3. Convergence of Technology and Services

Introduction

The convergence of computing and communications technology is altering the way that mass communication services are delivered, thus opening the way for new types of service, some of which can be considered to be forms of mass communication.

Advances in technology also allow, for the first time, efficient substitution of electronic distribution systems for physical distribution systems. For example, services that have traditionally relied on physical distribution such as:

- the film and video industry including sale and hire of video cassettes of all programming genres;
- the book publishing industry;
- the press including newspapers of all varieties, newsletters, news sheets, magazines, etc.;
- the music industry; and
- the computer software sector, including publication of applications, programs, games and information

are all now able to be distributed using electronic means.

Convergence is permitting the development of services so that once obvious differences between mass media are blurred. The regulatory regimes that currently apply are becoming increasingly inconsistent. This inconsistency raises the question of why broadcasting should continue to be treated differently from other media.

Technical Developments

Digitisation

The dominant technical innovation affecting all media and information systems today is digitisation, i.e. the use of digital techniques at each of the stages of production, storage, replication and dissemination of information. Digitisation is the building block on which all matters of communication convergence are founded.

Schaap's Dictionary provides a layperson's definition of digitisation as follows:

> Converting an analogue signal into a stream of on/off pulses.[1]

On/off pulses are able to be represented in electrical circuits as either the presence or absence of a current. This principle forms the basis of all modern information processing.

The move to digitisation of increasingly complex types of information has followed advances in the information sciences, and the continuing fall in real terms of the cost of computing technology. For example, when the first 80×86 microprocessor appeared in 1978, it contained 29,000 transistors and cost $360. The latest microprocessor in the 80×86 family, the Pentium, offers 3.1 million transistors and is estimated to cost only $900. The quoted prices are unadjusted for inflation. The previous generation 80×86 chip, the 80486, in the three years after its introduction, fell in price from $950 to $317.[2]

As the power of microprocessors grew and their availability became more widespread in response to falling prices, digital techniques were applied to consumer applications, firstly in the field of text and data, and since then, to still pictures, sound and, most recently, to moving images.

The advantages of digital systems over their analogue counterparts have been recognised for many years. Digitally recorded material exists as unambiguous *ones* and *noughts*, denoted by circuits being closed (on) or open (off). Since the signals are unambiguous, replication is also unambiguous, allowing endless copy generations to be made without impairment. The display resolution of a digitally recorded artifact is only limited by the sophistication of the coding technique and the amount of data used to record it. The techniques of digitisation have always had the limitation that a digital representation of an artifact can never be as accurate as the original, but the process of recording is so robust that no further flaws other than those created by the arbitrariness of the coding system are introduced. Coding systems are designed so that the arbitrariness of a signal only appears below the threshold of human perception.

This is generally not the case with analogue techniques which have to deal with a continuum of possible states, and thus of interpretations, at every stage. The process of recording and manipulating analogue material reinterprets this continuum, introducing a probability of distortion, even if that probability is very low. Often, after only a few manipulations, distortion can rise above the threshold of perception. Many manipulations occur between the recording and distribution stages, so, by the time an analogue recording reaches the consumer, it has already developed a probability of containing distortion. A good example of the limitations of analogue recording techniques is the presence of clicks, pops and static when listening to vinyl records on a stereo system.

Once digitally captured, artifacts are able to be stored and manipulated using digital techniques. For example, word-processors allow endless manipulation of text. Photographs can be retouched or enhanced using digital techniques and sound can be

masked, dubbed and recast according to any preferred profile. The implications of digital manipulation of video material are only now beginning to be explored, but the "morphological" processes, which allow one shape to be gradually flow into another, show some of the possibilities.

In almost every field of information collection, storage and retrieval, the preferred and most efficient techniques are digital.

New Developments in Telecommunications

Once an artifact is coded in digital form, consideration to decoding only needs to be made at the receiver. Decoding depends only on the selection of the correct decoding system to interpret the data. Data representing different media forms (whether they be textually based, graphic, photographic or full-motion video) can otherwise be transmitted in the same way as any other data, either physically (using magnetic or optical storage media) or over telecommunications networks or other electronic means. Trunk telecommunications systems lend themselves to data transmission. Telecommunications carriers have moved over the years to adopt digital transmission techniques so that they can take advantage of computer managed switching systems, with productivity improvements over electromechanical systems.

Digital transmission is now the standard mode of operation on trunk telecommunications networks. Australia's second telecommunications carrier, OPTUS Communications, is establishing a state-of-the-art wholly digital network.[3] Improvements such as Integrated Services Digital Network (ISDN), which permit digital origination and reception at the consumer end, and offering an enhanced range of services are available. Analogue telecommunications networks are still able to transmit data, but the data must be first converted to analogue form (sound) using a modem device.[4]

Broadband ISDN (B-ISDN) offers the promise of a technical leap beyond conventional ISDN, and utilises optical fibre cable connected directly to customer premises. Overseas, B-ISDN is being promoted by some telecommunication carriers who suffered significant erosion of their markets from competitors and customers bypassing them to use alternative systems such as satellites, microwave and coaxial cable. The response of these carriers, according to Cox, has been to install:

> optical fibre systems with huge capacities and relatively low bandwidth costs which can cater for a range of telecommunications, entertainment and educational programs. Accordingly, it is predicted that in the longer run, customers will be attracted back to the telecommunications companies.[5]

Plans for a B-ISDN optical fibre network in Australia received support from the Government during the 1993 Federal election campaign, when the Government committed itself to investigating the extension of Australia's optical fibre telecommunications net-

work to most houses, businesses and schools in Australia.[6] Reports of similar commitments in other countries have been made, including the US, and more recently in Singapore and Japan.[7] Reports also suggest that strategic alliances between international telecommunications carriers and software suppliers are currently being formed, possibly as a prelude to the implementation of B-ISDN. In Australia, there is evidence of such as strategic alliances forming, with the Packer/Murdoch/Telecom (PMT) syndicate being established. This syndicate may go on to develop pay television services using guided communication systems.[8]

Despite the undoubted optimism of some commentators, and the Government's commitment to investigate B-ISDN using optical fibre cable, some caution is warranted. The large capacity of B-ISDN systems raises questions about whether or not the infrastructure investment required is warranted, or whether these systems represent technological overkill. Cox notes that the capacity of a single optical fibre system is over 100,000 telephone and data circuits and at least 50 television channels.[9] It is hard to conceive the average Australian household requiring more than one or two *simultaneous* telephone calls and perhaps one or two *simultaneous* television channels. It is possible to have unlimited numbers of services over only one circuit, if one has access to appropriate switching capability. Trends in technology seem to suggest that this is now within reach, even for services that require large bandwidths, such as video services.

Telecommunications Network Productivity

One of the major areas of research for telecommunication carriers in recent years has been in the area of network productivity. The aim is to make the existing infrastructure capable of handling higher data transmission rates. In its February 1993 edition, *Broadcast Engineering News* (BEN) forecast a capability to provide full-motion video services along twister-pair copper cables. The forecast was based on a trial being run by Telecom of Asymmetrical Digital Subscriber Line (ADSL) techniques.[10] The significance of the ADSL trial is that it shows the potential for delivering signals up to the complexity of conventional television, directly to the home over existing telephone infrastructure.

The previously limited capacity of the twisted-pair copper cable network was reported by BEN as being the last technological impediment to *dial-up television*, analogous to being able to select a movie from the video store without leaving the lounge-room. Although the data rate required for video was not being achieved in the Telecom trial, BEN reported that the last five years have seen a 5,000 fold improvement in the capability of twisted-pair technology. On this basis, the BEN report made a prediction that the final hurdle of increasing productivity only another seven times (2 Mbits/s to 15 Mbits/s) from that of the trial system was entirely possible in the relatively short term. A later report in the August 1993 BEN indicated that US trials of ADSL technology being conducted by Bell Atlantic suggested that a 6 Mbits/s data rate was possible over short

(i.e. less than 1.5 km) cable runs, but that this quickly deteriorated to no more than 1.5 Mbits/s at 5 km. Bell Atlantic was hopeful that improvements in digital coding algorithms would allow up to four television channels over a single telephone line, but the report did not make clear what data transmission rate would be required to support this.[11]

The implications of ADSL for the development of media systems in Australia were pointed out by BEN:

> All of the other technology needed to build a full digital, broadcast quality video pay-per-view (PPV) distribution system exists right now ... Already in the computer industry, storage technology has moved to the point where the VCR is looking like a dinosaur, at least in a venture the scale of a pay TV system.[12]

If that is the case, then it would be possible to have a very broad range of program sources, certainly more than the 50 channels offered by B-ISDN, all available to the home over a single transmission channel, *on demand.* If these developments ultimately lead to consumer services being available, investment in optical fibre B-ISDN may never be warranted. Nevertheless, Telecom continues to work on B-ISDN concepts and is proceeding with fibre-to-the curb and fibre-to-the-home trials in Wollongong to gain a better understanding of the service opportunities.[13]

Digital Coding of Broadcast Media

It is now accepted more or less universally that digital transmission systems are the way of the future in conventional broadcasting too, and Australia has accepted this inevitability by specifically mandating the use of a digital transmission system for satellite delivered pay TV.[14] Digital audio broadcasting (DAB) is also on the policy agenda in Australia and is being considered by the Department of Transport and Communications, in association with industry.

Digital transmission systems allow for greater productivity in the use of radiofrequency spectrum. Because the signals carry unambiguous ones and noughts, higher levels of interference can be tolerated and thus lower powered transmitters are possible, allowing greater reuse of radiofrequency spectrum. In the field of satellite broadcasting, digital techniques are forecast to provide significant transponder productivity improvements, although the exact level of productivity improvement over existing technologies is not yet known. It could be as high as 8 to 16 times, depending on the nature of the program source being coded.[15]

Digital Coding of Other Media

The techniques of digital coding have been applied to other media for some time. For example, as a result of the introduction of computer-based composition and editing

techniques, Australia's leading newspapers and current affairs magazines have been available as computer databases for some time; able to be connected via modem or dedicated line directly to home and office based personal computers.[16] These services began as research services to business, offering free-text search and retrieval of information on current issues. As costs have fallen, they have become more widely available.

So far, these have been text only services, but as the transmission productivity of telecommunications networks increases, transmission of pictures and graphics in colour will become more practical. Digital colour graphic handling software has been available for personal computers for some time. For example, desktop publishers such as *Quark XPress* and *Pagemaker* are able to compose full colour digital photographs. These software packages, and others like them, are used by the publishers of magazines and journals and are available for personal computers. It is now technically feasible to distribute electronically a complete made-up magazine, with all its elements, via a telecommunication network directly to home computers for display on screen, or for remote printing.

To illustrate the potential, this dissertation was composed using *Pagemaker 5*, a sophisticated desktop publishing system. The whole document, occupies less than 1 megabyte of disk storage, representing barely 0.5 seconds of time on an ISDN network, and a fraction of that on a B-ISDN network. Even using a relatively primitive low speed data modem operating at only 2400 bits/s, total transmission time would be only of the order of 40 seconds. Already, moves are underway for academic journals to be disseminated electronically.[17]

It is conceivable that electronic dissemination may become the preferred mode of distribution, if only for economic reasons. Large savings in production costs are able to be made by moving to electronic dissemination. Printing information on paper using traditional printing techniques incurs large operating costs including for

- newsprint;
- depreciation of expensive presses;
- the cost of skilled labour to operate the equipment; and
- the cost of physical distribution.

All of these costs are either reduced or eliminated if electronic dissemination is used, although electronic dissemination may impose substitute costs such as spectrum access (for MDS or satellite, depending on the technology chosen) and perhaps enhanced information processing capabilities. To illustrate the costs of printing a newspaper, at *The Canberra Times*, newsprint accounts for about $5m of annual operating expenses.

Skilled labour to operate the presses costs about $0.72m. Depreciation on the presses is negligible because of their age, but if *The Canberra Times* re-equipped with new presses, depreciation would be about $1m per annum. New presses would allow savings in skilled labour of possibly 50 per cent.[18] While the cost of information technology continues to fall in real terms, a best-case estimate would see the cost of newsprint, labour and capital equipment remaining stable at best, but with a more likely forecast being for modest rises in line with inflation. According to the Editor of *The Age*, Alan Kohler, electronic dissemination would provide a net gain of 15 cents per copy of *The Age*, compared with printed versions, even taking account of the loss of display advertising.[19] One can therefore conclude that the cross-over in the relative economics of electronic versus printed newspapers has already occurred.

The only impediments at this stage that would temper a move to electronic dissemination are lack of consumer awareness of the possibilities, the psychology of newspaper and journal reading (perhaps reinforced by habit) and an insufficient number of suitable terminals in the home.

In a comment in *The Canberra Times*, Crispin Hull noted that one of the tenderers for MDS licences, Kerry Stokes (proprietor of *The Canberra Times*) intended to use MDS to distribute electronic newspapers.[20] Rupert Murdoch's News Limited is also reported to be investigating the possibility of moving into the electronic domain and has created a subsidiary, News Electronic Data (NEDI) to sell News Limited products in electronic form. In the US, a number of publishing houses are providing support to a Massachusetts Institute of Technology study investigating the electronic dissemination of newspapers.[21]

Digitisation has had profound implications for other media as well. Who can ignore the change that the compact disc (CD) has made to the appreciation of fine music? Digital recording and publishing has brought new standards in quality to the consumer. Digitally recorded music is now being published on tape as well as CD, using digital audio tape technology (DAT). CD and DAT techniques offer the same advantage of faultless reproduction as all other digital systems. CD technology has been applied to other permanent digital storage and distribution needs, including video material and computer software.

Nevertheless, both CD and DAT technologies represent physical means of distribution, and the physical distribution component represents a significant part of the overall cost of the software to the consumer. Furthermore, the steps involved in retailing the physical item have costs which the consumer must ultimately bear, including sales tax, retailer's markup, distributor's markup and transport costs.

The ADSL dial-up technology provides a means to bypass all physical distribution systems such as CD and DAT, at least to the home. Existing technology would permit a

consumer to select any work, by any recording artist in the world and have it transmitted to the home with equivalent quality to that provided by a CD on demand, just as if it was being selected in the home from a selection of CDs. Such a prospect is only a small incremental step from the MUZAK that currently pervades lifts and shopping centres.

Dial-up television has already been suggested as being on the new technological horizon. Digital journals and books are already available over telecommunications networks, as is computer shareware.

Digitised media are emerging everywhere.

Multimedia - a New Service Development

A recent trend in computing, discernible in any of the popular computing magazines such as *Australian Personal Computer,* is towards *multimedia*: a bringing together of text, audio, visual and computing technologies. Multimedia concepts exploit the attribute of digital systems that data representing text is no different to data representing graphics, sound, animation or full-motion video. Software techniques that recognise the different coding regimes used in production are able to provide for automatic selection of the correct decoding algorithms and output devices to allow seamless transition from text, to graphics, to video, and to sound, and so on. An example of this seamless transition between software products is the Object Linking and Embedding (OLE) used by Microsoft in some of its Windows products. OLE allows a word-processed document to contain charts generated by spreadsheets, or graphics, or photographs, and allows the editing software for each format to be invoked automatically with a double-click of a mouse. Spreadsheets, charts, graphics and photographs can all be edited from within the word-processor using all the tools unique to the program that generated the item, with the software selecting the correct set of tools automatically.

In the emerging multimedia information environment, information, text, audio and video representations are already being published together on CD, and in some circumstances are being disseminated over telecommunication networks. The technology that already exists allows the creation of CD multimedia encyclopedia which combines text with high quality digital sound and digitally compressed video footage. While the software is run on a computer, the output devices may be switched to include home stereo systems or television screens in any format.

The software required for such an encyclopedia can also be held in a central location and be disseminated over telecommunications networks, either on private wide area networks (WANs) or local area networks (LANs), which form the basis of much corporate communications, or over the public network operating as an analogue network, or by using ISDN or B-ISDN techniques. Computer modems that allow a

limited form of networking over the public switched telephone network (PSTN) at low data rates are probably not suitable unless the material is to be stored for later display.

Multimedia offers new and exciting possibilities for traditional publishers. Newspaper and magazine publishers could, conceivably, embed video footage supporting their stories within the text. The multimedia newspaper or magazine could provide background and editorialise issues in text, and complement this with either still pictures or video footage of events for support and impact. Such an approach seemingly offers to combine the best of television (its immediacy) with the best of newspapers (more extensive treatment of issues than television).

Satellite Technology

Satellites are increasingly being used to deliver programs of mass appeal to mass audiences. Already, there are a number of satellites in orbit with potential coverage of our region. By 1997, one informed estimate suggests that there may be capacity for as many as 900 television services in our region.[22] The attractiveness of the Pacific rim as a media market is demonstrated by the recent acquisition by Rupert Murdoch of 65 per cent of Star TV, based in Hong Kong. Murdoch is one of the most dynamic media proprietors in the world with press, TV and pay TV interests in Australia, the US, Europe, and Asia.

The Government is currently promoting satellite delivered pay TV using OPTUS satellites. However, once Australian consumers have become attracted to satellite television, they may also be attracted by the many other services offered from non-Australian satellites. One only needs to reorient one's satellite receiver antenna to the alternative host satellite, ensure the correct reception equipment (and this may well be standardised in the international community) and arrange for subscription authorisation to obtain access to these signals. With international credit cards and cheap international telecommunications, this becomes a relatively simple act. Already, there is a small number of people in Australia who have the equipment and regularly tune to international satellites. This can only rise as consumer awareness of satellite television grows.

The potential problem for Government is that it has limited power to regulate the reception of international satellite transmissions. Its support for the ABC's satellite television service into Asia would be difficult to justify if moves were made to ban such services from being received in Australia. If and when unregulated international broadcasting services become widely used in this country (they are already available), continued restrictive regulation of the domestic broadcasting sector will become more difficult to sustain.

Encryption and the Rise of Transactional services

By transactional services, I mean services where the service provider is able to exercise a discretion in determining who is, and who is not, able to receive the service. There is often a direct transaction between the supplier and the consumer that leads to authorisation of the service.

From the 1920s until 1986, broadcast media in Australia operated almost exclusively as free-to-air services. That is to say, anyone who had purchased a standard receiver was able to receive the services. This mode of operation could be considered, in part, to be an accident of history, as it was not the mode of operation when broadcasting first commenced in this country.

The first true broadcasting regulations in Australian law were inserted by the *Wireless Telegraphy Regulations* of 1923.[23] These regulations provided for the *sealed set scheme*, promoted by AWA, where receivers were licensed according to the stations that they could receive. The sets were sealed to those stations and could not be tuned to stations for which no licence had been granted. The best modern parallel for the sealed set scheme is pay TV.[24]

The sealed set scheme failed. Armstrong notes that one of the reasons for the failure was the absence of any technical device that would prevent eavesdropping by unauthorised listeners.[25] As technology has developed, analogue transmission systems have remained relatively easy to "crack" and decode. The sealed sets fell victim to the hobbyist's crystal set. Modern video scrambling systems such as E-PAL, developed in the mid 1980s for the transmission of television network interchange on AUSSAT satellites, are able to be cracked with relative ease.[26] Following the failure of the sealed set scheme, regulations for "A" and "B" class broadcasting stations were introduced, allowing funding from compulsory receiver licence fees (for the "A" class licences) and from commercial sources (for the "B" class licences).

One could speculate on how the broadcasting industry would look today if the technical means to deny access to free-riders had been available in 1923. The technical integrity of the sealed set scheme would never have been compromised, and the direction of development of electronic mass communication would have followed a different path. Electronic media commodities would probably not be considered differently to their physical counterparts such as books and magazines. The sorts of social control issues that pervade our current media system might never have been given the chance to emerge.

While we subsequently have had a long tradition of free-to-air broadcasting, that tradition is founded on what probably was, for commercial interests, a sub-optimal mode of operation. Advertising always added an element of uncertainty to the business of broadcasting, since broadcasting revenues depended on the vagaries of the advertising industry. Program strategies have been driven by ratings and the pursuit of mass audi-

ences. They have, therefore, been directed to safe, lowest-common-denominator programs. Our whole experience of broadcast media has been shaped by a mode of operation made necessary by free-to-air operation. The public service objectives attendant in a free-to-air system using a "scarce national resource" are an example of the mechanisms that society has invoked to deal with this sub-optimal operation.

A significant spin-off of the development of digital transmission systems is their ability to be securely encrypted. This is the key that may have been missing in 1923. Concerns about the security of information held within computers has prompted world-wide attention to the need for data security, and thus to the development of simple, cheap, but very effective and robust encryption systems for digitally encoded information.

The implication of the availability of secure encryption systems is only now becoming clear. Where once, it was technically necessary to broadcast free-to-air, that necessity has been overcome. Service providers are now able to negotiate directly with consumers without having to adopt program strategies to satisfy free-riders out of an ill-defined public trust obligation. They are also freed from having to maximise audience, and a small but committed high paying audience may be far more attractive to them than a large undifferentiated mass audience with relatively low commitment. Consumers have the ability to purchase what they want, and leave what they don't want when using these media systems, so they now have an influence over program supply through the normal mechanism of the market.

Technical Regulation

The Government has already reacted to some of the pressures of technological convergence by implementing sweeping reforms to technical regulation. This has been a product of wider Government concerns to promote micro-economic reform across the Australian economy. This program of reform has been aimed at:

> ...building a stronger, more competitive and more efficient Australian economy, and a fairer and more compassionate Australian society.[27]

As part of that program, the Department of Transport and Communications has conducted extensive reviews of arrangements applying to broadcasting and to guided and unguided electronic communication.

Broadcasting Reforms

The BSA introduced a number of reforms in the approach to technical regulation for broadcasting services which will influence the future environment in which broadcasting operates. Firstly, it removes the technical determinant of broadcasting that existed for most services under the previous regulatory scheme. It opens the way for all broadcast-

ers to use any technical means of delivery, including radiocommunications, satellites and cable, in any combination.[28] Broadcasting licences for alternative delivery systems are able to be issued over-the-counter. Selection of transmission systems is a matter solely for the operator.

Since there is an established audience base with equipment suitable only for the broadcasting services bands, these bands are felt to be desirable for the delivery of some types of mass free-to-air services. Currently, these services are the dominant forms of electronic mass communication in Australia - commercial, national and community radio and TV. The relative importance of these bands, however, may be overstated, and is not unassailable in the emerging environment. As domestic satellite receivers are introduced into the Australian market under the impetus of pay TV, they will provide an alternative means of distribution for mainstream broadcasting. If the PMT syndicate, or any other party, decides to pursue cable distribution of pay TV, then the infrastructure for cable television will be driven to the home by Telecom. In both cases, the new entrants will have a powerful incentive to promote their medium, so they will have an active interest in structuring their business to promote widespread use of the necessary reception equipment. This equipment will probably be able to receive the mainstream broadcasting services, just as cable television in the US carries standard broadcasting services as well as premium services. Nevertheless, terrestrial radiocommunication in the broadcasting services bands will continue to be the preferred method for delivering these types of mass audience service, at least for a few years.

The BSA introduced significant reforms in the way that spectrum is allocated in the broadcasting services bands. The most important of these is that the former statutory protection of the commercial viability of incumbent broadcasters has been removed as a constraint on planning, opening the way for the full capacity of the bands to be realised for the first time.

The BSA requires the ABA to plan the broadcasting services bands to their capacity to deliver services, based on transparent and public planning assumptions. The ABA is obliged to seek public input when framing these assumptions. Once the bands have been planned to provide services in accordance with these assumptions, the ABA is required to release all planned capacity for allocation by price-based means. The only exception to this is that the Minister has a power to reserve planned capacity for national and community services.

These moves should see a dramatic increase in the spectrum capacity being offered by the ABA, and once it has been offered for broadcasting, and if it is passed in, it will become available for narrowcasting and subscription services and for non-broadcasting services.[29]

Telecommunication Reforms

The Government's policy for telecommunication development through to 1997 centres around the strategy of moving towards full network competition by 1997. The process set out by the Government provides for the introduction of:

- a competitor to Telecom in the provision of network facilities;
- competition through the full re-sale of telecommunications capacity;
- the issue of three public mobile telephone service (PMTS) licences, one each to Telecom and its competitor, and one to a third competitor selected by tender;
- consideration to a further PMTS licence in 1995; and
- an end to the duopoly of Telecom and its network competitor on 30 June 1997.[30]

OPTUS Communications Pty Ltd was selected in November 1991 as the second telecommunications carrier and was subsequently issued with a general telecommunications carrier licence and a public mobile carrier licence. OPTUS contracted to pay the Government $800m for the opportunity to become the second carrier and as part of the arrangements, ownership of the domestic satellite system operator, AUSSAT Pty Ltd, transferred to OPTUS.[31] The third PMTS licensee, Vodafone, commenced operations on 1 October 1993.[32]

The Government's objective is to liberalise the Australian telecommunications market in the expectation that competition will lead to improved and cheaper telecommunications services to Australian consumers. Already, benefits that have been identified include real price reductions for STD and IDD telephone services, a wider range of customer equipment, free choice on supply of the first telephone, greater opportunities for private network operators using capacity re-sold by the carriers, and a wider range of innovative and competitively priced value added services.[33]

These reforms to the telecommunications sector have implications for the environment in which electronic mass communication operates. Access to telecommunications networks is now cheaper in real terms than ever before. The cost structure of services using telecommunications networks is therefore continually improving. Competition is leading to innovation in the sorts of network services that the carriers are able to provide and the carriers are more customer-focused than in the past. This can be expected to influence the flexibility that carriers exercise in configuring the networks to meet customer requirements.

The increasing emphasis on mobile communications, with three PMTS licences already issued, suggests that demand by telecommunications operators for radiofrequency spectrum is likely to increase. The reforms to spectrum management outlined below

may have the effect that increased demand from any one sector for increased access to the spectrum may displace other users, who will, in turn, seek access in other parts of the spectrum, and so on, leading to an overall reallocation of spectrum based on market, as opposed to engineering, principles.

Radiocommunication Reforms

In September 1992, the Government announced its program for reform to radiofrequency spectrum management.[34] Prior to the reform arrangements being implemented, management of all radiofrequency spectrum was done by the Department of Transport and Communications on the authority of the Minister. In essence, the spectrum was centrally planned, by officials.

The Government's spectrum management reforms appear to work from the premise that, by and large, the users of the spectrum are in a better position to plan and acquire spectrum according to their *own* needs, than are officials. Such a realisation may have been prompted by the former centrally planned administrative system experiencing difficulty in adjusting to new issues brought about by technological and service development, including increased overall demand for spectrum services and congestion in and competition for some specific bands. The wholly administrative system of spectrum management was seen as being out of step with both the telecommunications and broadcasting reforms.[35]

The spectrum management reforms have three main thrusts. These are:

- the selective and progressive introduction of a market-based system of spectrum management to operate in defined spectrum segments alongside the administrative system;
- improvement of the administrative system; and
- the establishment of a Spectrum Management Agency (SMA), as a separate agency within the Transport and Communications portfolio.[36]

By introducing market-based allocation mechanisms to resolve instances of high demand for some types of spectrum, the public will gain an appropriate return for granting access and users will be forced to think about the most efficient means of addressing their needs.

At the heart of the price-based allocation system is the notion of a *spectrum licence* which authorises the creation of radiation within a defined band of spectrum and within a defined area, provided that the radiation does not exceed specified levels outside these

boundaries. This differs from the traditional administrative approach to licensing which authorised operation of a piece of *apparatus* in what was considered publicly owned spectrum. Spectrum licensing is not concerned with the equipment operated, but creates a form of *property right* where radiation within the spectrum property defined in the licence is relatively unrestricted. The licence right may be traded, subdivided and amalgamated to provide wider bands of spectrum, or to cover larger areas.[37] Spectrum licences, once defined by the SMA are allocated using a price-based system (i.e. tender, auction etc.).

The spectrum licensing scheme is conceptually similar to the licensing process in the BSA for services operating in the broadcasting services bands, where a licence is defined in terms of spectrum occupancy and coverage area, and that licence is allocated using a price-based system.

The major difference between spectrum licensing and the technical authorisation inherent in broadcasting licensing within the broadcasting services bands, is that these bands are quarantined from competition from other types of users, thus creating an artificially limited market that is unlikely to return the value of that spectrum to the community. It presumes that the social worth garnered by the Government on behalf of the community by isolating this spectrum from full competition is greater than the economic value foregone by the act of quarantine. One is left with an observation that without open competition, the assumption of social value relative to economic value is not able to be tested.

Similar questions are also raised by the free access to broadcasting services bands provided by the BSA for national and community services. Our socially constructed broadcasting system may actually be provided at the expense of other socially desirable services such as hospitals, schools and general community welfare. While governments of all persuasions have traditionally accepted this state of affairs, the day may soon come when demands on the Government purse reach such a level that questions about the relative worth of policies which provide free access to broadcasters have to be reconsidered.

Summary

The intention of this chapter is not so much to make firm predictions about the sorts of services likely to emerge over the coming years, but more to identify trends. These trends can be summarised broadly under the terms digitisation, globalisation and de-massification.

Digitisation lies at the heart of convergence. Falling costs in computing technology allow for the adaption of quite powerful microprocessors to consumer products, allowing text, sound, still pictures and motion pictures all to be displayed on domestic customer equipment. These same trends allow for increases in telecommunications network

productivity, and a fall in real term costs of delivering telecommunications services.

On the one hand, technology is moving to the point where large numbers of information services are available to consumers over a single optical fibre. On the other hand, technology holds the promise of allowing access to a wide range of information sources over what were once considered limited channels of communication, such as copper telephone lines. In this latter case, services are expected to be able to be freed from the strictures of scheduling inherent in our current electronic mass media, allowing people to choose what they want, and when they want it.

Digitisation offers the promise of increased productivity in the radiofrequency spectrum, allowing greater utilisation at lower cost for a range of services. Existing spectrum, even when used more efficiently, may be subject to competition from new types of services based on services now existing only in the physical domain. These services might include newspapers which may ultimately develop into a multimedia hybrids.

Digitisation, when applied to the existing satellite technologies, allows for greatly reduced entry costs and so one could expect a proliferation of satellite based media operating in our region. Since satellite signals know no national boundaries, there is a likelihood that the Pacific rim will become a focus for transnational satellite broadcasting, just as Europe and North America have, offering an explosion of choice in a wide variety of languages.

As other media become digitised, it will not be necessary to make technical differentiation between service types based on their content. In the multimedia environment, a range of different types of service formats will be able to be assimilated; text, sound and video, and since they are all stored as data, they may use common storage media, or they may be disseminated over the same telecommunications lines. The only requirement is that the customer receiver has the correct decoding algorithm to decode and display the material.

Finally, digitisation of signals enables the encryption of services and thus allows them to be marketed as commodities, leading to a more direct relationship between suppliers and consumers, and freeing suppliers from having to satisfy free-riders. The power of these new media to influence depends on people electing to decipher them, thus transferring control over any influence from the state to the individual.

In keeping with many of these trends, the Government has initiated reform in the administration of each of the key sectors of telecommunications, radiocommunications and broadcasting. These reforms have been directed towards competition (in telecommunications), the creation of tradeable private property rights (in spectrum management) and the removal of artificial technical limitations on the conduct of providing broadcasting services.

Notes on Chapter Three

1 Schaap, R. (1993) *A Dictionary of the Australian Communication Debate: 1993*, Canberra: Glovebox, p.24.

2 *Australian Personal Computer*, Vol. 14, No. 5, May 1993, p.164.

3 Based on advertising material disseminated by OPTUS in the lead up to the preferred carrier ballot in the Canberra region during July 1993.

4 abbreviation for modulator/demodulator - a device for modulating digital information for transmission as sound for carriage over the PSTN.

5 Cox, F., *Developments in Telecommunications*, in More, E. and Lewis, G. (eds) (1988) *Australian Communications Technology and Policy*, Sydney: Kuring-gai CAE, p.33.

6 *The Canberra Times*, 28 February 1993, p.1.

7 *The Canberra Times*, 14 June 1993, p.15.

8 *The Canberra Times*, 24 April 1993, p.1.

9 More and Lewis, *op cit*, p.33.

10 *Broadcast Engineering News*, February 1993, p.1.

11 *Broadcast Engineering News*, August 1993, p.1

12 *Broadcast Engineering News*, February 1993, p.1.

13 Gerrand, P., Scott, C.J. and Sutherland, S., *Providing a Market Focus to the Development*

of Broadband and Multimedia Services, Seminar Paper to Strategic Technology Management Seminar *Telecommunications Technologies for a Competitive Market*, 4 March 1993.

14 see s.94 of the *Broadcasting Services Act 1992* as amended by the *Broadcasting Services (Subscription Television Broadcasting) Amendment Act 1992*.

15 Based on a discussion with Dr Graeme King of the Department of Transport and Communications (DOTAC). Similar predictions were also shared by visiting US Fulbright Scholar, Dr Jonathon Levy, who, in an address at the University of Canberra on 17 August 1993, suggested that a compression ration of at least 8:1 per satellite transponder on existing satellite systems is likely for new systems about to commence in the US.

16 AUSINET is one such system.

17 Based on a conversation with Dr John Penhallurick at the University of Canberra on 12 August 1993.

18 From an interview by the author with Mr Maurice Felizzi of *The Canberra Times* on 16 August 1993. Mr Felizzi said that *The Canberra Times* consumed about $100,000 of newsprint each week. The existing presses are nearly 40 years old, and the paper no longer makes any allowance for their depreciation. New presses would cost about $20m but would have a minimum operating life of 20 years. The existing presses require a skilled labour force of 18 people operating on roster. Salary costs assume an annual average salary of $40,000 per annum. Productivity gains from the installation of new presses would enable skilled manning levels to be reduced to about 8 to 10 people.

19 Alan Kohler quoted in *The Canberra Times*, 13 October 1993, p.31.

20 *The Canberra Times*, 29 March 1993, p.10.

21 *Australian Personal Computer*, Vol. 14, No. 6, June 1993, p.8.

22 Based on a discussion with Dr Graeme King, of DOTAC. Such an estimate is not hard to justify. If digital transmission techniques are ultimately able to deliver an 8:1 improvement in transponder productivity for television, then a typical satellite payload of 15 transponders would have the potential to deliver 120 channels. Only 8 satellites would be necessary to meet capacity for 900 services. The expectation of an 8 fold increase in productivity might never be realised, or it may only be realised for certain types of transmission (eg. talking heads). Nevertheless, whatever the exact figure, one can assume that there will be a very large amount of capacity for video services in our region within the next few years.

23 Australia, Postmaster General (1923) *Wireless and Telegraphy Regulations* - Statutory Rules, No 97 of 1923, Canberra: CGP.

24 Armstrong, M. (1982) *Broadcasting Law and Policy in Australia*, Sydney: Butterworths, p.35.

25 *ibid*.

26 E-PAL was developed by the three television networks for their satellite program services (SPS) which Government policy required be encoded. During trials of the security of E-PAL, Department of Communications engineers were able to determine the encoding scheme used and construct an effective decoder for the video components of the signal without any difficulty and without prior knowledge of the encoding scheme used! Despite the simplicity of the encoding schemes employed for the video components of the signal, E-PAL was subsequently approved for use because of the high level of security offered on the digital audio channels.

27 Stephen, Sir Ninian, HE the Governor-General (1987) *Opening of Parliament*, in Australia, *Senate Hansard*, 14 September 1987, Canberra: AGPS.

28 Australia, Department of Transport and Communications (1993) *Broadcasting Reform - a New Approach to Regulation*, Canberra: DOTAC, p.8.

29 *ibid*, p.11.

30 Australia, Department of Transport and Communications (1990) *Micro-economic Reform: Progress - Telecommunications*, Canberra: DOTAC.

31 Australia, Department of Transport and Communications (1992) *Annual Report 1991-92*, Canberra: AGPS, p.68.

32 *The Canberra Times*, 1 October 1993, p.4.

33 Evans, G, *Managing Policy and Organisational Change in the Department of Transport and Communications*, in *Canberra Bulletin of Public Administration*, No. 70, October 1992.

34 Australia, Department of Transport and Communications (1992) *Radiocommunications - Spectrum Management Reform*, Canberra: DOTAC

35 Australia, Department of Transport and Communications (1992) *Radiocommunications - Spectrum Management Reform*, Canberra: DOTAC, p.1.

36 *ibid*, p.8.

37 *ibid*, p.14.