chavan, Senior Lecturer, Macquarie University
Holly Raiche, Executive Director, Internet Society of Australia

When open competition was introduced through the Telecommunications Act 1997 (Cth), Part XIB – The Telecommunications Industry: Anti-Competitive Conduct and Record-Keeping rules and Part XIC – Telecommunications Access Regime were added to the Trade Practices Act 1974 (Cth) to underpin open competition. In moving from the former Government owned monopoly providers to open competition, new competitors to the former monopolist Telecom (now Telstra) had to be able to interconnect to Telstra’s infrastructure to be able to provide competing services. The Government’s aim was that, in the first instance, interconnection arrangements would be commercially negotiated. Failing successful negotiations, however, the Access Regime provided that the bottleneck facilities could be ‘declared’. Once a service is ‘declared’, the provider of the declared service has specific obligations to provide interconnection on specified terms, with the possibility that the ACCC can arbitrate disputes on access to ‘declared’ services. Ten years later, the effectiveness of the Access Regime is being questioned, by the competition regulator, by Telstra and by Telstra’s competitors.

The purpose of this paper is to review the effectiveness of the Access Regime and consider whether it can be further amended to improve its effectiveness (there have been significant amendments to the Access Regime in 1999, 2002 and 2005) or whether other measures to ensure a competitive environment in telecommunications should be considered.

The research for this paper has been an examination of written material, including significant reports on competition in telecommunications by the Productivity Commission and by ACCC reports on competition in the industry. It has also examined the many ACCC inquiries into Access Regime issues, submissions to those inquiries and public statements made by industry participants.

INTRODUCTION

COMPETITION IN TELECOMMUNICATIONS

Until 1989, public telecommunications services were provided by Government-owned monopolists: the Australian Telecommunications Commission (Telecom) and the Overseas Telecommunications Commission (OTC). Competition in telecommunications was introduced with the Telecommunications Act 1989. AUSTEL, an independent telecommunications regulator, was created and competition was introduced in two areas: the provision of value added services and private networks. Telecom and OTC, however, retained their exclusive right to provide infrastructure and basic services nationally and internationally. (Grant 2004, 2-5)

ACCESS UNDER THE TELECOMMUNICATIONS ACT 1991

Limited facilities based competition was introduced with the Telecommunications Act 1991, in the context of the explicit Government policy commitment (supported by both major parties) that open facilities based competition would be introduced in 1997.
Two categories of carriers were created, and two general telecommunications carriers and three mobile carriers were granted carrier licences, giving them the right to install infrastructure. Carriers were also given the right to connect with any other carrier’s network and facilities, with AUSTEL given power to arbitrate in cases where carriers could not reach agreement on interconnection arrangements.

The service monopoly was first breached in a limited way. The monopoly on service provision was also opened up. Both carriers and carriage service providers could provide domestic and international telecommunications services, although carriage service provider arrangements for interconnection to a carrier’s network and/or facilities were not on as favourable terms as inter-carrier arrangements. (Grant 2004, 5–15)

THE HILMER REPORT AND RECOMMENDATIONS

The liberalisation of telecommunications, promised by Government in 1991, became part of the larger Government competition policy reform, set in train by the Hilmer Report. One of the Report’s most important areas of concern was public monopolies, and their need for their structural reform. The Report identified two main policy concerns with public monopolies:

... Monopoly returns made in the monopoly market may be used to finance otherwise unprofitable prices in the competitive market, potentially driving out or disadvantaging competitors ...

A second concern can arise where there is a vertical relationship between the two activities, particularly when access to the natural monopoly element is essential for effective competition in the downstream or upstream market... In this case, integration of the natural monopoly element... and a potentially competitive activity... raises concerns that control over access to the monopoly element may be misused to stifle or prevent competition in the potentially competitive sector. (Hilmer 1993, 219)

The alternatives for addressing those concerns were given as either separating the natural monopoly element from potentially competitive elements or leaving the structure intact and placing more reliance on ‘intrusive regulatory controls’ to ‘guard against cross-subsidisation and, where a vertical relationship is involved, the potential misuse of control over access to the natural monopoly element’. (Hilmer 1993, 219)

The Report strongly supported structural reform over what it had called ‘the more intensive conduct regulation’. (Hilmer 1993, 266) However, the Report did recommend the establishment of an access regime to essential facilities’ but only if access to the facility would promote competition in the downstream market, and that declaration of such services would be in the public interest, having regard to the national significance of the facility and the national competitiveness such access would promote. (Hilmer 1993, 266)

There was also debate whether existing industry specific regulators (such as AUSTEL) should continue to regulate competition or the regulation of competition be done by a national competition regulator. The Committee’s Report came down firmly on the side of one competition regulator covering all industries. (Hilmer 1993, 325–328)
In the case of telecommunications reform, the Committee noted that the 1991 reforms did not include vertical separation ‘due to a concern that AOTC (the merged Telecom and OTC), at least for the 5 years from the introduction of competition, required economies of scale and scope of an integrated business to compete effectively in global markets’. (Hilmer 1993, 221)

THE TELECOMMUNICATIONS ACCESS REGIME 1997

THE POLICY RATIONALE FOR A TELECOMMUNICATIONS SPECIFIC ACCESS REGIME

The implementation of Hilmer Report recommendations resulted in significant changes to competition law in Australia. The Federal and State/Territory governments agreed in 1995 on a National Competition Policy, including State/Territory governments’ reform of monopoly areas such as the provision of electricity or gas, and significant amendments to the Trade Practices Act 1974 (Cth), particularly the introduction of a new Part IIIA – Access to Services.

While the new competition rules extended across all industry sectors, including former monopoly areas, special competition and access rules (the new Parts XIB and XIC) were introduced specifically for telecommunications.

As the Explanatory memorandum to the amending legislation explained, the telecommunications industry is a ‘complex, technically detailed network industry’ and it was thought that the industry-specific nature of the Access Regime reflected the particular Government policy interests in:

- promoting any-to-any connectivity;
- promoting diversity and competition in the supply of carriage services, content services and other services supplied by means of carriage services; and
- ensuring access to carriage services is established on reasonable terms and conditions and includes necessary ancillary services such as physical interconnection, billing information and access to conditional access customer equipment (such as set top boxes used in the supply of pay television). (Trade Practices Amendment (Telecommunications) Bill 1996)

PART XIC: ACCESS REGIME COMPONENTS

In summary, the Access Regime process begins with the ACCC’s declaration of a telecommunications service. Once a service is declared, providers of that service (access providers) have obligations to other service providers (access seekers) wanting to use that service in order to provide a service. Further, if access seekers are unable to commercially negotiate with the access provider for the use of the declared service, they may notify the ACCC of an access dispute, and the ACCC then has the power to arbitrate the matter. (ACCC 1999a)

A) SERVICE DECLARATION

The ACCC may declare a service, after initiating the declaration process itself or at the request of an access seeker, and the declaration process must include a public inquiry that allows for public submissions. The Declaration must adequately describe the service, and must contain an expiry date (no longer than five years). (Divisions one and two, Part XIC, Trade Practices Act – ‘TPA’).
The TPA lists the objects the ACCC must consider when determining whether to declare a service, which are grouped under the phrase, the ‘promotion of the long-term interests of end users’ (LTIE). In promoting the LTIE, the ACCC must have regard to the promotion of competition in the markets for services, achieving any-to-any connectivity in those services, and encouraging economically efficient use of and investment in infrastructure. (TPA s. 152AB). In particular, the ACCC must look at whether the service in question should be declared to underpin competitor access to services in circumstances where access might not be readily granted. As the ACCC explained in its recent decision to continue the declaration of the line sharing service (LSS):

Under the TPA, declaration of a service can promote competition in listed services by mandating access to those services that are supplied in monopoly-provided vertically related markets. (ACCC 2007a, 19)

B) STANDARD ACCESS OBLIGATIONS (SAOS)

Once the ACCC has declared a service, access providers of that service must:

- permit interconnection of its facilities with those of service providers;
- provide billing information in connection with the supply of the declared service; and
- take all reasonable steps to ensure that the service provider receives fault detection, handling and rectification of a technical and operational quality and timing that is equivalent to that which the access provider provides to itself. (s. 152AR TPA)

There is provision, however, for the ACCC to grant an exemption from the SAOs either for an individual service or class of service. (s. 152AS ff TPA)

C) TERMS AND CONDITIONS OF SERVICE PROVISION

The terms and conditions on which a declared service is provided must comply with the SAOs, unless an exemption has been granted. An access provider can also file an access undertaking with the ACCC that sets out the terms and conditions on which they will provide a declared service, providing the undertaking complies with all relevant SAOs. The undertaking may simply adopt terms and conditions set out in Model Terms and Conditions for Core services, developed by the ACCC. (ACCC – core services) (ACCC 2003a). Alternatively, an access provider may develop an undertaking, compliant with SAOs, relevant to the particular declared service. In both cases, undertakings must be submitted to the ACCC that can either accept or reject the undertaking, but not modify it. (Divisions 2-3, Part XIC, TPA). It should be noted that, of the many undertakings submitted to the ACCC, the only undertaking that has been accepted and is in force is FOXTEL’s undertaking for its digital set top box.

D) PRICING

The cost charged by an access provider has been one of the most contentious issues over the past ten years of the Access Regime. The TPA allows the Minister to determine pricing principles on which access costs will be determined, (s. 152CH TPA) but as yet, the Minister has not determined such principles. The ACCC also can determine principles relating to the price of access to a declared service (s. 152 AQA TPA) and has done so for a range of declared services, including for the ‘core services’.
PART XIC: SUPPORT FOR PART XIB

In dealing with access disputes, the ACCC considers whether the terms and conditions on which the service is offered are reasonable. Under s. 152AH TPA, determining the reasonableness of the terms and conditions involves consideration of the costs of providing access and any relevant operational and technical issues. Under Part XIB, the ACCC has the power to set record keeping rules – information they must provide to the ACCC – on carriers and carriage service providers. Such information assists the ACCC in determining the reasonableness of the terms and conditions being offered.

PART XIC: A REPORT CARD

Since its inception in 1997, the Access Regime has been amended in significant ways in 1999, 2002 and 2005. Those changes reflect concerns with the operation of the Access Regime and regulator/industry views on how the Regime could be made more effective.

1999 LEGISLATIVE CHANGES TO THE REGIME

The ACCC announced an inquiry into the declaration of local services (including the PSTN O/T, ULLS and LCS) in March 1998. (ACCC 1999a). The ACCC’s Final Declaration from this Inquiry raised all of the issues that are typically in contention by industry participants in later inquiries: will a service declaration promote competition, should the service be further unbundled, how should the service be described for the purposes of declaration, and are there technical matters that impinge on service declaration.

Telstra’s predominant position in the market is also documented. For example, when discussing declaration of the ULLS, the ACCC observed:

The customer access market is characterised by high barriers to entry. Telstra is the main supplier of services in this market, currently supplying around 98–99 per cent of services. Limited roll out of alternative customer access infrastructure has occurred in discrete areas, particularly the central business districts of Sydney and Melbourne. While additional roll out will gradually erode Telstra’s share of this market, Telstra is likely to hold the major part of this market for the foreseeable future.

The customer access services supplied in this market are used as inputs for the supply of services in downstream fixed telephony and high bandwidth carriage services markets. Telstra also operates in these markets and is thus in a position where it controls access to the majority of inputs necessary for downstream competition. (ACCC 1999a, 57)

Yet, at that stage, at least, the efficacy of Access Regime itself was not being questioned. All that was felt necessary by Government was ‘fine tuning’ to Parts XIB and XIC. The 1999 amendments to Part XIB included giving the ACCC power to disclose or require the disclosure of information provided to the ACCC under the Record Keeping Rules regime. The amendments to the Access Regime provided the following:
a. enabling the ACCC to give procedural directions to parties to negotiations under the Part XIC telecommunications access regime before a dispute has been notified;
b. enabling the ACCC to attend or mediate negotiations under the Part XIC telecommunications access regime; and
c. establishing as a standing obligation that access providers not use information supplied to them by competitors for purposes other than which it was supplied. (Telecommunications Legislation Amendment Bill (1998)

THE PRODUCTIVITY COMMISSION REPORT AND SUBSEQUENT AMENDMENTS TO THE REGIME

In 2001, the Productivity Commission was asked by Government to inquire into telecommunications specific competition regulation – specifically Parts XIB and XIC of the TPA and relevant parts of the Telecommunications Act.

The Report concluded that the Access Regime was still necessary to maintain ‘efficient competition over the medium term’. Nevertheless, the Report acknowledged that the current processes under the Access Regime were

... slow, uncertain and inefficient – with adverse consequences for parties seeking access. There are potential pitfalls in the criteria that determine services that are subject to access and in determining access prices. Associated with this there is a risk of reduced investment in core telecommunications infrastructure – with long-run consequences for consumers and for Australia’s overall economic efficiency. (Productivity Commission 2001, xxii and Chapter 9 for fuller discussion)

Some of the Report’s recommendations were about clarification of the objects of the Access Regime and its processes. The objects should recognise the need for certainty for investment decisions, and processes should be streamlined. (Productivity Commission 2001, Chapter 9)

The Report also highlighted more serious issues with the Regime. As the Report noted, the Access Regime was originally intended to be ‘light-handed’. In practice, however, the intention had not been met.

The ACCC has rejected Telstra’s four undertakings, and Telstra has said it will not be proposing any more. The TAF² has been ineffective – and the Commission recommends its removal for that reason. While there have been many commercially negotiated arrangements, for many major players and key services the ACCC has been obliged to determine access prices in arbitrations. These have involved protracted processes that, when appeal processes are considered, are not yet complete in most cases.

The Commission considers that the aspiration for ‘light-handed’ regulation – while commendable – is not realistic at present. This is because the key to an effective access regime is the determination of access prices. Such price regulation, whether implicit or explicit, is not light-handed. The key to reform, however, is to ensure that the regulations are well designed by following six strategies. (Productivity Commission 2001, xxix)
The Productivity Commission’s recommendations for change included the appropriate scope of regulation, encouragement of commercial arrangements, regulations to be applied only where there are problems, and only to the extent necessary to address those problems and, where possible, consistency with industry wide competition policy. (Productivity Commission 2001, xxix)

The Report acknowledged that a significant number of commercial negotiations had been successful and a number of competitors and competitive services were on offer. However, such negotiations were, in many cases, protracted and difficult. Larger firms were able to use the ACCC’s powers of arbitration to reach agreements with access providers (largely Telstra), but the smaller firms simply could not afford the legal costs. Most often, commercial settlements were reached where there were a number of access providers or competitor had the possibility of investment bypass of Telstra. (Productivity Commission 2001, 225ff).

The Report also questioned the value of undertakings as part of the Regime: up to the time of the Report, Telstra had submitted four undertakings – all of which had been rejected by the ACCC. Three of the undertakings had given Telstra too much discretion on when and to whom services would be provided, and the fourth undertaking set an access price that was ‘unreasonable’ based on ACCC calculations of the costs involved in providing the service. (Productivity Commission 2001, 231)

Another difficulty with the Regime was the significant delay in dispute resolution, due in part to the interaction of the ACCC’s consideration of undertakings and access disputes. In practice, the Report noted that the settlement of an arbitration would be delayed until consideration of an undertaking is finalised. The outcome is illustrated in the example given: in November 1997, Telstra lodged a PSTN undertaking with the ACCC. A year later, AAPT notified the ACCC of an access dispute with Telstra over access to the PSTN. Almost a year later, the ACCC issued an ‘interim’ determination for the ACCC on access prices – revised in June 2000. The ACCC had, at that time, yet to accept a Telstra undertaking on the PSTN. (Productivity Commission 2001, 235). As the Report observed:

Only five final determinations have been made. Of these, three were made over eighteen months after the disputes had been notified to the ACCC, another took eleven months, while the remaining dispute only took four months to finalise. The ACCC has terminated two disputes and 18 disputes have been withdrawn. The remaining 18 disputes have not been finalised – and have been active ranging from two months to over two years. Only five final determinations have been made. Of these, three were made over eighteen months after the disputes had been notified to the ACCC, another took eleven months, while the remaining dispute only took four months to finalise. The ACCC has terminated two disputes and 18 disputes have been withdrawn. The remaining 18 disputes have not been finalised – and have been active ranging from two months to over two years. (Productivity Commission 2001, 239)

The Report recognised that the process of bilateral negotiations and determinations could be improved if the ACCC could hold a class arbitration for bilateral disputes ‘that have a sufficient degree of commonality’. (Productivity Commission 2001, p. 329 Recommendation 10.6)
A related submission was that the ACCC be empowered to set benchmark prices for declared services – a ‘ceiling and floor rate’. This would allow access seekers to negotiate commercially within a set price range, based on their individual service needs. This would reduce existing uncertainty faced by access seekers on the access prices they are charged, and facilitate more successful commercial negotiations. The idea was accepted by the Commission in its recommendation that the ACCC be given the power to publish ‘an indicative price range’ that ‘reflects the outcomes of an interim or final determination’. (Productivity Commission 2001, 338 Recommendation 10.11)

Perhaps the most vexed issues in the Access Regime revolve around access pricing. The Report devoted a whole chapter to Access Pricing (Productivity Commission 2001, Chapter 11), but did not suggest major change. While there were some issues with the methodologies used to determine whether an access price was ‘reasonable’ within the meaning of the TPA, its recommendations were mainly of process – the objectives to be used, the clarity of the principles and other issues. (Productivity Commission 2001, Chapter 11. For a complete list of Inquiry recommendations, see p xxxvii)

Since the Productivity Commission’s discussion on access pricing, the ACCC has used its powers to suggest pricing principles and indicative pricing for ‘core services’. As the ACCC explained:

The ACCC is currently arbitrating a number of access disputes relating to the ULLS. Given the extensive consultation process being undertaken in those disputes, the ACCC considers that it is in a position to determine indicative prices for the ULLS. The ACCC also considers it beneficial to provide access providers and access seekers with the ACCC’s approach to ULLS prices in order to assist the parties in commercial negotiations by narrowing the boundaries for those negotiations and by providing tools in alternative dispute resolution processes. (ACCC 2008b, 1)

In the end, however, not all of the Report’s recommendations were accepted by Government. There were important amendments to the Access Regime made by the Telecommunications Competition Bill 2002, including a requirement that the ACCC determine non-binding model terms and conditions for ‘core services’, and addressing some of the contentious issues on non-price terms and conditions to the SAOs. (see Henderson and Rowland (2002) for a discussion of the Government’s response to the Report and resulting amendments to Part XIC of the TPA). However, many of the issues identified by the report remained.

THE ACCC’S EMERGING MARKET STRUCTURES REPORT

In March 2002, the then Minister for Communications, Information Technology and the Arts, Senator Alston asked the ACCC to provide advice on ‘... the extent to which emerging market structures are likely to affect competition across the communications sector, including through the provision of bundled pay TV, telephony and broadband services’. (ACCC 2003a, xiv) While the ACCC’s resulting report focussed primarily on competition issues raised by the FOXTEL, Telstra and Optus arrangements for pay television, the Report did make comments about competition in the wider telecommunications markets. There were increasing benefits from competition.
in telecommunications, but they were flowing primarily from the retail level and not from infrastructure competition. As the ACCC observed:

Importantly, Telstra owns two of the three major local access networks outside the CBDs of major cities. In addition to owning the copper (PSTN) network that connects virtually every household in Australia, Telstra owns the largest cable (HFC) network, which passes 2.5 million homes. The second largest carrier in Australia, Optus, owns the other HFC network. This network passes approximately 2.2 million homes. The extent of Telstra’s dominance of the sector is demonstrated by the fact it receives almost 60 per cent of total industry revenue, which is almost four times the revenue that its closest rival, Optus, receives. It is reported to receive over 90 per cent of total industry profits. (ACCC 2003a, xv)

For the ACCC, the consequence was its recommendation that Telstra should divest itself of the HFC network. (ACCC 2003a, xvii) and Chapter 4) The ACCC also acknowledged what it saw as the limitations of the Access Regime in promoting competition. One of the main deficiencies in the Regime was that it does not ‘change the underlying incentives of a firm not to provide fair, timely and non-discriminatory access to its upstream inputs when the firm also competes in downstream markets that rely on those inputs’. The consequence was that the Regime does not provide ‘timely outcomes, may be open to gaming (from both access providers and access seekers) and may cause a high level of uncertainty’. (ACCC 2003a, 23)

THE ACCC’S REPORTS ON COMPETITION IN TELECOMMUNICATIONS

The ACCC must report annually to the Minister on competition safeguards, and changes in prices paid by consumers in telecommunications (ss 151CL and 151CM TPA) In 2000/2001, the ACCC combined the requirements into one report: Telecommunications Competitive Safeguards. The latest report, for 2005/6, includes significant discussion on the Access Regime. (ACCC 2007b).

The report noted the benefits on increased facilities competition, with a number of carriers offering high speed broadband using the declared services of the ULLS and LSS. As a consequence, the number of ULLS and LSS in operation grew by seven per cent in the nine months to December 2006.

As the ACCC observed, however:

While there has been improvements in service quality and price competition resulting from these substantial and rapid increases in infrastructure investment, competition for the delivery of services to end users remains fragile. Access seekers remain reliant on Telstra’s ULLS and LSS. They are therefore exposed to substantial risk from unforeseen changes to the price and non-price terms and conditions of access. This may inhibit their access to Telstra’s network. (ACCC 2007b, 1-2)

It is arguable that the number of access disputes should not be used to indicate the successful operation (or otherwise) or the Access Regime. It could be argued that the use of the Regime,
with the possibility of ACCC determinations, demonstrates that the Regime is an important tool in competitors gaining access to an access provider’s network/facilities. It could also be argued, however, that because there are no undertakings in force for the telecommunications network, and because the ACCC model terms, conditions and prices are not binding on access providers, the number of access disputes points to difficulties with the overall Regime. In any case, the Report noted:

Twenty-eight new telecommunications access disputes were brought before the ACCC in 2006 for arbitration under Part XIC of the TPA. This is the highest number of disputes notified in a single year, compared to a low of zero disputes notified in 2002 and 2003. By the end of 2006, 92 access disputes had been notified to the ACCC since the legislation was introduced in 1997. Telstra has been a participant in 74 of the disputes, mainly as an access provider, while Optus has been in 31. (ACCC 2007b, 55)

ACCESS TEN YEARS ON: INDUSTRY VIEWS

A) ACCESS PROVIDERS’ VIEWS

Clearly, Telstra is not the only access provider. This is particularly true for mobile telecommunications, where there are three infrastructure providers (SingTel Optus and Vodafone as well as Telstra). There are two obvious consequences for access provider views on the Regime. The first is that other infrastructure providers are more equivocal about the Access Regime since it both supports their claims for access, but also supports other service provider claims for access to their infrastructure. The second is that they are also the subject of access disputes and ACCC determinations. Indeed of the ACCC’s published access determinations, in only one case was Telstra the subject of the dispute. In four cases, the access provider in question was Optus and in three others, Vodafone was the subject access provider.

As the ACCC has stated, and is quoted earlier in this paper, in the Telstra is still the provider of over 98 per cent of the fixed line access to customer premises (the CAN). And it is Telstra’s continued ownership of almost all of the CAN that gives rise to the access disputes over the ‘core services’. Therefore, while other access providers, particularly those with significant infrastructure, share some of Telstra’s views on the Access Regime, Telstra’s views are most uniformly critical of the Regime from an access provider viewpoint.

Telstra’s submission to the Productivity Commission summarises its criticisms of the Access Regime. In Telstra’s view, there was ‘intense competition’ in the telecommunications markets, and the regulatory regime, including the Access Regime, had as its aim, the ‘promotion of Telstra’s competitors rather than the promotion of competition. (Telstra 2000, 5) The Regime’s arrangements were ‘highly intrusive’ with a significant cost impost (Telstra 2000 – see particularly Chapter 1 for Telstra’s arguments why the access process for Telstra declared services were below Telstra’s costs). The outcome of what Telstra called ‘regulated access on uneconomic terms’ has lessened its incentives to investment outside of the CBD and its ‘continued investment in the core network’. (Telstra 2000, 28) And Telstra cited the number and length of ACCC arbitrations to underscore its view that the Regime was ‘a regulatory mechanism that was simply not working. (Telstra 2000, 2)
Telstra also argued that some of its declared services were competitively provided and there was, therefore, no need for service declaration. Further, the ACCC had declared services where substitutable services had already been declared – the example was that both local carriage service, and PSTN O/A had been declared. In Telstra’s view, the Access Regime was regulatory ‘overreach’ and, while it was appropriate to have an access regime in telecommunications, the industry wide access regime under Part IIIA was more appropriate. (Telstra 2000, chapter 4)

Telstra’s views have not changed in its subsequent submissions to ACCC inquiries. For example, it its submission to the ACCC’s Review of the Regulation of Fixed Services, Telstra called the ACCC’s policy of encouraging ‘stepping stone’ regulation under Part XIC a ‘failed policy and said the ACCC should only be regulating the ‘bottleneck’ hotspots – and in those hotspots, only regulating the bottleneck service. (Telstra 2006, 6)

B) ACCESS SEEKERS’ VIEWS

Not surprisingly, Telstra’s criticisms of the Access Regime were (and are) not those of its competitors. While the views of individual access seekers vary as between providers, and between the issues being considered, there are some common themes amongst them, particularly as set out by the Competitive Carriers’ Coalition (CCC).

In their submission to a review of Parts XIB and XIC, the CCC’s conclusion was that the philosophy underpinning the regulation – the negotiate/arbitrate – is ‘fundamentally flawed’.

The model assumes that there are incentives on both sides to reach commercial agreement, and that there is some bargaining power on both sides of the negotiation. In reality, Telstra is an unwilling seller of wholesale services, and its market power is such that it feels no compulsion to enter into commercial agreements unless it is forced to do so. (Competitive Carriers’ Coalition 2005a, 2)

The CCC rejected arguments made that the number of undertakings submitted and recent changes in legislation meant no further change to the Access Regime was necessary. Instead, the CCC argued that there had been ‘systematic gaming’ of the undertakings regime, and that the ‘rash of arbitrations’ only demonstrated that genuine negotiations between access seekers and providers remains ‘as elusive as ever. (Competitive Carriers’ Coalition 2005a, 2-3). All that the 2002 amendments had achieved was a ‘shift in tactics’ from a ‘gaming of the arbitration process’ to a ‘gaming of the undertakings process. (Competitive Carriers’ Coalition 2005b, 3)

There are other views.

AAPT’s submission to the Productivity Commission contained criticisms of competition in telecommunications under Parts XIB and XIC, but was perhaps less pessimistic, particularly about the efficacy of the Access Regime. Competition had developed in telecommunications markets, but not uniformly, and competition ‘is yet to broaden and deepen’; Part XIB had been important ‘both as a means of addressing anti-competitive conduct and as a deterrent against such conduct’; the Access Regime encouraged investment because ‘access-based competition leads to infrastructure-based competition’ and, although there are weaknesses in the Regime (notably delay and information asymmetry), the ‘effectiveness and administrative costs’ of the regime are ‘low as a proportion of industry revenue, less than costs under alternative regimes and more
fairly distributed'; and finally, looking forward, competition protections should be made stronger not weaker. (AAPT November 2000 p. 2 – summary of original submission)

In other submissions to the Productivity Commission, Hutchison said that it ‘uses commercial negotiation or other private arrangements to resolve access matters’, but that ‘delays have been considerable’. (Productivity Commission 2001, 224, quoting submission by Hutchison on pp 6-7). The Service Provider Industry Association also stated that commercial negotiation on access as ‘desirable’ but that, in many instances, proved to be ‘difficult, protracted, even impossible’ (Productivity Commission 2001, 224, quoting from the Service Provider Industry Association submission, p. 1).

POSSIBLE REFORMS

As discussed above, the Access Regime has been amended since 1997 as a consequence of both the recommendations by the Productivity Commission and Government views on how to make the regime more effective.

Some Access Seekers, however, believe that further reform of the Access Regime is necessary. Again, while the number of access disputes may not be indicative of the failure of the Regime, they do indicate that commercial negotiations alone do not result in agreement on access. As at 7 April 2008, there were 22 access disputes registered with the ACCC, covering seven declared services. All of them involved Telstra, with a range of access seekers also involved. The other fact worth noting that, also as at April 2008, only one undertaking had been accepted by the ACCC, as mentioned above in the terms and conditions of service provision as follows: ‘It should be noted that, of the many undertakings submitted to the ACCC, the only undertaking that has been accepted and is in force is FOXTEL’s undertaking for its digital set top box.’ and that relates to the FOXTEL digital equipment; there are no undertakings accepted by the ACCC that relate to declared services – particularly the ‘core services’.

The reforms that have been proposed have been directed towards strengthening ACCC powers, and what AAPT has called ‘incentive regulation’ – providing a framework in which, when commercial negotiations are not successful, the dispute can quickly be resolved.

The most contentious issue for access seekers has been price. As discussed above, the ACCC has exercised its powers to not only set pricing principles, but indicative pricing for core services. Indeed, in its submission to the Productivity Commission, one of the proposals AAPT made for reform was the introduction of ‘reference prices’ at least for ‘core services’ (AAPT 2000, 20)

In the CCC’s view, however, the introduction of indicative prices has not worked as intended, and ‘a more formal price setting regime’ should be introduced. (Competitive Carriers’ Coalition 2005a, 8). In that scenario, prices for core services would be predetermined by the ACCC after an appropriate inquiry process.

Another area for reform concerns undertakings. One suggestion is that they must be provided by access providers within set timeframes, generally after a public inquiry process. (AAPT 2000, 16) In addition to the requirement for mandatory undertakings, a further proposal would be to give the ACCC power to amend the undertakings if found unacceptable (Competitive Carriers’ Coalition 2005a, 17)

If not completely removed from the regime, undertakings must be varied so they deliver against their original intention. The CCC understands that the
ACCC has such an ability to require and amend undertakings in the gas and electricity industries. (Competitive Carriers’ Coalition 2005a, 8)

A more radical proposal is that, if the ACCC is given power to predetermine access prices for core services, undertakings be abolished. (Competitive Carriers’ Coalition 2005a, 8)

There have also been proposals for further procedural reform. These include giving the ACCC power to deal with arbitrations concurrently, if the issues under consideration are similar. Another is to create an information presumptions by the ACCC on factual matters. That is, the ACCC should be able to presume facts at issue based on facts available to it at the time. The proposal is to counter the information asymmetry between information known to access providers versus information available to the ACCC and access seekers. The hope is that the ability of the ACCC to presume information based on known facts would provide an incentive for access providers to provide information they hold but have not made public. (AAPT 2000, 20)

Increasingly, however, it is being suggested that a better response is some form of operational or structural separation of Telstra such that the wholesale and infrastructure areas are separated from its retail activities. This, it is argued, will counter the incentives in the vertically integrated Telstra to favour itself over other access seekers in providing access to its infrastructure. (Competitive Carriers’ Coalition 2005b)

The Operational Separation requirements have been significantly enlarged by Ministerial Determination (Determination 2005). The Plan requires Telstra to maintain wholesale, retail and network business units. The Determination goes further. Under the Determination, the wholesale, retail and network business units must operate in a manner that is ‘substantially separate’ from the other types of business units, and employees in one type of business unit must undertake work ‘principally’ for that type of business unit. (Determination 2005, Clauses 5 & 6). Further, the person(s) with direct responsibility for management of the wholesale business unit(s) must be equivalent to the person(s) with direct responsibility for the retail business unit(s), and the premises for retail and wholesale business units must be different, with appropriate security arrangements against access by non-business unit employees (although the requirement does not require the premises to be in separate buildings. (Determination 2005, Clause 7)

In addition, Telstra is required to develop strategies for service quality, information equivalence, information security and customer responsiveness, with specific requirements for each strategy set out. Telstra must then provide both the Minister and the ACCC with a copy of each strategy and have it available on its Internet site.

Perhaps the most significant requirements relate to ensuring the equivalence of services (Determination 2005, Part 14). Under these requirements, Telstra must develop, in consultation with the ACCC and the Department, a Price Equivalence Framework by 30 June 2006.
The irony is that the Hilmer Report, with its blueprint for competition reform, predicted the difficulties now being experienced over a decade later. As that Report forewarned:

where there is a vertical relationship between the two activities [wholesale and retail], particularly when access to the natural monopoly element is essential for effective competition in the downstream or upstream market... In this case, integration of the natural monopoly element... and a potentially competitive activity... raises concerns that control over access to the monopoly element may be misused to stifle or prevent competition in the potentially competitive sector. (Hilmer 1993, 219)

GLOSSARY

ADSL Asymmetric Digital Subscriber Line: A compression technology that supports high-speed digital services over conventional copper telephone lines. It has significantly greater capacity in one direction than the other.

CAN Customer access network (also referred to as the local loop): The portion of the PSTN which comprises the transmission system connecting customers to the local switch.

CCC Competitive Carriers’ Coalition: Members are Hutchison Telecoms, Macquarie Telecom, Verizon Business Strategy, PowerTel, Primus, TransACT, and iiNet, Agile Communications.

CORE Services: The domestic originating and terminating PSTN (PSTN O/T) access, the unbundled local loop service (ULLS) and the local carriage service (LCS).

DSLAM Digital subscriber line access multiplexers: DSLAMs are installed in a local exchange, allowing a competitor access to part or all of the fixed line service between the local exchange and the customer’s premises.

LCS Local carriage service: This is where the access provider provides the wholesale or network elements of local calls, and the access seeker provides the retail elements such as billing.

LSS Line sharing Service: the non-voiceband frequency spectrum of unconditioned communications wire.

PSTN Public switched telephone network: The switched telephone telecommunications network to which public customers can be connected.

SAOs Standard access obligations: under the Access Regime

ULL Unconditioned local loop: The copper wire between the end user’s network boundary and a local or remote switch

ULLS: Unconditioned local loop service

XDSL: A generic term for digital subscriber line technologies (see ADSL), which enable broadband services over copper wires.

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ENDNOTES

1 The ‘core services’ are the: domestic originating and terminating PSTN (PSTN O/T) access, the unbundled local loop service (ULLS) and the local carriage service (LCS).

2 The Australian Communications Access Forum was established in 1997 and was declared to be the Telecommunications Access Forum (TAF) as provided for under Division Four of Part XIC of the TPA. Its function was to recommend services to the ACCC for declaration. While the TAF did develop a model telecommunications access code, which was accepted by the ACCC (but later lapsed) it was never able to agree on recommending services to the ACCC, and was abolished in 2002.

3 The ACCC’s ‘stepping stone’ approach is that telecommunications competition can happen in three stages, beginning with service-based (resale) competition, based on access to wholesale services, moving to quasi facilities based competition where firms provide a range of services using a combination of their own infrastructure and access to wholesale/network services provided through another party’s network, then to full facilities-based competition, consisting of competing forms of stand-alone infrastructure that can directly serve customers and provide a range of end-to-end telecommunications services that are substitutable (ACCC 2006: 11).

REFERENCES

AAPT. 2000. Supplementary Submission by AAPT to the Productivity Commission Review of Telecommunications Specific Competition, November.


ACCC. 2003b. Final Determination for model price terms and conditions of the PSTN, ULLS and LCS services, October 2007.


This document offers an overview of each of the wireless and spectrum themed papers in this issue of TJA, and concludes with a Glossary of terms used.

Notwithstanding the current global economic situation and questions now raised in relation to telecommunication investment there are strong indications of a growing future role for wireless applications, and need for more market-oriented spectrum management approaches to replace older command and control models. Driven by attractive new applications, their cost effectiveness, high demand for mobility, availability of faster broadband and new expectations of geographical ubiquity, recent technologies and associated spectrum reforms are combining to bring such possibilities closer. A rapidly growing array of worthwhile, user-friendly wireless based services and hand-held devices are progressively appearing in the market. Not to be ignored also is the status some of these products bestow on purchasers.

Emerging market-oriented reforms in the allocation and management of spectrum at international and national levels are allowing these benefits to occur more quickly and efficiently. Progressive availability of some re-allocated spectrum, for example after the Digital TV switchover period in Australia between 2010 and 2013, will further this trend and also open up new broadcasting services. From April 30 to May 2 this year such issues were pursued at Radcomms08 in Melbourne. The special series of radio and spectrum reform related papers that follow also address similar issues and to some extent were prompted by that event, but have a more international focus.

Another impact of current global economics is the bad press that ‘market forces’ at its extremes have recently received. There are consequently already signs of some selective shift back towards stronger regulation. The ways in which this might or might not express itself in current spectrum reforms are yet to be played out.

TOMORROW’S TECHNOLOGY STARTS WITH TODAY’S SPECTRUM PLANNING

ACMA Chairman Chris Chapman’s paper is an edited version of his opening address to Radcomms 2008. It is as interesting for what it now says about ACMA’s new “can do” and more consultative approach to spectrum policy and management reform as it is for the good examples used to illustrate some of the wireless developments likely to continue to drive these reforms in Australia and elsewhere.

The “can do” approach is well illustrated by ACMA’s approach to the establishment of an impressive “Square kilometre Array” aerial system in Central West Australia for deep space radio tracking. Apart from the intrinsic value of this system to the scientific world its supporting communications grid connecting the port town of Geraldton with Kalgoorlie, Meekatharra and the surrounding townships is impressive and dismissive of any digital divide in and around those areas.

The need for spectrum reform is illustrated by various examples of developments in wireless-based systems ranging from Digital Audio Broadcasting to Intelligent Transport Systems. The
latter, for example, make commutes easier, safer and more efficient. Associated with that but also significant in its own right the example of radio Frequency Identification (RFID) devices which potentially also has major significant impact on our lives. Of course there are many other examples.

Radio devices in conjunction with the Internet, for business and pleasure, have significant impact on spectrum demand and management and are an important driver of ACMA reform. Responses to ACMA’s two discussion papers on Wireless Access Services (WAS) have highlighted some significant objections and concerns as well as support for re-planning and re-allocation of associated bands. In that context the paper also considers important benefits to the Australian economy of broadband that is ubiquitous.

The fast growing field of “sensing” technology including its use in environmental, climate and navigational applications also draw heavily on spectrum availability and management processes, particularly in conjunction with increasing use of satellite systems.

The paper concludes by reinforcing and illustrating the more consultative and transparent approach now adopted by ACMA to accommodate and fairly balance stakeholder needs in ways that more readily and quickly support new wireless developments and hence the Australian economy. These new processes are designed to make more effective ongoing use of a valuable but finite resource.

An ‘Editor’s Postcript’ updates some outcomes of ACMA initiatives outlined at Radcomms08 and affirmatively reinforce the notion of an emergent new era of spectrum stakeholder collaboration within Australia.

NEW DIRECTIONS FOR SPECTRUM MANAGEMENT: AN INTERNATIONAL PERSPECTIVE

In his paper ‘New Directions for Spectrum Management: An International Perspective’ consultant and part time ACMA Member Geoff Luther points out, in a private capacity, that changes in communications technology and markets have placed great strains on traditional approaches to spectrum regulation, which have had difficulty coping with the current rate of change in radiocommunications. He argues that new technologies including mobile telephony and wireless broadband have posed challenges for governments that needed faster and more objective means for allocating spectrum to competing commercial interests. He then points out that spectrum regulators have turned increasingly to market-based and more flexible approaches to regulation, including auctions, pricing and trading. In looking to the future he argues that challenges ahead include improving technology neutrality, improving the efficiency of use of government spectrum, and deciding how much spectrum to set aside for the spectrum commons.

Geoff emphasises that spectrum management reform is still very much a “work-in-progress”. His paper significantly suggests that despite the potential benefits from ensuring that government spectrum is used efficiently very few countries have attempted to address this. He refers to the UK exception and in particular the work of Professor Martin Cave in recommending that there should be a presumption that new spectrum needs should be met through the market, and that there should be greater sharing of government spectrum with others. In the following paper Professor Cave directly discusses these and other critical issues being pursued in Europe and the UK as part of their current and planned spectrum reforms.
MARKET-BASED METHODS OF SPECTRUM MANAGEMENT IN THE UK AND THE EUROPEAN UNION

Australia together with the US, Europe and the UK (amongst some others) are increasingly pursuing market-based spectrum management reforms. In this paper Martin Cave (Warwick Business School, University of Warwick) drawing on joint work with Fulvio Minervini of the University of Macerata and Warwick Business School considers the development within the European Union of common policies towards the application of market-based instruments of spectrum management, and with their development and use in the one member state, the United Kingdom, where they have been applied most fully. The European Commission legislative proposals if adopted would create frequency bands that are subject to trading and flexibility of use and predominantly rely on spectrum markets. It involves an extensive programme of spectrum awards, the development of a new method of specifying spectrum user rights to permit spectrum change and use, and integration of commercial and public sector spectrum markets.

With comprehensiveness, great clarity and minimal acronym use the paper outlines the methods under consideration, focuses on their potential role within the public sector, describes developments on the EU and UK respectively, and concludes with a helpful assessment of progress or otherwise so far. For anyone concerned with spectrum management reform this comprehensive and well-structured analysis is very accessible despite complexity of subject matter and provides a valuable assessment of the outcome so far of European and UK spectrum management reforms.

MAXIMISING PUBLIC BENEFIT DERIVED FROM USE OF THE SPECTRUM

Successful Spectrum management reform requires clear understanding of the limited availability of spectrum and actual and potential market value of that spectrum. In this context ACMA economist Rebecca Burdon discusses in this paper the roles of the market, the regulator and regulatory tests in promoting an efficient allocation of spectrum to maximise benefits from its use.

One of the tests relates to a “total welfare standard”, which the paper describes, and assesses the impact of regulatory proposals on total welfare to inform its decisions in relation to those proposals. The paper starts with a helpful background outlining core elements of Australia’s spectrum management regime. It then considers why a total welfare standard is the appropriate test in maximising spectrum management. Alternative approaches to spectrum management are often characterised by a command and control approach, market approaches based on exclusive property rights, and a commons approach in which there are few entry restrictions and limited protection from interference. Recognising the variables and complexities involved in alternative regulatory approaches and any measures of total welfare the paper considers the type of analysis likely to be involved in evaluating the various options.

The paper finally comments on when this sort of cost-benefit analysis is likely to be most useful. Its conclusion reminds us that whilst Australia has been at the forefront of development and implementation of flexible approaches and whilst the regulator remains responsible for shaping market rules, ultimately it is spectrum users who determine how spectrum is used.
OUTCOMES OF THE WORLD RADIOCOMMUNICATION CONFERENCE

Many of the developments discussed in these papers are possible because of much preliminary work and consequent agreements successfully fought out at the ITU World Radio Conference (WRC07) from late October 2007, on frequency allocations and associated services. Australia has long been active in the area of international standardisation and radio frequency allocation and planning and in particular devotes much effort to the latter.

In his paper, which is a record of significant WRC07, events and outcomes ACMA’s Stuart White systematically describes the process required to reach international agreement in this area, and outlines overall outcomes achieved for the world and that are of particular interest and importance to Australia and Australian industry. The paper appropriately highlights the exhaustive preparatory arrangements. Australia’s WRC07 broad objective was to promote the development of international world radiocommunication agreements that “enhance efficient and coordinated access to spectrum and increase Australia’s ability to implement and use satellite and terrestrial systems”, an objective that was satisfied overall. Preparations are already underway for the next Conference in 2011, in the process benefiting from regional collaboration via the Asia Pacific Telecommunity (APT).

BROADBAND WIRELESS – A TUTORIAL ESSAY

With all the ready commentary and speculation on alternative broadband wireless technologies and comparisons between them it is often assumed that readers understand the technology differences. Reg Coutts’ timely and helpful tutorial overview of the two dominant broadband wireless standards today, 3G (or HSPA) and WiMax provides that detail for those wishing to look more closely into these alternatives. After providing definitions for each of these particular solutions the paper describes their respective genealogy, and offers basic metrics for comparisons. To provide a further context for comparisons the paper then helpfully comments on the commercial rivalry between these alternatives.

An interesting observation offered by the paper is that any conclusion concerning the relative superiority of one of these broadband wireless technologies over the other is significantly influenced by differences in market assumptions and availability timing for the sought application. Technology factors are not the sole criterion. Choices by operators are also complicated by uncertainty over the sustained cost of implementation for one solution over another in a competitive supply chain where costs can vary significantly over time.

For those wishing to deepen understanding (or others somewhat masochistically inclined) readers are invited to accept the challenge of pursuing this tutorial!

WIRELESS BROADBAND TECHNOLOGIES FOR REGIONAL AND RURAL AUSTRALIA: A LAST-MILE PERSPECTIVE

In support of the paper’s stated objectives to provide a last-mile perspective on wireless broadband technologies for regional and rural Australia, the authors Dr Niloufer Selvadurai, AHM Razibul Islam, and Professor Graham Town begin with a helpful and comprehensive general review of alternative broadband technologies in the context of Australia’s population density and geographical distribution. The paper then offers a useful comparative analysis for each of these. This in
itself provides a valuable resource. The alternative technologies are analysed in terms of data rates and coverage distance in order to determine the best possible last-mile wireless connectivity solution for regional and rural Australia. Subsequently the paper focuses specifically on alternative last mile technologies that exploit wireless technologies, including wireless Local Area Networks (WLAN), 3G, Satellite, Wireless Local Loop, and WiMax. With respect to the latter the paper alludes to some successful international deployments of WiMax technology and relates these to potential use in Australia.

The paper concludes with comments on the need to be able to deploy a mix of wired and wireless last-mile technologies in order to achieve quick and cost-effective service provision, in all areas, that balances the needs of all stakeholders – customers, service providers and the Australian Government.

HIGH ALTITUDE PLATFORM STATIONS FOR AUSTRALIA

Imagination leading to Innovation are both characterised in this joint contribution on high Altitude Platform Systems (HAPS) by Les Davey & Richard (Dick) Butler of Sky Station – Australia and Richard Buchanan, Robert W Phillips and Dr Y.C.Lee of StratoCom Corporation. Whilst the concept has been a proposed solution for telecommunication and other services for several years it is only in recent times that the viability and actual potential of such solutions in particular situations has become clearer. The range of complementary solutions available to quickly satisfy particular telecommunication needs can now potentially include HAPS.

Of particular interest is the lighter-than-air vehicle (LTAV) which is attracting renewed interest in recent years as a potentially economic way to provide telecommunications infrastructure and services over wide areas. A number of trials of small scale airship HAPS have been conducted by companies in Japan, USA, and Switzerland.

The paper describes the technology, reviews progress towards a viable HAPS and considers potential applications in Australia, particularly for rural and remote areas. It also helpfully discusses business planning and regulatory issues together with some remaining technical challenges.

RADIO’S DIGITAL CHALLENGERS

Australian broadcasting has a rich history of challenge. The earliest AM radio broadcasters could afford to be at the forefront in introduction and innovation, given at the time radio’s novelty, ready market acceptance, important reach into outlying areas and lack of spectrum constraint. Amongst other things the introduction of television broadcasting in 1956 and FM in 1974 were further challenged geographically and by the standards choice from possible contenders, and particularly the band choice in the case of FM. In ‘Radio’s Digital Challengers’ Swinburne University’s Jock Given provides an excellent analysis of and background to decisions surrounding the many issues leading to planned official introduction of Digital Radio Broadcasting (DRB) in Australia in mid 2009.

DRB has faced and in some cases continues to face the earlier challenges together with a much broader and more complex set of issues. Collectively these include the nature and definition of DRB, its continually evolving functional potential, the question of whether or not it’s a replacement of or supplement to existing services, spectrum allocation and geographical challenges, new competition issues, the possibility of simulcast obligations, potential misalignment of stakeholders...
interests, rapidly evolving market and competing technologies, and its relatively high introductory cost compared to some alternative radio solutions.

The current economic climate is also acknowledged as an additional issue. However the paper observes that this medium does provide new opportunities and that the industry has historically dealt well with both depressed times and, over time, all its other challenges. Given that the UK is generally seen as digital terrestrial radio’s most successful market, the paper helpfully explores and draws from the history and present position of digital radio there. The paper provides a valuable analysis of past and current challenges and offers useful observations about those facing digital radio’s future.

REGULATING INTERNET AND CONVERGENT MOBILE CONTENT: THE NEW CONTENT SERVICES REGIME

Papers in this series have so far considered new developments for wireless based products and services and reform of processes to allocate and manage the spectrum they utilise. Whilst continuing the theme of new developments, the final paper in this series by David Lindsay, Sharon Rodrick and Melissa De Zwart of Monash University extends beyond spectrum considerations to helpfully explain the regulatory regime that applies to the wide range of content now delivered via mobile wireless devices as well as the Internet. The paper is a comprehensive and valuable resource as the content services regime represents an important attempt to establish a consistent, uniform regulatory regime that applies to the full range of content delivered over diverse new communications platforms. As such, it amalgamates and harmonises existing regimes, specifically the stored Internet content regime.

The scope and depth of contributions from leaders in their field make this set of papers a valuable resource. Amongst other things what is clear from them is the new focus on working collaboratively to create an environment in which innovation is encouraged and the benefits of many new wireless developments are more quickly delivered to users, and all other stakeholders. Despite some uncertainties over past decades there is little doubt now that with market and technology developments and spectrum reforms wireless has a strong future. As suggested at the start of this Overview it is yet to be seen whether current international signs of backlash to extreme free-market conditions will impact in any way on moves towards greater market-driven approaches to spectrum management.

Again given the scope of themed contribution this Overview now concludes with a Glossary of terms that also considers international readers less familiar with names of some identified local organisations.

GLOSSARY OF TERMS

3G 3rd Generation mobile technology standard
3GPP 3rd Generation Partnership Project
4G (future) Internet Protocol advancement of existing 3G mobile communication standard
ABA Australian Broadcasting Authority
ABC Australian Broadcasting Corporation
ACA Australian Communication Authority (preceeded ACMA)
ACMA Australian Communications and Media Authority
SSA  Sky Station Australia
STS  Stratospheric Telecommunications System
TTS  Transitional Telecommunications System
UE  User Equipment in 3G mobile telephone systems
UHF  Ultra High Frequency
USIM  UMTS equivalent of SIM Card
VDSL  Very high bit-rate Digital Subscriber Line
VOIP  Voice Over IP
WAPECS  Wireless Access Platforms-later changed to ‘policies’-for Electronic Comm. Services
WAS  Wireless Access Service
WiMax  Worldwide Interoperability for Microwave Access (a wireless broadband standard)
WLAN  Wireless Local Area Network
WLL  Wireless Local Loop
WRC  World Radiocommunication Conference

TOMORROW'S TECHNOLOGY STARTS WITH TODAY'S SPECTRUM PLANNING

Chris Chapman, Chairman, ACMA

This is an edited version of the Opening Address by ACMA Chairman Chris Chapman at Radcomms08, held in Melbourne from 30 April to 2 May 2008. It explores new radiocommunication-based technologies and applications that increasingly require the sharing of limited spectrum. Associated with that it also discusses new approaches to spectrum planning in order to facilitate adoption and further innovation in this rapid growth sector. A postscript briefly updates events since Radcomms08.

Spectrum is an exciting field, albeit that it has been somewhat of a comparative 'sleeper'. Now its time has come as we (the government, the Department, the regulator and industry participants), collectively, embark on various initiatives, reforms and developments that will ensure that spectrum delivers for Australia the maximum benefit possible from a scarce national resource. ACMA is committed to delivering on this legislative objective.

At the last RadComms conference, I spoke of a typical day in my life and how it was affected by spectrum. In a similar vein, on this occasion I would like to look at the seemingly 'small' things my spectrum planners do and how these 'small' things may make a material contribution to enabling momentous change in the world of tomorrow: be it 10 or 20 years hence.

Please bear in mind that these are things I think may eventuate; there are no guarantees, nor are they intended as any pre-emption. In setting some context for discussions over the next few days, I simply wish to explore the role of spectrum and its management in the greater scheme of things. So, let's have some fun for a moment, cast ourselves into the future, and take a peek at the effect of today's decisions many years down the track.

SQUARE KILOMETRE ARRAY

Around the time of the last RadComms conference ACMA's engineers did a small but unusual thing. They embargoed an area (not a frequency band but a small geographical area) around a small cattle station called Mileura in the central west of Western Australia. This embargo was unusual because, with the exception of spectrum-licensed bands, it covered all bands in that area under 25 GHz.

The purpose of the embargo was to create a Radio Quiet Zone to protect the site for the proposed Square Kilometre Array ('SKA'), for which Australia has been short-listed to host, in competition now only with South Africa.

When asked at the time 'why ACMA would do this?' our Andrew Kerans said 'It's like getting a whole paddock of wheat from planting one seed – bugger all work for us but the potential is huge!'

Radio astronomy, like other services such as Satellite Earth stations, comprises expensive facilities that need deep levels of protection... and Fred Watson, (tomorrow night's speaker), will no doubt amplify the benefits of such protections in his highly engaging way. As time moves on and populations grow, it is becoming less and less possible to protect such facilities where they are established close to, or even in, populated areas. ACMA was therefore impressed that...
the CSIRO had looked to the future and proposed a site for the SKA which was supportable in
the long term.

Well, ACMA has done a bit more work since the radio quiet zone was first established: the
engineers have written a licensing instruction (or RALI) that specifies the licensing arrangements
around the embargoed area. The area itself has moved a bit as well; it is now centred on Boolardy
Station (just a few km away), which in reality isn’t much of a change in the grand scheme of
things in WA!

Now the RALI is a comprehensive document, and it puts in place protections for the Radio
Quiet Zone, which gives the Australian SKA bid some definite advantages. Indeed, let’s just
imagine what benefits could flow from hosting the SKA in Australia.

The SKA is now huge: in the WA component alone we have a square kilometre of radio
telescopes.

The array spreads out to cover most of Australia, and even New Zealand in isolated sites,
giving the telescope itself a gigantic effective aperture with which to collect faint radio signals
from deep space.

The installation of this facility brought into the country not only dollars but also skills.
Australia is now a world leader in antenna and array systems’ design.

The communications grid which supports the SKA connects the port town of Geraldton with
Kalgoorlie, Meekatharra and the surrounding townships to the Perth communications grid. Any
suggestion of a digital divide for the people of rural WA long gone.

Maintaining the array is a significant task. An army of engineers, electricians, technicians
and riggers is being trained from amongst the ranks of local people, providing opportunities
never before experienced in these areas. The communications intellectual stock of the country is
much higher as a consequence... which is starting to combine with other spin-off benefits from
a smart digital economy.

The scientific discoveries from the SKA are prolific, putting Australia at the centre of the
world radio astronomy map. The crowning glory is that perhaps the SKA is the first device to
discover intelligent life in another galaxy!

ACMA is proud of the 'can do' people who saw this potential and decided that the amount
of work they would have to do was minimal in comparison to the potential benefits that could
arise. These are visions that the future is built on.

INTELLIGENT TRANSPORT SYSTEMS

Intelligent Transport Systems or ('ITS') are an example of an interesting mix of different techno-
logies all coming together to make driving easier and potentially safer.

Over the last two years, ACMA engineers have worked on spectrum arrangements to support
a number of technologies that promise to make our day-to-day commute easier and safer. Some
are obviously related to transportation; the impact of others is more subtle. Vehicular radar is
maturing, it now has an 'interim' band to operate in, one I might say that not everyone is happy
about because sometimes even international 'solutions' involve painful compromises.

So a future of collision avoidance and automated steering is not then a totally implausible
scenario.
ITS are like the Internet of cars and Radiofrequency identification, (or RFID), is a technology that will perhaps affect our lives almost as much as the Internet does. RFID is a technology that we already use: it is used to pay your motorway tolls, prevent shop theft and is increasingly being used in inventory monitoring and control. But it is also one where the applications are only limited by our imaginations.

Then – let’s look at my commute in 10 or 20 years time and see what changes have come about.

My car is now smart. Not only can it automatically keep its distance from the traffic in front, it constantly reports its speed, fuel status and destination to roadside ITS terminals. These terminals monitor all the traffic going past and the information is processed in a central computer.

Most traffic jams are caused by accidents. Vehicular radar has reduced the incidents of collision significantly. Since ITS can stop a car from running red lights, perhaps these collisions have all but disappeared as well.

And as ITS and vehicular navigation systems could ensure traffic is correctly spaced, it might begin to direct and monitor traffic flow before a problem develops, helping make traffic jams a thing of the past.

RFID will be your vehicle’s registration. Your registration fee will be charged depending on what roads you use, the weight of your vehicle, its emission profile and the length of your trip. If you choose to travel in peak hour you will pay for it, and thus market mechanisms will be used to control traffic and pollution as well.

That short paragraph quite obviously skates over a whole range of social policy and subsidy issues – and I’m sure glad this is a battle ACMA will not have a role in. Graeme can deal with that one too!

So RFID systems will have a major role in our lives, in applications which range widely from car registration, (which I have just mentioned), to the automated ordering of your household groceries. At the moment RFID is limited to inventory control and some charging applications, such as motorway toll charges... but in the last two years, ACMA has been involved with GS1 Australia in evaluating the effect of a power increase for RFID systems on adjacent systems in the 900 MHz band. If the increase is feasible, RFID is set to become an even more powerful influence in our daily lives.

RFID tags on our milk will tell our fridge when the milk is out of date, and milk will then be added to our shopping list by the fridge as a part of the 'Internet of Things'.

All of the information about your food will be on its RFID tag. You will be able to see where it came from, its 'organic' history and its freshness, either on your own home system or on your PDA while shopping.

All of your groceries will be tagged. Your kitchen will monitor them, reorder as you use them and even dispose of them if they go out of date. Your automated ordering system will correct for underused items.

And if you’re still one who likes the shopping experience, supermarkets will change, but not a lot. Reassuringly, human interaction with the product will still be important! Pricing will be updated and displayed electronically and your shopping trolley will have its own RFID reader. If you use an automated shopping list, the trolley will tell you where the next item is located. If you choose to just browse and impulse buy, then the trolley (connected to your PDA) will keep...
a running total of your purchases and, as you leave the store, automatically debit them via your phone or PDA. No checkouts, no queues, Nirvana.

Your home electrical appliances will be registered on the Internet, identified by its RFID tag. If it is stolen, it will quickly be traced. If the ID tag is removed, then the network won’t register it and the power system will refuse to supply power to it. This won’t stop theft, but it will certainly make it less attractive.

RFID will open up a myriad of opportunities, some simple, some controversial. We already tag our pets; some day will someone suggest that we tag our children so we can trace them and make sure they are safe? There are already companies that manufacture RFID bracelets for kids so parents can keep track of them when they are out shopping, in the park or even at home. Again, this debate will continue well into the future.

**THE INTERNET**

Two years ago the Internet was something I logged onto at work or at home. Since then, it and I have moved on. I can now log on almost anywhere with my laptop using a device the engineers call a 'dongle'. I remember three years ago 'dongles' were things we put into laptops so they could connect to WiFi, so it is reasonable to expect the 'Internet anywhere' dongles to be built into the next generation of laptops in just a year or so.

As the world of infotainment grows, people will become more reliant on their mobile data devices (currently laptops, phones and PDAs) for their news and entertainment. A recent IT article in The Australian highlighted the take-up of mobile Internet, but it didn’t touch on the spectrum required to deliver this 'anywhere, anytime' broadband connectivity.

In broad terms, the carriers to date have had access to sufficient spectrum to offer these increasingly sought after services. In the future, though, as customers demand more bandwidth, and as customer numbers grow, carriers will seek more spectrum for these applications. And as machines become part of the Internet, these demands will grow yet again.

Users (that is, people and machines) will want this connectivity everywhere. In the next few years, this will mean at least within the footprint of the larger cellular networks, but beyond that the word 'everywhere' may mean just that: on the land, on the sea and even in the air.

ACMA's spectrum planners anticipated this growing need, and more than two years ago commenced a process which looks at frequency bands and their potential for future broadband use. An important part of this study was examination of what was happening in spectrum allocations overseas; obviously a band that is used globally for Internet is one that logically we should be investigating for such possible use here in Australia. Having said that, let me squarely acknowledge major candidate bands that are potentially suitable in the short to medium term are already in use by other services. Responses to ACMA’s two discussion papers to date on Wireless Access Services (or WAS) have raised significant objections and concerns surrounding re-planning or re-allocation of these bands - as well as arguments in favour. ACMA has had some pretty serious thinking to do to develop sensible ways forward – and we hope to have something to say about ways forward by around the middle of the year.

For now let’s look at what ubiquitous broadband could deliver for the Australian economy.

Laptops will become 'connected' anywhere there is the population to sustain an economically viable connection. The government’s recent broadband initiative promises this sort of connectivity...
almost anywhere people live. That is an exciting prospect. Competition will affect price, and voice over IP will become a viable alternative to cellular telephony. Another plank in ensuring the digital divide does not divide us as citizens or consumers.

Devices will become connected, people with medical conditions can be remotely monitored and the early stages of a problem detected and dealt with. Perhaps medication may even be remotely administered through such implants. If the problem is larger, help may be dispatched. All of this, a small window on the complete transformation of the way government delivers its services – overwhelmingly online.

RFID will keep track of people and things; for example, airline passengers with an RFID boarding pass could be traced in an airport. The days of waiting for a passenger who has failed to board would be over!

Beverage and food containers will have inbuilt screens; they might show the news of the day to grab your attention, but they may also carry advertising to pay their way.

The possible applications of 'anywhere' connectivity may well be unlimited.

**SENSING**

There are so many ways in which radiocommunications will be by then a daily part of our lives but time this morning is short. Many technologies, like the Internet, or HD TV multichannelling, or the DAB digital radio you will be hearing more about later in this conference, are readily definable; others, though of equal importance, are not. Such a technology, or group of technologies, is remote sensing and control.

Climate change is an issue at the forefront of our minds, but can radiocommunications affect it? Even be part of the solution? The answer is 'quite possibly'.

Power generation is a major source of greenhouse gases, especially generation from coal-fired generators, which could be limited by controlling peak demand such that the peaks are smoothed and very little if no additional generation is needed to cover these periods.

This is where radiocommunications can help. As I touched on, the simple act of remote metering your car via a wireless link will save dollars and emissions by traffic smoothing. But taking this a few steps further and actually controlling appliances to smooth the load on power stations, promises significant reductions in required generator capacity and thus the sought after reductions in greenhouse gases.

Predicting the weather these days is a massive mathematical exercise. I was treated to a tour of how it is done at the Bureau of Meteorology. Like any big equation, the more data you have, the more reliable the answer.

The Bureau looks at what it calls 'the fingerprints of nature' and from that derives its forecasts. This is done from satellite, from balloons and aircraft, and from the ground.

Recently the Bureau approached ACMA's spectrum planners for support to protect a part of the 10 GHz band for space-based sensing. This was a difficult and complex question for our staff to tackle; after all, what is the value of the data derived from a foreign satellite imaging the Australian continent but provided to the Bureau at no cost? What is the impact of being able to predict the path of a cyclone? And how does it compare with the value of the band for other applications?
In the end, ACMA reached an agreement with the Bureau about protection for the band and we continue to work with them so that we better understand their needs and I hope they better understand the imperative ACMA has to manage the spectrum in the overall national interest.

What this sort of sensing means for the future cannot be understated. If global warming continues, then we know that weather patterns will continue to change. Being able to predict the changes, perhaps to track the first cyclone to hit Sydney, to be able to predict and maybe even redirect flood waters, could save the nation billions of dollars.

Information provided to future aircraft and ships could save lives, information provided to coastal cities could enable smart buildings to prepare defences while making the best use of the prevailing weather to generate power, store water or heat or cool ourselves.

Arrays of small sensors, joined together in a mesh architecture, will be able to provide more and more information. This should enable us to better control our valuable water resources, predict which crops will be viable and, when necessary, evacuate in good time towns and cities. This too will require spectrum and though sensor spectrum is indeed a new issue for us, it is one we increasingly have our eye on.

CONCLUSION

The spectrum arrangements that ACMA makes, and the services spectrum can deliver, have such a widespread influence that they continue to surprise me. We are constantly scanning the environment, digesting signs of change here and overseas, so that we can do our bit to ensure Australia benefits from new technologies.

We understand that spectrum is increasingly valuable for both incumbent users as well as for future uses. When we work through proposals for change we will listen carefully to all sides of the debate; but ACMA will in the end always strive to ensure that spectrum is put to the use that best serves Australia's national interest, now and in the future.

All of this (and a lot more) that may be conjured up 20 years from now won't happen if we don't start about today… something about a long walk starts with small steps.

Shortly after I arrived at ACMA, I challenged the management team to identify the steps that would make us the world's best communications regulator by the end of 2010. At this conference you will be hearing about some of the early dividends from that challenge.

Two papers in particular, the draft 5-year rolling spectrum outlook and the draft spectrum management principles, have their origins in ACMA's program of transformation. Along with public events such as this conference and a revitalised formal consultative committee (the Radiocommunications Consultative Committee, or RCC), ACMA has resolved to make its spectrum work program more transparent to the industries that rely on the spectrum; also to demonstrate its 'first actionable steps' to emerging demand pressures.

This is a key goal of the draft 5 year spectrum outlook – to publish, and to keep current by regular updates, ACMA's understanding of emerging demand pressures and also to give an indication of ACMA's forward work program for addressing those pressures. The program is of necessity indicative and, when you read the chapter on ACMA's forward work program, you will find the disclaimer that it is subject to three things:

- Resources;
• Government (or Ministerial) priorities; and
• Unanticipated changes in the environment.

I make no apology for the disclaimer, which merely acknowledges the realities. But to ensure industry as far as possible enjoys the regulatory certainty required to facilitate investment decisions, we have committed to keep the document current through annual updates and to consult each time before we finalise it. The result, I hope, will be an unprecedented shared understanding of the pressures for change building in the spectrum environment and of the regulator’s indicative thinking (on a more iterative basis) about how to respond. All of this, of course, is no substitute for detailed consultation on individual issues before decisions are taken that affect players in the spectrum space, rather it is something in addition, something new: the beginning, I hope, of a much more open discourse about what the priority issues are in spectrum regulation.

And transparency about priorities invites greater transparency about methodology and underlying philosophy. To this end, ACMA has also articulated in draft form its Spectrum Management Principles, a document not intended to supplant the legislative objectives that govern ACMA’s exercise of its powers and discretions but which should go some way to explain how we will approach those objectives.

You will have noticed that one of those ACMA proposed principles is indeed that we will do our work with appropriate transparency and opportunity for consultation.

But this conference is not simply about ACMA initiatives – in framing the agenda, we have sought to balance government voices telling you about what we are doing with industry voices, so that information flows both ways.

EDITOR’S POSTSCRIPT

Radcomms08 was not all that long ago. Already since then responses have been received to the Spectrum papers intended to guide future spectrum management arrangements in Australia. Consistent with its announced intention to be more iterative in its dialogue with stakeholders, ACMA has announced a Brisbane ‘Spectrum Tune-up’ as well, where one of the matters it will be commenting on is the 400 MHz Band.

The third meeting of the refined Radiocommunications Consultative Committee has since been held and work continues on evolving the operation and composition of that Committee.

A key observation that has emerged from all this is a new era of stakeholder collaboration in Australia that will help ensure the nation’s ability to encourage innovation and readily exploit advantages of many new and emerging radiocommunication technologies for the benefit of all Australians.

NEW DIRECTIONS FOR SPECTRUM MANAGEMENT
AN INTERNATIONAL PERSPECTIVE

Geoff Luther, Australian Communications and Media Authority

Changes in communications technology and markets have placed great strains on traditional approaches to spectrum regulation, which have had difficulty coping with the current rate of change in radiocommunications. New technologies including mobile telephony and wireless broadband posed challenges for governments who needed faster and more objective means of allocating spectrum to competing commercial interests. Spectrum regulators have turned increasingly to market-based and more flexible approaches to regulation, including auctions, pricing and trading. Challenges for the future include improving technology neutrality, improving the efficiency of use of government spectrum, and deciding how much spectrum to set aside for the spectrum commons.

The views expressed in this article are the author’s own and do not represent the views of ACMA.

INTRODUCTION

Over the last 15 or so years, new and often initially controversial policies have been introduced into the radiofrequency spectrum management regimes in many countries. These policies include a widespread use of market-based approaches as well as the introduction of more flexible regulation to replace the traditional administrative rules that tightly controlled how licensees could use spectrum.

Economists have long speculated on the possibilities of applying market forces to managing the radiofrequency spectrum resource. In 1959 Ronald Coase proposed a general scheme of property rights for the spectrum, arguing that defining and distributing exclusive property rights would allow the more efficient allocation of rights to access the spectrum (Coase 1959).

But for most of the period since Coase proposed his property rights approach, there was little pressure to change the pre-existing spectrum management model, and it was many years before these ideas were put into practice by spectrum regulators. The old system of central regulation and tight regulatory prescription over the use to which spectrum was put (often called a ‘command and control’ model) was able to cope in the relatively stable radiocommunications environment that prevailed during this time. In a period when the available supply of spectrum generally exceeded the demand, command and control regulation was able to allocate spectrum using a planned process that started at the international level through the International Telecommunication Union (ITU) processes, backed up by domestic regulation involving administrative allocation of spectrum to users.

The command and control model was predicated on a fear of interference between services. The tightly defined technical parameters and restrictions on use that applied under the command and control model were designed to minimise the risk of harmful interference between services, even at the cost of reduced spectrum productivity.¹

What then has produced the dramatic changes to spectrum management?
CHALLENGES TO COMMAND AND CONTROL REGULATION

In the last two decades the command and control model of regulation has come under increasing pressure because of the pace of change in both communications markets and new technologies. Most obvious has been the explosion in deployment and use of mobile telephony, but there have been many other radiocommunications services that also have developed or expanded rapidly, including wireless broadband, WiFi, digital mobile radio services, and fixed services (including for backhaul for mobile).

Spectrum-based communications services have also assumed much greater commercial significance. Revenue derived from mobile telephone services now usually exceeds revenue from fixed line services; revenues from other services such as wireless broadband and satellite broadcasting are also expanding rapidly. Spectrum based services are now vital and expanding parts of the economy. As a result, decisions by regulators about spectrum use assume greater importance and are more likely to be contested by one or other commercial interests.

One consequence of the proliferation and increasing bandwidth hunger of wireless services is that demand for spectrum is growing rapidly. The pace of technological change has imposed additional pressures. Under the command and control model, where a new spectrum allocation was needed it would be the subject of review and decision by the ITU, generally taking two or more World Radio Conference cycles to enable necessary studies to be done, negotiations to be undertaken between commercial interests and between administrations, and for standards to be developed. International decisions were then reflected in domestic spectrum plans. The result was long lead times, often at least a decade or more, before a new service could gain a spectrum allocation. If the new allocation meant that an existing service had to be moved out of the band, then the delays could be longer. There has been a widespread recognition that these processes can no longer cope in the face of rapid technological and market change.

There has, however, been no unanimity in how to deal with these pressures. Despite the pace of change, the command and control model still has a major (and generally the leading) place amongst regulators across the world.

Nevertheless, it is possible now to discern some clear policy trends to address these issues amongst reforming administrations. These can be summarised under two main themes: liberalisation and flexibility. Liberalisation involves the introduction of market mechanisms into spectrum management – liberalisation policies are aimed at leaving decisions about how to allocate spectrum as far as possible to the market rather than being imposed by administrative fiat. Flexibility means relaxing the tight command and control constraints on how spectrum is used, and permitting ready change of use as market circumstances or technologies change.

LIBERALISATION

Many of the most dramatic developments in spectrum reform have involved an attempt to introduce market mechanisms to supplement or replace administrative decisions about spectrum allocation. The major liberalisation instruments that have been deployed include:

- Auctioning the rights to access spectrum;
- The introduction of new forms of pricing for access to the spectrum (sometimes called Administered Incentive Pricing); and
- Allowing spectrum access rights to be traded in the secondary market.

**THE MARKET PARADIGM**

The rhetoric of market liberalisation has spread extensively, with many regulators or governments professing a commitment to market forces or at least recognising that market forces have a role to play in spectrum management. For example, Ofcom in the UK has said that it has a strong preference towards the use of market forces in this area. In the USA, the FCC has committed to moving towards more flexible and market-oriented regulatory models. Canada has said that it will rely on market forces to the maximum extent feasible; Hong Kong has expressed an ‘inclination’ to use of a market-based approach. New Zealand (together with Australia long a leader in reform) has said that it operates under an underlying assumption that market mechanisms will ensure spectrum is allocated to its highest valued use.

In Latin America, Guatemala and El Salvador have adopted liberalised spectrum management regimes, with users being permitted exclusive control over the use of spectrum and considerable flexibility of spectrum use (Hazlett et al 2007).

**SPECTRUM AUCTIONS**

Spectrum auctions were the harbinger of market liberalisation. The first spectrum auctions were held in New Zealand in the late 1980s, followed by Australia and the USA in 1994. Many countries have since auctioned spectrum including Canada, UK, Germany, Netherlands, Italy, Belgium, Denmark, Switzerland, Hong Kong, Singapore, Israel, Mexico, Guatemala and Nigeria.

Auctions have become the preferred means of allocating spectrum for new services across a range of countries, for example the introduction of new mobile phone technologies and/or broadband wireless. Indeed it can be argued that the widespread introduction of mobile telephony provided the impetus for the adoption of spectrum auctions. Governments realised that they needed a way to allocate spectrum amongst competing commercial interests, and they also sought to capture windfall gains from the introduction of the technology for the benefit of the community. Auctions have sometimes raised very large sums of money for governments (for example, the US PCS auctions in 1994-1995 attracted bids of over US$17 billion, and winning bids in the 3G auction in the UK in 2000 totalled over 22 billion pounds. More recently, the 2008 US 700 MHz auction raised nearly US$ 19 billion and the Advanced Wireless Services auction in Canada in 2008 raised almost C$4.3 billion.)

The seemingly extraordinary sums paid in spectrum auctions have been the most controversial element of market liberalisation, yet the continuing support for auctions demonstrates an acceptance among regulators of the benefits of auctions compared with other allocation tools such as ‘beauty contests’ or lotteries. Auctions help to ensure that spectrum is allocated to its highest value use and provide an objective basis for choosing between competing applicants for spectrum.

**SPECTRUM PRICING**

Fees for spectrum use were traditionally set to recover the costs of managing the spectrum. While this approach usually has widespread support amongst spectrum users, it means that the price for using spectrum is largely independent of the real value of that spectrum. This makes little economic sense, and does not provide incentives for spectrum to be used efficiently.
To address this lack of economic incentives, some administrations have sought to change the basis for fee setting. The current world leader in reforming spectrum pricing is the UK, which has introduced a system it calls Administered Incentive Pricing (AIP) into many areas of the spectrum. AIPs are at least notionally based on the opportunity cost of the spectrum; that is, the value of the spectrum in the next highest alternative use. The AIP system continues to expand, although it should be noted that calculation of AIPs based on opportunity costs can be complex, difficult and not fully transparent. These difficulties derive in part from the fact that AIPs represent a proxy for a market-based allocation of spectrum, and regulators attempt to calculate opportunity cost from whatever information is available. Market-based allocation (e.g. through auctions) avoids the need for such calculations.

Other countries have also moved to introduce incentive pricing. In Singapore, the IDA has said that it is looking to set fees in congested bands based on the opportunity cost of that spectrum. Hong Kong notes that its spectrum utilisation fee may be set to reflect opportunity cost (IDA Singapore 2008; Communications and Technology Branch, Hong Kong 2007).

In Australia, licence fees explicitly incorporate economic efficiency objectives, and are based on a fee formula that includes elements designed to recover costs as well as to provide incentives for efficient spectrum use. ACMA’s view is that in principle, spectrum denied to other users should be priced at opportunity cost (ACMA 2008). The Canadian approach to fee setting involves case-by-case consideration following public consultation. Its goals, however, include both economic incentive objectives (including to promote the efficient allocation of resources) as well as cost recovery objectives (to promote an equitable approach to financing government programs) (Industry Canada 2008).

However, most administrations base spectrum fees on cost recovery, and incentive pricing remains relatively unusual. For example New Zealand, despite its commitment to market-based policies, maintains a cost recovery based fee system.

**SPECTRUM TRADING**

Spectrum trading was generally not allowed under the command and control model, (although in practice licences could be traded if the company that held them was traded).

A few countries have moved to allow or encourage trading. In the USA, the FCC has adopted a secondary markets initiative, which it says will facilitate spectrum leasing and transfers. The UK has set itself the target of allowing trading in over 70 per cent of the spectrum over the next few years. While progress has been slower than anticipated, Ofcom has said that it will investigate ways to facilitate trading further over the next year or so (Ofcom 2008).

In Australia licences have been able to be traded since 1995. New Zealand and Canada also allow licences to be traded, and trading is also permitted under the liberalised spectrum management regimes in Guatemala and El Salvador.

There has been considerable debate within Europe about whether to allow trading. While at least notionally accepted in many European countries, in practice most countries still seem to require explicit regulatory approval before every trade (although Spain and the UK do not require such prior approval in parts of the spectrum able to be traded).

It appears that trading remains a difficult issue for some spectrum management authorities, perhaps in part because of a fear that people trading spectrum in the secondary market may make windfall profits. It is not altogether clear, however, why the fear of windfall gains should
be particularly acute in spectrum compared to other areas of the economy where resource trading
is normal.

**GOVERNMENT SPECTRUM**

One area of possible market oriented reform that has received relatively little attention is that
of government use of spectrum. In most countries, the government sector is a major if not the
largest spectrum user, but government use of spectrum largely remains outside of influence of
the market. Despite the substantial potential benefits in ensuring that government spectrum is
used efficiently, very few countries have been tempted to address this issue. One significant ex-
ception is the UK, where Professor Martin Cave undertook a comprehensive review of government
use of spectrum for the UK Government. The review made some far-reaching recommendations,
notably that there should be a presumption that new public spectrum needs should be met through
the market. It also recommended much greater sharing of government spectrum with other users
(Cave 2005). The recommendations of the review were accepted by the government, and groups
have been set up with the aim of increasing sharing, particularly in relation to defence spectrum.
In Australia, the Australian Communications and Media Authority commissioned a similar review
Holdings 2007). Few countries even charge government users for their access to spectrum, or
allow government spectrum to be traded.

**FLEXIBILITY**

Under the command and control model, regulation prescribed particular uses for particular
bands. But the traditional approach is incompatible with the need for rapid changes of use of
spectrum bands in response to changing market conditions.

New technologies are also to some extent putting an end to the need to dedicate specific
bands to specific technologies. For example technologies such as cognitive radio are designed to
permit new services to share spectrum with other services (by transmitting only when the spectrum
is not occupied). The growth of services such as WiFi in unlicensed bands (in Australia, class li-
censed bands) is another example of increased opportunities for different services to share a
spectrum band. Indeed proponents of a spectrum commons model (see below) sometimes argue
that the introduction of technologies such as cognitive radio, software defined radio and Ultra
Wide Band in time will remove the need for individual licensing of spectrum.

Policies to improve the flexibility of spectrum use have included attempts to create a technology
neutral licensing approach, the extension of the so-called spectrum commons, and efforts to im-
prove spectrum sharing between different users.

**TECHNOLOGY NEUTRALITY**

Attempts to create technology neutral licences were pioneered in New Zealand with the system
of management rights (allowing private spectrum management over some bands) and in Australia
with the introduction of spectrum licences (which in contrast to traditional apparatus licences
were designed to be technology neutral and divisible). As noted earlier, Guatemala and El Salvador
allow considerable flexibility over spectrum use.
More recently, Ofcom in the UK has been developing a technology neutral licensing approach called Spectrum Usage Rights. Some types of licences in the US have conditions that allow considerable flexibility in spectrum use – the so-called Personal Communications Services licences are examples of this. For PCS, the licensee is free for the most part to provide any service – fixed, mobile, private, common carrier, etc – and is free to use any technology to do so.

In Europe, the Radio Spectrum Policy Group has developed the Wireless Access Policy for Electronic Communications Services concept in an attempt to move towards greater flexibility. It provides a framework for the provision of electronic communications services within a given set of bands, where the services may be offered on a technology and service neutral basis (CEPT 2008).

However, full technology neutrality remains elusive. Most of the new concepts rely on making some assumptions about likely use in order to derive means of managing interference.

**SPECTRUM COMMONS**

There has been a lively academic discussion in the last few years between proponents of the so-called spectrum commons and the adherents of market-based allocation methods. Commons proponents have argued that market-based policies will be made obsolete by technologies that operate in unlicensed spectrum. They argue for an extension of the commons (unlicensed bands). On the other hand, the marketeers are concerned about the tragedy of the commons – that is, if spectrum is a free resource it will be overused by these new technologies to the detriment of all users. Spectrum regulators in a number of countries are now considering whether there is a need to increase the amount of spectrum devoted to spectrum commons (see for example Ofcom 2007). In the USA, the FCC in 2004 established the concept of private commons to improve access to spectrum, particularly by facilitating leasing.

**SPECTRUM SHARING**

A related issue has been discussion of some licensing techniques that could facilitate sharing and allow new technologies to operate, while at the same time maintaining a market-based approach. In the USA, the Spectrum Policy Task Force report of 2002 raised the notion of introducing 'easements' into licensed spectrum. Underlay easements would allow very low power devices to operate as an underlay in licensed bands. On the other hand, overlay rights would allow for example devices that listen for traffic in a band before transmitting. Such easements are yet to be adopted on any widespread basis.

**CONCLUSION**

The changes to spectrum regulation in a number of countries over recent years has been a reaction to changed technology and market conditions, but have in part also been enabled by those changes.

Pressures resulting from the need to allocate large amounts of spectrum to new services such as mobile telephony and wireless broadband have led governments to pursue quicker and more flexible allocation methods, and to examine ways to make spectrum use more flexible in response to changing market circumstances.
Spectrum management reform is still a ‘work in progress’. Debate still remains over a number of issues, including the extent to which spectrum can be managed under a commons approach or an exclusive use approach, how to improve technology neutrality within the regulatory scheme, and how to improve efficiency incentives. But spectrum management has been permanently changed, and has increasingly been integrated with policies applying in the wider economy.

ENDNOTES

1 Broadcasting represents a good example of this. In many countries including Australia television broadcasting services were planned conservatively, with gaps (“white spaces”) left between planned channels. While to some extent a conservative approach was necessary under analog technologies, it could be argued that regulators tended to be risk averse in television planning.

2 For example see Indepen 2007 for a description of some of the difficulties and data requirements needed for a robust application of AIPs to new areas of spectrum.

3 The present author was a co-author of the review report.

4 The views expressed in this article are the author’s own and do not represent the views of ACMA.

REFERENCES


MARKET-BASED METHODS OF SPECTRUM MANAGEMENT IN THE UK AND THE EUROPEAN UNION

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Market-based methods of spectrum management can be applied both at the primary stage of issuing spectrum licences, via auctions, and by introducing a regime of secondary trading of spectrum licences, thereby permitting both change in ownership of the licence and a choice on the part of the licensee over what technology to employ (technological neutrality) and what to produce (service neutrality). Moreover, the use of market methods need not be confined to spectrum used for commercial purposes. Government and public sector bodies can participate in spectrum markets, just as they do in other input markets. Both the European Union and individual member states are increasingly interested in applying market methods of spectrum management. The European Commission has put forward legislative proposals, which, if adopted, would create bands that were subject to trading and flexibility of use over the 27 member states. In one member state, the United Kingdom, a new regime of spectrum management has been designed and is being implemented involving predominant reliance on spectrum markets, an extensive programme of spectrum awards, the development of a new method of specifying spectrum user rights to permit change of use and the integration of commercial and public sector spectrum markets. The effects of these innovations are not yet clear.

INTRODUCTION

This paper is concerned with the development within the European Union of common policies towards the application of market-based instruments of spectrum management, and with their development and use in the one member state, the United Kingdom, where they have been applied most fully. Section 1 outlines the methods under consideration, and section 2 focuses on their potential role within the public sector. Sections 3 and 4 describe developments in, respectively, the EU and the UK, and section 5 contains an assessment.

MARKET-BASED INSTRUMENTS OF SPECTRUM MANAGEMENT

In most countries the command and control framework has been, and in many cases remains, the predominant method of spectrum management. However, administrative decisions over spectrum allocation and assignment, together with interference management focussed on technical features and (excessive) protection against the risk of interference, and above all the huge demand for new spectrum uses, have confronted spectrum regulators with the need to manage spectrum more efficiently. While the traditional paradigm was aimed at controlling interference, recent policy trends have focused on the issue of establishing a framework where spectrum can be put in the hands of those who value it the most. Indeed, the consideration that spectrum is a valuable resource has become crucial.

Therefore, in some countries (e.g. the US, the UK and Australia, but also developing countries such as Guatemala and San Salvador) spectrum policy is shifting away from the traditional methods of spectrum management and is increasingly relying on market-based methods, which
have been adopted, in particular, in order to assign spectrum, both at the primary level (auctions) and at the secondary level (via spectrum trading). In addition, relaxation of constraints on use and technologies (liberalisation) is also being pursued in countries that have been leading recent policy trends.

**SPECTRUM AUCTIONS**

Spectrum auctions have been the most prominent of the market-based mechanisms to be deployed. Until the late 1980s spectrum licences had been assigned applying many different ways, but only beauty contests (comparative selection procedures) explicitly accommodate a competitive element. Nevertheless, beauty contests sometimes open the door to favouritism and corruption. In the UK, the Radiocommunications Agency, in preparing for the auction of 3G licences, stated: 'Government should not be trying to judge who will be innovative and successful', thereby suggesting that market-based mechanisms should be preferred to administrative methods. Many European countries followed suit in the case of 3G licences, leading to a wide diversity of outcomes, described in Klemperer (2002).

It is clear, however, that auctions by themselves do not make a fundamental change in spectrum management, because they usually operate in a framework of command and control over the use of the licence that is being auctioned. Thus they introduce a competitive element into the assignment process, but do not necessarily introduce flexibility into spectrum use. But a combination of auctions with secondary trading and liberalisation does amount to a genuine market-based reform.

Spectrum assignment via auctions has raised a few concerns. In particular, it has been argued:

- 'Bid prices necessarily result in consumers paying more for services reliant upon radio spectrum';
- 'Auctions, particularly those where bids ascend over time, encourage bidders to over-value spectrum, resulting in spectrum prices being too high' (the winner's curse).

However, the first argument is normally fallacious. In well-designed auctions, bidders are required to pay for spectrum up front and, for successful bidders, the cost of spectrum will be a sunk cost if there is no secondary trading. Sunk costs do not influence market prices. In other words, when it comes to the factors that determine the market prices paid by consumers for services that are supplied using radio spectrum, past auction fees do not feature. This point has been made on many occasions by economists who have pointed out, in the case of cellular spectrum auctioned in different regions in the US, firstly, that prices for cellular services did not vary as widely as prices for radio spectrum and, secondly, that there was no statistically significant correlation between auction fees and the prices paid by consumers for mobile services.

The second argument – that auctions, particularly those where bids ascend over time, would encourage bidders to over-value spectrum – is also built on shaky grounds. In Europe, a lot of research has been carried out investigating the big differences in the outcomes of the numerous 3G European auctions of years 2000–2001 (Klemperer 2002). It is argued that key factors that played a significant role in those auctions are:
• Auction features (number of licences auctioned off, number of bidders in the auction, scope for collusive behaviour, and so forth);
• Evolution of market expectations for future development of 3G services and timing of the auctions.

Moreover, at least in some auctions, the cause of high prices may also be due to artificial scarcity arising out of the out-dated command and control approach to spectrum management: the limited spectrum often available, via administrative decisions, for high value applications (such as mobile telephony) inevitably leads to high prices at auction.

SECONDARY TRADING IN SPECTRUM

Spectrum trading denotes a market mechanism whereby rights (and any associated obligations) to use spectrum are transferred from one party to another for a certain price. Like any other transfer, spectrum trading has two features:

• The transfer of the rights to use the spectrum is initiated voluntarily, either by the present spectrum user or the potential user;
• The buyer of the rights to use spectrum pays a sum to the present user, who retains the sum, either in full or in part.

Spectrum trading should contribute to a more efficient use of frequencies and it complements the introduction of market-based mechanisms for primary assignments of spectrum (auctions). Auctions can be usefully applied to ensure that spectrum is purchased by those who value it the most. However, secondary trading of spectrum ensures that, if the valuation of spectrum change over time, resulting in the present spectrum holder’s valuation being lower than that of someone else, spectrum can flow from one use to another.

Efficiency is usually achieved when the users of spectrum are those with the highest valuations for the spectrum. A trade will only take place if the spectrum is worth more to the new user than it was to the old user, reflecting the greater economic benefit the new user expects to derive from the acquired spectrum. To facilitate transfers, it is crucial to establish a swift and inexpensive mechanism with transaction costs as low as possible – otherwise if transaction costs are too high compared to the potential efficiency gains, these efficiency gains will not be realised. However, the vast quantity of important details, which have to be agreed, means that legislation cannot be far-reaching in the specification of actual arrangements.

Historically, spectrum trades have not been possible between users entitled to rights on spectrum. Hence, in order to assign frequency bands to a different user, the spectrum had to be returned to the spectrum manager and then re-assigned – a much more rigid mechanism than secondary trading, with very high transaction costs.

Spectrum trading is arguably the most relevant market-based mechanism available – and more potent than auctions – as it makes the gravitation of spectrum to its most efficient use a permanent feature of the allocation system. Yet in practice its impact has been minimal so far. The level of trading outside the USA and Central America has been generally low (Wik Consult 2005).
Several possible reasons have been suggested, with each likely to have had some influence. Some of those reasons are closely related to features of spectrum markets:

- Insufficient level of liquidity in spectrum markets, which may take different forms (e.g. low volumes of tradable spectrum, low flexibility of tradable spectrum, licences issued on national rather than regional basis);
- Non-tradability of public spectrum holdings;
- High level of transaction costs (e.g. the procedures for authorising trades are complex and lengthy);
- Insufficient information provided around tradable spectrum (e.g. prices, frequencies);
- Inadequate development of private band managers who allocate spectrum licences (in particular, efforts to create band managers might have resulted in too few firms holding the most valuable spectrum);
- Efficient initial allocations of spectrum that market and technological changes have not altered;
- Large programmes of primary awards: spectrum users may have concerns over the risk of interference in spectrum acquired in secondary markets; hence they may prefer to buy spectrum at primary awards;
- Availability of unused spectrum.

A second set of reasons affecting the level of spectrum trades is more closely related to the regulatory framework:

- Uncertainties due to phased liberalisation of spectrum use (additional concerns may arise when trading and liberalisation are not introduced over the same bands at the same time);
- Likely modifications of spectrum usage rights by regulatory fiat to allow some unlicensed users to operate in spectrum licensed to others (e.g. ultra-wideband applications);
- Lack of alignment of licence terms and conditions (including technical parameters and tenures with different expiry dates);
- Length of licence tenures, which affects the potential for spectrum to be utilised for services that require substantial (and at least partially sunk) investment. For instance, a 20-year licence period will result in the licence value falling over time, as any buyer on the secondary market would have a shorter period within which to recover his or her investment in the spectrum.

**MARKET-BASED METHODS AND PUBLIC SECTOR USE OF SPECTRUM**

Historically public sector users have been gifted substantial amounts of radio spectrum to provide services in the public interest, such as defence, public safety and emergency services. As a consequence, in many jurisdictions the public sector holds a vast bulk of valuable frequencies. In the UK, for example, public sector spectrum use accounts for just under half of all spectrum use below 15 GHz.

Military use of spectrum, particularly for radar and communications, accounts for most of public sector use. In the presence of international military alliances, such as NATO, military spectrum allocations are often harmonised internationally. Furthermore, the strategic nature of
defence applications means that sometimes little is known in detail outside the immediate agencies concerned about how the spectrum is deployed.

Commercial and public sector spectrum allocations are managed in a broadly similar way by the same independent agency or government department (a major exception is the United States, where spectrum used by the Federal Government is managed by the NTIA, part of the Department of Commerce).

Under the command and control regime, public sector organisations, especially national defence departments, were accorded high priority in spectrum use and allocated spectrum for an indefinite period. But as demand for commercial spectrum grew, attention became increasingly focussed on the issue of whether public sector bodies crowded out much more valuable private sector users and uses of spectrum.

A few countries have taken bold steps to promote efficient use of spectrum by public sector bodies. In the US, an Executive Memorandum of 2003 required the NTIA and other federal departments to improve the efficiency of the use of spectrum. In the same year, the UK Government commissioned an independent audit of public sector spectrum holdings to inquire whether there is scope for re-allocation from public to private sector or within the public sector (Cave 2005). The Australian spectrum regulator has recently published a similar investigation into the use of spectrum by government (ACMA 2008).

These studies have suggested that public sector use of spectrum is inefficient and that excessive appropriations of spectrum for public services over the past may have occurred. For instance, significant returns of spectrum to the regulator were made in recent years by the French and UK Ministries of Defence, while India has experienced difficulties in carrying out government decisions to transfer spectrum from the military to the commercial sector. Therefore, in net terms, the public sector is like to be a supplier of spectrum to commercial users rather than a net demander, although there may be exceptions (for example, additional spectrum may be needed to provide emergency services with wireless broadband communications).

If, however, public sector spectrum users are to participate fully and effectively in spectrum markets, certain preconditions may have to be fulfilled. There are at least two major preconditions:

- Specification of rights and responsibilities: if public sector spectrum is to become tradable, the associated property rights must be fully determined. In many jurisdictions, government departments are not issued with detailed licences specifying rights and responsibilities;
- Access to information about spectrum uses: public sector spectrum use is, often for good reasons, swathed in secrecy. However, information necessary for potential users to make decisions about the purchase, leasing and sharing of such frequencies has to be made available whenever possible.

Eliminating the boundary between private sector and public sector spectrum markets is a bold, if logical, step, and one that many spectrum regulators are as yet generally unwilling to take. For example, the European Commission in its 2006 proposals for spectrum reform advocates a market for much of the commercial spectrum, but makes a broad exception for public service spectrum.
MARKET-BASED SPECTRUM REFORM IN THE EUROPEAN UNION

The European Union (EU) does not own or manage radio spectrum; this is a responsibility of member states. Nonetheless, in the field of communications, the exercise of some competencies in relation to spectrum falls to the European institutions – the Commission, the Parliament and the Council of Ministers (of the member state governments). As a result, spectrum management within the EU is influenced significantly and increasingly by European legislation, which is aimed at facilitating harmonisation of regulation and promoting competition through the liberalisation of markets.

The key legislation is contained in a number of directives and decisions passed in 2002. The Radio Spectrum Decision (EC 2002) laid the foundation for a general EU radio spectrum policy and is binding on all member states. The objective of the Radio Spectrum Decision is to ensure coordination of radio spectrum policy approaches by facilitating harmonised conditions for the availability and efficient use of radio spectrum.

The Radio Spectrum Decision encourages the European Commission (EC) to organise consultations to take account of the views of member states and all other stakeholders. To facilitate more effective consultations, the Radio Spectrum Policy Group (RSPG) was established by a separate decision. Since its inception, consultation has focussed on a number of issues, most notably:

i. a market-based approach to spectrum management (with an emphasis on secondary trading) and

ii. increasing flexibility in use.

Spectrum trading is not mandatory but allowable. Article 9(3) of the Framework Directive permits member states to allow for the transfer of rights to use radio frequencies between undertakings. In November 2004, following a consultation, the RSPG published its opinion on secondary trading (RSPG 2004).

In its opinion the RSPG adopted a cautious stance with regard to spectrum trading considering it to 'be beneficial in certain parts of the spectrum' and that 'European administrations should introduce secondary trading with due care'. The RSPG favoured a phased approach and was sceptical about the application of trading in bands catering for: government services (e.g. defence) and safety-of-life services (e.g. for civil aviation); terrestrial broadcasting services and broadcasting-satellite services, and scientific services (e.g. radio astronomy).

In December 2004, the Council of Ministers concluded that one should 'continue assessing different spectrum management models with a view to more flexible and efficient use of spectrum at European and global level'. Later on, the EC published a communication on market-based approaches to spectrum management (EC 2005a). It proposed a coordinated introduction of spectrum markets across the EU, and noted that roughly one-third of the spectrum below 3 GHz could have flexible usage rights and be tradable by 2010. Alongside the market-based approach, the traditional model was expected to continue to play a role where important public interests are at stake (e.g. defence and aviation, scientific research, earth observation satellites, etc).

The EC regards technology and service restrictions as increasingly incompatible with convergence. It anticipates a trading regime that embraces flexibility, i.e. the right of a spectrum holder...
to use it for any service, subject to technical constraints. Lack of flexibility in spectrum management has, according to the EC, led to a spectrum bottleneck for new radio technologies (EC 2005b). Detailed *ex ante* administrative decisions and a requirement for prior regulatory approval often delay or even prevent the introduction of new products. To render spectrum distribution more flexible, the application of spectrum markets (secondary trading) and licence-exempt use (the 'commons' model) have been embraced by the EC.

On 8 February 2007, the EC issued another Communication emphasising the need for greater flexibility in spectrum management (EC 2007a). In this document the EC stated that the deployment of innovative wireless services and technologies is increasingly hampered by the reservation of certain spectrum bands for narrowly-defined services. The Commission's priority is to look at those frequency bands where there are individual rights of use (licence exempt bands are to be considered at a later stage).

The EC identified 1350 MHz of spectrum where current legal restrictions should be re-examined with a view to permitting more flexible usage (EC 2007a). These bands are today used by the broadcasting, mobile and information technology sectors.

Further, the RSPG was invited by the Commission to prepare an Opinion on a co-ordinated EU spectrum policy approach for wireless communication radio access platforms, under the acronym WAPECS (Wireless Access Platforms – later changed to 'policies' – for Electronic Communications Services).

WAPECS aims to introduce more flexibility in the use of radio frequency spectrum, taking into account that, presently, different platforms and technologies may provide mobile, portable and fixed access for a wide range of electronic communications services, including converging applications. Therefore different networks can provide mobile, portable, or fixed access, for a range of electronic communications services (e.g., IP access, multimedia, multicasting, interactive broadcasting, datacasting), under one or more frequency allocations (mobile, broadcasting, fixed), deployed via terrestrial and/or satellite platforms using a variety of technologies to deliver seamless services to users.

The outcome of the process – an Opinion (RSPG 2005) – adopted the long-term objective of facilitating rapid access to spectrum for new technologies. For WAPECS frequency bands, technological neutrality and flexibility in the future use of the spectrum should be ensured. Equally, service neutrality should be achieved, subject to specific obligations, in the sense that electronic communications services in any WAPECS band should be provided over any type of network, and no frequency band should be reserved for the exclusive use of a particular service.

In November 2007, the European Commission proposed changes to the European regulatory regime, which include moves towards greater flexibility and the use of market methods in spectrum management (EC 2007b). This legislative proposal builds the earlier communications and seeks to strengthen the principles of technological and service neutrality, and also to create a mechanism to designate certain bands where, across the EU, licences could be traded in secondary markets. This introduced a new kind of 'meta'-harmonisation, under which what is sought is not consistent use of a band, but the consistent application of the same market-based method of spectrum management; the presumption being that firms can then achieve *de facto* harmonisation and achieve the 'single market' goal of supplying cross-national or even pan-European services via their participation in the spectrum. These proposals are subject to amendment by the European Parliament and the Council before they pass into law, and the Commission is careful to qualify
its pursuit of the efficiency objective for spectrum management by acknowledging the need to promote at the same time linguistic and cultural diversity and media pluralism – considerations to which the Parliament is likely to pay a great deal of attention.

**MARKET-BASED METHODS OF SPECTRUM MANAGEMENT IN THE UNITED KINGDOM**

Until the late 1990s, the UK applied a command and control approach to most spectrum used commercially and by public agencies (Cave 2002). However, there was some shared unlicensed access to a few frequency bands. Although this approach was regarded as appropriate in the past, a more flexible approach was identified as necessary in a major review of spectrum management and policy conducted by Ofcom, the British regulator (Ofcom 2005). Ofcom believes it is important to reduce restrictions on spectrum usage as far as possible – also as part of its light-touch approach to regulation. The liberalisation of spectrum usage rights was legitimised as follows in terms of regulatory economics:

- Users have better information than central regulators regarding their own costs and preferences;
- Users have strong incentives to react to market situations, so that frequencies are used efficiently;
- Market mechanisms enable faster reaction to changes in the market situation, making spectrum available for innovations and efficient uses;
- Market mechanisms are better than administrative processes at allocating spectrum to efficient uses.

The objective set out in the 2005 spectrum framework review was ambitious – to shift the entire centre of gravity of UK spectrum management from command and control to market mechanisms by 2010. Thus in the case of frequencies below 3GHz, where in 2000 96% were assigned by command and control and 0% by the market, the plan was to change these proportions to 20% and 66% respectively. By 2008, only 27% of frequencies had been transferred to market methods, however, and the new 2010 target was to raise this proportion to 54% (Ofcom 2008a, p 13). Although the original target will not be achieved, a major shift will be achieved in something like five years.

Ofcom is liberalising spectrum management in two different ways. Firstly, by means of changing existing individual licences. In this case, licence holders can apply for a change to the usage conditions or requirements with regard to the technical parameters for their licence(s). This gives Ofcom greater control of the interference potential, but it creates insecurity for the applicant for the outcome is uncertain, and it also involves high administrative costs. The second course of action is to change generically the licence conditions. This type of approach has the aim of generally making licence conditions as flexible and technology-neutral as possible. It creates greater investment security and is associated with lower transaction costs for those concerned. However, the definition of technology-neutral and use-neutral emission rights brings up complex, challenging issues. After along debate, Ofcom set out its (in some ways controversial) approach to spectrum usage rights in Ofcom (2008b).
A further feature of UK spectrum policy is the desire to place spectrum in the market by making major spectrum awards. This is done on the footing that, subject to assignments being both technologically and service neutral, there is no advantage in delaying the release of spectrum in the expectation that a better use will become available later. If such a better use does come to light, the market will accomplish the realignment. Accordingly, Ofcom has undertaken or planned major spectrum awards, using auctions as the method of primary assignment (Ofcom 2008a, p 11).

Devising auction processes that place competing uses on as level a playing field as possible has presented major challenges. In relation to the forthcoming auction of 112 MHz in the range 550-630 and 790-854 MHz (the so-called digital dividend spectrum to be fully released when analogue terrestrial broadcasting is closed down in 2012), Ofcom proposes to use a combinatorial clock auction (Ofcom 2008c). Shorn of considerable complexities, this means that the frequencies are divided into generic blocks of equal size, suitable for use for a multiplicity of services. A clock auction then takes place – ie the auctioneer raises the price until demand equals supply. Bidders are allowed to bid for combinations of blocks, as well as for individual ones. This ensures that no bidder ends up with assignments that do not meet its purpose. Finally, specific blocks are assigned to individual successful bidders to achieve the goal of minimising interference across spectrum users.

Finally, considerable progress has been made in integrating public sector spectrum into the developing spectrum market. Following an audit of mainly public sector spectrum holdings in 2005 (Cave 2005), the UK Government accepted and Ofcom has implemented, or assisted in the implementation of, a revised regime in which public sector bodies are granted freedom to lease, sell or share unused spectrum – and keep some or all of the revenues. Equally, they will have to go out into the market to acquire more spectrum. In addition, annual charges for spectrum use (so-called administrative incentive prices) are being levied more comprehensively on public spectrum users. Preparing public sector users for market participation has required much preparatory work (Ofcom 2008d), but the Ministry of Defence has instituted a project to audit its spectrum holdings and to make surplus spectrum available for sale or lease (Ministry of Defence 2008).

**ASSESSMENT**

It is quite clear that the United Kingdom has far outstripped the obligations placed on member states of European Union in respect of market-based methods of spectrum management. This is scarcely surprising given the federal nature of decision-making at the European level, and the diversity of views among national spectrum regulators and governments. There are also interests (especially broadcasters) with strong support in the European Parliament, that generally oppose spectrum reforms that might lead to the institution of charges for, or even the withdrawal of, their own spectrum holdings or the emergence of rival services. Nonetheless a direction of travel in spectrum management in Europe towards greater reliance on market methods can be discerned, even if its application if patchy.

The UK is already in a quite different place. Nearly half of its spectrum is subject to market mechanisms; a system of market-compatible spectrum user rights has been set up; numerous service-neutral auctions are accomplished or planned; and a pathway has been constructed for
integrating public and private sector spectrum markets. This is a considerable achievement. The outstanding question, though, is whether it has brought benefits to end-users. The evidence is still incomplete. The new regime does not seem to have precipitated a large number of trades – suggesting to some that it has not led to the immediate correction of major disequilibria. But this may be due in part both to the long-term nature of the correction process, in the face of sunk expenditures on equipment, and to the large number of spectrum awards which Ofcom has achieved or contemplates. The revenues from these awards show no signs of scaling the dizzy heights of the 2000–2001 3G auctions, and this may reflect lower expectations of spectrum scarcity, perhaps brought about by a more flexible regime of spectrum management. Ofcom recognises the problem of assessment but says that the benefits of increased competition and innovation are a long time in coming and are inherently unpredictable. It is difficult to quarrel with this judgement, but the co-existence within the European Union of member states with quite different approaches should provide better evidence in the future.

ACKNOWLEDGEMENTS

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ENDNOTES

2 Ofcom (2008a, p 12) records 18 licence trades in the UK as of March 2007.
6 Council Resolution 10 December 2004, see 15472/04 (press 345).
7 This is discussed in Cave, Doyle and Webb (2007) Chs 11–12.

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MARKET-BASED METHODS OF SPECTRUM MANAGEMENT

SPECTRUM REFORM

MAXIMISING PUBLIC BENEFITS DERIVED FROM USE OF THE SPECTRUM

Rebecca Burdon, Principal Economist, Australian Communications and Media Authority

This paper comments on the role of the market and the role of the regulator and regulatory tests such as a total welfare standard in promoting an efficient allocation of spectrum. It summarises key elements of Australia’s spectrum management regime, outlines why a total welfare standard is the appropriate test when assessing regulatory options in the context of spectrum management, and comments on when this sort of cost-benefit analysis is likely to be useful.

INTRODUCTION

The object of Australia’s Radiocommunications Act 1992 (the Radiocommunications Act) states, amongst other things, that spectrum should be managed to ‘maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum’ (Radiocommunications Act 1992, s3(a)).

This paper comments on the role of the market and the role of the regulator and regulatory tests such as a total welfare standard\(^1\) in promoting an efficient allocation of spectrum that will maximise the benefits derived from that resource. It outlines:

- core elements of Australia’s spectrum management regime by way of background;
- why a total welfare standard is the appropriate test in relation to spectrum management;
- the sort of analysis likely to be involved in evaluating the impact of alternative regulatory approaches on total welfare; and
- when this sort of cost-benefit analysis is likely to be useful.

BACKGROUND

Since radiocommunications services began around the beginning of the early 20\(^{th}\) century, governments and operators have determined that the frequencies used by wireless services need to be regulated to prevent interference and thereby maximise benefits from new technologies.

Technical regulations to control interference were seen as the key to making spectrum more usable. Interference control was based on grouping like services into bands and assigning different channels to different users. Transmitters and receivers relied on frequency separation and guard bands to operate effectively and reduce the risk of excessive interference.

In recent decades, wireless technologies have used the ever-increasing speed and capability of microprocessors to provide a range of new and advanced services. Technology has also extended the useable spectrum into higher frequency bands and made more efficient use of the spectrum through greater tuning abilities, more precise rejection of unwanted signals, better noise suppression, greater antenna directionality and enhanced signal compression.

Despite the increases in spectral efficiency enabled by technological change, demand for spectrum for commercial applications has increased significantly and is expected to continue to increase in the years ahead. The increase in spectrum demanded for commercial applications has been accompanied by greater demands for spectrum for radio astronomy, weather and climate...
information services, satellite and space services. Similarly, the communications requirements of
defence, security services, police and emergency services are increasing, leading to calls for
greater bandwidth and increased access to spectrum.

This has led to demand exceeding the supply of spectrum in some frequency bands and
geographic areas. Technology developments may enable greater sharing of spectrum but it is far
from clear that these developments will alleviate congestion of parts of the spectrum in the
foreseeable future.\(^2\)

Increasing the supply of spectrum that can be used by applications in highest demand is
complicated by the slow but useful process of harmonising spectrum allocations internationally,
and at times, by the presence of legacy technologies operating in those bands. Where Australia
is a 'technology-taker' it will continue to experience greatest demand for spectrum in those bands
that are in highest demand in large international markets. Competition for spectrum is most
acute in the UHF and SHF bands below 5 GHz. This demand is concentrated in dense population
areas. Ample spectrum is often available in less populated areas and at higher frequencies.

There is considerable recognition internationally that when excess demand exists, the outcome
that is efficient and consistent with maximising public benefits is most likely to be achieved when
the regulator uses market mechanisms in managing spectrum. As described by Freyens (2007),
economic efficiency in this domain arises from the speed at which new applications reach con-
sumers, contributing to enhanced production and consumption possibilities and economic growth.
From a regulatory perspective, spectrum efficiency is maximised when the spectrum management
regime is endowed with the flexibility to adapt spectrum access and usage to both market require-
ments and technological advances (Freyens, 2007, 4, fn 3).

Economists have been advocating market approaches since the 1960s, and spectrum regulators
have become progressively more sophisticated in applying these approaches since the late 1980s.
Technical regulation has increasingly been seen as necessary but insufficient to maximise the
public benefit from use of the spectrum.

Australia has been in the forefront of developments in spectrum regulation and the use of
market mechanisms to promote an efficient allocation of spectrum.\(^3\) Technologically flexible
spectrum licences were introduced in the Radiocommunications Act in 1992 and the first ones
were granted in 1997. Licences that confer exclusive usage rights are generally tradeable, irre-
respective of whether the licensee is a private sector or public sector entity. Administrative incentive
pricing\(^4\) has been used since the 1980s. Spectrum 'commons' have also been implemented for
classes of devices that are unlikely to create a significant risk of interference.

The debate over alternative approaches to spectrum management is often characterised as a
three-way tug between:

- a command and control model in which the regulator controls the use of the spectrum through
detailed restrictions on use;
- market approaches based on exclusive property rights; and
- a commons approach in which there are few restrictions on entry but limited protection from
interference (Freyens, 2007).
Australia’s spectrum management regime encompasses all three approaches. Under the Radiocommunications Act, the Australian Communication and Media Authority (ACMA) can use one of three licence regimes:

- Spectrum licences typically provide exclusive access to the licensee over a large spectrum space (frequency range and geographic area). The technical frameworks seek to provide the licensee with flexibility to change the use of the spectrum while managing interference at frequency and geographic boundaries. Spectrum licences are typically allocated at auction, although under certain circumstances prices for spectrum licences may be administratively determined;
- Apparatus licences typically specify technical conditions for the operation of a device or devices including frequency, transmit power, emission type and, importantly, geographic location. Apparatus licences are usually administratively allocated on a first-come, first-served basis although they are auctioned in some circumstances when there is expected to be excess demand for a licence. Prices for apparatus licences are set by ACMA and outlined in the Apparatus Licence Fee Schedule; and
- Class licences which are essentially a commons arrangement. Users do not need to apply to ACMA to operate in class licensed bands or pay any fees, although they must operate within the technical specifications of the class licence. To date class licences have generally been used for short-range low-powered devices that are unlikely to cause interference problems.

In all likelihood a combination of these approaches will continue to be appropriate for the foreseeable future although the proportion of spectrum accessed under each approach may change. Spectrum licences are likely to be appropriate for large networks that benefit from interference protection and that will be more efficiently managed by spectrum users with property rights and liberalised licensing frameworks. Apparatus licensing with centralised frequency coordination and strict rules of operation may be preferable for multiple users with narrow spectrum bands over small, specific geographic areas. For spectrum uses that have a low potential to cause interference, the commons approach provided by a class licence with minimal rules and no barriers to entry may be optimal.

Irrespective of the proportion of spectrum managed under each licensing regime, the regulator will continue to play an important role in making rules that shape the evolution of the administrative process and the market in which rights to access spectrum are acquired. Where it is not possible to be entirely technology-neutral, technical regulations instituted by the regulator will influence spectrum use and the value of certain bands to different parties.

In this context ACMA has recently articulated the framework and analytical tools that will guide its regulatory decision-making process. The regulatory debate is likely to benefit if it can operate with a common framework and language that stakeholders from a range of sectors can understand and engage with irrespective of whether their activities relate to telecommunications, broadcasting, meteorology, defense and law enforcement, aviation or any number of other key commercial and community services. The decision-framework is illustrated in Figure 1.
Figure 1 ACMA Spectrum Management Decision Framework
Note: 5-Year Spectrum Outlook refers to an ACMA document outlining demand pressures in various parts of the spectrum over the next five years. It is available at http://www.acma.gov.au/WEB/STANDARD/pc=PC_311105
OBLIGATIONS TO ASSESS IF A REGULATORY PROPOSAL IS LIKELY TO BE IN THE PUBLIC INTEREST: GOOD REGULATORY PRACTICE

As outlined in the diagram above, ACMA has stated that, where appropriate, it will use a total welfare standard to assess which regulatory approach is likely to be optimal. ACMA is not unique in applying a standard or test to assist in evaluating regulatory options. Such an approach was recommended in 'Rethinking Regulation: Report of the Taskforce on Reducing Regulatory Burdens on Business' and is consistent with the Office of Best Practice Regulation (OBPR) guidelines.

The OBPR test has its foundations in welfare economics and principles developed in the economics literature in the 1930s (Kaldor 1939, 549–552 and Hicks 1939, 696–712). These economic foundations form the accepted basis for modern cost-benefit analysis and the basis for the 'public interest tests' used by other regulators in Australia and elsewhere in their enforcement activities.

Despite this common foundation, regulators around the world have applied different tests. The total welfare standard is a widely accepted standard for cost-benefit analysis associated with regulatory interventions. The history of anti-trust adjudication in the United States has meant that the welfare standard in competition policy in a number of countries is the consumer standard rather than the total welfare standard.

In considering applications for authorisation, the Australian Competition Tribunal has, however, been reasonably consistent in adopting a total welfare standard and articulated its position on this as early as 1976. In 2007 the ACCC stated it would apply a public benefits standard in relation to authorisation. This is similar to a total welfare standard but may differ slightly in some cases. In defining its 'public benefits standard' the ACCC notes it may have regard to what weight society considers should be attached to the public benefit and the number and identity of the proposed beneficiaries (ACCC 2007, 34).

In the US in recent years economists have been debating whether a consumer welfare standard or a total welfare standard is appropriate in an anti-trust context (Pittman 2007; Carlton, 2007; Farrell and Katz 2006). There has been a similar controversy in Canada in relation to antitrust matters (Ross and Winter 2005, 471–503) and in New Zealand on other telecommunications regulatory issues.

Notwithstanding the OBPR's statements that support assessing the impact on total welfare (rather than consumer welfare or some other standard), given the debate over the appropriate standard in anti-trust matters and some other regulatory contexts it seems appropriate to consider what standard is appropriate in the context of spectrum management.

WHAT IS THE TOTAL WELFARE STANDARD?

A total welfare standard requires that to the extent possible:

- all significant benefits and costs arising from the regulatory proposal will be given the same weight regardless of the identity of the recipient; and
- the approach expected to generate the greatest net benefits is the preferred approach.
When a total welfare standard is applied, the impact of a regulatory proposal on the public interest is measured as the sum of the:

- direct effects on consumers (change in consumer surplus), producers (change in producer surplus), and government revenues;\(^{11}\) and
- the broader social impacts on others in the community. Externalities (or broader social impacts) might be important and where they are they should be included in the analysis. Consistent with generally accepted practice in cost benefit analysis indirect effects, or affects in secondary markets should not be taken into account.\(^{12}\)

The government sector can be treated in various ways when analysing the impact of a proposal on welfare. In some situations it may be included in the analysis in its role as a consumer or producer (as part of consumer surplus and producer surplus respectively). In others, and in particular where a regulatory proposal may affect the level of taxes or the form in which taxes are collected it may be identified as a distinct sector.

Payments that are simply transfers between government, consumers or producers are typically treated as transfers that result in no net increase or decrease in welfare. In relation to spectrum, payments for licences will generally be treated as a transfer between producers and government in a welfare analysis.

However, many forms of taxes impose economic costs by altering, for example, incentives to invest, incentives to work or the cost of goods or services. When taxes change consumption or production decisions, the impact on consumer or producer surplus should be taken into account.

WHY IS TOTAL WELFARE THE APPROPRIATE STANDARD IN SPECTRUM MANAGEMENT?

The benefits of a total welfare standard relative to other 'public interest tests' such as a consumer welfare standard can be demonstrated by using an illustrative example. At times the regulator needs to consider whether to facilitate a change in the use of parts of the radiofrequency spectrum. As a rule in Australia, ACMA as the regulator seeks to implement technical and licensing arrangements that are flexible and support a range of uses.

However, in some circumstances the regulator may need to make decisions about the technical or licensing arrangement that will affect the value of the band to current or potential users. In an extreme case it is possible that planning arrangements will prevent some potential users from operating in that part of the spectrum. When this is the case, the regulator should carefully consider which approach is in the public interest.

Changing the technical and licensing arrangements for a band may have a number of effects on welfare. For example in some cases:

1. It may impose additional costs on incumbent entities providing services using that band, and returns to those incumbent entities may fall as a result.
2. It may affect consumers of the services provided by those incumbent entities if prices rise or consumers face increased costs to access the service or a substitute services via an alternative platform.
3. It may increase the returns to parties who gain access to the band to provide new services.
4. It may increase benefits to consumers of those new services if it enables:
   a. new valuable services to be rolled out in Australia, reduces the cost of those services being brought to market, or increases competition in the provision of services;
   b. consumers to capture the benefits of global economies of scale in the production of equipment for utilisation in the bands; or
   c. consumers to reap the benefits of global roaming that is possible in part because of international standardisation.

If the regulator assesses whether it is in the public interest to facilitate a change in use of the band using a total welfare standard, it would seek to take into account all significant benefits and detriments in each of points 1–4.

If the regulator used an alternative standard, for example a consumer welfare standard, it would only take into account effects 2 and 4. The impact on producers would not be considered unless it also affected outcomes for consumers.

In spectrum management it is appropriate to have regard to the possible impact on producers, consumers, government and other members of the community when assessing whether a regulation would be in the public interest. Adopting a consumer welfare standard could lead to accepting regulatory proposals that confer benefits on consumers without proper consideration of the costs on others affected by the regulation.

Consistent with the welfare-economic underpinnings of the total welfare standard it is also appropriate to give the same weight to benefits or detriments irrespective of the identity of the beneficiaries. This is not based on an assumption that we (society or regulators) are indifferent to the distribution of income between individuals. Rather, as noted in King (2006), it reflects a recognition that ‘... economics strongly dictates that any socially desirable redistribution is best achieved through coordinated government tax policy and not achieved through ad hoc intervention, for example, under competition laws’ (King 2006, 38–48). Regulatory interventions focused on industry are imprecise and inappropriate policy instruments for achieving distributional objectives.

This is not to say that regulators or policy agencies should not consider as part of the analysis which members of society are better or worse off as a result of a change. Indeed, such an analysis may be part of the quantitative or qualitative assessment of the effect of the change. This analysis may influence other policy decisions, for example, the management of the transition from one regulatory approach to another. But these should generally be treated as distinct questions. In some cases they will be policy questions for government rather than matters for ACMA as the regulator.

**HOW SHOULD A SPECTRUM REGULATOR USE A TOTAL WELFARE STANDARD?**

The appropriate analysis will depend on the matter at hand. In some cases it may be a largely qualitative analysis, while in others quantitative analysis may be possible. A formulaic approach makes no sense given the range of spectrum management activities. The right approach will depend on factors such as:
• the regulatory options that are being considered;
• the factors relevant to understanding the impact of different approaches; and
• the information available in each case.

Having said that, there are a few general principles that should guide the regulator.
Assessments should consider the future with and without the proposed regulatory intervention. The benchmark is not the current situation, or some ideal world, but rather it is the environment expected to prevail if a regulatory proposal is implemented compared to the outcome expected if it is not.

Analysis should focus on the change in costs or benefits that will arise as a consequence of the regulatory proposal in question. Consider the spectrum example just discussed. In most cases spectrum planning decisions will affect the relative cost of delivering certain services or the price at which they services are supplied. It is an extremely rare case when a decision will affect whether the service can be delivered at all. Where the regulatory decision affects the cost of delivering services, the regulator should evaluate the implications for cost and any expected impact on price and demand for services. In these cases it will not be necessary or appropriate to determine how much society values the existence of the service.

There should be a reasonable expectation that the effects taken into account will actually result as consequence of the regulatory proposal. Regulators should seek to adopt an approach that is not naive but that has regard to the risk associated with different outcomes, and whether effects are likely to be enduring or ephemeral.

Significant economic and broader social (or non-economic) impacts should be taken into account, and in certain circumstances may be the critical factors.

Some benefits or detriments, and in particular some broader social impacts, may not be amenable to quantification. Where it makes sense to assess some impacts in qualitative terms, they should be evaluated and supported with evidence to the extent possible and given appropriate weight in the overall evaluation. Regulators should take care not to give excessive regard to certain factors just because they can be quantified.

Effects on dynamic efficiency are difficult to capture in an analysis of the impact of a change on total welfare. Nonetheless the expected impact of a regulatory initiative on dynamic efficiency may be of prime importance and should be considered and taken into account in the overall analysis.

**WHEN IS IT APPROPRIATE TO ASSESS THE EFFECT OF A REGULATORY PROPOSAL ON TOTAL WELFARE?**

This sort of cost-benefit analysis is likely to be appropriate when the regulator, as opposed to the market, needs to make a decision that will affect the allocation of spectrum. That is, the regulator should analyse the impact on total welfare when it is not possible to establish technology-flexible arrangements that enable potential users of the spectrum to compete in a market to determine the highest value use of the spectrum. Spectrum regulators’ responsibilities relate to dynamic and rapidly evolving sectors. In many cases market processes will reveal more information and be more likely to result in an efficient allocation of the spectrum than the regulator – irrespective of how much detailed analysis the regulator uses to inform its decision (Yarrow 2008).
In those cases, and wherever appropriate, we should focus on seeking to ensure that the market can work effectively. It is only likely to be appropriate to commit the resources required to assess the impact of regulatory options on total welfare when the legislative framework provides the regulator with discretion regarding the tests it might apply. If the relevant legislation requires the regulator to consider different criteria, the test in the legislation is the relevant test. In general, the Radiocommunications Act supports and does not preclude ACMA from using a total welfare standard. It is only likely to be net beneficial undertake this sort of cost-benefit analysis when a regulatory intervention is expected to have a significant impact on stakeholders. The analysis required will be time- and resource-intensive. The resources committed to the assessment of the impact of a regulatory intervention should reflect the magnitude of the issue being considered.

**SUMMARY**

Australia has been at the forefront of the development and implementation of flexible approaches that enable spectrum users to determine how spectrum is used. Market mechanisms such as price-based allocations, pricing administratively allocated spectrum, an ability to trade licences, and flexible technical and licensing frameworks all play an important role in this process. However the regulator remains responsible for shaping the market rules. Regulators should continue to explore how to design market rules and technical and licensing frameworks that both promote innovation and efficient use of the spectrum and provide appropriate interference protection.

The pace of change in the operating environment makes the regulator’s job more complex and increases the benefits of an informed discourse with stakeholders. When the regulator is required to make a significant regulatory decision that may affect the use of certain parts of the spectrum and benefit some existing or potential spectrum users and impose costs on others, it is likely to be appropriate to assess the merits of alternative approaches using a total welfare standard. This is one tool that can improve the regulatory discourse and the regulator’s ability to determine how to proceed in a highly uncertain environment.

**ENDNOTES**

1 ACMA held its RadComms08 conference from 30 April to 2 May 2008 and released several consultation papers beforehand. One of those papers sought comment on draft Spectrum Management Principles that ACMA proposes to use to guide its approach to achieving the spectrum management objectives outlined in the Act. In that paper and others ACMA noted that, where appropriate, it would assess the impact of regulatory proposals on total welfare to inform its decisions. The draft Spectrum Management Principles paper is available at http://www.acma.gov.au/webwr/_assets/main/lib310643/smp.doc.

2 For a short discussion of the implications of technologies such as cognitive and software defined radio see Cave et al., 2007, chapters 2 and 10.

3 Some other jurisdictions that have implemented market based approaches since the 1990s include New Zealand, the United States, the United Kingdom, and Guatemala. For a review see Marcus et al., 2005.
Administrative incentive pricing is the setting of prices for licences allocated over the counter to encourage efficient use of the spectrum. ACMA does this through the tax on apparatus licences. See the Apparatus Licence Fee Schedule. [http://www.acma.gov.au/WEB/STANDARD/pc=PC_1614](http://www.acma.gov.au/WEB/STANDARD/pc=PC_1614).

For example, Low Power Open Narrowcasting (LPON) apparatus licences are auctioned when there is expected to be competing demand for a licence. LPONs allow for the provision of niche radio broadcasting services, such as tourist and racing information, or ethnic and religious programming. They are offered on a rolling quarterly program and while most are allocated with no contest, there are typically three or four auctions each year.

Academics and regulators in a number of countries including Australia have been exploring whether it may be optimal for 'band managers' other than the regulator, to manage the detailed coordination and device registration process appropriate for some uses in parts of the radiofrequency spectrum (Cave et al., 2007, ch 10).

ACMA (2006: 203–204). 'A range of feasible policy options… need to be identified and their costs and benefits… assessed within an appropriate framework'.

Australian Government (2007. p 68). 'The Government requires that [Regulatory Impact Statements] include a comprehensive assessment of the expected impact (costs and benefits) of each feasible option. The objective should be to choose the most appropriate option for resolving the identified problem and to provide readily accessible evidence to support this decision. The overall expectation is that the benefits to the community of the recommended option exceed its costs and have the greatest net benefits (benefits minus costs) to the community of all alternative approaches considered.'


See the papers and submissions to the NZ Commerce Commission’s review of mobile termination rates.

See Boardman et al., 2006.

In taking externalities into account it is necessary to consider if other policy interventions exist or are likely to exist to address the issue. See for example, the discussion in Indepen-Aegis, 2005.

Transition measures may also generate economic costs. If transition measures are implemented it is important to ensure that the economic costs associated with those measures do not erode the benefits associated with the initial regulatory initiative.

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OUTCOMES OF THE WORLD RADIOMATICTION CONFERENCE

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The International Telecommunication Union (ITU) held the World Radiocommunication Conference (WRC-07) from 22 October 2007. Deliberations were concluded on 16 November 2007 with the adoption of an international treaty to meet the global demand for radiofrequency spectrum that has been fuelled by rapid technological developments and growth in the communications industry. Australia's objective at WRC-07 was to promote the development of international world radiocommunication agreements that enhance efficient and coordinated access to spectrum and to increase Australia's ability to implement and use satellite and terrestrial systems. This paper outlines Australia's objectives and WRC-07 proposals, describes the WRC process and Australian preparatory activities, then summarises the outcomes.

THE CONFERENCE

More than 2,900 people/delegates participated over the four weeks of WRC-07. A total of 162 member countries were represented at the conference, which was marked by intense negotiations on the future of wireless communications. Australia's delegation of 38 members was the largest Australian delegation to a WRC and came from a cross section of government, industry and the private sector.

The Australian preparatory process for the conference was extensive and comprehensive. The process led to the development of proposed Australian positions to the conference that were submitted to the former Minister for Communications, Information Technology and the Arts. The Minister provided final approval to the Australian Delegation Brief to WRC-07 prior to the conference.

The purpose of the WRC is to revise and update the international treaty known as the Radio Regulations, which govern the use of the radiofrequency spectrum and satellite orbits.

Australia's objective at WRC-07 was to promote the development of international world radiocommunication agreements that enhance efficient and coordinated access to spectrum and to increase Australia's ability to implement and use satellite and terrestrial systems.

The conference's 30 agenda items were broad and varied and related to almost all terrestrial and space radio services and applications, including future generations of mobile telephony, aeronautical telemetry and telecommand systems, satellite services including meteorological applications, maritime distress and safety signals, digital broadcasting, and the use of radio in the prediction and detection of natural disasters.

Australia participated in ITU-R activities leading up to the conference, contributing both individually and via the Asia-Pacific Telecommunity (APT). The APT countries provided Common Proposals on most WRC-07 Agenda items with the majority of APT countries signing up to these proposals. The APT countries represent the majority of the world's population, with potentially huge future markets, along with significant operational and supply industries. Common Proposals therefore carry significant ‘leverage’ in international fora. The coordinated activities of APT countries during the WRC were successful in gaining acceptance of many of these proposals with little modification.
Additionally, Australia independently submitted five proposals to the conference. Most of the proposals contained individual proposals calling for modification or suppression of a particular element of the ITU Radio Regulations. Australia proposed:

- regulatory and procedural amendments to the mitigation techniques developed for operation of the sensors and emission limits for future active systems to enable a gradual transition of remote sensing systems within the 10.6-10.68 GHz band. This aimed to ensure that, over a period of time, levels of ambient man-made RF interference are gradually reduced to a level that will allow coexistence of the current active and passive systems in this band;
- an allocation to the aeronautical mobile service in the band 4 400-4 949 MHz for aeronautical mobile telemetry (AMT) for flight testing, but did not support an allocation in the 5 925-6 700 MHz band, as studies did not clearly demonstrate that AMT could share with existing FSS, FS and MS users in the band;
- the update to various regulatory instruments contained in ITU Radio Regulations relating to the notification and registration of assignments in the use of the 47.2-47.5 GHz and 47.9-48.2 GHz bands by high altitude platform stations;
- that no change be made to any HF allocations between 4-10 MHz, as detailed analysis of Australia’s domestic spectrum usage indicates the requirement to accommodate new allocations is outweighed by the necessity to maintain and protect existing services and allocations; and
- to add the threshold levels to an existing resolution in the ITU Radio Regulations to allow compatibility between radio astronomy and active services in adjacent or nearby bands.

**OUTCOMES**

Australia’s proposals and positions, together with the enterprise of the APT members, resulted in satisfactory Conference decisions for Australia on virtually all matters of interest. The following provides a brief outline of the key decisions of WRC-07:

**BROADCAST SERVICES**

The 698-862 MHz band has been allocated for International Mobile Telecommunication (IMT) 2000¹ applications such as future wireless services. Countries may individually elect by footnote to allocate this band for IMT applications. The 520 to 820 MHz band is already designated as a broadcasting services band in Australia.

**SATELLITE SERVICES**

WRC-07 considered the 3400-4200 MHz band (3400-3700 MHz is known as Extended C band; and 3700-4200 MHz is known as C band) for additional spectrum for future wireless services. There was no agreement to re-allocate C band (3700-4200 MHz) which remains for satellite service applications. However, a compromise agreement was achieved at WRC-07 that allows countries to individually elect by footnote to identify 3400-3600 MHz (part of the Extended C band) for future wireless services. Australia did not put its name to such a footnote at WRC-07.

Satellite mobile telephony was allocated to the bands 1518-1525 MHz and 1668-1675 MHz.
MOBILE
Harmonised spectrum in the following bands was identified for use by International Mobile Telecommunications (IMT):

- 450–470 MHz band;
- 698–862 MHz band in Region 2 (North and South America) and nine countries of Region 3 (Asia, Subcontinent, Pacific),
- 790–862 MHz band in Region 1 (Europe and Africa) and Region 3,
- 2.3–2.4 GHz band, and
- 3.4–3.6 GHz band (no global allocation, but accepted by many countries).

MARITIME PROCEDURES
International regulations related to the maritime mobile service were brought in line with current maritime communications technology, including distress and safety transmissions within the Global Maritime Distress and Safety System (GMDSS).

- 156.525 MHz (156.4875–156.5625 MHz) was made the international distress frequency for Digital Selective Calling.
- 161.975 MHz and 162.025 MHz, the Aeronautical Identification System frequencies, were also made available to the Mobile Satellite Service for reception of Automatic Identification System information.

AERONAUTICAL SERVICES
Aeronautical security has been enhanced and civil aviation telecommunication systems modernised through:

- upgrading radiolocation service to primary allocation status in the bands 9 000–9 200 MHz and 9 300–9 500 MHz;
- allocating additional spectrum for aeronautical telecommand and high bit-rate aeronautical telemetry, and
- adding new allocations for the aeronautical mobile (R) service.

EARTH-EXPLORATION SATELLITE SERVICE (EESS)
Existing primary frequency allocations for EESS (which monitor the planet as well as predicting and monitoring natural disasters, meteorology and climate change) were extended, allowing research and exploration of Earth resources and environmental elements.

WRC-07 also approved proposals concerning the use and further development of satellite systems using highly inclined orbits, high altitude platforms, as well as the compatibility and sharing between different space and terrestrial services.

WORLDWIDE PLAN FOR FIXED-SATELLITE SERVICE (FSS)
Technical and regulatory provisions for fixed-satellite service in the 800 MHz band used in different regions for applications such as communications, TV and Internet, were revised to allow access to spectrum.
GENERAL

WRC-07 also approved proposals concerning the use and further development of satellite systems using highly inclined orbits and high altitude platforms (HAPS), as well as the compatibility and sharing between different space and terrestrial services. Allocation was made for low power secondary amateur use of band 135.7-137.8 kHz.

WRC-07 also advocated the development of spectrum management guidelines for radiocommunication in emergency and disaster relief, as well as identification and maintenance of available frequencies for use in the early stages of humanitarian assistance in the aftermath of a disaster. The ITU will develop a database for frequency management in disaster situations.

The results of WRC-07 will require substantial follow up work, both internationally and within Australia. The ITU Radiocommunication Bureau will implement the decisions of the conference on a wide range of changes to service allocations and the Radio Regulations. Within Australia, the outcomes of WRC-07 will need to be ratified by the Government. The Australian Communications and Media Authority will arrange, in consultation with industry bodies and users, changes to the Australian Radiofrequency Spectrum Plan to take account of outcomes of WRC-07.

CONCLUSION

Overall, the majority of Australian positions were successful at the conference. A number of the contentious items took a considerable amount of time to reach consensus, with Australian delegates working long hours to achieve suitable outcomes.

It is estimated that the Final Acts of the Conference were signed by 154 of the 162 member states present. The majority of the provisions revised by WRC-07 shall enter into force via the ITU Radio Regulations from 1 January 2009.

Australia’s activities in preparation for the next Conference in 2011 have already started. Government and industry representatives have begun identifying their interest in the WRC-11 agenda and initiating participation in the necessary studies. Regional activities have also commenced with the first APT preparatory group meeting held in Bangkok, Thailand, held from 6 to 8 March 2008.

ACMA, with the assistance of the Australian delegation, presented an industry debrief on the outcomes of WRC-07 to an audience of almost 100 interested parties at the National Convention Centre in Canberra on the 28th February 2008.

Further information about the ITU and WRC can be found at http://www.itu.int/newsroom/press_releases/2007/36.

ENDNOTES

1 IMT refers to the family of advanced mobile technologies that will support for example, 3G and wireless broadband services such as WiMAX.

The paper provides a tutorial overview of the two dominant broadband wireless technology standards in the market today – HSPA and WiMAX. After providing a definition, the essay describes their respective genealogies and the basic metrics for comparison, and outlines the commercial market rivalry context to enable informed judgements to be made.

Wireless Broadband technologies have evolved to be a key access component of the deployment of broadband infrastructure in both developed and developing countries around the world. This paper provides a tutorial overview of the two dominant broadband wireless technology standards in the market today – HSPA and WiMAX. After providing a definition, the essay describes their respective genealogies and the basic metrics for comparison, and outlines the commercial market rivalry context to enable informed judgements to be made.

The first question is: what wireless technologies are we talking about? In the Web World there are many sources of information on HSPA and WiMAX, but I recommend Wikipedia on the Web as my first reference point.

**HSPA:** In Wikipedia [http://en.wikipedia.org/wiki/HSDPA](http://en.wikipedia.org/wiki/HSDPA), ‘High-Speed Downlink Packet Access (HSDPA) (sometimes known as High-Speed Downlink Protocol Access) is a 3G mobile telephony protocol in the HSPA family, which provides a roadmap for UMTS-based networks to increase their data transfer speeds and capacity’. The more generic term HSPA (High Speed Packet Access) is used in this essay, covering enhancements in both directions.

UMTS is the European 3G mobile technology standard, one of several 3G technology standards currently accepted by the International Telecommunications Union (ITU). UMTS has been adopted in Australia by all of the telecommunications carriers and is referred to as WCDMA or 3G. The evolution to HSPA is seen as the current preferred technology evolution roadmap of telecommunications carriers, as it builds on their installed GSM and 3G network infrastructure. This essay considers the HSPA mobile technology at about 850/900 MHz, which can be used for fixed broadband access as well as mobile broadband. The next phase of technology evolution roadmap is termed Long Term Evolution (LTE) discussed at [http://en.wikipedia.org/wiki/3GPP_Long_Term_Evolution](http://en.wikipedia.org/wiki/3GPP_Long_Term_Evolution) which is still to be ratified but is being targeted at the UMTS extension band at 2.5GHz.

**WiMAX:** In Wikipedia [http://en.wikipedia.org/wiki/WiMAX](http://en.wikipedia.org/wiki/WiMAX) WiMAX is defined as ‘Worldwide Interoperability for Microwave Access by the WiMAX Forum standardised by the North American IEEE standards process. The WiMax Forum was formed in June 2001 by the equipment industry to promote conformance and interoperability of the IEEE 802.16 standard, officially known as Wireless MAN (or metropolitan area network). WiMAX aims to provide wireless data over long distances, in a variety of different ways, from point-to-point links to full mobile cellular type access. In practical terms this enables a user, for example, to browse the Internet on a laptop computer without physically connecting the laptop to a wall jack. The Forum describes WiMAX as ’a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL’.
While promising a revolution in mobile broadband quite distinct from HSPA, the major current application of WiMAX is for fixed access in developing countries and 'gap-filler' applications in developed countries. WiMAX conforms to two broad standards: the IEEE802.16d standard decided in 2004 for which certified equipment is available and the other mobile WiMAX IEEE802.16e standard decided in 2005 for which certified equipment is now starting to appear. Networks using this mobile standard are seen as both competitor and complimentary to those using UMTS/HSPA depending on the context. The WiMAX community of equipment vendors and operators have focused on the 2.5GHz and the 3.5GHz bands for initial mobile WiMAX equipment availability.

The main thrust of this tutorial essay is on the technical capability comparison between 3G/HSPA and WiMAX for wireless broadband, including the likely timing of the availability of equipment and new features such as MIMO. My observation from experience is that many supposedly 'fabulous' technologies often take decades to reach the market and only occasionally deliver the projected commercial gains espoused at the outset. While 'fixed' WiMAX technology is already a commercial success, 'mobile' WiMAX is still very much the challenger to HSPA although in the last 24 months WiMAX has had some success. The longer-term view is more contentious, and abounds in hyperbole where the global rivalry between what is seen as the old 'telco model' and the new 'consumer content and devices' model has been increasing in intensity, at least until the current financial melt down.

Before going on to compare the two broadband wireless technologies, a basic introduction to link budgets is required to understand the range and data rate limits of all of wireless broadband technologies. Firstly consider the downlink transmission from the base station over a distance to a terminal device. There are three basic components that determine the link budget:

- The effective radiated power from the base station transceiver, which will depend on the power radiated, amplified by the directional antenna at the base station. Typically a base station will use a 120-degree sector antenna.
- The path loss over the distance to the receiver. For line of sight (LOS) the path loss increases with the square of the distance. (i.e. the loss increases by 6dB for each doubling of the distance) The usual system nominal coverage is greater than LOS in order to serve more users with a single base station and uses the fact that wireless transmission refracts over the horizon. The path loss beyond LOS increases more steeply depending on frequency and terrain. This path loss can be reduced by increased antenna height (i.e. to preserve LOS) and using a directional antenna. For the fixed application the receiver can use a directional antenna on the roof of the house that results in a significant increase in link margin.
- The minimum required received power at the receiver for a prescribed bit error rate is a measure of sensitivity, and this measure is directly related to the bandwidth of the modulated signal and the modulation scheme as they are called. For example, a high order modulation such as 64QAM allows a greater bit rate per unit of spectrum requires more received power. The spectrum efficiency factor is quoted in bit/s/Hz and varies between about 1 up to under 5 for 64QAM.

One must also consider the uplink budget, which operates to different constraints; for example systems are often 'up-link limited' due to the limitations of the mobile. Further when comparing
overall system spectrum efficiency between wireless systems and/or technologies, one needs to consider 'frequency re-use' over the service area providing contiguous coverage. A discussion of potential re-use factors and how they depend on system parameters and propagation factors (eg frequency and terrain) is beyond the scope of this essay. Suffice it to say that equipment vendors often only consider link spectrum efficiency, and that can be misleading.

Overall, the development of wireless technologies is best exemplified by the mobile phone revolution. The growth in capacity in less than two decades has been amazing – but so has the development of 'fixed' technologies, which have very different performance and cost trade offs to wireless. They are complementary technologies, and while comparisons of fixed and mobile technologies are a source of continuing rivalry amongst engineers, these two technology families should not be considered as substitutes as economists would see it. Intense rivalries between technology standards are not new, and the rivalry in the late 1980's between the GSM standard from Europe and the CDMA standard from North America for digital mobiles dominated the industry discussion in Australia at the time.

These debates reinforce the importance of the appropriate radio spectrum and industry standards to enable a commercially scalable wireless technology. However, unlike the evolution of mobile technologies that have forged and secured international agreement on spectrum over twenty years, WiMAX, the 'new boy on the block', has faced the challenge of finding suitable unoccupied radio spectrum on an international basis. While making significant headway in just a few years, the spectrum bands for WiMAX are still fragmented to a degree within the major regions of the world and this has been an obstacle to the timely development of low-cost globally compatible equipment.

To compare wireless technologies one needs to consider the industrial embodiment of the technologies into commercially available equipment that can be engineered into systems to a standard to achieve scale economies. Broadly comparing the two embodied technologies then, HSPA technology has the advantages of being a more proven product with many networks being rolled out around the world compared to those using mobile WiMAX technology. Fixed WiMAX product is certainly available and being deployed. Given the global growth in HSPA networks under way, economies of scale in HSPA terminal equipment are already being seen in the 2.1GHz band. However, WiMAX promises a better alternative evolution path for new operators, offering higher data capacities for fixed rural users and a choice of potential frequency bands. The WiMAX camp argue that the broad adoption of future mobile WiMAX in our volume city markets, more aligned with the broader consumer device and content revolution, promises to offer similar scale economies to GSM in a very short period. Thus WiMAX is more a revolution than an evolution, building on the back of the current success of WiFi technology that enables every laptop computer to access an office Ethernet or public WiFi network for nomadic access to the Internet.

Essentially the technological difference of WiMAX over 3G/HSPA is that the architecture is built in modules or sub-carriers rather than a single wideband modulated carrier\(^3\). From an architecture perspective, WiMAX offers the prospect of greater flexibility to enable the utilisation of available bandwidth, mix of services and variable traffic asymmetry. To support higher bit rates closer to the base station current WiMAX compared to HSPA\(^4\) uses very high order modulation schemes up to 64QAM and with 10MHz can offer 8Mbit/s per sector and potentially higher bit rates with the greater bandwidth available. A WiMAX service provider in Australia
could potentially have access to some 100MHz at 2.3GHz for fixed rural application and so one might hope the data rate can be increased with demand.

Access to spectrum bands that are in common with large markets around the world is a key issue for wireless broadband where for rural application, lower bands are preferable for mobile services in countries with smaller markets such as Australia. For mobile services operation at 2.3GHz, mobile WiMAX is at a disadvantage compared to mobile services operating at 900MHz. However, a fixed customer installation using a higher gain rooftop antenna enables a WiMAX system at 2.3GHz using only 10MHz to match HSPA data speeds up to a distance of about 19km. Comparison between HSPA and WiMAX for fixed rural broadband requires a very different perspective from the widely discussed comparisons for an urban mobile broadband application. Access to more than 20MHz for WiMAX would suggest the potential for even higher data speeds for WiMAX compared with HSPA, but early WiMAX implementations constrain this possibility in the medium term.

Global standards are important and while HSPA has been long accepted as one of the principal standards in the ITU IMT2000 family, WiMAX at 2.5GHz at least has been recognised by the ITU as part of IMT2000 that was important in Europe for the forthcoming spectrum auctions at 2.5GHz. In the longer term, with WiMAX accepted into the ITU IMT2000 standard, the standards for 4G (called IMT-Advanced by the ITU) will likely utilise OFDMA, the fundamental technology that underpins WiMAX. The WiMAX evolution path has many technical advantages over the alternative LTE (Long Term Evolution) but commitments by a number of major wireless carriers over the last 12 months to deploy the as yet unratified LTE have implications for what will emerge as the future 4G mobile broadband standard.

Radio spectrum availability, including its impact on equipment availability and effective deployment, is a key issue for wireless broadband. Both the availability and sufficiency of suitable spectrum bands for the application of WiMAX in Australia are crucial issues in any comparison of HSPA offered by Telstra at 850MHz, now being followed by Optus and Vodafone at 900MHz. Two bands of particular interest to both WiMAX and HSPA (and LTE) are the 2.5GHz band in the near term and the 700MHz band, available in the medium term as a result of the transition from analogue to digital TV (by 2013 in Australia). The 700MHz spectrum, termed the ‘digital dividend’ spectrum, was auctioned in the US earlier in 2008 and two of the large new spectrum holders AT&T and Verizon have committed to LTE. On the other hand, the 2.5GHz band is the focus for mobile WiMAX to be deployed this year by Sprint-Nextel and BT in the UK has announced its objective of bidding for the 2.5GHz band to deploy mobile WiMAX.

In Australia there are three types of spectrum licences:

- an **apparatus licence** for specific transmitter/receiver licensing charged on a per terminal basis,
- a **class licence** to allow a variety of low power and thus short range devices and
- a **spectrum licence** that is not specific to particular technologies and subject to broad non-interference limitations charged at market dependent rates.

While a class licence is free, requiring no specific licence fee or registration, the spectrum is intended for many users and the emitted power restrictions limit the range of operation compared to the use of spectrum licences at the same frequency. For example transmitters in the free class-licensed 5.8GHz band would be required to operate at some 12dB lower power (i.e. < 10% of
the power) than a transmitter in a licensed band such as 2.3GHz, which therefore impacts on the range of the link. Thus network operators generally prefer spectrum licences, although they can be costly, as they allow full control of spectrum utilisation and assure non-interference – whereas small players such as ISPs or communities who cannot afford to buy spectrum licences prefer class-licensed operation.

It is useful to compare the development of the WiMAX concept out of the preceding WiFi technology. WiFi technology uses free ‘public shared spectrum’ and is now a low cost part of every laptop. WiMAX was originally intended to develop in a similar way but WiMAX requires significant range and more complex radio planning than WiFi, which has lead to the current focus on licensed spectrum. The original concept promoted by Intel envisaged that WiMAX would be an evolution of the WiFi revolution, operating in unlicensed spectrum with low cost WiMAX chips integrated in every laptop. This development would allow low-cost Internet access from anywhere, anytime. While the WiMAX application context still envisages low-cost WiMAX chips, the equipment industry is now primarily focused on a number of licensed bands to assure network economics and service quality. The telecommunications operators want to use exclusively licensed^9 spectrum in preference to class licensing.

For rural application, lower frequencies are preferred as they allow longer propagation distances, and therefore enable a greater possible coverage area per base station, particularly for mobile stations. Frequencies below 1GHz have the added advantage that propagation does not need to be line-of-sight. While for fixed application at higher frequencies this propagation range can be increased with directional antennas, this option is more challenging for mobile application. The advantage of higher frequencies, such as those above 1 GHz, is that greater bandwidth is potentially available to operators, thus allowing higher bit rates. Higher bit rates are inevitably associated with being closer to the base station, whatever wireless technology is used!

To achieve sufficient scale for equipment development, the equipment industry develops equipment in different bands with priority related to the potential market size for application. It is therefore critical for smaller economies like Australia to open up spectrum bands that match these mass-market bands for which equipment is being developed. Thus this essay focuses on the bands that are emerging for near term WiMAX equipment development namely, the 2.3GHz and 3.5GHz bands, in comparison with many countries around the world.

Further spectrum at 2.5GHz has been identified by the ITU and cleared in Europe for extension of IMT2000. It is referred to as the IMT2000 extended band but a number of countries in Europe intending to auction this spectrum band in about 2008 are open to the use of WiMAX in this band. These bands had been designated for IMT2000 technologies but the WiMAX community, particularly the equipment supply industry, have been successful in having WiMAX accepted into the IMT2000 family of acceptable technologies. In the near term the two broad bands that the equipment supply industry and country spectrum regulators are focusing on to allow application of WiMAX technology are the 2.5GHz bands^10 in North America and the 3.5GHz band in Europe and a number of countries in Asia have made spectrum available.

To decipher the ‘marketing’ hype of the supply industry, it is important to have an understanding of the interdependence of the various performance characteristics that determine the relative capabilities of the two wireless broadband alternatives. While it is not apparent from corporate marketing information from vendors, there are inevitable trade-offs involved in assessing
the claims of the equipment supply industry and their operator customers. ‘Hero Experiments’, as they are termed in the industry, stress one or two of the system parameters at the expense of all the others and overall system reality in order to capture the imagination of non-technologists. However, such publicised information is a potential source for confusion by the non-technologist legislator, regulator or bureaucrat trying to understand the various functional trade-offs comparing technology platforms for broad application. Unrealistic expectations of wireless broadband technology are commonplace because of the lack of understanding of the fundamentals of wireless and the intrinsic trade-offs in a realistic system. Statements from credible sources like the OECD like 'The technologies behind WiMAX should allow for data speeds of up to 40Mbit/s over a distance of 10 kilometres using relatively inexpensive equipment' can be very misleading.

Many parameters need to be considered in a comparison between HSPA and WiMAX depending on the application context. This essay considers the application to fixed rural broadband so as to develop of an understanding of the basic attributes of the two technologies and how trade-offs in performance parameters are treated in planning wireless broadband networks. Performance metrics enabling comparison of different scenarios are a first requirement in any framework. Further, many of them are 'network centric' in the sense that they provide an engineering template for network design, but it is often a challenge to relate these to 'user centric' performance, as these are statistical in nature. Furthermore, the user bit rates quoted for both technologies are for lightly loaded systems (i.e. <50% loading). The basic metrics used in this essay are summarised as follows:

- **User Bit rate [Mbit/s]** – This is the user experience bit rate; only a statistical measure can be given as the Peak bit rate is only applicable to users close to the base station (BTS) (i.e. the dominance zone) for lightly loaded systems.
- **Cell-edge bit rate** – This bit rate is normally planned down to the 'lowest tolerable' bit rate to support standard services e.g. 64 kbit/s is commonly used
- **Cell Throughput [Mbit/s]** – This bit rate relates to network characteristics and is normally measured based on an actual BTS on a sector basis where a cell has 3 or 4 sectors per cell. For radio planning and technology evaluation, this is typically calculated by averaging the user bit rates ranging from the minimum bit rate up to the peak bit rate supported by the different Modulation and Coding schemes (MCS)
- **Spectral Efficiency** – This efficiency measure is expressed as the ratio of the Cell Throughput over the spectral bandwidth. Typical values for wireless technologies in the past have been from 0.2–2.0 [bit/s/Hz] but both WiMAX and HSPA+ are exceeding the previous benchmark, reaching 5bit/s/Hz.
- **Cell Range [km]** – This is the maximum distance from the BTS to the mobile while supporting both the uplink and downlink minimum bit rates. The cell range is set based on a planned coverage probability of the minimum bit rates (typically 85–95%)

Normally, networks are limited in the uplink due to the comparatively lower power of the mobile terminals compared to the BTS.

It is important to understand the factors that affect performance and to do this in a way that reflects a common frame of reference. For example, comparisons of spectral efficiency between HSPA and WiMAX often don’t consider the technologies at the same equivalent stage of market
readiness. While this is understandable, given that suppliers of technology will always tend to overstate the case for their technology based products, an understanding of trade-offs is essential.

In broad terms, the factors affecting performance are:

- The likely user bit rate experienced by the broadband wireless user is much more variable, involving many more interdependent factors, than for users on DSL systems.
- More spectrum bandwidth is required for higher bit rates, but more available bandwidth does not mean higher bit rates can initially be offered due to equipment availability.
- A user more distant from the base station although within a nominal coverage may see reduction in data speeds. The often-quoted rates are only experienced in 'high dominance areas' or clear line of sight of the base station.
- BOTH the uplink and downlink need to be considered where the two data rates can be different (eg usually assumed to be asymmetric in the past). Given the changing balance of traffic asymmetry, this can be a source of different perspectives.
- There is a significant need for signalling overhead which affects actual capacity that can be very significant in more fully loaded systems.

All of these areas are significant in their own right and are discussed in broad terms as they affect the comparisons and are crucial to the framework for understanding claims by the various parties.

For example with respect to bit rate, suppliers of HSPA talk of a peak bit rate of 14.4Mbit/s – whereas taking into account coding overheads, a realistic peak figure is 9.6Mbit/s; and this data rate can be further limited by initial limited code and terminal capabilities. The user bit rate would be less for mobile operation. Similarly in the case of WiMAX, the figure of 42Mbit/s is often mentioned, whereas even in a very good radio environment about 19Mbit/s\(^\text{11}\) is more realistic, which for a 1:2 TDD ratio, is greater than that for HSPA for the same 10MHz amount of spectrum. The reasons for this difference are related to the higher order modulation schemes\(^\text{12}\) and TDD flexibility for WiMAX. If the comparison had been made with HSPA+ and WiMAX with a 1:1 TDD ratio, they would be the same for the same spectrum allocation. It is illustrative of why engineers say: ‘You never get anything for nothing’ and businessmen say ‘There is no such thing as a free lunch’.

My overall observation of any comparison of the two broadband wireless technologies (including this one) is that differences in application timing and market assumptions result in different conclusions. Developing an understanding of the strengths and weaknesses of the two technologies is in many ways the easy part. The rivalry between the technology camps as expressed in the press would have you believe that it’s a technology issue, but the difficult judgement that one needs to make as an operator or service provider is the likelihood of a sustained supply of cost-competitive industrial embodiment of the technologies that can be cost effectively deployed!

ENDNOTES

1. MIMO http://en.wikipedia.org/wiki/Multiple-input_multiple-output stands for Multiple-input Multiple-output technology that exploits the ‘channel memory’ (ie multipath channel) to increase data capacity.
2. The increased need for bit coding protection decreases the theoretical efficiency possible.
In the mid 1970s at the dawn of data communications this was referred to as ‘parallel data transmission’ and didn’t require complex adaptive equalisers!

For HSPA the use of 64-QAM is part of the HSPA+ further development.

At least the radio access technology component.

The equipment variety is specified including power limitations to allow random usage in the community. For example 2.4GHz is used for microwave ovens, WiFi and Bluetooth in mobile phones; unintended interference can occur and is accepted under the regulations.

While not specific to GSM mobile technology for example, the Spectrum Marketing Plan developed by the ACMA is framed to best package spectrum blocks for commercial usage.

ACMA would likely be concerned if one single operator using the band effectively denied use by smaller players.

‘Private park’ licences under consideration by the ACMA may be a future option but are not discussed in this essay.

Equipment is also being developed for the 2.3GHz bands which is close to 2.5GHz for markets like Australia and Malaysia.

This is based on 1:2 uplink to downlink TDD ratio to match the typical data speeds asymmetry.

This comparison is with HSPA not HSPA+ which will also use 64-QAM to get higher peak bit rates in the same bandwidth closer to the base station.
INTRODUCTION

The deployment of wireless broadband networks to deliver high-speed broadband services to regional and rural Australia is increasingly being examined as a viable alternative to the deployment of wired technology. Whilst last-mile connectivity (i.e. the connection which links the end-user to the network backbone) can be very expensive for carriage service providers deploying wired technology, the deployment of wireless technologies, typically characterised by lower capital and operational costs, can provide a more effective solution to the connectivity problems presently experienced by these remote demographics.

It is recognised that the provision of high speed broadband is critical to communities in regional and rural areas as it serves to expand economic capacity and stimulate commerce. However, accessibility and availability of broadband networks are generally lower in rural areas than the urban areas in both developed and developing countries due to low population density and poor economies of scale. Recent developments in wireless network technology however have the potential to provide access to broadband technology in regional and rural communities at reasonable cost. Hence, wireless technology has the potential to empower local communities and expand economic capacity and commerce in regional and rural areas.

The central purpose of this paper is to explore the alternatives presently available for the deployment of wireless broadband networks for regional and rural Australia. The alternative technologies will be analysed in terms of data rates and coverage distance in order to determine the best possible last-mile wireless connectivity solution for regional and rural Australia. The paper begins with an analysis of the broadband networks and services presently prevailing in Australia. This discussion is followed by an analysis of the motivation for the provision of wireless broadband networks in remote and rural areas in the country and the available technology options. Building upon these findings whilst allowing for geographical and radio propagation uncertainties at this stage in some regional and remote areas of Australia, the paper outlines certain recommendations as to suitable last-mile technologies to support connectivity for such areas. The proposals are based both on appropriate technology and identified economic drivers of broadband deployment.

THE CHALLENGE OF LOW POPULATION DENSITY

It is widely agreed that the provision of affordable access to effective broadband networks and services is critical to the development of e-commerce and the success of the national economy through enhanced global competition of local firms and industries. Technology, particularly Information and Communication Technology (ICT), has made a significant contribution to Aus-
tralia’s strong productivity growth, accounting for some 40 to 70 per cent of the total productivity growth in manufacturing and service industries between 1984–85 and 2001–02 (Department of Communications, 2005). Additional to the increased productivity and economic benefits, areas such as education, health and community services greatly benefit through the deployment of broadband networks and services at an affordable price (Department of Communications, 2006a).

The definition of ‘broadband’ can have different meanings in different contexts. Generally, the term ‘broadband’ refers to a baseband signal with a minimum data rate equal to or greater than 64 kbps where usage is based on data volume (megabytes) rather than connect time. The Australian Communications Authority (ACA) notes that providing broadband wirelessly called as ‘broadband wireless access’ involves connection capabilities higher than 2 Mbps (House of Representatives Standing Committee on Communications Information Technology and the Arts [HRSCCITA], 2002, p. 2).

Australia covers an area of about 7.7 million square kilometres – a little less than that of the United States, about 50 per cent larger than Europe (excluding the former USSR) and 32 times larger than the United Kingdom (Australian Bureau of Statistics [ABS], 2000). In the 2006 Census (held on 8th August 2006), there were 19,855,288 persons usually resident in Australia and the resident population of Australia was projected to be 21 million approximately based on the estimated resident population at 30 September 2007 (ABS, 2008a).

Whilst Australia is not far behind in size, its population compared to Europe is 30 times smaller. Japan's population density is 336 persons per km\(^2\) and the United Kingdom's is 244 persons per km\(^2\), compared to Australia's 2.6 persons per km\(^2\) (Geo Science Australia, 2005). Australia's population density varies greatly, ranging from very low population density in remote areas, to very high population density in the inner city areas. The ACT had the highest population density of the states and territories in June 2007 with 145 people per square kilometre, followed by Victoria with 23 and New South Wales with 9. The Northern Territory had a population density of only 0.2 people per square kilometre, the lowest of the states and territories (ABS, 2008a).

For infrastructure deployment requiring cabling, low population density is a significant disadvantage as the people living in rural and regional areas are dispersed over large areas. As of 30 June 2007, 68.5% of Australia’s population resided in the major cities of Australia and only 2.3% of the population resided in remote or very remote Australia (ABS, 2008c). The density of population in the most populated urban cities in the country, Sydney and Melbourne, are respectively 2058/km\(^2\) (ABS, 2008b) and 1566/km\(^2\) (ABS, 2008e). Figure 1 represents statistical local area (SLA) population change in 2006–2007 and clearly demonstrates the increase or decline of population in the geographical units called SLAs.

A COMPARISON OF ALTERNATIVE BROADBAND TECHNOLOGIES

Broadband providers in Australia offer a range of technologies from fixed services Asymmetric Digital Subscriber Line (ADSL) to wireless and satellite broadband. At the end of December quarter 2007, there were 7.10 million subscribers to the Internet in Australia. This comprised 964,000 business and government subscribers and 6.14 million household subscribers.
Digital Subscriber Line (DSL) continues to be the dominant access technology used for non dial-up subscribers, with 3.81 million, or almost 73% of total non dial-up subscribers being connected using this means. Internet Service Providers (ISPs) operating in Australia as at 31 December 2007 are 421. Wireless technology continues to increase to over 481,000 subscribers at the end of the December quarter of 2007, compared with 186,000 subscribers at the end of the September quarter 2006. Satellite technology increased to over 58,000 subscribers at the end of the December quarter 2007. Internet connections with download speeds of 1.5 Mbps or greater increased to 2.51 million or 35% of subscribers in December 2007, compared to 1.13 million or 17% of subscribers at the end of September 2006.

Figure 2 presents the broadband technologies and their subscribers in the country at the end of December 2007. Most of the market is serviced by the 10 largest ISPs, including Telstra and Optus, which together provide services to 77 per cent of subscribers. Telstra is the largest provider of local and long distance telephone services, mobile services, dialup, wireless, DSL and cable Internet access in Australia. On the other hand, to provide services, Optus owns and operates
its own network infrastructure, as well as using the services of other network service providers, most notably Telstra Wholesale to provide broadband, wireless and dial-up Internet services.

For the purpose of the analysis, it is useful to consider in detail the nature and characteristics of each of the broadband technologies presently being offered in Australia, which are as follows:

**ADSL**

ADSL is a form of DSL, a data communications technology that enables faster data transmission over copper telephone lines than a conventional voice band modem can provide. Data transmission speed to the subscriber is higher than data transmission from the subscriber and hence the qualifier 'asymmetric' is used. The maximum transmission speed is from 2 to 8 Mbps and the maximum range is up to 2 kilometres (for 0.4 mm cable). Currently about 90 per cent of households can access ADSL broadband, providing maximum speeds of between 2 Mbps and 8 Mbps from a choice of 19 Internet service providers depending on the distance between the premises and the exchange. At 31 January 2007, there were 2,432 exchanges providing ADSL service coverage to 91 per cent of the Australian population (Telstra, 2006). But in some metropolitan and regional areas, network components are primarily installed to facilitate low data rate voice service rather than other broadband services.

Figure 3 shows the number of ADSL and ADSL2+ enabled exchanges in Australia.
ADSL2+

ADSL2+ services are provided outside the regulated broadband requirement of the national provider Telstra and as such are primarily enabled in areas where there is high interest. Fifteen service providers with 400 exchanges in metropolitan areas and regional centres have allowed for the provision of ADSL2+ services in the country. The delivering speed can be up to a maximum of 20 Mbps depending on the distance between premises and exchanges because of noise, interference and crosstalk generated in the system. Again, for the last mile connectivity in regional and rural Australia, ADSL 2+ can not provide connections and hence, a wireless technology solution is required.

HYBRID FIBRE CO-AXIAL (HFC) CABLE

HFC combines fibre network with co-axial cable for broadband network services. By using frequency division multiplexing, an HFC network may carry a variety of services, including analog TV, digital TV (standard definition and high definition TV), video on demand, telephony, and high-speed data. Services on these systems are carried on Radio Frequency (RF) signals in the 5 MHz to 1000 MHz frequency band. In this type of network, optical fibre is used in main paths (from head-ends to optical nodes) while coaxial cables distribute signals from optical nodes to subscribers. The maximum transfer rate is 30 Mbps to the subscriber and 10 Mbps from the subscriber.

The existing HFC networks in Australia offer a maximum data rate of 17 Mbps to 2.7 million premises in the major capital cities (Department of Communications 2006b). Optus and Telstra run the major HFC cable networks in Australia. Telstra's network passes 2.5 million homes in...
Adelaide, Brisbane, the Gold Coast, Melbourne, Perth and Sydney. Optus’ network is capable of servicing 1.4 million homes in Brisbane, Melbourne and Sydney. There is a considerable degree of overlap between these networks, resulting in an estimated combined coverage to 2.6 million homes. Telstra uses its HFC network for television and broadband services, as does Optus, which also uses HFC for voice telephony services.

While the HFC cable passes 2.25 million homes in urban Australia, only 1.4 million are 'serviceable'. Telstra’s Foxtel HFC network treats only seven per cent of the 2.5 million homes passed by its network as unserviceable (Bartholomeusz, 2008). There are a variety of reasons for this including network design, the practical difficulties of dealing with body corporate premises, and the bulkiness of the necessary equipment that has to be installed in each apartment. In regional Victoria, Neighbourhood Cable uses its HFC network to provide broadband, pay TV and voice telephony services, high-speed data services and virtual private networks in Ballarat, Geelong and Mildura.

**SATELLITE**

For rural and remote Australia, the satellite network has the attraction of offering additional bandwidth to connect these regions to international destinations. Satellite broadband services provide 100 per cent coverage of Australia’s land area. In April 2007, there were around 41 satellite broadband service providers operating in Australia, with most of these service providers being regional ISPs that resell satellite broadband to regional, rural and remote customers (Market Clarity Database, 2007). Satellite coverage of the Australian continent is provided by Orbcomm, Iridium, New ICO, Globalstar, Inmarsat, Intelsat (which acquired PanAmSat in mid 2006), SES Global, NewSat, Optus and iPStar. Satellite phones are used in remote Australia using local carriers Telstra and Vodafone and satellite operators including GlobalStar, New ICO and Inmarsat. However, the high costs and low speeds of satellite technologies have relegated them to be truly a last-option broadband technology. It is clear that without Australian Government subsidies, prices for satellite services would be significantly higher than those for other broadband technology platforms. Hence, it is unlikely that affordable broadband services can be provided in the regional and rural Australia with satellite coverage.

**OPTICAL FIBRE**

Australia’s main line telephony network relies primarily on optical fibre networks, with copper lines connecting households to local exchanges. The country’s inter-capital and metropolitan fibre optic transmission network traverse 44,645 km and 135,556 km respectively, equivalent to circling the Earth 4.5 times (Australian Competition and Consumer Commission, 42). The fibre ‘backbone’ is supported by a comprehensive carrier-operated microwave network consisting of 25,289 transmitters and base stations (Australian Competition and Consumer Commission, 45). Fibre to the node/kerb (FTTN/FTTK) and Fibre to the Premises/home (FTTP/FTTH) are the two main fibre-optic technologies being considered in Australia. In FTTN, fibre optic cable connects the telephone exchange to the cabinet on the street. Customers connect to this cabinet using traditional coaxial cable or twisted pair wiring. FTTK is similar technology and consists of fibre-optic cables which run to a platform that serves several customers. Each of these customers has a connection to the central platform via coaxial cable or twisted pair. FTTP/FTTH extends optical fibre directly onto the customers’ premises or business.
In Canberra, TransACT Communications offers an FTTK network in which optical fibre is taken to within 300 metres of the connection to the home, from which very high speed DSL (VDSL) is used to carry voice and data transmissions over copper to around 45 to 65 customer premises. In May 2007, TransACT announced the rollout of a FTTH development in the community of Forde, which will provide download speeds up to 30 Mbit/s and 10 Mbit/s for uploads. FTTH services will be provided to more than 1,000 homes in the community by 2013 (TransACT, 2007). The Queensland Government has initiated Project Vista, which plans to bring a 100 Mbit/s broadband service to Brisbane through a deployment of FTTH technology. The project is estimated to cost $550 million and is scheduled for rollout in 2008. The Victorian Government has developed the Aurora project, which aims to deliver FTTH broadband services to approximately 8,000 residents in the Aurora estate in Melbourne’s northern suburbs. Residents will be offered voice telephony, data and video services over the network, including pay TV, free-to-air television and the emerging video-on-demand (VOD) services (Australian Government, 2008). The Tasmanian Government is pursuing the TasCOLT project, which is a pilot project with aerial fibre cabling using new-generation passive optical networking technology.

However despite the above, per-household deployment costs for these technologies are presently too high to attract investment by broadband providers. Therefore, regional and rural areas in Australia require a combination of technologies to provide affordable broadband services rather than the complete deployment of fibre itself.

WIRELESS

There are approximately 204 companies providing wireless services in Australia, with more than half of these companies providing services to regional areas of Australia (Market Clarity Database, 2007). At present, 60 wireless broadband providers are working in the country. Future proposals suggest that up to 12 Mbps or more are expected to be available using wireless technology for broadband services.

Wireless broadband can provide last-mile connectivity to customer premises using a number of technologies in different spectrum bands. Broadband wireless access (BWA), Fixed wireless access (FWA) and Wireless access services (WAS) are types of services to provide wireless Internet connections in Australia. Telecommunication carriers, ISPs and other carriers using a radio connection from end-user to core network can deliver wireless broadband services. A variety of different technologies can be used for BWA, FWA and WAS services, and these will be detailed in the sections to follow.

MOTIVATION FOR WIRELESS BROADBAND CONNECTIVITY

As detailed above, the existing broadband technologies being offered in Australia primarily focus on main cities and areas closer to main cities. A study by the Bureau of Rural Sciences, titled '2008 Country Matters: Social Atlas of Rural and Regional Australia', has found that only 24 per cent of remote communities have access to broadband, compared to 46 per cent of homes in major cities.

Hence, to serve the 835,000 premises of regional and rural Australia, last-mile connectivity becomes a crucial challenge. A relatively small population spread over vast Australian regions
(especially in the remote and rural areas) makes it difficult to use wired-based technologies particularly in the last-mile connections to customer premises.

Currently, ADSL exchanges cannot access most of the remote and rural parts of Australia and broadband services are not being delivered in these regions with this technology. The high capital and operational costs associated with such expansion has to date deterred investment.

In comparison, as wireless technology involves lower capital costs and operational costs, it is a more effective means of linking these demographics. On the basis of the present state of technology, coverage distance and data rates are sufficient to support broadband connectivity using wireless technology.

Additionally, the current dilapidated state of wire-line infrastructure in regional Australia strengthens the need for wireless connectivity option for last-mile connectivity. Therefore, it is high time to consider possible candidate wireless broadband technologies to provide sufficient broadband connectivity from the backhaul network to the end-user premises in these parts of Australia.

To further analyse the possible wireless broadband technology options in the last-leg of the network in regional and rural Australia, a number of possible options will be canvassed below. The basic objective of this analysis would be to find out pros and cons of technology issues of candidate wireless broadband technologies considered for this research. Later, we will narrow down our technology options based on this analysis. Based on the selected technology alternatives, some proposals would be made to find out a compromise for the last-mile connectivity in rural and regional Australia.

A COMPARISON OF ALTERNATIVE LAST-MILE TECHNOLOGIES

Building on the consideration of the alternative technologies available to support the provision of broadband services, it is necessary to consider the alternative wireless last-mile technologies. These include:

1. Wireless Local Area Network (WLAN)
2. 3G Mobile
3. Satellite
4. Fixed Wireless Access (FWA) and Wireless Local Loop (WLL)
5. Worldwide Interoperability for Microwave Access (WiMax) and Long Term Evolution (LTE).

WLAN

WLAN is a type of network that is established by the linking of two or more devices or computers using IEEE 802.11 standard and its successors. Network Interface Cards (NICs) are inserted in the devices or computers that need to be connected wirelessly using WLAN. WLAN needs to be operated in Ad-Hoc wireless mode for wider outdoor coverage in the regional, rural and remote Australia. In this mode, NICs between two computers or devices connect wirelessly forming a network directly. To get a better coverage distance, NICs can be connected to directional antennas rather than their own in-built antennas. A bi-directional amplifier between the NIC and the dir-
ectional antenna can increase the coverage distance adding up some costs. This kind of point-to-point WLANs can provide 11 Mbps to 10 km or 1 Mbps to 40 km distance in regional Australia.

ISPs can provide this kind of wireless coverage over substantial regional or rural areas. In this process, a high bandwidth backbone network connection can be connected using an access point of WLAN. The access point signal can then be directed by using omni-directional antennas with suitable radiation pattern to serve the population of that area. In this process, each subscriber should have an NIC connected to his/her device connected with directional antenna to access the signal in a point-to-point fashion. A speed of 11 Mbps is achieved using this kind of technique in an area with radius 5 km. Extended coverage distance is possible with lower data rates. In Australia, 802.11 can be deployed on the following bands (HRSCCITA, 2002, 18):

- 2400 – 2463 MHz at 4W Effective Isotropic Radiated Power (EIRP)
- 2463 – 2483.5 MHz at 200mW EIRP
- 5150 – 5350 MHz at 200mW EIRP
- 5725 – 5875 MHz at 1W EIRP
- 5795 – 5815 MHz at 2W EIRP.

3G MOBILE

Third generation mobile services can provide both voice and broadband data access. In this process, data can be supplied in both fixed and mobile devices. 3G mobile technologies include Code Division Multiple Access (CDMA) 2000, Wideband CDMA (W-CDMA), Universal Mobile Telecommunications System (UMTS). General Packet Radio Services (GPRS) and Enhanced Data Rates for GSM Evolution (EDGE) are falling under 2.5 G technologies in between the transition from 2G to 3G technologies and hence will not be discussed.

With CDMA-2000, a data rate of 144 kbps per customer is possible using 1x EV variant. Nortel proposes developing a progressively modified 800 MHz CDMA system (a 3G technology) based on existing CDMA infrastructure, and expects it to be able to provide both mobile and fixed wireless data access for 97% of the Australian population (Nortel Networks 2002, 13–20). Nortel believes that its CDMA2000 product could solve much of Australia’s regional Internet problem (King, 2002).

W-CDMA systems work on a RF bandwidth of 5 MHz, much wider than the CDMA2000 carrier size of 1.25 MHz. This wider carrier size helps the receiver to better separate different incoming signals and to enhance performance. 144 kbps per customer data rate is also experienced in this standard.

Hutchison was the first to offer a service using 3G technology in Australia. In March 2007, the network was upgraded to the High Speed Downlink Packet Access (HSDPA) protocol, allowing typical download speeds ranging from 600 kbps to 1.5 Mbps, with a theoretical maximum of 3.6 Mbps (Zdnet, 2007). HSDPA is a family standard under UMTS.

Optus has planned use of 3G in the 900 MHz frequency range to address smaller regional centres as well as rural and remote locations. The new network is reported to initially provide speeds of up to 3.6 Mbps using the HSDPA protocol, with an eventual upgrade to 14.4 Mbps planned (Optus, 2007).

Telstra started its own 3G network in 2006 called ‘Next G’ using 800 MHz 3G UMTS technology. Telstra claims that coverage now reaches 98.8 per cent of the population, covering
1.9 million square kilometres (Telstra, 2007). In April 2007, Telstra claimed that its Next G network was capable of providing network speeds of up to 14.4 Mbps in the downlink and 1.9 Mbps in the uplink, yet user side hardware is only capable of a maximum 7.2 Mbps. Telstra recently announced that they have the largest mobile phone subscribers in Australia (9.7 million) (Cellular-news, 2007).

In October 2006, Vodafone announced that it had switched on HSDPA on the network, increasing download speeds to Vodafone customers up to 1.8 Mbps (up from 384 kbps) (Australian Communications and Media Authority [ACMA], 2007, 22).

Figure 4 shows the increase of 3G mobile phone subscribers along with the fall of fixed line subscribers between 30th June 2006 and 30th June 2007 (ACMA, 2008). It is evident from the figure that 3G mobile services and mobile services in general will play a very important role in regional, rural and remote parts of Australia.

![Figure 4 Trends of Mobile Phone Subscribers in Australia](source)

SATELLITE

Satellite broadband technologies are offered both in backbone transmission networks and last-mile connectivity (i.e. local area access networks). Satellite can be a backbone transmission networks for remote or rural areas where fibre or copper networks are not available. Many satellites (mostly US based) have some coverage over Australia, but C&W Optus and PanAmSat have satellites (GEO) with Australian dedicated footprints (Technology Applications Group, 2001).

Bigpond, a subsidiary Internet service provider of Telstra, provides satellite Internet connections for regional customers who live too far away from ADSL or cable exchanges. Both One-way satellite and 2-way satellite were used by Bigpond. Recently, from 30 November 2008,
BigPond will no longer provide one-way Satellite (BigPond Satellite Info, 2008). Speeds on BigPond Satellite range from 256 kbps down/64 kbps up to 800 kbps down/128 kbps up.

The first domestic player in the Satellite market, Optus, has fleet of satellites – Optus A1, A2, A3, B1, B2 and B3, C1, D1 and D2 – which cover Australia, Papua New Guinea and the Southwest Pacific islands. The satellites are used along with the international satellites such as Intelsat, PanAmSat and Asiasat to provide broadcast services, VSAT (very small aperture terminal) services and other satellite services. SatWeb and Satdata are two forms of satellite services offered by Optus. SatWeb offers one-way or two-way high-speed access to the Internet with data speeds up to 200 kbps in one way and 400 kbps in two-way connections. SatData (Internet protocol-based broadband via satellite) offers two-way point-to-point connections to wirelessly connect remote sites forming a WLAN using IEEE 802.11 standard. Data rates from 8 Mbps to 36 Mbps are possible through this process.

The Australian Broadband Guarantee Project started in 2007, aimed at ensuring that all Australians living in regional areas have access to metro-comparable broadband and provided subsidies for the rural customers using satellite broadband connections. But still, as a last-mile connectivity approach, satellite broadband connectivity proved to be a higher cost alternative than other broadband wireless technologies.

FWA AND WLL

WLL connects the end-user to the core network. The core network could be the public switched telephone network (PSTN), an integrated services digital network (ISDN), the Internet or a Local/Wide area network. When the end-user or a customer connects to the core network by means of equipments installed in a fixed location, it is termed FWA. WLL can also be implemented using wireless access with extended roaming capabilities termed as BWA. Therefore, in general, WLL can be implemented using a number of different wireless and radio technologies whether it is FWA or BWA. In our analysis in sections to follow, we will segment the description of FWA access based WLL and BWA based WLL (such as WiMAX) to better differentiate the feasibility status of their respective deployment in remote, rural and regional parts of Australia.

FWA solutions can be either terrestrial-based or space-based. Terrestrial-based systems are classified as Local Multipoint Distribution Systems (LMDS) and Multichannel Multipoint Distribution Systems (MMDS). A space-based system is suitable for remote areas where cable-based systems or terrestrial based systems such as 3.4 GHz wireless broadband systems are not economic.

LMDS generally works in the microwave range across the 26 GHz and 31 GHz. It is a particularly suitable point-to-multipoint technology for outer urban and rural areas where line-of-sight communication is possible within a range of 15 to 25 km. Minimal installation costs are required for deployment of LMDS as it only requires the network interface unit and antenna to be set up on the customer's roof top. The communication is established between the Base Transceiver Station (BTS) and customer through line-of-sight.

MMDS works below the 10 GHz range. It can support 3.2 Mbps per base station and a maximum coverage of 20 to 40 km, which is generally more than LMDS. Like LMDS, it can provide point-to-multipoint voice and data services. It is more commonly used for pay-TV applications in remote or sparsely populated areas. Table 1 below represents the frequency spectra used for LMDS and MMDS applications in Australia. AAPT and Optus have LMDS network. On the other hand, AUSTAR and Akal have MMDS coverage in Australia. AAPT’s LMDS offers
2 Mbps data rate throughout various regions of regional Victoria for data, Internet and voice applications. It has been noted by m.NET that in the case of LMDS, a lack of equipment availability and a high cost structure has seen limited deployment in Australia (HRSCCITA, 2002, 43). Also, overseas experience suggests that strict line-of-sight requirements and sensitivities toward the proliferation of base station towers need to be addressed before LMDS is a viable alternative to the fixed line platforms.

<table>
<thead>
<tr>
<th>Service</th>
<th>Band</th>
<th>Frequency range</th>
<th>ACA Licensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMDS</td>
<td>2.3 GHz</td>
<td>2302–2400 MHz</td>
<td>spectrum licensed</td>
</tr>
<tr>
<td>LMDS</td>
<td>27 GHz</td>
<td>26.5–27.5 GHz</td>
<td>spectrum licensed</td>
</tr>
<tr>
<td>LMDS</td>
<td>28 GHz</td>
<td>27.5–28.35 GHz</td>
<td>spectrum licensed</td>
</tr>
<tr>
<td>LMDS</td>
<td>31 GHz</td>
<td>31.0–31.3 GHz</td>
<td>spectrum licensed</td>
</tr>
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Table 1: Frequency spectrums for LMDS and MMDS applications in Australia

These systems have a range of approximately 5 km and provide high data rates with approximately 100 watt of power (HRSCCITA, 2002, 43).

Unwired Australia Pty Ltd has announced plans to develop a national fixed wireless broadband network, operating in the 3.4 GHz band. In 2005, Australian Pay TV operator Austar, which owned licenses for 100 MHz of the 2.3 GHz spectrum Australia-wide, made a deal with Unwired Australia to swap spectrum for wireless broadband services across the country. In 2006, Austar United and Unwired together with Soul Company formed AUSalliance for the purposes of obtaining funding from the Australian Government’s Broadband Connect Infrastructure Program and rolling out a regional broadband network (Austar United, 2006). In 2008, Austar sold its 2.5 & 3.5 GHz spectrum licenses (previously used for MMDS applications) to the OPEL (Optus & Elders) consortium for AU$65 million which has been later cancelled by the current Federal Labor Government (Austar United, 2008).

**WORLDWIDE INTEROPERABILITY FOR MICROWAVE ACCESS (WiMAX) AND LONG TERM EVOLUTION (LTE)**

WiMax is an IEEE 802.16 standard-based technology enabling the delivery of last-mile wireless broadband access as an alternative to cable and DSL. To accommodate non line-of-sight access over lower frequencies, IEEE 802.16a includes support for mesh architecture. 802.16a operates in the licensed and unlicensed frequencies between 2GHz and 11GHz. IEEE 802.16 can provide wireless access using both point to point links and mobile cellular access. These connections would be ideal for connecting a single location in a village or town via a high-speed wireless link back to the nearest fibre point of presence.

In particular, IEEE 802.16d is termed ‘fixed WiMax’ since it does not provide mobility. IEEE 802.16e is called ‘mobile WiMax’ and this version is one of the five major wireless standards referred to as ‘3.9 G’. WiMax technology is particularly suitable for areas with low population and flat terrain. For countries that have skipped wired infrastructure as a result of prohibitive costs and unsympathetic geography, WiMAX can enhance wireless infrastructure in an inexpensive, decentralised, deployment-friendly and effective manner (Wikipedia, 2008a).
IEEE 802.16d uses frequency in the range of 2 GHz to 11 GHz. Currently, there is no global licensed spectrum for WiMax. The WiMAX Forum has published three licensed spectrum profiles: 2.3 GHz, 2.5 GHz and 3.5 GHz, in an effort to decrease cost. Economies of scale dictate that the more WiMAX embedded devices (such as mobile phones and WiMAX-embedded laptops) are produced, the lower the unit cost (Wikipedia, 2008a). In general, the higher the frequency, the shorter the range WiMax signal can cover in an urban environment.

5.8 and 3.4 GHz were the planned frequencies to use for WiMax deployment in the recently terminated OPEL consortium (The 7:30 Report, 2008). In practice, with mobile WiMax technology, a maximum speed of 10 Mbps over 10 km can be provided with a line-of-sight environment, especially in the remote/rural areas. Fixed WiMAX is also seen as a potential standard for backhaul of wireless base stations such as cellular, Wi-Fi or even Mobile WiMAX (Wikipedia, 2008a).

Under the third generation partnership project (3GPP), LTE is the project name of a new air interface for wireless access. Increased capacity (100 Mbps download and 50 Mbps upload rate) and higher spectrum efficiency are possible with this technology. Using multiple antenna configurations, a maximum download data rate of 326.4 Mbps and upload rate of 86.4 Mbps can be expected. Most carriers supporting GSM or high speed packet access (HSPA) networks can be expected to upgrade their networks to LTE at some stage and is expected to be commercially available in around 2010.

**COMPARISON OF DATA RATES, COST EFFECTIVENESS AND ACCESS**

Based on the above analysis, it is clear that Australia has a number of wireless broadband technologies available for use by customers. In this paper, the main concern for the regional, rural and remote wireless connectivity solutions for last-mile connectivity in Australia has been to address the following three objectives:

a. Wireless broadband solution with reasonable data rate
b. Cost-effective and affordable technology deployment and
c. Create business opportunities through Internet access among rural people or people living in remote areas.

As discussed, generally the choice of wire-line or wireless technologies depends on the market and the services offered, on the basis of performance, price, quality of service, geographical coverage, user friendliness, customer service and customer satisfaction. Considering these factors, a wireless broadband solution for last-mile users has been a popular solution in Europe using WiMAX. On the other hand, the same WiMAX technology did not get full acceptance in the United States because the cost of deployment does not allow the desired return on investment (Wikipedia, 2008b). Wireless broadband connectivity can offer cheaper and faster deployment in specific circumstances where wire-line solution is expensive or difficult to reach. Hence, regional, rural and remote Australian territories can be provided with wireless broadband last-mile connectivity using a combination of wireless technologies. Again, the data rate and the cost of the wireless connectivity solutions to create business opportunities would be the drivers to determine which technology would be the best for a particular region in Australia.
Deploying wireless broadband technology can be a very cheap solution using the free licence spectrum of Instrumental, Scientific and Medicine bands at 2.4 GHz WLAN or WiFi. For example, Airnet in Adelaide and community groups such as Melbourne Wireless both use the free-access 802.11b WiFi band to establish broadband data connections (HRSCCITA, 2002, 43). Wire-line backbone networks can be connected with the end-users through WiFi in rural areas of Australia where regional town centres have fibre backbone networks. But in order to provide sustainability, licensed spectrum would be the best solution for infrastructure development in those regions planning future upgrade to higher bit rate services. With unlicensed spectrum a wireless broadband service could be offered to consumers in a certain location, but at any time unacceptable service interruption may arise if additional transmitters are deployed or sources of interference discovered within the service area (Nortel Networks, 2002).

From the service provider’s point of view, a service provider needs to achieve an acceptable return on investment for installed infrastructure and ongoing operational costs. Therefore viable business cases are required for the service providers as well as selection of appropriate technology for last-mile connectivity in Australian regional, remote and rural areas. On the other hand, users need to get the services at an affordable rate. It would be necessary to reduce the spectrum licensing costs from the Australian government as far as regional, remote and rural Australian territories are concerned. The Northern Territory government submitted that ‘the cost of spectrum must be kept low or offered at no cost where delivery is into remote communities’ (HRSCCITA, 2002, 74).

Based on current commercial offerings, satellite broadband is almost twice the price of terrestrial services. This places those remote communities that need these services the most, but are too distant from an exchange to access terrestrial broadband, at a distinct disadvantage (HRSCCITA, 2002, 81). Particularly, in remote Australia, satellite may be the only option still now for a ‘last-mile’ distance of more than 50 km. But suitable fibre optic backbone development can provide a better solution by connecting the rest partly wirelessly using CDMA 2000 or HSDPA based 3G mobile technologies as currently used by different service providers in the country. Another way to bring satellite costs down for end users is to use ‘neighborhood networks’ to connect users to a shared satellite base station. Conxtel already offers such a product, which uses 802.11b Wi-Fi links to make the user connections (HRSCCITA, 2002, 81). Effective high-gain antennas or directional antennas can also be used to increase the range of WiFi devices.

For financial viability, reduced wholesale prices for wireline or satellite broadband capacity must be available to wireless access providers. All restrictions with regards to reselling, redistributing or third-party sharing that are currently manifested in the terms and conditions of many of these companies must be abolished (HRSCCITA, 2002, 68).

Nationwide fibre optic backbone development would lead to a sustainable development for the provision of high-speed last-mile wireless connectivity in rural or remote demographics. Complete deployment of fibre itself in the rural or remote areas may be commercially less viable from service provider perspectives as return on investment is critical in those regions.

Among the existing backbone networks, microwave, satellite and optical fibres can play important roles to provide long haul access up to the regional resource servers (RRS) located in any regional town centre or rural town centre. Last-mile networks can then be connected from the RRSs to the end-users in remote or rural regions using suitable wireless technologies as in Figure 5.
For fixed wireless connectivity in rural areas like wireless local loop (WLL), CDMA 450 or 700 MHz technology can be leveraged for the last mile approach other than CDMA 2000. Zapp networks in Romania were able to establish connectivity by CDMA450 standard for non-mobile endpoints at a distance of 50 km with data connectivity of 1.3 Mb/s (uplink was 110 kbps) (Harris, 2004).

Finally, both fixed and mobile WiMAX can be deployed for rural and remote areas mainly using the existing frequency bands in 2.3, 2.5 and 3.5 GHz. Fibre backbone located in the regional town centres (RRS) can be utilised to provide WiMAX connectivity for customers within 10 km of ranges. Telstra’s 800 MHz UMTS technology ‘Next G’ can be extensively utilised in this regard to provide connectivity along with WiMAX deployment in these regions. ‘Next G ‘and mobile WiMAX could be very successful in creating business opportunities with their inherent high-speed data connectivity.

CONCLUSION

Wireline technologies are well-established to meet the maximum data speeds envisaged for 2020 and beyond (Dominic Quai, 2007). In Australia’s regional, rural and remote areas, this can be best provided with fibre backbone connectivity throughout the regional or rural town centres of the country. However, as discussed, wire line technologies have a variety of limitations. Accordingly, for the last-mile connectivity, a combination of wired and wireless broadband technologies offers the most affordable and best reasonable data rates with an inherent advantage to quick deployment of the connectivity in these demographics.
Such a policy would facilitate business opportunities in these regions by combining data speed and cost compromise with the mobility advantage of wireless broadband solution in the last-mile. Further economic analysis on wireless broadband deployment in the last-leg of the network in regional and rural demographics will need to be conducted to determine the best wireless technology; see also (Mishra et al., 2005), (Camp et al., 2006) and (Smura, 2004). As discussed, it will also be necessary to identify the appropriate technology drivers, which will vary depending on several factors outlined in section V. These factors need to be assessed and weighed in the context of the needs of regional and rural communities to determine the best compromise for customers, service providers and Australian government.

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HIGH ALTITUDE PLATFORM STATIONS FOR AUSTRALIA

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The paper reviews the current progress towards a viable HAPS, including transitional tethered aerostats, and their potential application to Australia, especially for rural and remote areas. Business planning and regulatory issues are also briefly discussed, as well as some of the remaining technical challenges for HAPS.

INTRODUCTION

High Altitude Platform Stations (HAPS) is a concept that has been a proposed solution for telecommunications and other services for several years (Butler, 1998). One of the most promising platforms has been a lighter-than-air vehicle (LTAV), which has been attracting renewed interest as a low-cost means to provide telecommunications from the stratosphere. Interest in the LTAV has increased in recent years, and aerostats are once again being eyed as an economic way to provide telecommunications infrastructure and services over wide areas.

This paper reviews the current progress towards a viable HAPS, including transitional tethered aerostats, and their potential application to Australia, especially for rural and remote areas. Business planning and regulatory issues are also briefly discussed, as well as some of the remaining technical challenges for HAPS.

BACKGROUND

The potential of HAPS to provide wide area near line-of-sight fixed wireless services has been recognised for some time. Most research has concentrated on airships or aeroplanes operating in a quasi-stationary position at altitudes in the stratosphere around 20–30 kilometres. HAPS platforms at these altitudes are safely away from problems with commercial air-traffic heights and can find an optimum height where the winds and turbulence are lowest. This paper concentrates on the airship HAPS providing fixed wireless communication services.

Airships proposed for HAPS use very large helium-filled containers, typically over 100 metres in length and over 20 metres in diameter, to provide sufficient buoyancy in the less dense air at stratospheric altitude. The prime power for the communications payload and for station-keeping is provided by lightweight solar cells covering the upper surfaces of the airship, with power stored in regenerative fuel cells and/or batteries. Electric motor driven propellers are used for station-keeping (Tozer & Grace, 2001).

Tethered transitional telecommunications system (TTS) HAPS have also been designed as an immediate and cost-effective transitional arrangement to stratospheric HAPS. A typical tethered aerostat-based HAPS operates at an altitude of 1.5 kilometres and is illustrated in Figure 1.
Figure 1 Illustration of an aerostat-based HAPS over an African city

Figure 2 Network architecture for a HAPS providing fixed wireless communication services
The potential benefits of HAPS technology, compared to the use of conventional terrestrial or satellite networks, for providing wireless communication services are:

- line-of-sight propagation paths to most fixed users
- a single HAPS platform can replace a large number of terrestrial towers, with savings in cost, site acquisition delay, and environmental impact
- the platform can carry additional payloads for surveillance and monitoring applications

The network architecture for a Stratospheric Telecommunications System (STS) HAPS providing wireless communication services, including telephony, broadband data and video, is illustrated in Figure 2.

From Figure 2 it can be seen that the Connectivity Service and Operational Support Centre (CSOSC) is the interface between the STS/TTS payload (via the Gateway Link) and the remote customers. The CSOSC interconnects to the PSTN via a backhaul link, to the Internet via fibre or satellite, and can receive radio and TV programmes either off-air or via satellite for streaming to the customers. WiMAX can be used to provide a wireless broadband Internet service from the STS/TTS payload to the customer premises. This WiMAX connection can provide a VoIP telephony service, high speed Internet, and also streamed TV and radio services.

RECENT HAPS DEVELOPMENTS AND TRIALS

There have been several recent developments in the LTA HAPS arena. The continued use of aerostats as a platform for surveillance on many international borders has demonstrated them to be a reliable, proven technology. A number of trials of small-scale airship HAPS have been conducted by companies in Japan, USA, and Switzerland (Stratocomm http://www.stratocomm.net/about.php), (Stratxx http://www.stratxx.com).

Several programmes are now focusing on HAPS providing fixed wireless broadband communications using IEEE 802.16 (WiMAX) services (Thornton, White & Tozer, 2007). However, it is expected that it will be some time before full size commercial HAPS systems are deployed.

In the interim, StratoComm (http://www.stratocomm.net/about.php), formed in 1992 as a telecommunications infrastructure development company, has designed a TTS tethered system as a means to immediately enhance telecommunications capacity in under-served areas, that will provide for a seamless transition from the aerostat-based systems to its stratospheric systems once commercially available.

The StratoComm TTS is a lighter-than-air aerostat system positioned at an altitude of approximately 1,500 metres over the region to which it is providing telecommunications services. The aerostat is connected via a high-strength steel and Kevlar tether to the ground, thereby maintaining its position and ability to support subscriber services, as well as providing access to power, operational control and data service via fibre optic cable and electrical conductors embedded within the tether.

The transitional aerostat is approximately 37 metres in length and 12 metres at its widest point. It meets all US Federal Aviation Administration (FAA) requirements, including the presence of an emergency flight termination system and proper lighting. The aerostat carries an internally designed telecommunications payload weighing approximately 225 kg, which is capable of supporting subscribers with broadband Internet, wireless voice, broadcast video, or various combin-
ations of all three services. Each TTS supports a coverage area of 80 kilometres in diameter. The TTS is illustrated in Figure 3.

For stratospheric deployment, StratoComm has conceptualised a fleet of lighter-than-air vehicles that can provide telecommunications, security, surveillance and an array of other services to large metropolitan and surrounding areas throughout the world. Each airship, known as a Stratospheric Telecommunications System (STS) will be capable of fixed station keeping flight at an altitude of 20 kilometres. The STS is equipped with autonomous navigation, radio controlled command and telecommunications payload stabilisation systems.

![Figure 3 Tethered transitional aerostat system](image)

The airship itself leverages lighter-than-air (LTA) technology, being made of high-strength, light-weight materials; and is accompanied by advanced propulsion systems that maintain proper positioning. The stratospheric airship is launched using a specified volume of helium separated from the air to maintain its shape. As the STS rises the helium expands and at the proper altitude displaces all of the air within the STS. Once it is in the stratosphere the STS is remotely controlled and moved into position. A combination of solar cells, batteries and fuel cells will power the STS during its five-year planned deployment. The STS also incorporates telemetry to remotely transmit data and redundant systems to serve as back-up measures; features that are designed to provide the STS with a high level of availability, reliability and safety.

The STS is being designed to hold approximately 1,000 kilograms of communications payload capable of supplying focused mobile, broadband, narrowband and wireless backbone telecommunications services to approximately 3 million subscribers. The configurations can be dynamically changed in milliseconds to reallocate capacity as needed, such as to highly trafficked
commuter routes during peak travel times, to business districts on weekdays, or to stadiums during events. The STS is illustrated in Figure 4.

The transition from TTS to STS is illustrated in Figure 5, indicating the large increase in service coverage area and number of subscribers that can be supported.

![Diagram of Stratospheric Telecommunication System Coverage](image)

**Figure 4** Wireless coverage area for a stratospheric HAPS

![Diagram of StratoComm TTS to STS](image)

**Figure 5** Transition from TTS to STS
Sky Station – Australia (SSA) was established in 1996 with the objective of bringing HAPS technology to Australia to establish HAPS manufacturing and launch facilities, and to provide wireless communication services, especially for rural and remote areas.

A number of potential Australian HAPS systems have been advance notified by SSA to the ITU-R through the Australian administration.

Within Australia, there are multiple market opportunities that can be serviced by TTS/HAPS solutions, and SSA and StratoComm are working together to investigate these opportunities for applications including:

- Telecommunications (mobile, voice, data, video)
- Emergency services/Disaster Relief communications
- Surveillance
- Coastal and climate monitoring

Of these potential uses, the telecommunications services may have the largest impact. The ability to cost-effectively deliver services to underserved rural and remote areas within Australia makes HAPS an ideal solution.

As the Australian government is seeking solutions to provide broadband services to the two per cent of homes and businesses which may not be covered by the National Broadband Network initiative (Department of Broadband, Communications and the Digital Economy, 2008), the TTS approach is worth considering. As an example, the coverage area for a TTS providing wireless broadband services to the remote Queensland town of Mt Isa is illustrated in Figure 6.

**BUSINESS ISSUES**

TTS are finding application providing wireless broadband services such as WiMAX in developing countries, and rural and remote areas, where telecommunications infrastructure either does not exist or where its capacity is limited. The TTS is usually supplied as a turn-key installation, and can be deployed relatively rapidly compared to the alternative of establishing a network of terrestrial Base Stations.

For application to rural and remote parts of Australia, the main business consideration is the development of a Business Case that can demonstrate the generation of sufficient revenue from residential and business wireless broadband services including VoIP, broadband Internet and streaming video services to obtain a suitable return on the investment in the TTS platform, and the cost of access to the wireless spectrum.

Deployment of conventional terrestrial-based infrastructure in remote and rural areas is excessively costly. With most telecommunications technologies, the capital costs of establishing infrastructure are difficult to support within a business model without a large subscriber base. The TTS/HAPS solutions offer a significantly lower establishment cost, due in part to the use of wireless solutions for the “last mile” connections. The TTS solution can be deployed, and be financially viable and self-sustaining in communities such as Mount Isa, Queensland with its 20,000 inhabitants and surrounding area. The transition from StratoComm’s TTS to HAPS solution and its 400 km coverage area will support profitable and reliable operations.
REGULATORY ISSUES

The main regulatory issues for HAPS are the availability of adequate RF spectrum in usable frequencies for the payload, CPE and gateway links.

Considerable progress has been made in international regulatory arrangements for HAPS during ITU-R studies leading up to WRC-07. This has included the development of a number of Recommendations concerning the use of HAPS for providing IMT services, for feeder links, and for sharing with other services. Also, for the current studies towards WRC-11 one item is the identification of spectrum for HAPS Gateway Links in the 5850 – 7050 MHz band.

CHALLENGES

The main technical challenges for the successful development of stratospheric HAPS are considered to be:

- Diurnal Thermal Management
- Helium containment
• Weight to power management
• Recovery operations
• Operation of IMT Services protocols at altitude

Solutions to these challenges are emerging and are being tested in scaled-down test flights, leading on to full-size tests.

CONCLUSION

HAPS has shown its viability for several applications including telecommunications. Platforms from several manufacturers are in the detailed development stage and will soon become available commercially. Tethered Transitional Telecommunications Systems offer an immediate transitional cost-effective solution to stratospheric HAPS, and are finding application in developing countries, and have potential application for providing broadband wireless services for rural and remote parts of Australia. SSA and StratoComm are working together to investigate the potential of TTS/HAPS to provide broadband wireless services to the homes and businesses which may not be covered by the National Broadband Network initiative.

HAPS can also be used for other applications in Australia including coastal monitoring, surveillance, climate monitoring, and emergency communication services.

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RADIO'S DIGITAL CHALLENGERS

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This article describes the early decisions taken about digital radio in Australia in the 1990s, the second round of decisions implemented in legislation in 2007 and subsequent developments, the state of digital terrestrial radio in what is generally to be considered its most successful market, the United Kingdom, and the challenges facing digital radio when it is introduced in Australia in 2009.

'Digital radio broadcasting will assist radio to compete in the future world of substantial competition from digital audio services delivered by other means.' (ABA DRB Task Force 1996, 4) This was the view of the then Australian Broadcasting Authority’s (ABA) Digital Radio Broadcasting (DRB) Task Force more than a decade ago. Since then, Australia has got a lot of digital audio services delivered by other means, but still no digital radio. That should change in May 2009 when the commercial, ABC, SBS and some community stations in the state capital cities launch digital terrestrial services. But they will be competing in an audio environment very different from the one that existed when the first decisions were taken about Australian radio’s digital future.

This article describes the early decisions taken about digital radio in Australia in the 1990s, the second round of decisions implemented in legislation in 2007 and subsequent developments, the state of digital terrestrial radio in what is generally to be considered its most successful market, the United Kingdom, and the challenges facing digital radio when it is introduced in Australia in 2009.

EARLY WORK AND DECISIONS IN AUSTRALIA

The Australian Broadcasting Authority (now the Australian Communications and Media Authority) established a DRB Task Force in 1994/95. Its work overlapped that of a Digital Radio Advisory Committee (of which this author was a member), set up in 1995 by the Labor communications minister, Michael Lee. The advisory committee published its final report in August 1997. (DRAC 1997) A few months later, the Coalition Government announced policy decisions about digital radio and television. (Alston 1998) Amid the first Internet boom, the digitisation of the terrestrial transmission networks that took radio and television to their audiences was treated as an inevitable but urgent step to ensure these established electronic media could keep pace with opportunities emerging in online and portable digital media.

Like digital television, digital radio had taken different technical directions around the world. (Given 2003, 130-33) In 1987, the Federal Communications Commission (FCC) in the United States authorised experimental digital sound transmissions from Boston stations WGBH-FM and WGBX-TV. The same year, a joint project to investigate digital sound broadcasting technology was established by the European Broadcasting Union (EBU) and the European Community’s ‘Eureka 95’ audiovisual support scheme. It involved the mainly public service broadcaster full members of the EBU, like the BBC and Italy’s RAI, public telecommunications corporations like British Telecom, research institutes, universities, and equipment manufacturers like Nokia, Quantel, Thomson and Grundig. As the 147th Eureka project, digital sound broadcasting became ‘Eureka Project No 147’. (De Sonne 1990, 14-16) Support in Australia for the ‘Eureka 147’
system that came to be known as DAB (Digital Audio Broadcasting) was strong. The ABA and ministerial advisory groups both recommended its adoption, primarily using L-band spectrum. Minister Alston concurred, saying it was 'likely' that digital radio would be introduced with DAB and L-band spectrum, although there would be 'consideration of VHF spectrum in regional areas'. (Alston 1998)

There was less unanimity about who should get the chance to offer digital radio. 'Narrowcasters' licensed under the new categories created by the 1992 overhaul of broadcasting legislation to provide tourist, racing and other specialist-information and non-English language services, dissented from the majority recommendations of the ABA's Task Force. They 'vigorously opposed any suggestion that digital broadcasting should be restricted to established broadcasters'. The history of FM radio in Australia, they argued, was:

> highly instructive as to the policy dangers in allowing long established broadcasters to monopolise new transmission technologies, and of the advantages in fostering entrepreneurship, innovation and diversity through a policy of favoured access for new broadcasters. Established services have little incentive or motivation to develop a new medium, when their prime investment is anchored to incompatible technology.

As 'the new force in radio in the mid-90s', narrowcasters 'possess the same qualities of enthusiasm, innovation and entrepreneurship that were so critical to the successful development of FM'. Since they couldn't be fully accommodated on the AM and FM bands, they 'should be accorded favoured access under any licensing or access regime established for digital radio'. Narrowcasters did not wish to deny established broadcasters access to digital capacity if it was available, but if there was insufficient capacity to accommodate them all, it thought 'new operators, such as narrowcasters, should be given preference'. (Minority opinion by FANSS, Appendix C to ABA DRB Task Force 1996) This view found limited support on the ABA's Task Force, whose majority noted 'broadcasters are aware of the lessons of history and do not wish to repeat the mistakes of the past. On this occasion they recognise digital radio broadcasting as the way of the future'. (ABA DRB Task Force 1996, 15)

The minister's advisory committee hedged the very different views of its members. National broadcasters and licensed commercial and community broadcasters and narrowcasters 'should have a right to automatic access to digital radio broadcasting... Detailed planning should provide capacity for other narrowcasters and other services as a next priority.' It was described as a two-step process: 'a developmental phase, where existing players would simulcast on analogue and digital technology and experiment with, and develop, the new... technology and services' and 'full service provision', where new entrants could get access to frequencies. (DRAC 1997, vii-viii)

Alston announced existing national, commercial and community broadcasters, though not narrowcasters, would be able to convert to digital. They would be given the opportunity to share digital transmission multiplexes, each of which would carry five CD-quality stereo audio services. Transmission capacity of 256 kbits/sec would be available for each service, from the total of around 1.5 Mbits/sec available from each multiplex transmitter. Broadcasters would be required to simulcast on digital and analogue for a period 'to ensure that listeners are not disadvantaged'.
Beyond that, a Planning and Steering Committee, chaired by the minister's department would develop 'a comprehensive planning framework'. (Alston 1998)

The ABA did more work on VHF options, concluding that the 6 MHz-wide VHF Band III channel 9A could be used for three DAB multiplexes in metropolitan areas – or four if the difficult but not impossible job of retuning VHF TV Channel 10, 1 MHz upwards was undertaken. This would be enough for fifteen to twenty radio services of near CD-quality, or more of lower quality. There would, however, be serious problems finding sufficient VHF spectrum for country radio stations to convert. Consistent with the 1998 decisions, the ABA gave more focus to the L-band, where it concluded that

'while vacant spectrum... was hardly super-abundant, there was substantial spectrum... still available and the potential exists for full conversion of existing services using L-band alone over time'. (Tanner 2002)

The problem was that because of the propagation characteristics of signals in the two bands, more transmitters, and thus more dollars, would be required to cover the same area using L-band. This was potentially a major problem in regional areas.

There were plenty of disputes about the government's digital TV policy, but its timetable remained on track and services launched in metropolitan areas in January 2001. Digital radio services did not. There was still much talk that a move to digital transmission was essential and inevitable, but the technical choices had become even more complex and the overseas experience was not encouraging. Commercial stations were not sure how the new technology would generate extra revenue to pay for itself; the Coalition Government was no friend of the country's biggest radio broadcaster, the ABC; and many community stations were shoestring operations that struggled to make ends meet with the costs of FM, let alone new digital services. The Productivity Commission's March 2000 report on broadcasting opposed the government's conversion model. It concluded that 'the costs to consumers of converting existing AM and FM stations to digital would be substantial, but the benefits in terms of freed spectrum appear to be relatively minor... Digital radio should be allowed to augment, rather than replace, existing radio.' (Productivity Commission 2000, 18)

The minister then appeared to retreat from the commitment to convert all commercial, community and national broadcasting stations to digital. (Alston 2000) The established industry was sending mixed messages about its commitment to digital transmission. Late in 2000, one of Alston's senior officials demanded a consolidated view from industry. The government did not want to impose a technology or set of standards but did want certain principles to underpin any process for introducing digital services. These included: serving the public interest; minimising disruption to existing radio audiences; promoting increased diversity of service and service quality, especially in regional areas; ensuring that receivers are affordable; providing opportunities for new entrants; addressing issues of interoperability, compatibility and flexibility; and ensuring that spectrum was not just given away to commercial interests. (Holthuysen 2001) Reporting on its inquiry into regional radio in 2001, the House of Representatives Standing Committee on Communications, Transport and the Arts said the main elements of the submission it received from commercial radio were 'ambit and... hardly likely to form the basis of responsible radio industry policy'. (House of Representatives 2001, 130-1)
A new Digital Radio Study Group was established in 2003 and later that year the ABA authorised trials using VHF channel 9A to be conducted in Sydney by Commercial Radio Australia and in Melbourne by Broadcast Australia. (‘Digital radio trials' and ABA 2003) SBS and Broadcast Australia also ran a trial of another technology, Digital Radio Mondiale in Canberra. (Broadcast Australia 2008) Two years later, a new policy for digital radio was announced by new minister Helen Coonan.

‘With increasing competition from new digital platforms such as the Internet and mobile phones,' she said, 'the radio industry needs the certainty to plan and promote the potential benefits of digital radio'. (Coonan 2005)

THE NEW POLICY

Coonan’s 2005 framework, implemented in legislation passed in May 2007, differed from Alston’s in many important ways. First, although the expectation that digital services would eventually replace analogue was never as clear for radio as for television, the new policy made the distinction explicit. The second reading speech explaining the legislation stated: ‘The key premise of the framework is that digital radio will supplement existing analogue radio services for a considerable period, and may never be a complete replacement.’ (Johnston, 2007: 122)

Second, less ambitious coverage and newer technology were foreshadowed. The initial launch would occur only in the state capital cities. A review to be conducted by 2011 would reconsider the position in country areas. European DAB technology would still be used in metropolitan areas, but the government would consider adopting newer versions of what was now a 'mature technology' once approved by international standards bodies. DAB+ was subsequently endorsed. It employs the more sophisticated AAC+ or MP4 audio codec, rather than DAB's MP2. Better compression allows two-three times the number of stations to be transmitted and more sophisticated multimedia content. Australia is one of the first countries to endorse the new version of DAB. (World DAB 2008) Coonan said a version of DAB was, however, 'unlikely to be a suitable platform to address the extended coverage requirements of some regional and remote services'. Developments with other systems, especially Digital Radio Mondiale, would be monitored as part of the development of policy about digital radio outside the state capitals.

Third, different spectrum would be used for the primary digital radio transmitters – VHF Channel 9A, not L-Band frequencies, although L-Band might be used 'for infill, localised services and where VHF Band III spectrum is unavailable, or insufficient'. Some L-Band spectrum would also be reserved for satellite digital radio services. The choice of VHF 9A meant only three multiplexes could be accommodated. This limited the number of operators more severely than Alston had contemplated in 1998. There are two multiplexes for commercial and community stations in Sydney and Melbourne, and one in the other capitals. The ABC and SBS share a full multiplex (around 1.5 Mbits/sec) in each city. Coonan’s framework gave all the existing commercial stations and some city-wide community stations capacity of 128 kbits/sec to introduce a digital service, one ninth of the capacity of a multiplex transmitter. Some might get more, depending on the numbers of stations in different cities. The legislation passed in 2007 required joint venture companies to be established by the commercial and community broadcasters that are guaranteed transmission capacity in each licence area. Community broadcasters have to form representative companies, which in turn can acquire a 2/9ths stake in the joint venture multiplex companies.
In practice, although the joint venture companies have been formed, community broadcasters have not yet taken stakes in them. The ACCC released a Discussion Paper about access undertakings for the transmission services offered by the commercial and community multiplexes in late October. (ACCC 2008)

Fourth, there was an explicit moratorium on further commercial radio competition. No new commercial stations will be licensed to use the broadcasting services bands within six years of the commencement of the first digital broadcasts. This commitment, given by the Coalition in the 2004 election campaign, was ‘consistent with the period of legislative protection provided for digital television' and would 'provide a measure of stability and certainty for the commercial broadcasters'. (Johnston 2007) There are not, however, any new restrictions on current or potential commercial digital radio services operating outside these bands. This would allow, for example, digital satellite radio services. (See separate article in this issue)

Fifth, there was no obligation to simulcast existing analogue services. On the contrary, the new policy stressed the importance of new content to encourage listeners to buy digital receivers. Broadcasters are able to provide multiple program streams and ‘digital program enhancement content’, defined to include text, still images and other forms prescribed by the Minister. This does not, however, include moving images. (More sophisticated versions of the DAB family of standards, DMB [Digital Multimedia Broadcasting] and DAB-IP, provide much more scope for multimedia applications even than DAB+.) A new licence category was also established to enable non-radio broadcasters to use the digital radio platform to deliver services other than radio, including text, data and images.

Legislation setting out the scheme was passed in May 2007. (Broadcasting Legislation Amendment (Digital Radio) Bill 2007 and Radio Licence Fees Amendment Bill 2007 and see Johnston 2007) A very brief inquiry into the legislation by the Senate Standing Committee on Environment, Communications, Information Technology and the Arts, was described by Labor senators as ‘an abuse of process which shows complete disregard and contempt for the Senate’s role as a house of review’. Their minority report criticised the Bill’s omission of technologies other than DAB, despite the acknowledged need for technologies like Digital Radio Mondiale to get digital radio to country areas; the omission of animation and video clips from the definition of enhanced content able to be offered by digital radio broadcasters, despite already being available on mobile phones; and the onerous obligation for community broadcasters to have to form representative companies to hold shares in the joint venture multiplex operating companies. (Senate Standing Committee 2007: 17–19)

In the 2007/08 Budget, the Coalition Government agreed to provide funds for digital radio to the ABC, SBS and community stations. The national broadcasters would get money to introduce digital radio services in the six state capitals on 1 January 2009 and then establish up to 57 infill translators. The precise amount would be determined by tender. The community sector would get $10.5 million, to be distributed by the Community Broadcasting Foundation. (Coonan 2007) Minister Coonan indicated when announcing the new policy framework in 2005 that the Government would consider offering financial assistance to regional commercial radio broadcasters, as they did for regional TV broadcasters. (Coonan 2005)

The incoming Labor Government subsequently agreed to defer the 1 January 2009 start-up date to no later than 1 July. Legislation was passed by the Parliament in October giving effect to this. The same legislation relieved Hobart broadcasters of the obligation to start services at
the same time as the mainland state capitals, and extended by 12 months the period for community radio representative companies to join the joint venture multiplex licensee companies. (*Broadcasting Legislation Amendment (Digital Radio) Bill 2008*

**UK EXPERIENCE**

The United Kingdom is generally seen as digital terrestrial radio's most successful market. Regular DAB services were started by the BBC in 1995. A national commercial digital operator, Digital One, began services four years later. (Given 2003, 134) In the third quarter of 2008, 29 per cent of people aged 15 and over claimed to own a DAB receiver, up from 22 per cent a year earlier. Just 11 per cent of radio listening, however, was to DAB, up from 9 per cent a year earlier. (RAJAR 2008)

In February 2008, less than a year before digital radio services were due to launch in Australia, the major shareholder in Digital One, GCAP, announced it was quitting the medium. In its view, DAB was 'not an economically viable platform for the Company'. (GCAP 2008b) As well as its 63% stake in Digital One, GCAP owned two digital-only stations, Planet Rock and theJazz, and analogue FM and AM radio stations in more than 40 cities. Britain’s commercial digital radio pioneer thought it had a future in analogue FM radio and online audio, but was selling its shareholding in Digital One for 'a nominal sum' and closing Planet Rock and theJazz. This seemed to be a vote of no confidence in digital radio by a commercial organisation uniquely placed to understand its possibilities, operating in a market where the medium had been relatively successful.

Some interpreted GCAP's plans primarily as a defensive response to a takeover bid from Global Radio, and the personal mission of a new chief executive who departed soon after. That takeover was completed in June, theJazz closed and Planet Rock was offloaded, but the latter was acquired and saved by passionate fans of its 'rock aristocracy' format (Led Zeppelin, Pink Floyd, AC/DC). No further public announcement has been made about Global's plans for GCAP’s stake in Digital One (pers comm., 10 October 2008). The February Strategy Presentation given by its now departed chief executive has been removed from GCAP's website, which now states the company is focusing on 'platforms that generate revenues and profit (FM, broadband, innovative mobile digital technologies)'. (GCAP 2008a)

A licence to operate a second commercial digital radio multiplex was awarded to a consortium led by television broadcaster Channel 4 in 2007, which saw radio as a way of diversifying its business. 4 Digital planned to introduce ten new radio stations when the service launched in 2008. But doubts about the likely speed of commercial returns from a move into digital radio, especially for an advertiser-funded broadcaster like Channel 4 already confronting declining revenues, slowed the plans. In early October, Channel 4 announced it was closing its radio division, leaving 4 Digital's fate to its other, minority shareholders. Chief Executive Andy Duncan said the decision had been taken 'very reluctantly'. He continued to believe DAB had a 'strong future', but Channel 4’s plans 'have been overtaken by a drastic recent downturn in our revenues'. It could not afford the short-term investment and would 'have to forego this future profit stream'. (Plunkett 2008. See also Sweeney 2008; Plunkett and Brown 2008)

A particular reason UK digital radio developments are important to Australia is the close relationship between broadcast transmission providers in the two countries. Broadcast Australia,
the current incarnation of the national network of ABC and SBS transmitters privatised in 1999, and the UK's dominant broadcast transmission provider Arqiva are both parts of the Macquarie Communications Group. The Group's chairman, former Telstra and ABC executive Gerry Moriarty, is chairman of Broadcast Australia and deputy chairman of Arqiva. Also on the Group's board are former Telecom managing director Mel Ward and former SBS managing director and now part-time ACMA member, Malcolm Long. Arqiva's Executive Chairman is former Telstra executive, former Foxtel director and former Unwired Chairman and CEO, Peter Shore. He is now Executive Director, Macquarie Capital Group in London, responsible for the telecoms and technology sector within the Macquarie Capital Funds group. (Macquarie 2008; Arqiva 2008)

CHALLENGES AND CHALLENGERS

Digital radio has always promised three main benefits: better sound quality, more listening choices, and extra features. There are, however, many factors complicating the experience listeners will actually get in the many different environments where they might tune in.

Choosing DAB+ rather than DAB will enable services of a given quality to be delivered at much lower bit rates. Some say CD-quality will require 128 kbits/sec. The ABC says high quality music transmission will be possible at 56 kbits/sec and is likely to adopt 64 kbits/sec for music and 40 kbits/sec for speech. The audio quality listeners actually hear, however, will still depend on the decisions the broadcasters make about how to use this capacity. In the meantime, the digital audio competition is not standing still. Internet radio stations generally use MP3, Windows Media Audio or RealAudio. The ABC offers MP3 at 128 kbits/sec for its music channels Triple J, Classic FM and the 'dig' stations, and Real and Windows at up to 132 kbits/sec, depending on the speed of the user's connection.

A still more basic factor is ensuring adequate signals can be received right across the service areas. Maps drawn up in late 2007 and leaked to *The Australian* in early July showed coverage of just 50% of the population in Sydney and 'only slightly better coverage in other cities'. Commercial Radio Australia's Joan Warner says the maps were out of date, and more recent testing shows 80–90% of all the state capital cities will be covered when services commence. (pers comm., 20 August 2008) But even if these levels are achieved, there are many people in places where they won’t be able to listen in to radio’s future when it gets underway in 2009. The ABC's head of transmission, Mark Spurway, says much progress has been made by the national and commercial broadcasters and ACMA, but he was not prepared to comment on expected coverage levels until ACMA releases a further draft plan in October. (pers comm., 20 August 2008)

The extra listening choices likely to be made available are not yet clear. The public broadcasters are more open about their plans than the commercial stations at this stage. SBS wants to extend its second radio network beyond Sydney, Melbourne and Canberra, use another two channels for time-shifted versions of both its networks, and expand its late-night/early-morning youth program Alchemy into a whole channel and introduce new channels for different language groups over the next few years. (SBS 2008) The ABC has its three ‘dig’ stations already available online, able to be included in a suite of digital radio services. It also has content that could sustain standalone services rather than being squeezed into broadcast slots, like sport, specialist music, health talks and children's radio. Some of this will be possible within existing funding but the
more ambitious plans will require extra money from a Government facing an increasingly perilous budgetary task.

Among the commercial stations, which account for three-quarters of radio listening in Australia, the Australian Radio Network already has a PureCountry station streaming online. Departing Austereo chief Peter Harvie told *The Australian* his Triple M and Today Network stations will each introduce an extra station, plus data, still pictures and interactivity. (Tabakoff 2008) Some of the metro-wide community stations are working together within and across cities to develop plans for new services, and infrastructure and services already exist to share programs within this sector. Britain’s gay and lesbian Gaydar Radio, Digital Station of the Year at the last two British commercial radio awards, launched its online service in Australia in September in partnership with the Melbourne-based GoConnect, and is likely to be interested in opportunities for terrestrial transmission.

The terrestrial digital radio services will have competition from a subscription radio service delivered over 3G mobile phone networks and online, launched in October 2008 by music and commercial FM radio pioneer Glenn Wheatley. Subscribers will pay $7.95 a month for 30 commercial-free music channels initially. (Donovan, 2008) Stripe is an Australian version of the digital subscription radio services delivered by satellite and terrestrial rebroadcast in North America. Two competing services, Sirius and XM, have just merged, hoping to stem the huge losses both have been suffering since their launch several years ago. They expect to have a total of 19.5 million subscribers by the end of 2008 paying a little over US$10 a month (Sirius XM 2008), but costs are high for both the operators and customers, who have to buy special receivers.

The extra features offered by digital radio start with small things, like locating stations by name on a screen, rather than frequency on a dial. The same small screen can display song titles and artists. More expensive digital receivers with hard drives can pause, rewind and record live radio. Some receivers sold for the subscription digital radio services in the US feature a ‘Love Button’, enabling one-touch recording of individual songs. But that requires record companies and other rights-holders to authorise downloading as well as live streaming.

DAB+ expands the visual possibilities of radio beyond static and scrolling text to include features like ‘slide-show’. Radio listeners can become radio viewers, although the receivers that let them do it will be more expensive. Radio broadcasters also hope to offer location-based services, either to ‘radios’ or to the increasingly popular GPS devices in cars. The Australian Radio Network’s stations already transmit traffic information on their FM sidebands for the Suna Traffic Network. This data, describing incidents, locations, likely delays, detouring options and estimated arrival times, can be received on suitable sat-navs. These present it as graphics or spoken word, or re-route around the delay. The service currently operates across 8000 km of road in Melbourne, Sydney and Brisbane. Ford has introduced sat-navs that work with it as an option on the new Falcon. The new version of the transmission standard used by Suna will allow the same service to be offered via DAB+, but there are other competitors eager to offer greatly expanded location-based services.

Perhaps the biggest challenge for Australian radio broadcasters is that the long delays in adopting digital transmission have allowed a different kind of audio world to be built. In 2008, the sound quality, extra listening choices and new features long promised by digital radio seem much less exclusive. Many radio broadcasters contributed enthusiastically to the transformations of Internet radio and podcasting. Now they have to find investment dollars to build new terrestrial
transmission networks at a time when the share market is tumbling and banks are struggling to find money even to lend to each other.

For optimists, these circumstances provide opportunities. In 2007, the number of mobile phone services overtook the number of people in Australia. (ACMA 2008) Customers upgrade their handsets regularly to get more features and smoother operation. If the radio industry can convince the manufacturers to incorporate DAB+ receivers, opportunities to sell the newly enabled devices will come quickly. Nielsen Media Research data supplied by Commercial Radio Australia shows nearly half of all Australians aged 14 and over owned an MP3 device in May 2008. For people aged 14–17, the figure was nearly four in five. GfK says there were more digital media players (2.6 million) sold in Australia in 2007 than any other product tracked for its Canon Digital Lifestyle Index – more than DVD players and recorders (2.4 million), digital still cameras (2.2 million), games consoles (1.5 million) and LCD and plasma TV sets (1.4 million). In the December 2007 quarter alone, digital media player sales reached 1.15 million. With DAB+ receivers in them, they become part of the radio industry’s solution instead of its problem.

The interests of radio broadcasters and the manufacturers and retailers of mobile phones and digital music players, however, are not necessarily aligned. Apple wants users to buy music from iTunes rather than listen to it for free from radio broadcasters. Mobile phone companies investing heavily in 3G networks, WiFi hotspots and handset subsidies want their customers to use their portable devices to consume bandwidth. Telstra, like Apple, wants them to buy from its music store.

The global economic downturn creates a crisis for investment, but radio broadcasters with long memories might recall that their medium dealt well with the depressed times it faced soon after its birth in the 1920s. Cinemas and recorded music crashed, but radio thrived, a source of cheap entertainment amid financial and political trauma. Broadcasters contemplating the launch of digital radio next year might not like the comparison. They also know well that the affordable competition they offered so successfully three-quarters of a century ago is already here, via the Internet and portable audio devices. This time, it is broadcast radio that faces the challengers.

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The purpose of this article is to explain the new regulatory regime (the ‘content services regime’) that applies to the wide range of content delivered via the Internet and mobile devices. The article will first outline the various regimes that regulated content delivered by these technologies prior to the introduction of the content services regime. It will then provide an overview of the new regime, including details of its objectives and of the legal complexities involved in determining its scope. It will then summarise the Australian system for classifying content, and explain how the content services regime adapts and applies the classification system to forms of content delivered via the Internet and mobile devices. After detailing some of the minutiae of the scheme, the article will conclude with comments about the policy choices made in designing the new regime and some observations about the likely effectiveness, and the attendant benefits and costs, of the regime.

INTRODUCTION

Content in Australia is regulated by means of a system of classification that is aimed at providing adults with information about the nature of the content, while protecting children from unsuitable material (ALRC 1991; Mason 1992). The classification model of content regulation has been challenged by new delivery technologies, in particular, Internet streaming and delivery via convergent devices, which include 3G mobile phones and other mobile communications devices ‘that can act as multimedia platforms and, in particular, deliver audiovisual content’ (DCITA 2006, 1). The Australian response to the challenge of new technologies has been to extend the traditional classification model to apply to content delivered by these new technologies, with appropriate adaptations. Initially, this was done via the introduction of disparate regulatory regimes which applied to content delivered over the Internet and by mobile phones. More recently, a comprehensive new regulatory regime – referred to in this article as the ‘content services regime’ – has been introduced. The content services regime amalgamates the previously disparate regimes, extends content regulation to live Internet services and to services that link to other content and applies uniform standards across these diverse content platforms.

The purpose of this article is to explain the new omnibus regulatory regime that applies to the wide range of content delivered via the Internet and to mobile devices, and to identify aspects of the regime that merit further analysis. In particular, the article will:

- outline the various regimes that regulated content delivered by the new technologies prior to the introduction of the content services regime;
- provide an overview of the new regime, including details of its objectives and of the modifications that have been made to the pre-existing regimes for regulating content as a result of its introduction;
• explain the legal complexities involved in determining the scope of the new regime;
• summarise the Australian system for classifying content, and explain how the content services regime builds upon, and adapts, the existing classification system to apply to new forms of content;
• explain the new system for dealing with complaints about content;
• set out the regulatory procedures for issuing notices for the removal of, or the disabling of access to, content that is deemed to be offensive or unsuitable;
• outline the industry code of practice, which is an important component of the new co-regulatory regime;
• explain the new restricted access regime, which regulates the arrangements for controlling access to content that is not suitable for children;
• set out the flexible, tiered system for enforcing obligations imposed under the regime; and
• make some preliminary observations about the policy choices made in designing the new regime.

The article concludes with some observations about the likely effectiveness, and the attendant benefits and costs, of the regime. It should be noted that both the original, disparate regimes and the new content regime were introduced and, in respect of the former, modified and/or replaced, in response to a plethora of government and industry reports and reviews, and amidst considerable public discussion and debate. However, these processes are not described in this article. Nor does the article address consumer protection issues that are generated by Internet and mobile phone content, or the problem of inappropriate contact being made with children.

REGULATION OF INTERNET AND CONVERGENT CONTENT BEFORE THE INTRODUCTION OF THE CONTENT SERVICES REGIME

Before the introduction of the content services regime, Internet content and content delivered to telephones were each regulated separately and in a disparate manner. This section will briefly outline the nature of this regulation.

TELEPHONE CONTENT: THE TELEPHONE SEX SERVICES REGIME

Part 9A of the Telecommunications (Consumer Protection and Service Standards) Act 1999 ('the CPSSA') was enacted to deal with access by minors to premium voice services, known as 'telephone sex services'. The legislation defined a 'telephone sex service' to mean a commercial service:

• supplied by way of a voice call made using a standard telephone service; and
• having regard to the way in which the service is advertised or promoted, and the content of the service, it would be concluded that a majority of people calling the service are likely to do so 'with the sole or principal object of deriving sexual gratification from the call' (CPSSA, s 158J).

In summary, the regime imposed the following requirements on service providers, to restrict access to telephone sex services:

• • •
• such services could only be offered by means of numbers with a 1901 prefix;
• access to 1901 numbers was barred, unless the customer elected in writing to access the number range; and
• service providers had to provide customers with a Personal Identification Number (PIN), or some other means of restricting access, to such services (CPSSA, s 158B).

While the legislation did not, in its terms, restrict telephone sex services to minors, it was based on the assumption that the requirements would make it difficult for minors to access these services. In the event that access to telephone sex services was not restricted as prescribed by the regime, a carriage service provider was prohibited from including a charge for the service in bills to customers.

INTERNET CONTENT: THE STORED CONTENT REGIME

The first stage in the regulation of Internet content was the introduction of the Broadcasting Services Amendment (Online Services) Act 1999 (the 'OSA'), which came into effect on 1 January 2000. The OSA inserted Schedule 5 into the Broadcasting Services Act 1992 (the 'BSA'), which established a comprehensive co-regulatory regime that applied to stored Internet content. This 'stored content regime' provided a mechanism for the take-down of 'offensive' content hosted in Australia in response to complaints made to the Australian Communications and Media Authority (ACMA). The regime pragmatically dealt with offensive Internet content hosted outside Australia essentially by obliging Internet Service Providers (ISPs) to comply with an industry code that mandated the provision of ‘family-friendly’ filtering software to end-users (Lindsay 1999; Penfold 2000). One of the deficiencies of the scheme was that it did not extend to streamed Internet content. This became apparent in 2006, when controversy erupted over offensive content that was streamed live over the Internet by the Big Brother reality program. As the content was neither broadcast nor stored, ACMA found that it was not covered by an existing content regulatory regime (Jaggers, Neilsen and Jolly 2007, 6).

THE MPS DETERMINATION AND MPSI SCHEME

The increased functionality of mobile devices in the years following the introduction of the telephone sex services regime – including their ability to deliver audio-visual content – created gaps in the regulatory regimes. These gaps were dealt with in the short term by means of patchwork interim policy responses. The most significant response was a direction by the then Minister to the former Australian Communications Authority (ACA)\(^1\) to introduce short-term regulatory controls on access to prohibited and age restricted content supplied to premium mobile services (MCITA 2004). These controls would take the form of a service provider determination that would require adult content supplied by premium mobile services to be accessible only by specified number ranges, that would completely prohibit the supply of certain content, and that would impose access restrictions on other content considered suitable only for adults. The ACA independently identified further issues that it considered should be addressed in a service provider determination relating to premium mobile services, including concerns about consumer protection and about 'chat' services being used to 'groom' children. On 29 June 2005, the ACA made the Telecommunications Service Provider (Mobile Premium Services) Determination 2005 (No. 1) (the 'MPS Determination'), pursuant to s 99(1) of the TA.
In relation to content regulation, the MPS Determination established rules that applied to content supplied by premium rate SMS (short message service) and MMS (multimedia message service) services, and to ‘proprietary network services’. SMS services differ from MMS services in that SMS premium services deliver text-only content, such as horoscopes and sporting results, while MMS premium services deliver a combination of audio-visual information and text, including video clips and games (Lee 2006, 100). ‘Proprietary network services’, on the other hand, include ‘walled-garden’ services (or closed network content services), whereby a mobile service operator supplies content to its users at a premium rate that is not generally accessible to persons not connected to that mobile network (MPS Determination, clause 2.1(2), Note, ‘Example of proprietary network services’).

The MPS Determination introduced a co-regulatory regime that was designed to ensure ‘appropriate community safeguards’ for mobile premium services, by making rules:

- to prohibit, and restrict, certain mobile premium services, in line with the principles established under the classification legislation and with community expectations about the accessibility of those services;
- to promote the safety of children in relation to mobile premium services that might facilitate illegal contact between children and adults;
- to ensure that customers of mobile premium services are provided with information to enable them to make informed decisions about the use of the services;
- to ensure that an independent complaints handling mechanism is available to customers of mobile premium services (MPS Determination, cl. 2.2(a)).

In dealing with content regulation, the Determination drew a distinction between ‘prohibited content’ and ‘age-restricted content’. Prohibited content, which service providers were absolutely prohibited from supplying, was defined as material classified as RC or X18+ by the Classification Board, or material that had not been classified, but that would be likely to be classified X 18+ or RC (MPS Determination, cl. 1.3 (definition of ‘prohibited content’)). Age-restricted content, on the other hand, was defined to mean material classified R18+ or MA15+ by the Classification Board, or material that has not been classified, but that would be likely to be classified R18+ or MA15+ (MPS Determination, cl. 1.3 (definition of ‘age-restricted content’)). Service providers were prohibited from supplying age-restricted content unless a customer requested access to the service, and the service provider implemented a mechanism for verifying that the customer was at least 18 years old (MPS Determination, cl. 3.4).

The MPS Determination established a co-regulatory regime, with important elements of the regime left to be addressed by an industry self-regulatory scheme, known as the Mobile Premium Services Industry Scheme (the 'MPSI Scheme') (MPS Determination, Part 5). Given the complexity of the regulatory regime, and of industry negotiations, the MPSI Scheme took more than a year to develop, entailing the expenditure of considerable resources by the industry (Australian Mobile Telecommunications Association 2007). The scheme was finally approved by ACMA on 28 September 2006, and came into effect on 29 October 2006 (Communications Alliance 2006). Amongst other matters, the MPSI Scheme provided for a system of assessing premium mobile content by means of a certified assessor and complaints handling rules (MPSI Scheme, cll. 7, 10).
The scheme was supplemented by more detailed practical guidelines, which elaborated on the rules established by the scheme (Communications Alliance 2007).

**INTRODUCTION OF THE CONTENT SERVICES REGIME**

The content services regime was implemented by the *Communications Legislation Amendment (Content Services) Act 2007* (the ‘CSA’), which came into effect on 20 January 2008. The CSA introduced a new Schedule 7 into the BSA. The scheme imposes a comprehensive, uniform regime on services that were previously regulated under the disparate regimes outlined above, and extends content regulation to live streamed Internet content services, to content delivered to convergent devices, and to services that provide links to content.

**OVERVIEW OF THE SCHEME**

The content services regime consists of the following main elements:

- Schedule 7 of the BSA, which establishes the regulatory framework for the content services regime for content with an Australian connection;
- the Internet Industry Association *Content Services Code*, which was approved by ACMA on 14 July 2008, and which is an essential component of the co-regulatory regime; and
- the *Restricted Access Systems Declaration 2007*, which requires content service providers to implement age verification systems for people accessing content classified MA15+ and R18+.

In broad summary, the main rules that apply to content with a relevant Australian connection under Schedule 7 of the BSA are as follows:

- a prohibition on content classified as X18+ and RC (Refused Classification);
- a prohibition on content classified as R18+, unless it is subject to appropriate access restrictions;
- a prohibition on commercial MA15+ content, unless it is subject to appropriate access restrictions;
- in order to provide R18+ and/or commercial MA15+ content by hosting services, live content services, link services or commercial content services, service providers must have appropriate access restrictions in place;
- a complaints procedure that may result in ACMA issuing notices to remove content, or disable access to content, that is the subject of a complaint; and
- the development of industry codes of practice to deal with details relating to the classification of content, complaint handling procedures and increasing public awareness of issues relating to the use of content services.

The details of the rules established under the content services regime are explained below.

**OBJECTIVES OF THE CONTENT SERVICES REGIME**

The Second Reading Speech to the Bill implementing the content services regime, which was introduced in mid 2007, stated that:
The main focus of the Bill is to extend the general approach adopted by the Government in relation to content regulation to those services where it considers adequate safeguards are not currently in place (Coonan 2007, 43).

This focus was reflected in amendments made by the implementing legislation to the objects and regulatory policy of the BSA. As explained below, the content services regime applies to services known as 'designated content/hosting services'. First, the legislation introduced the following new object to the BSA:

- to ensure designated content/hosting service providers respect community standards in relation to content (BSA, s 3(ha)).

Secondly, the legislation introduced a new statement of regulatory policy, indicating that Parliament intends designated content/hosting services to be regulated in a manner that:

- enables public interest considerations to be addressed in a way that does not impose unnecessary financial and administrative burdens on the providers of those services; and
- will readily accommodate technological change; and
- encourages the development of communications technologies and their application, and the provision of services made practicable by these technologies to the Australian community (BSA, s 4(3AA)).

Despite these general statements, the decision to introduce an omnibus regulatory regime required a series of policy responses to the features of content delivered by new technologies that differed from traditional content. The policy choices involved in establishing the content services regime were enunciated in the Explanatory Memorandum (EM) to the Bill that implemented the regime.

To begin with, the EM identified the main problem arising from the pre-existing platform-specific regulation of content services as the possibility of inconsistent rules applying to diverse content – such as a telephone sex service, a premium mobile service or Internet content – that could be delivered to the one convergent device, such as a 3G mobile phone. The EM proceeded to assess the options for regulating stored content, live content and mobile access to Internet content.

In relation to stored content, the EM concluded that regulation of content based on the extent to which service providers can control content, rather than on the specific communications platform, was likely to be 'more robust and adaptable in the face of new technologies and the development of innovative content services' (EM, cl. 69). Given that mobile service providers are taken to be able to directly or indirectly control stored content (DCITA 2006) – service providers have direct control over branded content on their own portals and contractual control over third party content made available on a revenue share basis (EM, cl 54) – the content services regime effectively applies to all stored content that is not regulated by another regime. In relation to live content, the EM first explained that, while live content supplied over the Internet, such as chat services, is generally not offered commercially, where such services are supplied to mobile devices they are usually offered commercially. Proceeding on the assumption that it is feasible to develop a pre-assessment regime for live commercial content (DCITA 2006), the EM explained
that it had been decided to align the regulation of such services, as much as possible, with the regulation of stored content. Accordingly, it was decided to bring the regulation of telephone sex services within the new general framework for regulating live content. Finally, in relation to mobile access to Internet content, the EM explained that, as filtering products are not yet commercially available, it was decided to give the Minister the power to exempt mobile service providers from regulatory obligations to supply filtering products for Internet access.

**MODIFICATIONS OF EXISTING REGULATORY REGIMES**

The content services regime effectively supersedes the disparate regulatory regimes that had previously applied to telephone sex services under Part 9A of the CPSSA; to stored Internet content under Schedule 5 of the BSA; and to mobile premium services under the MPS Determination.

In particular, and as explained further below, the regulation of all stored Internet content with an Australian connection has been removed from Schedule 5 of the BSA and relocated to Schedule 7 of the BSA. While Schedule 5 continues to regulate access to stored Internet content hosted outside Australia, Schedule 7 deals with all stored content services with an Australian connection, whether accessed by the Internet or by mobile devices.

In relation to mobile premium services, ACMA was required to amend the MPS Determination to remove those aspects of the Determination that applied to content regulation and restricted access arrangements. As a result of the ACMA amendment, the content regulation of mobile premium services, including premium rate SMS and MMS services, is exclusively dealt with under Schedule 7 of the BSA (ACMA 2007a). The amended MPS Determination maintains a residual operation. For example, it continues to impose safety requirements on mobile chat services.

In conjunction with the amendments to the MPS Determination, ACMA was required to take two further important regulatory steps. Under clause 14 of Schedule 7 of the BSA, ACMA was obliged to develop a ‘restricted access systems declaration’, to regulate access to all R18+ and commercial MA15+ content with an Australian connection falling within the scope of Schedule 7. Following public consultation on a draft declaration, ACMA issued the *Restricted Access Systems Declaration 2007* (the ‘RAS Declaration’), which is an essential part of the new regime, on 20 December 2007 (ACMA 2007b). The RAS Declaration replaces the *Restricted Access Systems Declaration 1999 (No. 1)*, which had applied to access to stored Internet content under clause 4 of Schedule 5 of the BSA. The Determination is dealt with further below. ACMA was also required to vary the *Telecommunications Numbering Plan 1997* to move the imposition of restrictions on mobile premium content to prefixes specified in the MPS Determination so that this is now dealt with under the national numbering plan (ACMA 2007c).

Finally, the regulation of telephone sex services was removed from Part 9A of the CPSSA and transferred to Schedule 7 of the BSA. Part 9A of the CPSSA continues to exist, but it simply requires telephone sex services to be supplied to numbers with a 1901 prefix (CPSSA, ss. 158B, 158H).

**SCOPE OF THE CONTENT SERVICES REGIME**

A great deal of the complexity of the content services regime lies in ascertaining the services that fall within the regime, and in distinguishing between the different categories of services that are
regulated by the regime. These matters will be summarised and explained in this section of the article.

'CONTENT SERVICES'
In general terms, the content services regime in Schedule 7 applies to services that fall within the definition of a 'content service'. A 'content service' is first defined broadly, before being limited by means of a long list of exceptions. Applying the broad definition, content services consist of the following two forms of service, regardless of the technology used to deliver the service:

- a service that delivers content to persons having equipment appropriate for receiving the content, where the delivery of the service is by means of a carriage service; or
- a service that allows end-users to access content using a carriage service (BSA, Schedule 7, cl. 2 (definition of 'content service', paras (a), (b)).

'Content' is defined to mean content whether in the form of text, data, speech, music or other sounds, visual images or any other form or combination of forms (BSA, Schedule 7, cl. 2 (definition of 'content'). As a 'carriage service' is defined broadly by section 7 of the TA to mean 'a service for carrying communications by means of guided and/or unguided electromagnetic energy', the broad definition encompasses all services that deliver, or provide access to, content by electronic means. Moreover, as end users that use a link to a content service are taken to have accessed the content service, links also fall within the definition of a content service (BSA, Schedule 7, cl. 8 (d)). This broad definition gives effect to the intention that a uniform regime should apply, in principle, to all electronic content, regardless of the technological platform used to make the content available.

Given the breadth of the services included in the basic definition, the most important part of the definition is the list of exempted services. Before turning to the specific exemptions, however, it is necessary to explain when content will be dealt with under Schedule 5 of the BSA and when it will be dealt with under Schedule 7.

'AUSTRALIAN CONNECTION': SCHEDULE 5 OR SCHEDULE 7?
Although it is not an integral part of the definition of a content service, a content service is only regulated by Schedule 7 if it has an 'Australian connection'. Under clause 3 of Schedule 7, a content service has an Australian connection if:

- any of the content provided by the content service is hosted in Australia; or
- in the case of a live content service, the service is provided from Australia (BSA, Schedule 7, cl. 3(1)).

Content services that do not have an Australian connection are either dealt with under Schedule 5 of the BSA or not regulated at all. Schedule 5 of the BSA, which formerly contained the entire stored content regime, now applies only to 'Internet content' that is hosted outside Australia. As was the case under the previous stored content regime, 'Internet content' is essentially defined to mean information that:
• is kept on a data storage device; and
• is accessed, or available for access, using an Internet carriage service (BSA, Schedule 5, cl. 3 (definition of 'Internet content')).

This means, for example, that live content that is streamed from outside Australia remains unregulated.

In summary, Schedule 5 of the BSA requires ISPs, including mobile service providers that provide Internet access, to comply with an industry code, which must impose obligations relating to 'family-friendly' filtering, in relation to content stored outside Australia. Implementing the recommendations of a departmental review of convergent content in relation to mobile access to Internet content, the CSA amended Schedule 5 to allow the Minister to determine that the filtering obligations do not apply to particular devices, such as mobile telephone handsets (BSA, Schedule 5, sub-clause 60(8A)). Access to Internet content stored outside Australia continues to be regulated by Version 10.5 of the Internet Industry Association's Internet Industry Codes of Practice, which was established pursuant to Schedule of the BSA and (IIA, 2005), and registered by ACMA on 26 May 2005 (IIA 2005). The IIA's Schedule 5 codes of practice, which are under review, require ISPs to make 'family friendly' filters available to end users, and to provide information to end users about 'family friendly' filters.

EXCLUSIONS FROM CONTENT SERVICES REGIME

The extensive list of exclusions from the definition of content service include services, such as broadcasting and datacasting services, that are dealt with under established content regulatory regimes, as well as services that are intended to remain unregulated, for example, because they are either low risk services or services, such as traditional voice telephony, for private communications.

For mobile service providers, the most important exempt services are as follows:

• **exempt point-to-point content services** – services that are produced or packaged by the service provider, which deliver content by email, instant messaging, SMS or MMS, and which do not specialise in prohibited or potential prohibited content. Commercial services that are provided for a fee, and adult chat services, fall outside this exemption. Adult premium SMS or MMS services also fall outside the exemption, as they specialise in potential prohibited content (BSA, Schedule 7, cl. 2 (definition of 'content service', para. (k); definition of 'exempt point to point content service'));

• **services that enable end users to communicate with other end users by means of voice or video calls, or by means of email** (BSA, Schedule 7, cl. 2 (definition of 'content service', paras (n),(o),(p)).

• **instant messaging services, SMS services and MMS services** – provided that the service enables end-users to communicate with other end-users, and is not an adult chat service ((BSA, Schedule 7, cl. 2 (definition of 'content service', paras (q),(r),(s)).

As is clear from the list of excluded services, the content services regime applies to services known as adult chat services, which are excluded from the exemptions from exempt point-to-point services, instant messaging services, SMS services and MMS services. Consequently, the
concept of adult chat services differentiates services that are subject to the content services regime from the forms of 'private' communications that are exempted from the regime. For the purpose of the regime, an 'adult chat service' is defined to mean a chat service where, having regard to:

- the name of the chat service;
- the way in which the service is advertised or promoted; and/or
- the reputation of the service;

it would be concluded that the majority of the content is reasonably likely to be prohibited content or potential prohibited content ((BSA, Schedule 7, cl. 2 (definition of 'adult chat service'). The content services regime therefore regulates content previously regulated as telephone sex services under Part 9A of the CPSSA, which forms a sub-set of services now classified as adult chat services. It should also be noted that whether or not a service is a proprietary network (or 'walled garden') service is not a relevant factor in determining whether the content services regime applies.

**DESIGNATED CONTENT/HOSTING SERVICES**

The substantive rules established by the content services regime apply to a sub-set of content services known as 'designated content/hosting services'. A 'designated content/hosting service' is defined to mean a hosting service, a live content service, a links service, or a commercial content service (BSA, Schedule 7, cl. 2 (definition of 'designated content/hosting service')).

- A 'hosting service' is a content service provided to the public (whether for a fee or otherwise) by a person who hosts stored content, other than content consisting of voicemail messages, video mail messages, email messages, SMS messages or MMS messages (BSA, Schedule 7, cl. 4).
- A 'live content service' is a content service provided to the public (whether for a fee or otherwise) that provides live content (BSA, Schedule 7, cl. 3 (definition of 'live content service')).
- A 'links service' is a content service provided to the public (whether for a fee or otherwise) that provides one or more links to a content service that specialises in prohibited content or potential prohibited content (BSA, Schedule 7, cl. 3 (definition of 'links service'); cl. 8).
- A 'commercial content service' is a content service that is operated for profit and is provided to the public only on payment of a fee (BSA, Schedule 7, cl 3 (definition of 'commercial content service')).

Importantly, a content service only falls within one of the above four categories if the service is 'provided to the public'. Schedule 7 provides that a service is 'provided to the public' if it is provided to at least one person outside the 'immediate circle' of the person who provides the service (BSA, Schedule 7, cl 7). This means that the content service is not regulated if it is provided only to the 'immediate circle' of the service provider.

What amounts to a person's 'immediate circle' is set out in considerable detail in section 23 of the TA (BSA, Schedule 7, cl 2, (definition of 'immediate circle'). For example, if a person is an individual, the person's 'immediate circle' consists of that person and employees (TA, s. 23(1)(a)). This means that an individual can supply a content service to employees without the service being regulated by the content services regime.
The complexities involved in determining the circumstances in which a content service is provided to the public may be illustrated by examining the position of universities. Section 23 of the TA provides that the 'immediate circle' of a tertiary education institution consists of the institution, together with the following persons:

- a member of the governing body of the tertiary education institution;
- an officer or employee of the tertiary education institution;
- a student of the tertiary education institution (TA, s. 23(m)).

Moreover, in addition to the members of the 'immediate circle' identified in section 23, ss 23(2) of the TA provides for Ministerial determinations that can specify additional persons who are part of the 'immediate circle'. A Ministerial determination made in 1998 extended the 'immediate circle' to contractors and to for-profit joint venture partners (Alston, 1998). Provided a university provides content services only to those persons who fall within the institution's immediate circle, those services are not regulated by the content services regime. Insofar as the university supplies content services to persons outside of the institution's immediate circle, however, such as by a generally accessible web-site or mobile service, the service falls within the content services regime.

The categories of service regulated by the content services regime are divided into 'stored content' and 'live content'. 'Stored content' is defined to mean content kept on a data storage device, other than content stored 'on a highly transitory basis as an integral function of the technology used in its transmission' (BSA, Schedule 7, cl. 2 (definition of 'stored content')). 'Live content' is content other than stored content (BSA, Schedule 7, cl. 2 (definition of 'live content')).

**CLASSIFICATION OF CONTENT**

The content services regime, like the stored content regime before it, uses the classification structure established by the existing national scheme for classifying submittable print publications, films and computer games. In particular, in order to ensure consistency with the regulation of offline content, the terms 'prohibited content' and 'potentially prohibited content' in the content services regime are defined by reference to classifications under the national classification scheme. To appreciate the operation of the content service regime, it is therefore necessary to have an understanding of the national classification scheme.

**THE NATIONAL CLASSIFICATION SCHEME**

The national classification scheme is a cooperative arrangement between the Commonwealth, States and Territories, established by the *Classification (Publications, Films and Computer Games) Act 1995* (the 'Classification Act'). The Classification Act is mirrored by State and Territory legislation, which complements the Commonwealth Act, and provides for the enforcement of the scheme.

The Classification Act establishes the Classification Board, that has responsibility for classification decisions, and the Classification Review Board, that is responsible for reviewing classification decisions. The Classification Operations Branch of the Federal Attorney-General's Department provides secretariat support to the Classification Board and the Classification Review Board, and classification training for industry and government bodies. The national scheme in-
cludes separate schemes for the classification of submittable publications; films, DVDs and videos; and computer games. The Classification Act expressly provides that the following matters are to be taken into account in making classification decisions:

- the standards of morality, decency and propriety generally accepted by reasonable adults;
- the literary, artistic or educational merit (if any) of the publication, film or computer game;
- the general character of the publication, film or computer game, including whether it is of a medical, legal or scientific character; and
- the persons, or class of persons, to or amongst whom it is published, or is intended or likely to be published (Classification Act, s. 11).

Material must be classified in accordance with the National Classification Code (NCC), which is set out in a Schedule to the Classification Act, and the classification guidelines (Classification Act, s. 9). The Classification Act establishes the types of classifications, while the material falling within each classification is set out in the NCC. The classification guidelines, namely the Guidelines for the Classification of Publications and the Guidelines for the Classification of Films and Computer Games, explain the application of the NCC in greater detail, as well as defining the terms used in the NCC. The NCC sets out the following principles to which classification decisions should endeavour to give effect:

- adults should be able to read, hear and see what they want;
- all people should be protected from exposure to unsolicited material that they find offensive;
- minors should be protected from material likely to harm or disturb them;
- the need to take account of community concerns about:
  - depictions that condone or incite violence, particularly sexual violence; and
  - the portrayal of persons in a demeaning manner (NCC, cl. 1).

The Classification Act sets out the following classifications for publications, films and computer games:

**PUBLICATIONS**

- Unrestricted;
- Category 1 restricted;
- Category 2 restricted;
- RC Refused Classification (Classification Act, s. 7(1)).

**FILMS**

- G General;
- PG Parental Guidance;
- M Mature;
- MA 15+ Mature Accompanied;
- R 18+ Restricted;
- X 18+ Restricted;
• RC Refused Classification (Classification Act, s. 7(2)).

COMPUTER GAMES

• G General;
• PG Parental Guidance;
• M Mature;
• MA 15+ Mature Accompanied;
• RC Refused Classification (Classification Act, s. 7(3)).

PROHIBITED CONTENT

The content services regime is aimed at preventing or restricting access to particular content, referred to as 'prohibited content' or 'potential prohibited content'. These categories of regulated content are defined by reference to the classification categories established under the national classification scheme.

'Prohibited content' refers to content that has received certain classifications by the Classification Board. While the national classification scheme only provides for the classification of submittable publications, films and computer games, the content services regime allows for applications to be made to the Classification Board for classification of all content regulated by the regime. Films and computer games are to be classified in a corresponding way to the way in which they have been, or would be, classified under the Classification Act (BSA, Schedule 7, cl. 24). Eligible electronic publications, which are electronic editions or audio recordings of print publications, are to be classified in the same way as the corresponding print publications have been, or would be, classified under the Classification Act (BSA, Schedule 7, cll. 11, 24). If the content does not consist of the entire unmodified contents of a film, a computer game, or an eligible electronic publication, then the content is to be classified in a corresponding way to the classification of a film under the Classification Act (BSA, Schedule 7, cl. 25).

In relation to films, computer games and all content other than eligible electronic publications, the relevant classification categories are RC, X18+, R18+ and MA15+. RC classified material is defined by the NCC to refer to items that:

• depict, express or otherwise deal with matters of sex, drug misuse or addiction, crime, cruelty, violence or revolting or abhorrent phenomena in such a way that they offend against the standards of morality, decency and propriety generally accepted by reasonable adults to the extent that they should not be classified; or
• describe or depict in a way that is likely to cause offence to a reasonable adult, a person who is, or appears to be, a child under 18; or
• promote, incite or instruct in matters of crime or violence (NCC, cl. 3, item 1).

The NCC defines X18+ classified material as material that contains real depictions of actual sexual activity between consenting adults in which there is no violence, sexual violence, sexualised violence, coercion, sexually assaultive language, or fetishes or depictions which purposefully demean anyone involved in that activity for the enjoyment of viewers in a way that is likely to cause offence to a reasonable adult, and which is unsuitable for a minor to see (NCC, cl. 3,
item 2). R18+ material is defined as material that is unsuitable for a minor to see (NCC, cl. 3, item 3). Finally, MA15+ material is defined by the NCC to mean material that depicts, expresses or otherwise deals with sex, violence or coarse language in such a manner as to be unsuitable for viewing by people under 15 (NCC, cl. 3, item 4). In each case, material that falls within the immediately preceding and more serious category is excluded. For example, material that would be classified X18+ is excluded from the R18+ classification.

The following forms of content (other than eligible electronic publications) are defined as prohibited content under the content services regime:

- Content classified as RC or X18+;
- Content classified as R18+, where access to the content is not subject to a restricted access system;
- Content classified as MA15+, that is commercial content provided on payment of a fee, that does not consist of text or still visual images, where access to the content is not subject to a restricted access system and is provided by a content service that is operated for profit; and
- Content classified as MA15+, where access is provided by means of a mobile premium service, and is not subject to a restricted access system (BSA, Schedule 7, cl. 20(1)).

A 'mobile premium service' is defined to mean a commercial content service where a charge for the supply of the service is either expected to be included in a bill sent by a mobile carriage service provider, or a charge for the content service is otherwise payable to the mobile carriage service provider (BSA, Schedule 7, cl. 3 (definition of 'mobile premium service')).

In relation to eligible electronic publications, prohibited content is defined in terms of the classifications that apply to printed publications, to mean publications classified as RC, category 2 restricted or category 1 restricted (BSA, Schedule 7, cl. 20(2)). RC classified publications are defined by the NCC to essentially refer to the same categories of material falling within the RC classifications for films and computer games (NCC, cl. 2, item 1). Category 2 restricted publications are defined to mean publications that explicitly depict sexual or sexually related activity between consenting adults in a way that is likely to cause offence to a reasonable adult; or depict, describe or express revolting or abhorrent phenomena in a way that is likely to cause offence to a reasonable adult and are unsuitable for a minor to see or read (NCC, cl. 2, item 2). Category 1 restricted publications are defined to mean publications that explicitly depict nudity, or describe or implicitly depict sexual or sexually related activity between consenting adults, in a way that is likely to cause offence to a reasonable adult; or describe or express in detail violence or sexual activity between consenting adults in a way that is likely to cause offence to a reasonable adult; or are unsuitable for a minor to see or read (NCC, cl. 2, item 3).

**POTENTIAL PROHIBITED CONTENT**

Potential prohibited content refers to content that has not been classified by the Classification Board, but if it were to be classified, there is a substantial likelihood that the content would be prohibited content (BSA, Schedule 7, cl 21). However, content that consists of an eligible electronic publication is not taken to be potential prohibited content if there is no substantial likelihood that it would be classified RC or category 2 restricted (BSA, Schedule 7, cl 21(2). Content likely to be classified category 1 restricted is not regarded as potential prohibited content. Neve-
ertheless, if the content is actually classified as category 1 restricted, it becomes prohibited content.

The category of potential prohibited content is required as, given the vast amount of material regulated by the regime and its inclusion of ephemeral content, it is not feasible to require all such content to be actually classified under the national classification scheme. As the EM to the implementing legislation explained:

The DCITA review has found that it would be unreasonably burdensome to require classification of convergent content services under the national classification scheme. This is because of the dynamic nature of the content, the number of content items likely to be involved, their time specific value and their rapid refreshment rate. (EM, paragraph 58).

COMPLAINTS ABOUT CONTENT

In general, regulatory action under the content services regime is initiated by a complaint made about the availability of prohibited content or potential prohibited content. Complaints can be made where a person has reason to believe that end-users in Australia can access prohibited or potential prohibited content, where a person has reason to believe that a hosting service is hosting prohibited or potential prohibited content, or where a person has reason to believe that end-users in Australia can access prohibited or potential prohibited content by using a link provided by a links service (BSA, Schedule 7, cl. 37).

ACMA is generally required to investigate complaints made to it under the content services regime, but need not investigate a complaint that could have been made under a registered industry code (BSA, Schedule 7, cl. 43). As explained below, ACMA has registered a content services industry code prepared by the Internet Industry Association (IIA). This means that complaints should, in the first instance, be made to the content service provider, and not ACMA. The requirements for dealing with complaints under the Internet Industry Association’s industry code are explained further below. If the complainant is not satisfied with the service provider’s response, it may then complain to ACMA.

In addition, ACMA has the ability to investigate the availability of prohibited or potential prohibited content to end-users in Australia on its own initiative (BSA, Schedule 7, cl. 44).

TAKE DOWN AND SERVICE CESSION PROCEDURES

The content services regime establishes a framework for ACMA to issue notices to designated content/hosting service providers that require the removal of, or disabling of access to, prohibited or potential prohibited content.

The regime provides for ACMA to issue two main forms of notice: final notices and interim notices. A final notice is issued in relation to content that has been classified as prohibited by the Classification Board. An interim notice, on the other hand, is the means by which the regime deals with unclassified content. It is issued in relation to potential prohibited content, and directs the service provider to take certain action pending classification of the content by the Classification Board. Where ACMA issues an interim notice, it must apply to the Classification Board to have the content classified. If, in response to the application, the Classification Board classifies the material as prohibited content, ACMA must issue a final notice. The Schedule does not specifically
address what is to happen if the material is not classified as prohibited content. Presumably either the ACMA would formally revoke the interim notice, or it would lapse.

The precise form of final and interim notices depends upon the category of service provider to whom the notice is given, and on the classification of the content. Notices may be given to hosting service providers, live content service providers and links service providers. Hosting service providers may be given take-down notices which, in general, require them to cease hosting the content or to cease providing the content service to the public (BSA, Schedule 7, cl. 47). Live content service providers may be given service-cessation notices that, in general, require them to cease providing the service (BSA, Schedule 7, cl. 56). Links service providers may be given link-deletion notices which, in general, require them to cease providing a link to content or to cease providing the content service to the public (BSA, Schedule 7, cl. 62).

Regardless of the service provider to whom the notice is given, notices issued by ACMA must direct service providers to take action to ensure that one of two forms of situation, known as a 'type A remedial situation' or a 'type B remedial situation', comes into existence. An ACMA notice must require action to ensure a type A remedial situation where the content (other than an eligible electronic publication) is classified, or likely to be classified, as RC or X18+. An ACMA notice must, on the other hand, direct a type B remedial situation to come into existence where the content (other than an eligible electronic publication) is classified, or likely to be classified, as R18+ or MA15+. Reflecting the difference in the classifications applied to the material, a type A remedial situation exists, in general, where the content is removed or is not able to be accessed by the public, whereas a type B remedial situation may exist where the content is removed, or is not able to be accessed by the public, or is subject to a restricted access system.

Table 1 summarises the notices that may be issued by ACMA in relation to complaints about particular content services with an Australian connection, and the actions that must be taken by service providers in response to ACMA notices.

In addition to the above notices, provision is made for ACMA to issue 'special' take down, service-cessation and link-deletion notices that require the removal, or disabling of access to, material that is similar to the material that was the subject of the complaint (BSA, Schedule 7, cls 52, 59A, 67). This measure is designed to deal with attempts at avoiding the regime by simply removing the specific material identified in a notice and replacing it with similar material.

Service providers are required to comply with notices as soon as practicable after the notice was given or, in any case, by 6 pm on the next business day (BSA, Schedule 7, cls 53, 60, 68). The rules requiring service providers to comply with ACMA notices are known as designated content/hosting service provider rules. Apart from notices, the content services regime establishes a procedure for ACMA to accept written undertakings from service providers as an alternative to issuing formal notices. Provision is also made for the voluntary withdrawal of content or the voluntary deletion of links.

Service providers may seek a merits-based review of ACMA decisions to issue take-down notices, service-cessation notices or link-deletion notices by means of an application to the Administrative Appeals Tribunal (AAT) (BSA, Schedule 7, cl. 113).
<table>
<thead>
<tr>
<th>Service</th>
<th>Content</th>
<th>Notice</th>
<th>Remedial situation</th>
</tr>
</thead>
</table>
| **Hosting service** (not eligible electronic publication) | Prohibited content classified RC or X18+.        | Final take-down notice.  | Type A:   
  - content not hosted;  
  - content not provided to the public. |
| **Hosting service** (not eligible electronic publication) | Prohibited content classified R18+ or MA15+.     | Final take-down notice.  | Type B:  
  - content not hosted;  
  - content not provided to the public;  
  - access to content subject to restricted access system. |
| **Hosting service** (eligible electronic publication)   | Prohibited content classified RC, category 2 restricted, or category 1 restricted. | Final take-down notice.  | Type A:  
  - content not hosted;  
  - content not provided to the public. |
| **Hosting service** (not eligible electronic publication) | Potential prohibited content likely to be classified RC or X18+. | Interim take-down notice. | Type A:  
  - content not hosted;  
  - content not provided to the public. |
| **Hosting service** (not eligible electronic publication) | Potential prohibited content likely to be classified R18+ or MA15+. | Interim take-down notice. | Type B:  
  - content not hosted;  
  - content not provided to the public;  
  - access to content subject to restricted access system. |
| **Hosting service** (eligible electronic publication)   | Potential prohibited content likely to be classified RC or category 2 restricted. | Interim take-down notice. | Type A:  
  - content not hosted;  
  - content not provided to the public. |
| **Live service**                     | Prohibited content classified RC or X18+.        | Final service-cessation notice. | Type A:  
  - provider does not provide service. |
| **Live service**                     | Prohibited content classified R18+ or MA15+.     | Final service-cessation notice. | Type B:  
  - provider does not provide service;  
  - access to content subject to restricted access system. |
| **Live service**                     | Potential prohibited content likely to be classified RC or X18+. | Interim service-cessation notice. | Type A:  
  - provider does not provide service. |

Table 1 Take-Down and Service-Cessation Notices
<table>
<thead>
<tr>
<th>Service</th>
<th>Content</th>
<th>Notice</th>
<th>Remedial situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live service</td>
<td>Potential prohibited content likely to be classified R18+ or MA15+.</td>
<td>Interim service-cessation notice.</td>
<td>Type B:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ provider does not provide service;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ access to content subject to restricted access system.</td>
</tr>
<tr>
<td>Links service</td>
<td>Prohibited content classified RC or X18+.</td>
<td>Final link-deletion notice.</td>
<td>Type A:</td>
</tr>
<tr>
<td>(linked content</td>
<td></td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>not eligible</td>
<td></td>
<td></td>
<td>▪ content not provided to the public;</td>
</tr>
<tr>
<td>electronic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>publication)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Links service</td>
<td>Prohibited content classified R18+ or MA15+.</td>
<td>Final link-deletion notice.</td>
<td>Type B:</td>
</tr>
<tr>
<td>(linked content</td>
<td></td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>not eligible</td>
<td></td>
<td></td>
<td>▪ content not provided to the public;</td>
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<tr>
<td>electronic</td>
<td></td>
<td></td>
<td>▪ access to content subject to restricted access system.</td>
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<tr>
<td>publication)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Links service</td>
<td>Prohibited content classified RC, category 2 restricted or category 1</td>
<td>Final link-deletion notice.</td>
<td>Type A:</td>
</tr>
<tr>
<td>(linked to</td>
<td>restricted.</td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>eligible</td>
<td></td>
<td></td>
<td>▪ content not provided to the public;</td>
</tr>
<tr>
<td>electronic</td>
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<tr>
<td>publication)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Links service</td>
<td>Potential prohibited content likely to classified RC or X18+.</td>
<td>Interim link-deletion notice.</td>
<td>Type A:</td>
</tr>
<tr>
<td>(linked content</td>
<td></td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>not eligible</td>
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<td>▪ content not provided to the public;</td>
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<td>electronic</td>
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<tr>
<td>publication)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Links service</td>
<td>Potential prohibited content likely to be classified R18+ or MA15+.</td>
<td>Interim link-deletion notice.</td>
<td>Type B:</td>
</tr>
<tr>
<td>(linked content</td>
<td></td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>not eligible</td>
<td></td>
<td></td>
<td>▪ content not provided to the public;</td>
</tr>
<tr>
<td>electronic</td>
<td></td>
<td></td>
<td>▪ access to content subject to restricted access system.</td>
</tr>
<tr>
<td>publication)</td>
<td></td>
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</tr>
<tr>
<td>Links service</td>
<td>Potential prohibited content likely to be classified RC or category 2</td>
<td>Interim link-deletion notice.</td>
<td>Type A:</td>
</tr>
<tr>
<td>(linked to</td>
<td>restricted.</td>
<td></td>
<td>▪ provider ceases to provide link;</td>
</tr>
<tr>
<td>eligible</td>
<td></td>
<td></td>
<td>▪ content not provided to the public;</td>
</tr>
<tr>
<td>electronic</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>publication)</td>
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</tbody>
</table>

Table 1 (cont’d) Take-Down and Service-Cessation Notices
THE CONTENT SERVICES CODE (CSC)

The content services regime is a co-regulatory regime, with significant details dealt with by an industry code, and with ACMA having the power to make mandatory industry standards in the absence of a satisfactory code. Under clause 81 of Schedule 7 of the BSA, the following matters must be dealt with in an industry code that applies to commercial content service providers:

- the engagement of trained content assessors;
- ensuring that unclassified content that is potentially prohibited content – other than live content or an eligible electronic publication – is not provided by commercial content services, other than news or current affairs services, unless it has been assessed by a trained content assessor;
- ensuring that live content is not provided by commercial content services, other than news or current affairs services, unless there is no reasonable likelihood that the content would be classified RC, X18+, R18+ or MA15+, or the content has been assessed by a trained content assessor;
- ensuring that an unclassified eligible electronic publication that is substantially likely to be classified RC or category 2 restricted, is not provided by commercial content services, other than news or current affairs services, unless it has been assessed by a trained content assessor.

Clause 85 of Schedule 7 of the BSA provides that ACMA must register an industry code once it is satisfied of certain matters.

The Internet Industry Association (IIA) facilitated the development of the Content Services Code (the CSC), which was registered by ACMA on 10 July 2008 (IIA 2008). In doing so, ACMA was required to be satisfied that the IIA is an association that represents hosting service providers, live content service providers, links service providers and commercial content services providers, with an Australian connection (BSA, Schedule 7, cl. 85). The CSC deals with arrangements for classifying content by trained content assessors, complaints handling and procedures for complying with ACMA notices.

ASSESSMENT OF CONTENT AND CLASSIFICATION

Clause 8 of the CSC sets out the circumstances in which a commercial content service provider must arrange for a trained content assessor to classify content. It provides that unclassified content must be assessed in the following circumstances:

- **Stored content (other than an eligible electronic publication)** – where the service provider, acting reasonably, considers the content to be substantially likely to be prohibited or potential prohibited content;
- **Live content (other than a news or current affairs service)** – where the service provider, acting reasonably, considers the likely or anticipated content to be of a kind which is substantially likely to be potential prohibited content;
- **Eligible electronic publication (other than a news or current affairs service)** – where the service provider, acting reasonably, considers the content to be of a kind which is substantially likely to be classified RC or Category 2 restricted.
COMPLAINTS

Clause 9 of the CSC requires designated content/hosting service providers to investigate complaints in the following circumstances:

- **Hosting service provider** – should investigate a complaint regarding stored content if it is reasonable to believe that end-users in Australia can access prohibited or potential prohibited content; the complaint is not frivolous or vexatious, and is made in good faith; the content is hosted by the service provider; and the complaint is made within 30 days of the content being made available to the complainant.

- **Commercial content service provider** – should investigate a complaint regarding stored content if it is reasonable to believe that end-users in Australia can access prohibited or potential prohibited content; the complaint is not frivolous or vexatious, and is made in good faith; the content is provided to end users in Australia by the service provider; and the complaint is made within 30 days of the content being made available to the complainant.

- **Links service provider** – should investigate a complaint if it is reasonable to believe that end-users in Australia can access prohibited or potential prohibited content using a link; the complaint is not frivolous or vexatious, and is made in good faith; and the complaint is made within 30 days of the link being made available to the complainant.

- **Live content service provider** – should investigate a complaint regarding live content if it is reasonable to believe that end-users in Australia can access prohibited or potential prohibited content; the complaint is not frivolous or vexatious, and is made in good faith; the content is provided to end users in Australia by the live content service provider; and the complaint is made within 30 days of the occurrence of the incident complained of.

The CSC requires designated content/hosting service providers to publish complaints handling procedures, and to provide an end user with a copy of, or electronic access to, the published procedures when requested to do so (CSC, cl. 9.7, 9.8).

TAKE DOWN AND SERVICE CESSSION PROCEDURES

The CSC includes diagrammatic summaries of the procedures for service providers to follow in response to ACMA notices. Although the diagrams do no more than summarise the rules established by the content services regime, and dealt with in Table 1, they are reproduced here in figures 1 to 4, with minor modifications, to assist in clarifying the relevant processes that must be followed.

RESTRICTED ACCESS SYSTEM (RAS)

As explained above, content (other than an eligible electronic publication) that is classified R18+ or MA15+ is not prohibited content if it is subject to a restricted access system. Given the difficulties encountered in establishing standards for restricted access systems, the requirement to implement restricted access systems for R18+ and MA15+ material has been one of the most controversial aspects of the content services regime.
Figure 1 Final Notices: Content other than Eligible Electronic Publications (EEPs)
Source: IIA

Figure 2 Final Notices: EEPs
Source: IIA

Figure 3 Interim Notices: Content other than EEPs
Source: IIA
Clause 14 of Schedule 7 of the BSA requires ACMA to make a declaration that a specified access-control system is a restricted access system for the purposes of the content services regime. To comply with this requirement, ACMA introduced the RAS Declaration which came into effect with other aspects of the new regime on 20 January 2008. The RAS Declaration, which replaced the previous ACMA Restricted Access Systems Declaration 1999 (No 1), also supplanted access control rules established under the MPS Determination. The RAS Declaration deals separately with the minimum standards for MA15+ content and for R18+ content.

MA15+ CONTENT

The minimum requirements for an access-control system that restricts access to MA15+ content are as follows:

- **Application for access.** The content must be accessed by means of an application, and the applicant must provide a written or electronic declaration that he or she is at least 15 years of age.
- **Warnings and safety information.** The access-control system must provide, for each application for access, a warning about the nature of the content and safety information about how a parent or guardian may control access to the content by persons under 15.
- **Limitation on access.** The system must not provide access to the content unless it has verified that an application has been made in the required form (together with a declaration) and the required warnings and safety information have been given. Access may, however, be granted if the applicant has previously submitted an application (and declaration) in the required form, and the required warnings and safety information have previously been given to the applicant. Repeat access may, for example, be authorised by means of a Personal Identification Number (PIN), or by some other means of limiting access.
- **Quality assurance measures.** The system must include measures that will remove an applicant’s access to the content without delay where the limitations on access are not complied with (RAS Declaration, cl. 5-9).

R18+ CONTENT

The minimum requirements for an access-control system that restricts access to R18+ content are more stringent than those that apply to MA15+ content. They are as follows:
- **Application for access.** The content must be accessed by means of an application.
- **Warnings and safety information.** The access-control system must provide, for each application for access, a warning about the nature of the content and safety information about how a parent or guardian may control access to the content by persons under 18.
- **Age verification.** The system must verify that the applicant is at least 18 years of age by requiring the applicant to supply evidence of age, and applying a risk analysis.
- **Limitation on access.** The system must not provide access to the content unless it has verified that an application has been made, that the required warnings and safety information have been given, and that the applicant is at least 18 years of age. Access may, however, be granted to repeat applicants if there is some means of verifying compliance with the system, such as by use of a PIN.
- **Risk analysis.** The system must include a risk analysis that identifies and assesses the risk that the evidence of age submitted to the system could be used by someone other than the applicant, or by a person who is younger than the age identified in the evidence.
- **Quality assurance measures.** The system must include measures that will remove an applicant’s access to the content without delay where the limitations on access are not complied with, and must provide for periodic reviews of the effectiveness of the required risk analysis.
- **Record keeping requirements.** The system must provide for the keeping of records, for a period of two years, to demonstrate how the age of applicants has been verified (RAS Declaration, cll. 10-17).

The requirements imposed on content service providers under the RAS Declaration are supplemented by provisions of the CSC, which provide service providers with some practical guidance on complying with the obligations to provide warnings and safety information (in relation to MA15+ and R18+ content), and age verification and risk analysis (in relation to R18+ content). Importantly, the CSC provides the following guidance in relation to the obligation to engage in risk analysis before providing access to R18+ content.

- **Age authentication methods.** It is unlikely that the age of the applicant would be falsified where the service provider obtains a credit card number in the name of the applicant, or sights an original or copy of one of the following documents that indicate the age of the applicant: an identification card issued by a tertiary education institution; a licence or permit issued under a law of the Commonwealth, State, Territory, or another country; a passport; or a birth certificate (CSC, cl. 19.3).
- **Mitigating risk.** The risk of an applicant falsifying his or her age can be mitigated by the service provider collecting the applicant’s name, and, if applicable, the account number or other unique identifier of the user’s contractual relationship with the service provider. The risk that the person who accesses the content might be younger than the evidence of age indicates can be mitigated by obtaining a declaration that the user is at least 18 years of age (CSC, cll. 19.4, 19.5).
- **Confirmation of access.** The risk of falsification of identity can be mitigated by the service provider providing confirmation of access to the named user in written or electronic form, or instigating an authorised charge on the user’s credit card (CSC, cl. 19.6).
ENFORCEMENT

The content services regime establishes two enforcement regimes: the enforcement of the designated content/hosting service provider rules and the enforcement of the industry code.

DESIGNATED CONTENT/HOSTING SERVICE PROVIDER RULES

As explained above, the rules requiring service providers to comply with ACMA notices are known as designated content/hosting service provider rules (the 'service provider rules'). Moreover, provision is made for ACMA to determine additional service provider rules (BSA, Schedule 7, cl. 104).

The content services regime establishes a tiered regime for the enforcement of the service provider rules. The flexible enforcement options available to ACMA allow for regulatory responses to be calibrated in accordance with a number of relevant considerations, such as the seriousness of the breach and whether the service provider is a repeat offender (Ramsay 2005). The tiered regime that applies to the enforcement of the service provider rules consists of the following options:

- **Formal warnings** – ACMA may issue a formal warning to a content service provider where it is satisfied that the service provider has contravened, or is contravening, a service provider rule (BSA, Schedule 7, cl. 109).
- **Remedial directions** – ACMA may give a content service provider a written remedial direction, requiring the service provider to take specified action to remedy a contravention, where it is satisfied that the service provider has contravened, or is contravening, a service provider rule (BSA, Schedule 7, cl. 108). It is an offence for a person to contravene an ACMA remedial direction.
- **Civil penalty** – A person who contravenes a service provider rule is subject to civil penalties (BSA, Schedule 7, cl. 107).
- **Criminal offence** – A person who engages in conduct that contravenes a service provider rule commits a criminal offence (BSA, Schedule 7, cl. 106).
- **Federal Court order** – If ACMA is satisfied that a content service provider is contravening a service provider rule, it may apply to the Federal Court for an order that the service provider cease providing the service (BSA, Schedule 7, cl. 110).

In proceedings relating to 'special' take-down notices, or 'special' link-deletion notices, it is a defence for the service provider to establish that it did not know, or could not, with reasonable diligence, have ascertained, that the content was prohibited or potential prohibited content (BSA, Schedule 7, cll. 53(4), 68(4)).

ENFORCEMENT OF THE CSC

As explained above, the IIA CSC imposes obligations on service providers in relation to matters including pre-assessment of commercial content services, complaints handling, and Take Down and Service Cessation procedures. The content services regime establishes a tiered regime for the enforcement of compliance with the CSC. The tiered regime provides for ACMA to take the following actions to enforce compliance with the CSC:
• **Formal warnings** – ACMA may issue a formal warning to a participant in a section of the content industry where the content service provider contravenes a registered industry code (BSA, Schedule 7, cl. 90).

• **Direction to comply with CSC** – If ACMA is satisfied that a participant in a section of the content industry has contravened, or is contravening, a registered industry code, it may give a written direction to the content service provider to comply with the code (BSA, Schedule 7, cl. 89).

The requirement to comply with an ACMA direction relating to a registered industry code is a service provider rule. This means that, once ACMA has issued a written direction to comply with an industry code, the full range of options that are available for enforcing compliance with the service provider rules becomes available to enforce the ACMA direction.

**PRELIMINARY OBSERVATIONS**

Regulatory regimes imposing controls over content involve establishing a balance between protecting the freedom of adults to access content, on the one hand, and protecting children from unsuitable material, on the other. New technologies for delivering content, especially multifunction mobile devices, threaten the balance traditionally struck, insofar as they enable users, including children, to access a vast amount of unclassified material, wherever and whenever the user wishes.

The increasing use of mobile devices by children, and the ability of such devices to access the full range of available content, poses problems, as mobile devices are far less amenable to parental supervision than other ways of accessing content. Moreover, available research suggests that children may be unlikely to report instances of accessing unsuitable material (Livingstone and Bober 2005). This means that greater emphasis is necessarily placed on age-verification systems for restricting access to age-inappropriate material, and on content filtering solutions (Ofcom 2008).

The content services regime is a novel solution to the problems posed by new technologies for delivering content in so far as it seeks to impose a uniform regime across the complete range of content services that fall outside of established regimes, such as the classification regimes that apply to broadcast content, print publications, films and computer games. The new regime purports to apply to content as diverse as premium rate mobile services (including adult chat services), live Internet streaming, online games and even online virtual worlds. Whether it is possible to apply the relatively complex regulatory regime explained in this article to new forms of communications content, without incidentally chilling Australian innovation, remains to be seen. Meanwhile, it is important to acknowledge that differences between traditional technologies for delivering content and the newer technologies have necessitated policy choices relating to the classification regime that, in our view, require further consideration. In particular, there are at least three aspects of the content services regime that merit further analysis.

First, as explained above, the regime is designed to regulate access to commercial content that is classified, or is likely to be classified, as MA15+, where access is provided by means of a mobile premium service and is not subject to a restricted access system. As further explained, the RAS Declaration requires access to such content to be subject to an application process, in-
cluding a declaration that the applicant is at least 15 years of age. Given user demands for instantaneous access to mobile content, the regime clearly imposes costs on adult users in terms of the additional time taken to access services, as well as on service providers. Furthermore, in the absence of any accepted means for distinguishing users that are under the age of 15 from those that are over that age, the effectiveness of the regime in limiting access to MA15+ material must be questioned. Finally, it is important for policy-makers in this area to recognise that it is important for children to actively engage with technology, and to balance that imperative against the need to protect them from unsuitable material. In this respect, the findings of the UK Byron Review, which has no equivalent in Australia, offer a much-needed corrective to some of the more unbalanced views surrounding children and new technologies (Byron 2008). As the Byron Review points out, interaction with technologies is an important part of child development in the twenty-first century, and it is just as important for children to make decisions for themselves, as it is to manage the risks associated with unsuitable material. This is not to say that such risks do not exist, but merely that we should be careful about tilting the balance too far in favour of an over-protective and 'risk averse' culture.

Secondly, the content services regime applies only to content with an Australian connection. As explained above, stored Internet content hosted outside Australia remains subject to Schedule 5 of the BSA, which essentially requires ISPs to supply 'family-friendly' filtering software to end-users. The Commonwealth government is currently considering imposing more onerous requirements on ISPs relating to filtering of Internet content (Conroy 2008). An assessment of these proposals falls outside the scope of this article. Nevertheless, the global nature of content delivery platforms, especially the Internet, continues to pose significant challenges for national jurisdictions seeking to regulate access to content.

A predictable response to the imposition of more onerous and costly restrictions in any one jurisdiction is for content providers to locate their services in jurisdictions where they are subject to less regulatory burdens. For example, while an Australian provider of an online game or virtual world would be subject to obligations under the content services regime, a US based service provider is under no such legal obligations. In this respect, the extent to which the regime fulfils the statutory regulatory policy objectives of encouraging 'the development of communications technologies and their application', and 'the provision of services made practicable by those technologies to the Australian community', or whether it simply encourages elements of the content industry to move offshore, must be questioned.

Thirdly, the complexities associated with determining whether or not a content service falls within the content services regime would seem to impose relatively high regulatory costs. The regime deliberately extends content regulation to forms of delivering content, or making content available, that have previously been unregulated, including Internet streaming and providing links to prohibited or potential prohibited content. There are, however, considerable uncertainties arising from the complex way in which the regime distinguishes regulated from unregulated services. For example, determining when a service is provided 'to the public' may require expert legal analysis. Furthermore, decisions about the classification of content, which are required in order to determine whether content is prohibited or potentially prohibited, are far from black and white.

The overall effect of the complexities and legal uncertainties associated with the regime may well be that risk averse content service providers decide against providing some material aimed
at an adult audience. Moreover, it seems likely that the regulatory framework, which requires complaints to be directed to service providers in the first instance, is likely to result in service providers removing material, rather than risking complaints to ACMA. In this respect, it is notable that, while provision is made for service providers to appeal from an ACMA notice to the AAT, there is no provision for those who are responsible for content, such as a person who requests a hosting service provider to host content, to appeal against a decision of the service provider to remove content.

**CONCLUSION**

The content services regime represents an important attempt to establish a consistent, uniform regulatory regime that applies to the full range of content delivered over diverse new communications platforms. As such, it amalgamates and harmonises existing regimes, specifically the stored Internet content regime under Schedule 5 of the BSA, the telephone sex services regime under Part 9A of the CPSSA, and the premium rate mobile services regime under the MPS Determination. In addition, the regime extends content regulation to previously unregulated content services, including live Internet streaming services and services providing links to prohibited or potential prohibited content.

The introduction of the regime has the benefit of establishing uniform standards, and removing potential inconsistencies from the previous disparate regulatory regimes. At the same time, questions remain about the extent to which it has correctly balanced the competing policy objectives in this area. While it is important to ensure that children are appropriately protected from unsuitable content, it is also important to ensure that adults are free to access content and to foster an innovative local content industry. Moreover, in terms of child development, it is important to acknowledge the difficult balance to be struck between encouraging children to use and explore new technologies, while ensuring adequate protection from age-inappropriate material. This is a more complex social problem than simply prohibiting all access to material that some sections of the community may consider offensive or challenging.

Given that the regime has only recently been established, there is insufficient information about how it will work in practice for any definitive views to be expressed about its effectiveness. Nevertheless, an analysis of the overall regulatory framework suggests that the legislatively mandated review, which is required to take place within three years after commencement (BSA, Schedule 7, cl 118), should take the regulatory costs of the regime fully into account. These costs include not only the compliance costs imposed on industry, but also the costs that may arise from useful material not being available as a result of the regulatory incentives to remove material, and of Australian content services moving offshore. If the regime proves to have more symbolic value, in allowing politicians to make claims that they are protecting children, than actual effectiveness in controlling access to material, then a full assessment of the costs clearly becomes more important.
ENDNOTES

1. In 2005, the Australian Communications Authority merged with the Australian Broadcasting Authority to become the Australian Media and Communications Authority.

2. Sub-clause 1.3 of the MPS Determination defined a ‘premium SMS or MMS service’ to mean a carriage service or content service supplied by way of a call to a number with the prefix 191, 193, 194, 195, 196, 197 or 199. A ‘proprietary network’ was defined to mean ‘a telecommunications network used by a mobile carriage service provider that enables customers of that provider to access, by way of a mobile device, a premium content service that is not otherwise generally available’.

3. These diagrammatic summaries are reproduced in this article with the permission of the Internet Industry Association.

4. A civil penalty, which may include non-monetary as well as monetary orders, is a penalty imposed by courts imposing civil rather than criminal processes (Ramsay 2005).

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Wrong Number or Simply Crosstalk?

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Anyone familiar with the judicial criticism of Henry Ergas for performing more as an advocate than as an expert will not be surprised by this book. He has become a familiar figure in the development of competition policy in Australia, dating from the days of his return from the OECD and working alongside Alan Fels at Monash University. However, over recent years his advocacy has drifted from the arguments he mounted when representing OTC and its desire to enter the value-added services market to his latter incarnation as an expert regularly retained by Telstra.

The book freely acknowledges Telstra’s help and they would not regret their support, as the outcome is a collection of arguments of the horrors of the telecommunications regulatory regime (well, actually only one part, the access regime in Part XIC of the Trade Practices Act). These are arguments that Telstra will appreciate, if only because they have almost all been aired by them at some point in the past.

It is, however a pity that some of that funding could not have provided better editorial resources for the volume. It is jarring to find three grammatical (or typographical if we are generous) errors in the first paragraph of a book. This is not a trend that continues, except for some strange section numbering included in the introduction to Chapter 3, which indicates that in an earlier iteration this was actually Chapter 4 and the incorrect labelling of the horizontal access of Figure 7.4. I could also quibble over the choice of terms selected for inclusion in the index.

As an advocate, Ergas does an excellent job in the book of clearly laying out his arguments in a way that makes his reasoning easy to follow. However, clarity of argument does not make up for false or missing hypotheses (or facts or assumptions) or for invalid syllogisms. The detailed structure of the arguments presented here makes them no more persuasive than they have been on the other occasions they have been offered.

The impasse of the subtitle that the book sets out to resolve is the claimed under-investment in telecommunications infrastructure, a situation that is described in the concluding chapter as ‘a new major wave of telecommunications investment is required to complete … restructuring and renewing the CAN. This is the key to making the network capable of providing end-to-end very high-speed service. It will not happen in a timely and efficient manner unless the regulatory regime is overhauled.’

The argument that is laid out in the book uses the dictums of all great sermons: tell them what you are going to tell them, tell them, and then tell them what you told them. It does make the book a tad repetitive at times, and does result in some of the more robust parts of the argument getting lost.

The overall argument proceeds as follows. There has been an underinvestment in telecommunications networks because access seekers get access to the Telstra network at artificially low prices and so don’t invest in their own networks, while at the same time Telstra is under-investing because it cannot achieve a satisfactory return. The cause of this state of affairs is argued to be a poorly designed regulatory regime that provides too much scope and discretion to the regulator.
in determining what services to provide access to, that provides insufficient guidance to the regulator in how to set prices and has insufficient opportunities for appropriate review of decisions. The specific outcomes are claimed to be an excessive list of services brought within the scope of access regulation, and the prices for the services being set using methodologies that are time inconsistent and biased towards achieving the lowest rather than most appropriate price. All of this has been justified by the regulator on the basis that despite the regulation Telstra remains profitable, which amounts to 'soak the rich' taxation and masks the achievement of short term profits by choosing to under invest.

A review is not the place for a detailed response to all the elements of the argument; the comments here will be limited to an overall assessment of the exposition provided. There are many weaknesses in the arguments, and a sample will be chosen that represent the categories of these weaknesses.

All arguments (in the logical sense) start somewhere; the logician calls these hypotheses but other more practical types call them facts or assumptions. For an argument to produce true conclusions the hypotheses need to be true (and complete) and the reasoning valid. The book fails in its choice of hypotheses and misrepresents others. The reasoning in the book suffers from an inadequate comparison, inadequate consideration of the interests at play and most importantly from inconsistent application of economic theory.

This book chooses 1997 as a point in time to start the analysis, and builds from this a conclusion that telecommunications regulation has failed because Optus failed to build a business relying on its HFC network; in doing so three important activities preceding 1997 are ignored. These are the choice of competition model chosen for Australia (in long distance), the strategies by Telstra to introduce pricing plans known as Flexiplans and Strategic Partnership Agreements (SPAs) and the decision of Telstra to overbuild the Optus HFC network.

The model of competition in long distance commenced in 1991 was modelled on the US experience with long distance competition. The very different regulatory model where interstate calls had always been treated differently from intra-state calls (due to the constitutional arrangements) was ignored. The competitor to Optus (Kaloori) did not bid in the end because of the problem with providing a local service. The model was compounded by the decision (opposed vigorously by Ergas and his client OTC) to merge Telecom with OTC.

More damagingly, both the pricing plan decisions and the decision to overbuild were strategies developed by Telstra to respond to Optus. In fact both resulted in actions by Optus under Trade Practices law. The first was settled with an undisclosed payment to Optus, but which all in Telstra regarded as minor compared to the competitive advantage achieved. The second was settled with a payment that Bill Scales describe as a 'trifling amount'. While both were probably settled with no admission of liability by Telstra, they both reflect that there has been a lot more in play than the 1997 access regime.

Telstra’s current campaign of complaint about the under-utilisation of the Optus HFC is merely a case of Telstra complaining about the success of its own strategy. They set out to destroy the Optus HFC business case and succeeded.2

This leads to another incorrect statement that the book repeats twice: that Telstra is no more or less horizontally or vertically integrated than its major counterparts overseas. In reality Telstra is very unusual; in most markets the incumbent fixed line provider is excluded from Pay TV.
ADSL was the outcome of goal-directed research by the old integrated AT&T for a competitive response to cable operators entering telecommunications. In many markets incumbent operators face competition from operators who have vertically integrated operations at least on the same continent, Telstra has a continent to itself.

Also in these introductory chapters it is claimed that over $3B of taxpayers money has been appropriated to telecommunications schemes and implying that the Government's $4.7B for the National Broadband Network was additional to that. This is erroneous, as it includes the $2B for the Communications Fund in both amounts. But even this claim is later confused as the book states "Telstra, having had cost recovery continually compromised, refuses to invest in the roll-out of a new high-speed access network unless that network is massively subsidised" (P.163). This is not Telstra's claim; their claim is that they will not build without regulatory relief.

The final area of discussion on hypotheses is the way that Ergas, following Telstra, tries to represent the ACCC's decisions on the price of ULLS as a declining price despite input costs rising. The reality is that the final price rises over time, but that the ACCC was engaged in a protracted process in arriving at that price. The explanation of why the ACCC was forced to revisit the pricing is addressed later, but the use of the outcome as a statement of fact about the pricing is misleading in the least and deceptive at worst.

It is, however, the structure of the argument that is the issue of greatest interest. The primary argument deployed through the book is to describe the characteristics of a 'good' access regime, and then to compare and contrast the telecommunications regime to that standard. In this argument the Part IIIA access regime, the energy access regime and the Gas Code are quoted. In this process the argument relies heavily on an assumption that these other regimes are, in fact, preferred regimes. However, the primary evidence provided for this claim is the relatively limited use of these regimes, the small number of services declared or access decisions made.

The argument can be summarised as a hypothesis that a good access regime is one that is lightly used; these other regimes are more lightly used than the telecommunications regime; therefore the telecommunications regime is bad. This is a poor, if not invalid, argument. Worse, it at times masks some of the more substantial criticisms, including the inconsistent approach the ACCC took to some declarations; the most notable of these is WLR and LCS. These declarations had their origin in the importance of these services to competition in long distance but became subverted to an ACCC campaign for competition in local service.

The argument also fails to recognise that each of these other regimes is dealing only with elements of the structure of telecommunications. For example the Gas Code corresponds only to the declared transmission service and has no comparison to ULL. Similarly many other economic sectors did solve the access issue structurally, relieving the access regime of a burden. None of these regimes has an issue akin to the issue of the bundling of diverse services requiring differential access as occurs in the local and long distance service case.

The argument in the book relies too much on the idea that the only variable in play is the construction of the regulatory regime and perhaps the motivations of the regulator (if the proposition is accepted that the regulator has an interest in expanding regulatory involvement.) This ignores completely the role of other players, notably Telstra's wholesale customers but also of Telstra itself. The first of these comes through in the treatment (pp33–34) of incentives to invest and the failure to recognise that other players make investments complementary to the acquired access service.
The bigger issue is the extent to which Telstra itself was a player and how the regime in practice is a creature of Telstra’s behaviour. The book does not deal at all with Telstra’s failure to effectively utilise the Telecommunications Access Forum to develop pricing principles for inclusion in an access code; it does not detail the drawn-out process of the only arbitration that went to merits review and the way Telstra managed that matter for delay.

The book criticises the 2002 amendments, which it claims bowdlerised the undertaking process, but were actually motivated by a desire by the Government for greater use of the process in preference to disputes. It tries to lay the blame for rejection of undertakings at the feet of the regime or the regulator, rather than with the providers. The best example of this was the ULLS undertaking. After the ACCC rejected Telstra’s undertaking, Telstra submitted a new undertaking at the ACCC’s indicative price. However, Telstra advanced all the same supporting material and attempted to intimidate the ACCC. This resulted in the ACCC taking another detailed look at Telstra’s claims and ‘opened the door’ for arguments about the wider distribution of the so-called ULLS specific costs.

An alternative view of where the access regime has taken us is that Telstra has consistently taken a bet that it will be able to intimidate the regulator, the Government or its customers into submission. This bet has consistently failed (though there have been moments of weakness). Where there are avenues for appeal, Telstra has consistently lost.

Last but not least the book relies at times on various pieces of economic theory. This is a combination of very static analyses of markets including things like the risks of double marginalisation. At other times the book uses more dynamic arguments, even mounting institutional or evolutionary arguments about the role of monopolists in innovation. While these are all individually convincing, they cannot be consistent. This would be a bit akin to trying to apply quantum mechanics and Newtonian mechanics in analysing the one problem.

As a consequence we see claims that ‘inefficient outcomes would obviously never prevail were the regulator an omniscient, omni-benevolent social planner, capable of setting the terms and conditions of access with Goldilocks-like precision’ (P.35) but in a subsequent discussion of structural separation we are told that the price system cannot possibly manage the co-ordination of upstream and downstream investments. That which is beyond the capabilities of a regulator is supposedly within the talents of the Telstra CEO!

This reasoning ultimately results in Ergas asking us to believe that it is necessary for us to accept the inefficiencies necessary for firms to earn rents as incentives to invest, but does not ever explain why these inefficiencies are better than the inefficiencies which are claimed to arise from dealing with the issue structurally.

Those who are familiar with the issues in telecommunications regulatory policy will find nothing new in this book. It is also not sufficiently wide in scope to work as an effective primer on the subject. The pity is that the telecommunications regulatory regime is failing us, and that failure rests with the excessive reliance on the role of the ACCC as a price setter; but this book does not make a persuasive case for change. Its principal failure is that it wants to find the fault in others, rather than in the way that Telstra has managed the regime.

Perhaps the way to solve the impasse is to find a modern day Heracles to clean out Telstra’s Aegean stables of the accumulated detritus of their economic advisers and start with the assumption ‘we are where we are because of us, not them.’

The reviewer must confess to having been directly involved in the development and marketing of the SPAs, and as Account Director Media being one of a small number in Telstra who worked hard to get the News/Telstra relationship to the point of agreement (though had no direct role in the subsequent structure of the venture). There is a useful discussion of the HFC plans in Frank Blount and Bob Joss, Managing in Australia.
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John Costa is Principal of telecommunications consulting company John Costa & Associates and has 39 years' professional experience as an engineer in diverse areas of the industry, previously with Telstra and its antecedents. Commencing initially in Radio Branch of the then PMG’s Department, he subsequently worked with GEC Telecommunications in the UK for two years on early digital radio and line transmission systems, then focused much of his subsequent work back in Australia on network planning, international telecoms developments, and standardisation activities associated with the ITU and regional standards organisations including ETSI in Europe. He managed Telstra’s standardisation activities at that time then subsequently managed Telstra’s international regulatory group. More recent consulting projects have included the establishment of a state-wide communication network for the mental health sector, international spectrum studies and other regulatory projects. John is Member of the Institution of Engineers and the Wireless Institute of Australia. He has been an active member of the TJA Editorial board for 19 years during which time he served a term as Editor-In-Chief, and has been made a TSA Life Member.

![John Costa](image1)

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Reg Coutts is Emeritus Professor of Telecommunications of the University of Adelaide, and consults through Coutts Communications www.couttscommunications.com, which specialises in the development of business opportunities of wireless and mobile telecommunications technologies, including regulatory strategies.

![Reg Coutts](image2)
Reg brings to this sector nearly 30 years’ experience which includes 12 years in technology research, five years in commercial business strategy in Telstra, then 10 years at the University of Adelaide building telecommunications expertise and now in his own company Coutts Communications.

Professor Coutts maintains his relationship with the University and supervises graduate students in Engineering and in technology commercialisation, and has a technology venture of his own. Reg is Director of the Telecommunications Board of the Australian Computer Society (ACS), which now incorporates the activities of the former Telecommunication Society of Australia (TSA).

In March 2008, Reg was appointed to the Government’s NBN Expert Panel to assess proposals to award a A$4.7 billion contract to part fund the construction of the National Broadband Network for Australia.

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Prof Town leads the Guided Wave Optics and Photonics Research group, and is a member of both the MQPhotonics and the Quantum Science and Technology Research Centres at Macquarie University.

Prof Town has authored or coauthored over 130 journal and conference papers, including 4 invited conference papers and 4 book chapters, primarily in the areas of broadband optical fibre lasers, nonlinear fibre optics, and guided-wave filter design.

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