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Table of Contents

Telecommunications is an Essential Service

Editorial

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Abstract: The Australian Government has responded to the Productivity Commission inquiry into the Universal Service Obligation (USO). The primary issues identified by the Government include the cost of providing the USO and how it's provision might be competitively distributed. Secondary issues and issues that did not get a guernsey include improved access to telecommunications (and broadband) for the socially disadvantaged, improved service reliability and quality and an acknowledgement that telecommunications is an essential service. Over the next decade telecommunications will take centre stage as the way that we live, interact with our family and friends and the things around us changes faster than at any time in history. Papers in this issue of the Journal cover a range of topics that cover historical events, book reviews and international telecommunications markets including a unique look at the development of the telecommunications market in Canada.

In This Issue

In this issue, the *Journal* includes topical articles that cover international telecommunications, historical events and a book review on the preparing the next generation for the Machine Age.

Preparing the next generation for the Machine Age is a book review of 'Changing Jobs. The Fair Go in the Machine Age' by Jim Chalmers and Mike Quigley.

Alice Springs Telecommunication Facilities are two papers from 1939 and 1990 that describe and contrast the telecommunications facilities and lifestyles at Alice Springs.

Telstra's Future Mode of Operation - the transformation of the Telstra's Network - 1992/93 provides a striking insight into the telecommunications market deregulation and how Telstra's Future Mode of Operation strategy was implemented.

Historical paper: The 2004 Proposal for the Structural Separation of Telstra re-presents the paper 'Revisiting the Structural Separation of Telstra' published in the Spring 2004 issue. This

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paper presented the policy rationale for structural separation, and detailed how it could have been achieved

Tony Newstead (1923-2017) is an obituary for Mr Tony Newstead, who passed away on 6 November 2017. Mr Newstead was a pioneering figure in Australian and worldwide telecommunications network planning, as well as in Australian trad jazz as both a trumpeter and early bandleader. This obituary attempts to do justice to his career in both fields. In an Attachment, Dr Clemens Pratt provides a short memoir in appreciation of Tony's role as his career mentor and colleague, and John Burke provides an appreciation of Tony's innovatory role in pioneering open planning in Australian telecommunications.

An Introduction to Telecommunications Policy in Canada provides an introduction to telecommunications policy in Canada, outlining the regulatory and legislative environment governing the provision of telecommunications services in the country and describing basic characteristics of its market for retail telecommunications services. The discussion focuses on broad trends and major players and identifies key regulations and policies in place in 2017, with information drawn primarily from regulatory and policy documents.

The Potential for Immersive Technology combined with Online Dating provides an insight into online dating and how immersive technologies are now being incorporated into online dating systems. The first forays into immersive VR online dating have only just being made in the past year. To what degree this type of technology will change the way that we date is potentially quite different from the current way that online dates are conducted. The way the technology works could make virtual dates seem as real as a physical date. Understanding how immersive technology functions gives some insights into the future of online dating and also the impact on the digital economy.

Telecommunications is an Essential Service

The Australian Government response (2017) to the Productivity Commission inquiry on the Universal Service Obligation (USO) (2017) has failed to address key issues that were identified by the Productivity Commission and has instead focused narrowly on the cost and provision of the USO.

There is the potential for the government's focus to miss the point of the USO, and to fail to identify the need for the USO's scope to increase rather than decrease over the coming decades. This is not to argue that the cost to provide the USO should increase if the USO's scope is enhanced, but that there needs to be an improved USO as a result of the proposed changes to the way that the USO is delivered.

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The cost of providing telecommunications is decreasing, yet Australia remains one of the most expensive telecommunications markets in the world. The reason for this is not because Australia is a large nation nor is it the population size. Australia suffers from the 'Australia tax', multi-nationals that fail to pay their fair share of tax, corporations that fail to reasonably contribute towards research and development and multi-nationals that treat Australia as a backwater branch office. The challenge for government is to tackle the underlying problems holding the telecommunications market back.

Advances in telecommunications and computing technologies have facilitated the technological society. Over the next decade, the way that we live and interact with the things around us will be fundamentally changed.

Telecommunications is an essential service and it will only be when this is recognised by government that telecommunications policy direction will focus on outcomes that are in the nation's best interest.

The government has an opportunity through USO reform to begin the process of bringing improved telecommunications to all Australians, irrespective of where they live and work and their social advantage.

Looking Forward

The digital economy is growing at a spectacular rate and Australians should benefit from increased competition among retailers due to Amazon's decision to take a more active role here. Papers are sought that explore the digital economy and its shifting landscape.

The *International Telecommunications Legislation and Regulations* and *International Mobile Cellular Regulation and Competition* themes are set to continue for some time as the opportunity to attract papers from around the globe continues. We encourage papers that reflect on where the telecommunications market is now, how it got to where it is and what is going to happen next.

Papers are invited for upcoming issues and with your contributions the Journal will continue to provide the readership with exciting and informative papers covering a range of local and international topics. The Editorial Board values input from our readership so please let us know what themes you would like to see in the coming year.

All papers related to telecommunications and the digital economy are welcome and will be considered for publication after a peer-review process.

Mark A Gregory

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Preparing the next generation for the Machine Age

A review of '*Changing Jobs. The Fair Go in the Machine Age*' by Jim Chalmers and Mike Quigley

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Abstract: A book review of 'Changing Jobs. The Fair Go in the Machine Age' by Jim Chalmers and Mike Quigley, *Redback 13*, Schwarz Publishing, September 2017, 199 pp.

Keywords: Information society; Industrial sociology; Australia

"*Redbacks are Books with Bite. These short books on big issues are written by leading Australian writers and thinkers. They range in style from essay to dispatch, from analysis to provocation.*" – Schwartz Publishing

'Changing Jobs' is a long-form essay, with each of its seven chapters designed to stimulate attention. It tackles a very important policy topic: the need to prepare Australians "for a future in which many routine jobs, both manual and cognitive, will be done by machines". It aims to provoke, and it will succeed in that. It is a timely book, and deserves wide reading by policy wonks – and I use that term with affection. But the book also merits some criticism for its limited vision of the future of work – a perspective which might surprise the authors, whose clear intention is to jolt many decision makers out of their current complacency.

The two co-authors lend considerable credibility to their essay from the start, being distinguished in their different fields of expertise. Mr Quigley is one of the most highly respected telecommunication engineers in Australia. His outstanding achievements, particularly in building the National Broadband Network from scratch in its first four years 2009-13, were recognised by TelSoc awarding him the Charles Todd Medal in 2013.

Dr Jim Chalmers is currently federal Shadow Minister for Finance, a political scientist turned politician, and a former chief of staff from 2010 to 2013 to Mr Wayne Swan when Federal Treasurer. Dr Chalmers has earned a fine reputation (as have his colleagues Dr

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Andrew Leigh, Tim Watts, Clare O'Neill and Mark Butler) for their writings on serious policy development that look well beyond winning the next election.

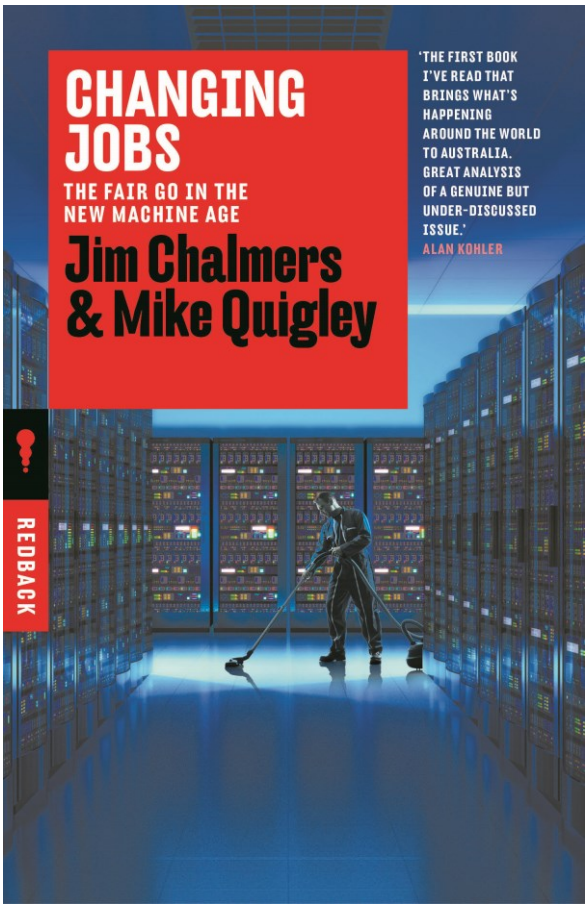

Figure 1 Changing Jobs cover

How the book flows

Changing Jobs is part literature review and part analysis, leading to a set of useful recommendations, as one would hope.

The authors make it engaging by starting the introductory Chapter 1 with an anecdote about Mr Quigley's use of the Duolingo app for learning foreign languages. And Chapter 6 ('What governments should do') relates the heart-wrenching story of the 16-hour working day endured by the six-year-old Elizabeth Bentley in 1815, as reported to a UK parliamentary inquiry – to show us how far working conditions have improved in Western countries over the past 200 years. Similarly, Chapter 7 ('What each of us can do') begins with Mr Quigley drawing upon his career experience in technology transfer working in China some decades ago, with his wistful reflections on how that helped transform China into the West's greatest commercial competitor.

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Chapters 1 and 2 serve to create awareness of how serious the impact of Artificial Intelligence (AI) will have on our society, presented within the usual historical perspective of human evolution via the Agricultural, Scientific, and Industrial Revolutions to the current Digital Revolution. In fact, one of the book's finest features is its explanation of AI for a lay readership (pp.42 to 52).

Chapter 3, 'How will employment evolve in a technology-dominated economy?', is the bedrock of the essay. The following chapters tease out its implications for 'opportunities versus inequality' (Chapter 4), for the education system (Chapter 5), for government (Chapter 6) and 'for what each of us can do' (in the final Chapter 7).

A critique of the book

If one is expecting a highly original analysis or startling conclusions, one will be disappointed. This is forgivable given the importance of its mission: policy suggestions to mitigate the threat of major workforce displacement through technology disruption. And the long-term policy perspective of the essay is especially important, given the current Australian Federal Government appears to be so focused on its day-to-day survival that it is struggling with the longer-term policies needed to address workforce displacement.

The many voices who have alerted us to the potentially drastic impacts of technological change on our society, including President Obama in his 2017 farewell speech, are well summarised in the essay's literature review sections. Likewise, writers such as Andrew Leigh, Miles Corak, Mendolia & Siminski and others, who have drawn attention to Australia's increasing structural inequality in personal income and assets. Strangely, Thomas Piketty's ground-breaking work on global inequity, 'Capital in the Twenty-First Century' (2013), is not mentioned. Perhaps this is because the authors want to focus so heavily on Australia's predicament – although they are diligent in drawing on a range of international examples of promising initiatives, where relevant.

The authors' analysis is on balance conservative, as they do not put great emphasis on planning for worst-case conclusions. Instead they run rather neutrally with a range of unemployment impact estimates. At the optimistic end, they cite Melanie Arntz et al. (2015) who concluded in 2016 that 9% of current jobs are at risk of automation across the OECD (p.63). At the pessimistic end, they cite Frey & Osborne (2013) who predicted in 2013 that 35% of jobs in the UK will disappear in the next two decades as a result of automation (p. 60). Hugh Durrant-Whyte et al (2016) are quoted as having applied Frey & Osborne's methodology to Australia in 2015, and concluded that 40% of current jobs would have greater than a 70% chance of being automated within the next 15 years (p.61). I would have

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thought that prudent risk management would put greater emphasis on planning for these worst-case estimates.

The authors are also far too complacent about the merits of Australia's current welfare system, which they claim is "the best-targeted means-tested social safety net in the world" (p. 128). To justify this claim they cite a 2014 paper by Prof. Peter Whiteford which demonstrates that Australia leads the OECD in the ratio of government benefits ("transfers") received by the poorest 20% to the government benefits compared to the transfers to the richest 20% (Whiteford, 2015).

But Whiteford's paper does not directly comment on the *adequacy* of the transfers to the poorest 20%, let alone to the poorest 5% or 10% of Australians– and neither do the authors. There is good reason to believe that those transfers are much more adequate in the Nordic countries. Indeed, Prof. Whiteford's paper reveals that:

> "total social security payments in Australia, at 12 per cent of average household income, **are the third-lowest in the OECD** [*my emphasis*]. For the OECD as a whole, the figure is around 22 per cent; for Denmark, Finland and Norway it is between 24 and 32 per cent." – *OECD Household Income Survey 2014, Table 5*.

Even the Business Council of Australia has joined with ACOSS[1] – and the charities that are stretched in supporting the poorest Australians – in deploring the grossly inadequate level of unemployment benefits.

We all know that the current standard measure used by government statisticians to estimate unemployment – where employment is defined by having a minimum one hour per week of paid work – greatly underestimates the extent of underemployment, as measured by *those earning insufficient money to survive financially*, either alone or when supporting dependents. Thus, when the ABS[2] declared on 17 August 2017 that the "unemployment rate remained steady at 5.6%", amounting to 730,600 unemployed individuals, we can reasonably estimate – given the regular publicity on the exploitation of casual workers – that twice that number of eligible workforce participants, i.e. at least 10%, do not have financially viable employment. In planning for supporting the future workforce, in and out of employment, we should also consider the fate of Australia's estimated more than 100,000 homeless people, most of whom receive no government welfare benefits whatsoever, since they don't satisfy Centrelink's eligibility requirement of having a fixed address.

When we add to that 10% estimate of the currently unviable unemployed, the possible 35% of jobs to be lost via automation over the next 20 years, using Frey & Osborne's estimate, we are reaching a possible figure of 45% of future unemployed. The authors reassure us that many will find new types of jobs that currently do not exist, but we would be wise to assume

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that only 20% will be so lucky. That leaves us with the prospect of 25% real unemployment within twenty years.

Reshaping the education system

As mentioned, the book begins with the example of the free learn-a-new-language app Duolingo, as an exciting new business model. The Duolingo example raises the hope of imagining a range of new scenarios for not just online businesses, but also new modes of individual employment – but these fail to materialise. Once the essay's literature reviews gain momentum, the book becomes a conventional analysis of the skill sets (largely STEM[3]) needed in order to gain paid work producing, servicing or simply using as support systems, advanced IT innovations in the new Machine Age.

Undoubtedly the need to refashion our K12 education system around STEM remains an important policy message. It was championed valiantly during 2014-16 by the then Chief Scientist Prof. Ian Chubb at a time of arguably the most anti-science government in Australia's history (2013-15). Given that so little of the K12[4] national curriculum has yet been implemented around STEM, this is a message worth repeating. However *Changing Jobs* focusses almost entirely on applying the new STEM skills to conventional, paid employment.

Given that a clear inference from the book's literature survey is that the chances of real unemployment in the future Machine Age could reach an irreducible 25% or worse, the essay could have gone further than its aim of ensuring that Australians are well positioned, and equitably so across our demography, to gain full employment within the shrinking number of adequately paid jobs. But what can we do for the rest of the population, likely to be at best seriously underemployed and at worse unemployed for life?

Fundamentally, *Changing Jobs* assumes that the only way for most people to achieve happiness is through the self-esteem generated by paid employment. Let me quote the authors:

> "… the biggest problem is that welfare without work doesn't guarantee happiness. Work is about more than earning money. It's about making a meaningful contribution, about teamwork, motivation for education and self-improvement". (p.130).

Yet if we are to be realistic and allow for the contingency that 25% or more of the available workforce could remain more or less permanently outside paid employment – as was the case for several countries, e.g. Spain and Greece, for years following the Global Financial Crisis of 2008 – we need an educational system that goes beyond teaching STEM and coding. We need to prepare the next generation for a society in which many worthwhile and

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satisfying roles, including lifetime learning and volunteering, can be found outside paid employment.

Do citizens need to be in paid employment in order to 'make a meaningful contribution, to enjoy teamwork, to be motivated for further education and self-improvement', to paraphrase the authors? One can observe that many individuals in retirement make valuable contributions in just those ways (and many more), provided they enjoy reasonable health and are supported by adequate superannuation – or by a much more generous old age pension than is currently available in Australia. Is a comfortable retirement pension not an example of a socially useful, age-range specific, Universal Basic Income?

Universal Basic Income

Changing Jobs is far too dismissive of the concept of Universal Basic Income, before the current Finnish experiment has concluded and its results can be properly assessed.

UBI is the concept of giving unemployed and underemployed citizens a guaranteed and unconditional monthly subsistence wage for doing nothing — even if they get a job. (In a more idealised version, every citizen, employed or unemployed, is given the same UBI.) A two-year trial of UBI started in Finland on 1 January 2017, with 2,000 randomly picked unemployed Finns being given a guaranteed monthly income of €560 (Whigham, 2017).

Some of the counter arguments used against the UBI in *Changing Jobs* remind me of the arguments raised against the original introduction of universal health insurance – e.g. warning against allocating "the same amount of government support to a high-level CEO as to a single mum struggling to keep food on the table" (pp. 128-9).

The authors quote Dr Chalmers' colleague Dr Leigh as pointing out that if UBI replaced the current welfare system, it would actually increase inequity. Well of course it would – if Australia's Swiss-cheese tax system, which currently enables many of the richest Australians to pay zero income tax as well as laughably minimal company taxes, is not reformed at the same time.

A tight and fair tax system would ensure that the UBI allocated to individuals earning medium to high incomes would be recouped by the Tax Office, reducing the UBI's net cost to government to less than its current welfare bill. And if individuals on say $100,000 p.a., whose UBI might be 51% recouped by the ATO, find themselves sacked without retrenchment benefits, it would be of great benefit to know they would receive the UBI immediately, without a six weeks' wait (as required to obtain current employment benefits). Let alone the indignity and stigmatisation of random drug testing, as proposed by the Turnbull government.

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Clearly the UBI is not intended to be a panacea for all the weaknesses of a dysfunctional economy. It is merely a simpler safety net which can reduce the indignity of applying for welfare, as well as reducing the overheads in providing unemployment relief. Let us wait for the results of the Finnish experiment to come in.

Conclusions

Changing Jobs is well worth reading and discussing, as we have a responsibility towards the next generations to make ourselves well informed on the policy options for remaining a society of relatively high employment. And we surely want to see a majority of those jobs being well-paid and contributing high value; and for there to be social equity in obtaining those jobs.

The book has done well in recommending policies that ensure that Australians become as well positioned as any other nation's citizens to gain employment *within the shrinking number of well paid jobs*, and to achieve this with reasonable equity across our future adult population.

The series of recommendations made by the authors all have merit, and I support them as far as they go.

However, my fundamental criticism of *Changing Jobs* is that it ignores one of the critical inferences from its own literature review: that the chances of real unemployment in the future Machine Age could reach an irreducible 25% or worse – as was experienced in several First World countries, for several years, after the GFC[5].

What can we do to support a high-quality (if not well paid) life for the rest of the population, with one in four adults likely to be at best seriously underemployed and at worse without conventionally paid employment for life?

That should be an essential consideration within any set of policies that aim to provide a Fair Go in the New Machine Age.

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Endnotes

[1] ACOSS = Australian Council of Social Services

[2] ABS = Australian Bureau of Statistics

[3] STEM = Science, Technology, Engineering and Mathematics

[4] K12 = Kindergarten to Year 12 schooling

[5] GFC = the Global Financial Crisis of 2007-8.

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Alice Springs Telecommunications Facilities

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Abstract: Two papers from the Journal in 1939 and 1990 respectively contrasting the telecommunication facilities and lifestyles at Alice Springs.

Keywords: Telecommunications, History, Alice Springs, Overland Telegraph

Introduction (Style: Heading 2)

The original paper (Dale, 1939) was published prior to the Second World War and provides a lively account of the telecommunications facilities radiating from Alice Springs. It describes the establishment of the overland telegraph and the increasing importance of this remote town and challenges faced by the local inhabitants. The second paper (Leahy, 1990) fast-forwards nearly 50 years and details the telecommunications facilities at Alice Springs in 1990. The author is obviously proud of the advances in technology and amenities of the region. He closes with the words "The area still suffers from floods and droughts and these can be trying times. However, when all is taken into account there are not too many places I'd rather be than a 'Town Like Alice'". It is a pleasure to reprise these two historic papers.

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The Historical Papers

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Alice Springs and its Telecommunications Facilities — Then and Now

Part 1: Alice Springs and the Overland Telegraph Line

At a recent National meeting of the Telecommunication Society of Australia it was suggested that, on occasions, a suitable article from earlier Journals could be reprinted, together with an update of the items covered.

This is the first such article and deals with Alice Springs, the Overland Telegraph Line and the hazards faced by PMG staff in the 1930s, and Alice Springs today with its modern telecommunications services.

R.C.M. Dale (Reprinted from TJA, February 1939)

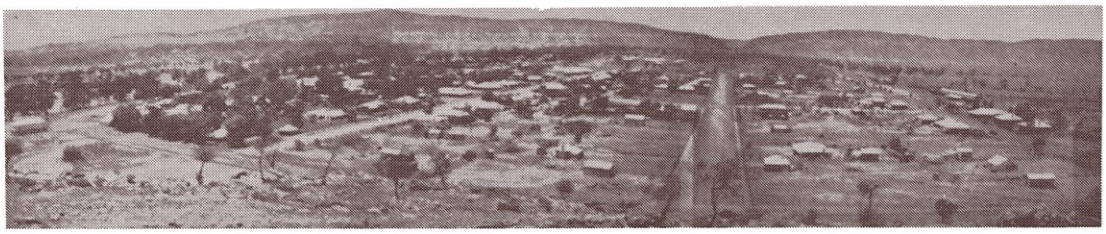
The name "Alice Springs" is really a misnomer, because the deep pool of water after which the place is named is not a "spring" but a soak. The town, a panorama of which is given below, is in the centre of the continent on the Overland Telegraph Line between Adelaide and Darwin. The locality was given its name by a party engaged on the construction of the Overland Telegraph Line in 1871 when they sighted the big, deep waterhole in the bed of the dry creek or river now known as the River Todd. The Todd only flows after each rain, and at this place there is a large outcrop of granite

Although the continent was crossed for the first time by the explorer (McDouall Stuart) in 1862, less than ten years later a telegraph line had been completed practically along the route taken by him. In the late 1860s there was great rivalry between Queensland and South Australia as to who should have the honour of linking their telegraph system with the cable being laid from Singapore to Darwin. Each wanted the other Australian colonies to support the project from their particular point of view. When in June, 1870, no agreement had been arrived at and the Cable

The older portion of the town.

Heavitree Gap, through which the railway enters from the south.

Aerodrome.



Alice Springs, looking south from Anzac Hill.

rocks. The swirling of the quickly flowing water keeps this big hole washed out and leaves it full of water. Quite good soakage water can be obtained anywhere in the creek at about six feet down, and this soakage keeps the hole full of water, and because the hole does not dry out, it was probably thought by the party that there must be a spring at that place. There are, however, many springs in the MacDonnell Ranges, but none at the particular spot after which the old Telegraph Station was named.

Company seemed to favour the land line being constructed from Darwin to Brisbane, the South Australian Government, evidently realising that some drastic action was necessary if they were to have the line in their State, made an offer to the Cable Company to build a telegraph line from Adelaide to Darwin (1,975 miles) and have it completed by the time the Company had completed their cable, this being estimated at eighteen months from the time of the offer. The offer, which meant that the telegraph line had to be

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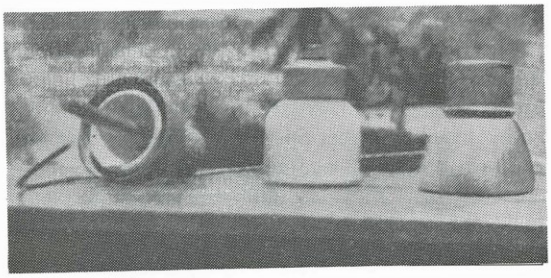
constructed at the rate of 110 miles per month, was accepted, and heavy penalties for non-completion of the line in the time were provided for in the agreement. Actually it was not until about the middle of August that year that the construction was commenced. The route was divided into three sections — from Port Augusta to latitude 27 deg. S. (about 60 miles north of where Oodnadatta is now, a distance of 550 miles), from 27 deg. S. to 19 deg. 30 mins. S. (approximately where the present town of Tennant Creek is, about 570 miles), and thence to Darwin, approximately 650 miles. The first section was in more or less settled country and provided very little difficulty, the northern section had some difficulties but not very great, but the centre section was in practically unknown country and therefore was the most difficult. Each section was sub-divided into many sub-sections, and a party allotted to construct each sub-section. A small exploring party went ahead of each main party and marked out the route to be taken. The equipment of each party included 15 horse wagons, 17 bullock drays, one bullock wagon, five express wagons, 165 horses and 200 bullocks. A depot was established at the Finke River (about 830 miles from Adelaide) for the provision of fresh meat for the men working on the adjoining sections, and 2,000 sheep were sent there. It must be remembered that all the material, provisions, etc., had to be hauled from either Port Augusta or Darwin by horse, bullock vehicle, or camels, and some idea of the difficulties experienced can be realised by the fact that it took Harvey's party, who constructed one of the central sub-sections, eight months to reach the beginning of their section.

It was far too big a job to be done in the time, and when the period had expired (December, 1871), there were still many gaps in the line. A delay had also occurred in the cable construction, and although not far off completion, the cable was not completed on the contracted date. A compromise was reached regarding the infliction of penalties, which were considerably reduced but not entirely abolished, and the South Australian Government redoubled its efforts, but it was not until 22nd August, 1872, that the last gap was closed and telegraphic communication established between Australia and England. The total cost of the line was £479,154.

The original line was a 7/14 stranded iron wire conductor, and although most of it was removed and replaced by a 400 lb. G.I. conductor many years ago, there are still some small sections of the original wire in use.

During October, 1938, it became necessary to remove a small piece of the original wire in connection with the establishment of a Telephone Office at Finke, and it was found that the old wire was in perfect condition and not showing any signs of deterioration. Several types of insulators appear to have been used. One type was of porcelain, about 4 inches across at the bottom, but having a metal top, two inches in diameter, screwed on to the porcelain. A metal plate bolts on to the metal top, and two holes, through which a wire could be passed were formed when the plate was screwed down. Apparently only one hole was used, but the tightening of the bolt held the wire firmly between the plate and the metal top of the insulator. There were thus no tie wires necessary with this type. Another type is similar to the present day trunk line insulators, a little smaller, but completely covered with a metal armour. The metal armour is shaped exactly like the insulator, and the wire was tied to this similarly as is done on present day porcelain insulators. The porcelain was set into the armour by a kind of cement, and a thread was provided in the porcelain for the spindle. A number of these insulators are still to be seen lying along the line, and although over 66 years old, do not show the slightest sign of rust or deterioration.



Old types of insulators used on the original Overland Telegraph Line and a piece of the original iron wire. The two outer insulators are the metal armoured type and the holes through which the wire was passed can be seen in the top of the centre insulator.

In many instances the line did not take a direct route between various points, but followed creeks and watercourses. The reason for this was that most of the poles were cut from the timbers growing along these watercourses, and also that it was necessary to follow them in order to obtain water. However, the white ants soon showed their presence, and although there are some of the original butts still to be seen besides the present iron poles, most of the wooden poles had very short lives, perhaps only of a few years' duration. In 1880, re-poling with Siemens and Oppenheimer poles was commenced in places, but it was not until 1898, when a 265 lb. copper conductor was added that the line was fully iron-poled. During the erection of the copper wire and the final iron poles, the line route was considerably straightened, now following a more direct route and not keeping to the watercourses. No more wires have been added since then, but the methods of telegraphy used have kept abreast of the times and enabled the growing volume of traffic to be handled satisfactorily.

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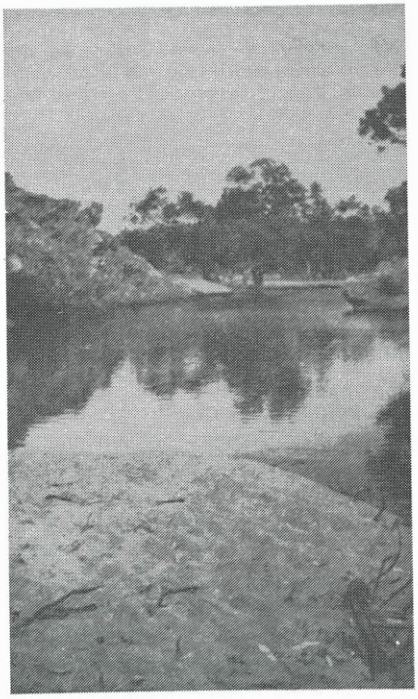
Originally the messages were repeated by hand at several stations along the route, and in between these stations were many others at which linemen were located. These latter were placed at points where water could be obtained, and varied in distance from 95 to 180 miles apart. As the country became opened up and telegraph systems improved, it became possible to abolish many of these stations, and one by one they have passed out of the Department's control. Some are now police stations, some are cattle station homesteads, and others railway stations. Today the only repeater stations apart from Port Augusta, in the circuits, are Alice Springs on the copper line, and Marree, Powell Creek and Alice Springs on the iron. Besides these the only other stations remaining in the Department's hands are Tennant Creek, Daly Waters and Katherine.

In time, hand repeating gave way to "pole changer" repeaters, and about 1926 relay repeaters were installed at the three repeater stations. Just recently the B.P.O. relays have been replaced (on the copper circuit) at this station by Creed 1927 type, and although Alice Springs is the only repeater between Darwin and Port Augusta (1,775 miles) no difficulty was experienced in working Creed duplex at 100-120 words per minute. Creed working has now given way to the Teleprinter, and I understand that this is the longest physical in Australia on which Teleprinter working is done. In these areas during summer, an amount of foreign current is noticeable, sometimes as much as 6 m.A.s. Providing it remains steady, it can be overcome by adjustments to repeater and home station receiving relays, but occasionally the foreign current will vary from spacing to marking or vice versa within a few minutes, and continue doing this for hours, and then Teleprinter working becomes very difficult.



Jay Creek Water-hole, 28 miles from Alice Springs

Nearby the pool which the first party had mistaken for springs, the Alice Springs Telegraph Station was built. For many years it was a lonely outpost, receiving its mail only once every six weeks or two months. At first it came by packs and camels from Port Augusta, later from Marree, still later from Oodnadatta, and in 1927 the railway line was completed to Stuart Town, two miles south of Alice Springs Telegraph Station. Although Stuart Town was surveyed in the late 1890s, it did not take shape until the completion of the railway. With the growth of the town it became necessary to establish an official office, and in 1932 the old telegraph station at Alice Springs was closed and a new post office opened in what was originally Stuart Town, but which now had its name changed to "Alice Springs". Business has continued to grow, and the office is now quite a busy Grade 2 office. Some idea of the town's growth can be gauged from the population, which increased from 398 in June, 1936, to 700 at June, 1938. There is also a quite large outback population served by the office. Many substantial buildings have been erected in the town and many more are in the course of erection, including a large business house, hospital, and other Government buildings. The streets are well made and properly kerbed, and thousands of ornamental trees have been planted along them. The town is dependent on the pastoral and mining industries, and these, especially the latter, are growing steadily. Many ores are found in the surrounding country, including wolfram, tin, mica, gold, silver-lead, and other base metals.

The climate is certainly hot, but it is a clear heat, and it is seldom that we do not have a cool night. In the winter many frosts are experienced, some so severe that I have seen limbs of quite big shrubs covered with ice because the frost had caused the bark to break and had frozen the sap where the bark had split. Citrus fruits, vines, vegetables and most flowers do remarkably well, but the stone fruits do not thrive, principally because of the frosts. The town nestles in between mountain ranges, and is becoming popular as a tourist resort. Most of the better scenic attractions are, however, some miles out, but they are well worth visiting, and there are people who claim that our Stanley Chasm is quite equal to the famous Grand Canyon of Arizona.

Some lengthy mail services radiate from here — that to Tennant Creek being 341 miles, Birdum 657 miles, and Huckitta 502 miles. Motors are used on all these services, but in the wet season (November to April) packhorses are used on the Powell Creek-Birdum

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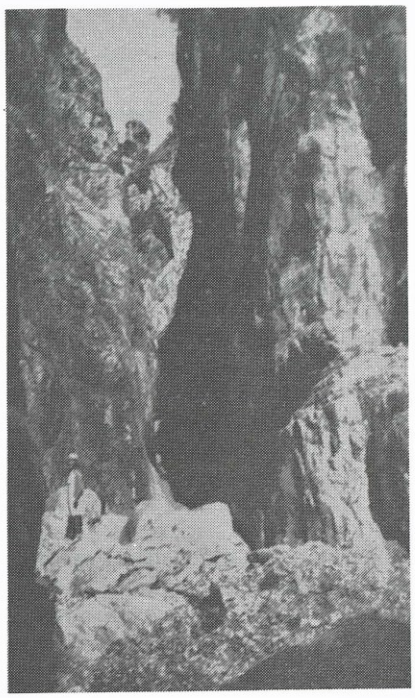

Looking down into Stanley Chasm

section of the Birdum route. On the Huckitta route there is only about 60 miles of cleared road, the remainder of the journey being over bush tracks, across wide creeks, and over some very rough hilly country. There is still one camel mail service operating in North Australia, being that which leaves Rumbalara once monthly and serves the stations north and north-west of there.

The Alice Springs' Line Foreman's district extends from Oodnadatta to Taylor's Crossing (about 26 miles north of Barrow Creek), a distance of 510 miles. The whole section is patrolled by him twice each year, usually just before and just after the wet season. The portion north of Alice Springs (205 miles) mostly follows fairly well defined tracks or bush roads, but on the southern section to Oodnadatta (305 miles) there are very little of even tracks, and he just follows the telegraph line, whether it be through sand-hills, over gibber plains and clay flats or across creek and watercourse beds. Some of these plains a few days after a rain appear to be quite dried up and firm, but beneath a thin crust is a real quagmire. In October, 1938, the Line Foreman and his assistant were returning from the patrol to Oodnadatta and about 120 miles north of there, were passing over what appeared quite firm and dry ground, when all of a sudden the truck broke through the crust and straight away dropped until it was resting on the running boards. Immediately water began to ooze through, and in a few seconds was almost flowing from where the crust had been broken. It took them until midnight that night digging drains to carry the water away. The next day was spent in trying to build up a corduroy under the truck with timber cut from the sparse mulgas nearby. Although the weather was very hot (the shade temperature at Alice Springs being over 100), they had to wait until the water had drained away before they could move, and then their disappointment can be imagined when, after going only a few yards, down they sank again and were no better off than they had been 24 hours earlier. It meant doing the same thing over again, and it was not until two days later that they got out of this hole. Usually a good supply of provisions is carried, but as the patrol had finished and they were returning home and anticipated replenishing at Finke the evening they first got bogged, the supply carried was not large, and so, after the second day, although they still had plenty of good water, the only foodstuff remaining was tinned pineapple, and for two days they lived solely on this. On the evening of the third day they managed to get out of the second boghole, but on examining the surrounding country decided to wait at least another day before attempting to go any further. They were thoroughly tired out after cutting scrub, digging trenches to carry water away and attempting to get the truck out of bogs. On the evening of the fourth day they managed to reach Finke (30 miles away) but not before some more anxious moments had been spent in crossing other bad patches of country.

View in Palm Valley, near Alice Springs. This particular variety of palm is not found anywhere else in the world.

It is not often that we get a good downpour of rain, but we usually manage one good one each year. On

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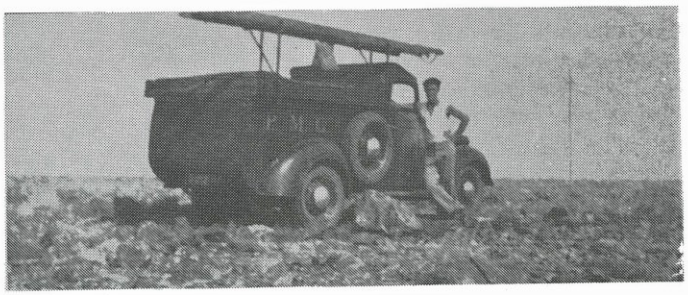
19th February, 1938, from two to five inches of rain fell from Alice Springs to Oodnadatta. Rivers ran bankers, and at one time the Alberga was flowing 16 feet above the railway bridge and over half a mile wide. Communication with Adelaide was completely cut off for several days, and the train service was not restored until six weeks later. Miles of railway line was washed away and many sections of the telegraph line carried away in the floods. Where the telegraph lines cross the Alberga there were two 28 ft. iron beam poles, but after the water had subsided they were found in different places about a quarter of a mile downstream, one end of each just showing through the mud and the other end under between six and seven feet of mud and silt. Some food supplies were brought to Alice Springs by aeroplane, but by the time the train service had been restored, there were many items which were unprocurable in the town, despite that rationing had been resorted to.

When the waters had subsided sufficiently to allow movement, Mr. E. Colson, of Bloods Creek Telephone Office (the nearest resident to the Alberga River), offered to attempt repairs to the lines, and set out on camels to do the job. Progress was slow, as it is a fair day's ride to do 30 miles by camel, especially in wet country, and stoppages were frequent in order to clear debris away from the lines. In addition, many detours had to be made to get across creeks and rivers which were still flowing, and he estimated that to traverse the 100 miles of line from his place to Oodnadatta, he travelled 160 miles. At the Alberga crossing he and three natives worked most of one day in water up to their arm-pits, rigging up temporary supports for the line. These were tripods about 10 feet high, and were constructed from timber cut from the trees growing nearby. Insulators were tied on to them, and the lines in turn tied to the insulators. Altogether it took eight days to travel and repair the 105 miles of line between Bloods Creek and Oodnadatta.

On the south side of the Alberga no wire was left on the poles (which were washed out and bent all shapes) for a quarter of a mile, the wire evidently having been caught and carried away by debris which was washed down. Many miles of railway line and two bridges were washed away, and it took nearly five months to repair the permanent way. It is interesting to note that none of the railway bridges carried away have been replaced. Instead, the line is laid on a built-in rock foundation in the bed of the creek or river. Excavations are made to some depth in the river bed and stone or rock firmly packed therein and the line laid on top of the stone. This method was first tried out when the Finke bridge carried away about six years ago, and has proved to be quite effective for, at the most, the damage amounts only to a short length of railway line being twisted, instead of an irreparable costly bridge.

Still, with all nature's vagaries, there are many who do not wish to leave here. The town is complete with most of the modern comforts, including an excellent electric lighting and power service, we have three air mails each week, a remarkably well built office which keeps cooler in summer than some southern offices I have worked in, and last, but not least, a good-hearted public to commune with.



"On the South Patrol." Many miles of country, such as this, have to be traversed.

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Alice Springs and its Telecommunications Facilities — Then and Now

Part 2: From Telegraphs to Stored Program Exchange

John Leahy, Telecom Australia

Alice Springs is today a large and thriving rural centre, a far cry from the township of less than 1000 people at the beginning of the Second World War. This article describes some aspects of the living style of the residents and the changes to telecommunications that have occurred over five decades.

ALICE SPRINGS TODAY

Alice Springs at the edge of the nineties is a large modern township, some would say city, of 23 — 24 thousand permanent population. This is increased by between 2 — 3 thousand itinerants during the tourist season which officially runs from March until October. It is a far cry from the 800 souls who resided here in 1938.

The construction of a mall, several large multi-storey commercial buildings, modern hotel and motel complexes, and the advent of Coles, Woolworths and K-Mart type shopping facilities has forever altered the character of the town. It has gone from that of an outback frontier peopled by cattle drovers, horses and dogs as portrayed in some movie productions to that of an up to date, thriving community.

Today the town is largely supported by the tourism and transport industries. The mining and cattle industries, once the dominant forces, play a somewhat lesser role than previously.

Henley on Todd

Alice Springs is internationally famous for the 'Henley on Todd' regatta, held annually in September. It regularly attracts crowds of 10 — 12 thousand people. The event is a 'mock up' of more normal regatta's held on water. 'Henley on Todd' is held in a dry river bed. The regatta is contested by homemade boat shells supported by crews whose legs protrude through the bottom of the boat so that they may run along the dried bed. If you think it is easy, try staying in step with 6 — 7 other people, bunched together in some type of boat frame, running in deep sand, with a useless sail flapping above. You will find out that it is not for the unfit.

The highlight of the day is a race for the 'Australia's' cup between a team from the American contingent based at Pine Gap, just south west of the town, and a local crew. The team that can lodge the most protests generally appears to win.

Other events such as surfing and lifesaving help to make the day memorable.

Many schools and clubs combine this event with a trip through the centre.

The Camel Cup

Another event with an international flavour, which up until a few years ago, was unique in Australia to Alice Springs, is the Camel Cup. The event originally started between local camel owners about thirty years ago as a race along the bed of the Todd. It is now an annual event held at the local showgrounds.

Every second year a team of enthusiasts from Nevada, USA, come to participate in the cup. A reciprocal visit follows from Alice Springs in the next year.

It is not widely known that Australian camel stock is regarded as the best in the world. In the past few years our stock has been exported to Arabian countries so that the quality of herds in those countries can be improved.

The Ghan

The railway line from Port Pirie to Alice Spring which carries the train known as 'The Ghan' is named after the Afghan cameleers who pioneered the route. The train is internationally famous and has been listed as one of the 'Great Railway Journeys of the World'. In the past it was indeed an adventure to those who travelled it. The old German made carriages, with their polished wood decor exuding old world charm, and the camaraderie that was produced by groups of people kept together in a confined space for a short span of time, made for a relaxed and interesting journey. Today the line and rolling stock have been upgraded to provide a fast, modern service. The trip is still worthwhile.

For those who long for the past the 'Ghan Preservation Society' has preserved 35 kilometres of the old track to Ewaninga. They have obtained several

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of the original carriages and other pieces of rolling stock and run regular daily trips on this portion of the original track which follows in part the old telegraph line.

Other Attractions

During the year there are many other attractions beside the various scenic attractions in the surrounding areas. These attractions include rodeos, race meetings and Bangtail musters. Most of them occur during the tourist season.

Every second year the Central Australian Masters Games are held. The third such games is to be held in 1990. Approximately 3000 masters athletes are expected to compete in 26 sports this year. Many of the athletes will be coming from overseas.

Community Spirit

On Christmas day 1974 Cyclone Tracey hit Darwin. The eleven thousand people then in 'The Alice' rallied strongly behind their 'Top End' brethren, raising 105,000 dollars relief money in three days, quite a considerable sum at that time. The townspeople mobilised all the towns services including communications to help. A flood of refugees headed 'down the track' and the town's facilities were overwhelmed, however with everyone doing their bit, all the problems were overcome and Tracey became Northern Territory history.

THE FORTIES, FIFTIES AND SIXTIES

Expanding Transmission Facilities

During the Second World War Alice Springs served as a staging camp for the armed services and there are still many people today with fond memories of those times. Some of these people returned to 'The Alice' after the war to give the district along with its communications a steady growth pattern through the forties. Compared with todays communications, facilities were rather sparse and somewhat primitive.

Heavy reliance was still placed on the telegraph and there was very limited vf capability. Transmission north and south was provided by open wire lines with multi office trunks and vf repeaters where required. In the late forties and fifties the installation of 3 channel carrier systems expanded the trunk capacity to Adelaide, Darwin and the outside world. Improved access was also provided to many of the little outstations along the track such as Finke, Oodnadatta and Leigh Creek to the south, Ti-Tree Barrow Creek and Tennant Creek to the north.

The advent of 12 channel systems and 2vf signalling during the fifties and sixties expanded communications in Alice Springs considerably.

The HF Radio Telephone Network

In the early sixties the Weapons Research Establishment asked the then PMG's Department to arrange for communications to several remote homesteads to assist that organisation in tracking rockets during firing programmes from Woomera. Thus was born the HF Radio Telephone Network. In the Northern Territory two separate areas were set up, one based at Alice Springs and the other in Katherine. Each of these areas was ultimately served by five networks with a capacity of 20 customers on each network being manually connected to the PSTN. At its peak there were approximately 80 customers connected in each area. In conjunction with the Royal Flying Doctor Service these networks provided some communication to the majority of remote stations and communities in the Northern Territory.

The development of the Digital Radio Concentrator System (DRCS) and the commencement of Telecom Australia's Rural and Remote Programme (RRAP) in 1986 is aimed at providing remote areas with direct access to the PSTN. As the implementation of the programme has progressed, the decline of the HF Radio Telephone network has resulted. This decline is such that in 1989 Alice Springs became the sole Northern Territory base and some networks have been switched off. It is expected that the last HF customer service will be switched off towards the end of 1992.

Switching Automation

In 1964 automation struck the town with the installation and commissioning of a 1000 line ARF group. There had been a 'B' type RAX installed in the Gap area for a short time before the ARF installation but that was recovered. An additional 1000 lines was installed shortly afterwards to cater for increased town growth which was well above the national average, six thousand being the population in 1967.

The then Manual Assistance Centre housed in the Post Office had outgrown its area and an additional area was added to the Post Office to house the expanded MAC which increased to seven boards.

THE SEVENTIES AND EIGHTIES

Continued growth stretched facilities to the limit such that in July 1974 construction of a new exchange building commenced. At the time of Cyclone Tracey local communications consisted of 2,000 lines of ARF plus two co-located ARKs (1,000 lines) and the MAC. There were no STD facilities at the time.

Installation work in the new building was completed towards the end of 1975. A new MAC (type AFM 102) and 2000 lines of ARF was the initial equipment to allow for the recovery of co-located ARKs and growth. During the ensuing years existing equipment was transferred from the old premises to the new and installation of a solar powered microwave transmission system commenced between Alice Springs and Tennant Creek.

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The solar powered microwave system was commissioned in 1979 with much publicity and fanfare and some regrets. At the time of its commissioning it was the longest system of its type in the world and the then Minister for Posts and Telegraphs (Mr T Staley) visited the centre for the opening which was held at the old telegraph station. Alice Springs had joined the STD grid and entered the world of national and international automatic communications. Open wire trunks, multi office circuits and party lines became a thing of the past.

As the eighties progressed and higher levels of technologies were introduced the town experienced an era of unprecedented growth achieving the reputation of being the fastest growing exchange in Australia at one period during the mid eighties.

An AXE node plus LSS and RSS (Larapinta) switching stages were installed in 1986 and 87. The optical fibre route from Darwin to Port Augusta was completed in June 1988. All of this adds up to 12 000 local lines (a mix of ARF and AXE) and up to date transmission facilities for the area as we enter the nineties.

SERVICING THE CUSTOMER

While the growth of the local network was continuing our 'Bush Customers' were demanding more and better quality service. The remote district cell was starting to grow. Our remote district covers an area larger than Victoria and roads and travelling conditions in the seventies left much to be desired. If several homesteads or communities on a particular route were to be visited we would drive. This meant several days of travel over rough dusty roads carrying food, water and camp gear, as well as service equipment. For safety reasons as well as assistance two people were required to travel, a costly exercise. As a result flying was the preferred method of travel.

Seasonal conditions could be hazardous with thunderstorms creating flash floods and heavy rain turning the country into a quagmire. If there was rain about you had to be quick. One of the technicians had to be helicoptered out in 1979 when he was trapped for three days by flooded creeks near the Queensland border.

Aircraft are now used to fly to remote homesteads, buzzing the homestead on arrival to ensure someone will be at the airstrip to pick up the technician and equipment. It is not unusual for the pilot to have to buzz the strip first to chase away cattle and check for any water or rough patches that may endanger the landing.

REFLECTIONS

People say to me why do you live in the Alice, it seems so isolated. Well that's true it is isolated, it's 500 kilometres to Tennant Creek, the nearest town of any size. However modern transport has largely solved that problem. It is now only 2 hours to Adelaide by plane.

It has a great climate. True summer temperatures are high (45 degrees Celsius) but it is a clear heat not oppressive like some areas and not too uncomfortable. Winter temperatures again can be cold (recorded minimum −7.5 degrees) but again except for an occasional very cold south wind it is not too uncomfortable and in between there are 300 odd days of nice sunshine with cool sleep easy nights.

The Alice lifestyle is still easy going, good natured and friendly without a large amount of the pressures on living that apply in other areas although that is changing to some degree.

Many of the people that have not been here still perceive the town as being in the middle of the desert surrounded by sand. The reality is that the scenery through the McDonald Ranges is the equal of any place in the world. We are a long way from the beach they say, well again that's true, easier to say we are close to the sand but a long way from the water.

The area still suffers from floods and droughts and these can be trying times. However when all is taken into account there are not too many places I'd rather be than a 'Town Like Alice'.

John Leahy commenced work with the Postmaster General's Department as a Technician in Training in January 1956. He joined the Country Installation group in 1959 and in October that year was sent to Alice Springs to assist in the installation of the first 12 channel system for the district. He returned in 1967 for further installation work and eventually settled there in 1974 transferring to the maintenance group after completing the installation of the AFM in the new exchange building. He is currently the O I C of the Alice Springs exchange maintenance group.

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Telstra's Future Mode of Operation

Network transformation between 1992 to 1993

Ian Campbell
Telecommunications Association

Abstract: The Australian & Overseas Telecommunications Corporation (AOTC), later Telstra, was established on 1st January 1992, as a government-owned corporation and as the national telecommunications carrier. At the same time the Australian telecommunications market was deregulated and network competition was expected to begin within several months. Studies had indicated that AOTC's inter-exchange network was perhaps five years behind similar networks in the USA and uncompetitive with the network to be built by the incoming competitor, Optus Communications (Optus). AOTC's first Chief Executive Officer, Frank Blount, was an experienced senior executive of AT&T, one of the most respected telecommunications businesses in the world, which had been operating in the highly competitive telecommunications market in the USA over the previous eight years. Blount decided that one of his highest priorities, if not the highest, was a major transformation of the AOTC's inter-exchange network. Within seven months the AOTC board approved Plan D, an interim hybrid strategy which broadly achieved what was required for the network to be competitive. Within fourteen months the Board approved the Future Mode of Operation (FMO), a strategy to achieve a fully competitive, almost fully digital inter-exchange network which would approach world parity within five years. The FMO strategy would leap a gap close to ten years within five years. This is the story of the rationale and planning to launch Plan D and the FMO, the building of the first competitive telecommunications network strategy in the Postmaster General's Department (PMG), Telecom Australia (Telecom) and AOTC (Telstra) in over 90 years.

Keywords: telecommunications, networks, Telecom, OTC, AOTC. Optus

Introduction

In 1988 the Commonwealth Government released a statement on the future structure of the telecommunications industry: “Australian Telecommunications Services; a New Framework”. Over the following years to 1991, legislation, the establishment of a regulator (AUSTEL), and a number of inquiries by AUSTEL, would drastically change the

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telecommunications market in Australia. The main outcomes of legislation and regulation to 1992 were:

- the *Telecommunications Act 1991* formalised the new telecommunications industry structure and related regulation, including a framework for licensing telecommunications carriers, maintaining the concept of a standard telephone service and related funding, the regulatory structure, and the powers of the new industry regulator (AUSTEL).
- the *Australian & Overseas Telecommunications Corporation (AOTC) Act 1991*, established AOTC (later Telstra) in 1992 with the merging of the Australian Telecommunications Corporation (Telecom) and the Overseas Telecommunications Corporation (OTC) and granted common carrier licences for providing landline and cellular mobile network services.
- the loss-making satellite operator, AUSSAT, was privatised and formed part of the package for a second common carrier licence (to AOTC's), which was awarded to Optus for providing landline, digital cellular network and satellite services.
- a third common carrier licence was granted to Arena (in addition to AOTC and Optus) for providing digital cellular mobile network services.
- GSM was selected to be the digital cellular standard for Australia, and services from all three licensed network service providers could be offered in 1993.
- AOTC was required to permit Optus to resell AOTC's landline network services and Optus and Arena to resell AOTC's Analogue Mobile Phone Service (AMPS) from January 1992, with wholesale rates to be determined by AUSTEL.
- Optus and Arena could commence the marketing of GSM mobile services on their own networks in 1993, with rates for interconnection with Telstra's networks to be determined by AUSTEL.
- if a later review assessed the 1989 de-regulation a success, full-scale competition in network services could be introduced by 1997.
- to make the two new mobile licences more attractive to bidders and to release radio spectrum, Telstra's AMPS network would be shut down when the three digital networks had sufficient coverage, so as not to disadvantage analogue customers. The date of the shutdown was later determined to be 2000.

Although Telstra could have provided GSM services in 1992 and was the first operator outside Europe to join the GSM club, in order to create a "level playing field" Telstra was prohibited from offering GSM services until 1st April 1993 when Optus was expected to be

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ready. Telstra was later required to again delay its launch until 23rd April to meet the government's interception requirements.

Disclosure

This is not an academic paper; a more accurate description would be a reflective historical paper about the eighteen months over which the plan for the FMO was developed and implementation began. The paper provides some detail about Telstra's task as the national carrier and its operations and culture, to afford a better understanding of judgements and events.

The author is not an engineer and has no qualifications, training or experience in network engineering. It is possible that this paper has technical errors which the author would acknowledge.

The paper is supported by a number of records of the period, including business plans, business cases, and trading statements. The records are incomplete but are sufficient to support the points made. A number of these records no longer exist or are not easily accessible such as those in the archives of Telecom and Telstra.

Opinions and judgments are the author's unless otherwise stated. Those of Telstra and Telecom are expressed using standard private sector criteria including growth, market share, customer service and profit, rather than using public service criteria.

The Telecom Network in 1991

In June 1991, Telecom's 8.1 million landline telephone services reached 95% of Australia's homes – up from 60% in 1975; the huge objective of providing almost every Australian and the 800-900,000 businesses in the in the country with a telephone service was broadly achieved. The network, by landline and satellite, reached every hamlet, tourist resort, mining site, cattle station and aboriginal community in the outback. During the 1991 financial year landline customers made 9.4 billion local calls, 1.8 billion trunk calls and 117 million international calls.

Since 1984/5 Telecom’s Rural and Remote Areas program had connected 45,000 customers in outback areas across some of the country’s most inaccessible regions. Almost every Australian in the outback had access to a telephone service.

Some 290,000 customers, about 5% of Australians, owned a mobile phone, and the mobile phone service covered over 80% of the Australian population. The number of customers had increased by nearly 250% over the past year and during that time mobile customers made 158 million calls.

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Telecommunications traffic nationally was in a transition from "voice" to data services including digital data, imaging and video access and transmission, and soon cable TV. Data services were well established and the number of customers was growing rapidly. Telecom alone provided 85,000 data modem services, 94,000 Digital Data (DDS) services, and 8,600 packet switched (AUSTPAC) services. The number of data points and the volume of data traffic were poised to explode.

There were 38,000 kilometres of optic fibre cable linking the exchanges of all of Australia's capital cities and major towns across the nation. Over the past year 10,500 kilometres had been laid, and rapid expansion was programmed.

$3.3 billion in capital works were planned for 1991/2, at least 50% of this for the interexchange network.

The AOTC (Telstra) Network in 1992

The merging of the Telecom and OTC networks into the AOTC network began in August 1991. From January 1992, with the merged networks, AOTC was the third largest owner of submarine cables in the world, and the sixth largest shareholder and user of the 122-member international satellite communications consortium (INTELSAT).

AOTC's network comprised four conceptual components: the landline network, the cellular mobile networks, the agreement with Optus to use the AUSSAT satellites, and the overseas cable and satellite networks linking Australia with other countries.

The AOTC network was highly complex. As with almost all advanced telecommunications networks in developed countries there were "legacy" problems: older technologies, network designs and network components – exchanges, transmission links etc – which were now obsolete and uncompetitive. Most of the legacy exchanges and links were still operating in rural and outback areas because of the lower revenue potential and the cost of upgrading equipment. However, older equipment was still in operation in many areas of the major cities and important regional towns. For example, in 1992 AOTC closed the last of the manual telephone exchanges (with switchboard girls, plugs and cables) at Longreach, Queensland, a significant regional town; museums from around the world sought to acquire the switchboard.

In addition, AOTC's network had other complexities. For example:

- there were three digital switching platforms: Ericsson AXE, Alcatel System 12 and Nortel DMS.

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- overlaid on the hybrid analogue/digital telephone network switching and transmission components were a number of dedicated networks performing a range of functions, including:
    - the telex service,
    - links for radio and TV designed for regional and interstate program distribution,
    - the AMPS cellular mobile network,
    - the new GSM network being constructed,
    - the dedicated data networks; the Digital Data network (DDS), the packet switched network (AUSTPAC), and the ISDN network,
    - a number of smaller specialised networks such as for electronic trading.

These complexities – the legacy analogue systems alongside the newer digital systems, the number of switching platforms and the overlay networks – were an inefficient use of network elements and capacity; were becoming more complicated to manage; and were more-costly to build, operate and maintain. They duplicated functionality, and required multiple network management platforms and operational support systems. In addition, they inhibited the range of services offered, compromised the reliability and quality of service, and inflated capital and operating costs.

Two studies of Telecom's network – in 1985 and 1991 – reported that Telecom's network was years behind advanced networks in many other first-world countries and poorly prepared for the competition due to begin in 1992.

The 1985 study

This study of telecommunications utilities in the USA, UK, Sweden and France by the General Manager Operations, George Hams, reported that Telecom lagged in key areas including employee productivity, deployment of digital switching, and the development of major operational information systems.

For example, Telecom's staff per 1,000 services was roughly double that of the US, about 40% higher than Sweden and 20% higher than the UK; of the telecommunications businesses examined by British Telecom, Telecom was only ahead of Portugal and Ireland. The proportion of digital switching in Telecom's network was low; Canada, France, Japan and Sweden were in the range 13-20% compared to Telecom's 1%.

All the utilities visited had a strong determination to reduce staff numbers and costs; to accelerate penetration of digital switching and optic fibre transmission; to reduce the levels

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of management and supervision; to outsource areas where internal staff had neither the skills nor performance levels needed; and to align payment and incentives to performance and productivity.

A reasonable expectation from the study was that Telecom's top management would immediately order task forces to rapidly improve performance, at least in the network and computer systems development programs, but no significant such actions resulted.

The 1991 study

This project, commissioned by Telecom's Deputy Managing Director, Doug Campbell, was a comprehensive benchmarking study by Booz Allen Hamilton (BAH) of the network and the related information systems for operating and maintaining the network. The study compared Telecom's performance with seven regional Bell operating companies (RBOCs) in the USA.

The study found that while Telecom ranked well in a few areas, there were potential savings of over $700 million per year in the network and the related information systems, accommodation and overheads. This scale of savings was considered credible as it was supported by the management involved in the study. Other findings were that the RBOCs achieved a superior performance in the key areas of network services, operating costs, and capital and labour productivity by more aggressive use of technology, stronger and more focussed management and related systems, and more disciplined management of the field force.

Examples were the more aggressive use of concentrators and pair gain systems; faster deployment of digital switching; and more remote control of switches, particularly electro-mechanical switches. Telecom's proportion of digital switching was about 29% compared to the lowest RBOC, US West, with over 40%, unremarkable in the USA. Telecom was also considered to be underfunding information technology projects.

The consultant commented that, based on the US experience, when responding to competition in the industry, culture change in Telecom was slow; it was two to six years before real change emerged. Some 15 years after Telecom was launched, Telecom was perhaps five years behind an Australian competitor operating at the US level.

Finally, it was clear that Telecom had been slow in preparing the network for competition and the demands of a competitive market. AOTC's network was years behind world parity, and except in some metropolitan areas the products and services offered were behind those offered in the USA and Canada. More urgently, AOTC's network performance was lower than what Optus, the incoming competitor, would achieve with a fully digital network. In almost all the important areas the new, simpler, more advanced Optus digital network would be

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built with lower construction costs and could be expected to perform better with lower capital and operating costs.

A benchmarking study in June 1992 provided an updated and more accurate understanding of the status and performance of the network and the results were daunting – see later.

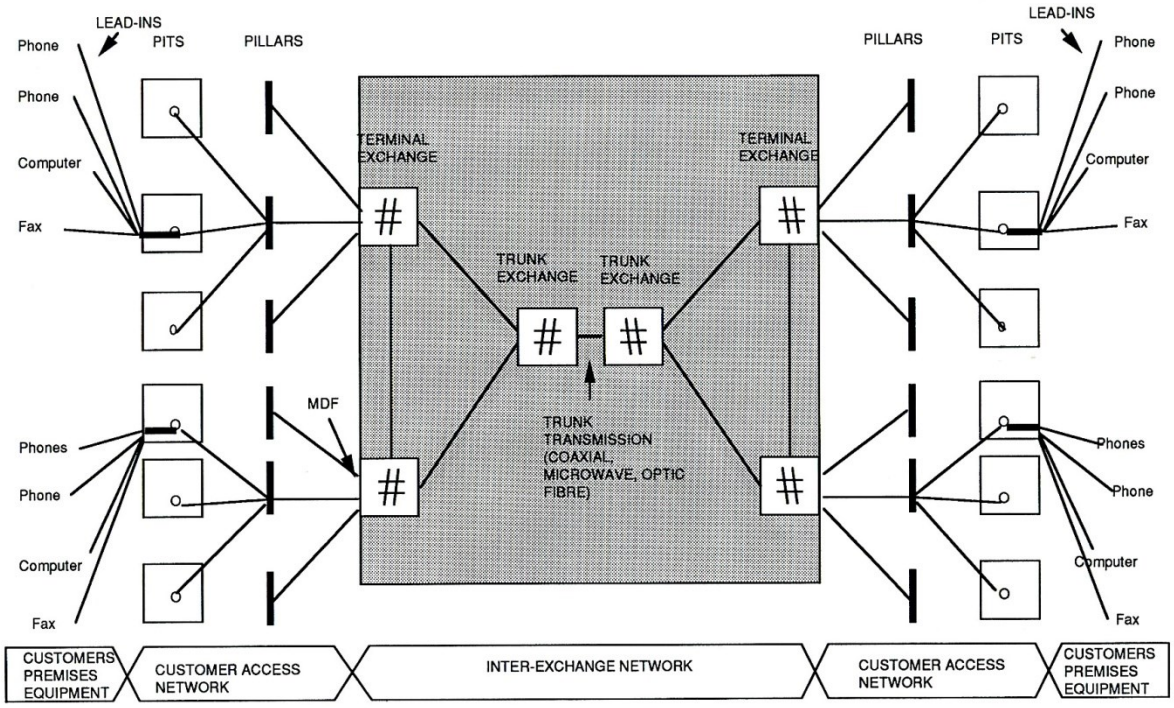

Figure 1. 1992 AOTC Domestic Network

Notes:

- The shaded area is the Network Products Group operation
- Not shown is the number of "overlay" networks in the interexchange network and the international gateways and satellite links

The AOTC Chief Executive Officer

AOTC's new CEO, Frank Blount, appeared a close match with what AOTC needed. His education, training and experience in telecommunications, particularly in competitive markets, was impressive.

Blount was awarded a Bachelor of Science in Electrical Engineering at Georgia Institute of Technology in 1961, an MBA from Georgia State University in 1969, and a Masters Degree in Management Science from the MIT Sloan School of Management in 1971. Blount had been employed by AT&T for all of his career, advancing through the engineering stream. He served in various executive positions with AT&T, rising to be the Group President, Communications Products Group from 1989 to 1991.

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Blount had observed the anti-trust suit pursued by the US government against AT&T from 1974; the resulting divestiture of the Bell System in 1984; the following change in the AT&T culture to be competitive; the competitors that emerged and their tactics after 1984; and AT&T's loss of market share under full competition.

The AT&T divestiture forced one of the most drastic changes in corporate culture ever undertaken by a major American corporation. The old Bell System, as a regulated monopoly, had been largely insulated from market pressures for most of its history. Its culture venerated service, technological excellence, reliability, and innovation within a non-competitive internally-driven framework of taking the time and money to "do things right". The new AT&T had to discover and deliver what its customers wanted when they wanted it, in competition with others who fought for the same customers. AT&T began as a new company on January 1, 1984. Of the $149.5 billion assets the Bell System had the day before, AT&T retained $34 billion. Of its 1,009,000 employees it retained 373,000.

The long distance telephone service became an intensely competitive market. From a monopoly business, AT&T's market share fell from over 90% in 1984 to around 50% ten years later. The competitive pressure and new technologies (primarily fibre optic transmission), caused prices to plummet, dropping by an average of 40% by the end of the 1980s. The volume of calls exploded. In 1984, AT&T carried an average of 37.5 million calls per average business day; in 1989, the equivalent volume was 105.9 million, and 270 million in 1999. In the 1990s, the growth of computers, and the emergence of the internet led to an increasing percentage of network traffic being data rather than voice. AT&T invested heavily to quickly transform and digitise its entire network.

AOTC in 1992 faced a similar situation to that of AT&T in 1984. On paper Blount appeared to have the skills, experience, credibility and tradition needed for the AOTC job.

Establishing the AOTC Structure

Blount retained the Boston Group to advise on the new AOTC organisation and Russell Reynolds to evaluate the top twenty or so senior managers of Telecom and OTC. Based on their advice the AOTC organisation was finalised in early January and the new management team was appointed by the end of January.

The new AOTC organisation featured five customer-facing retail business divisions, providing the services they forecast were required at retail prices – see Figure 2. A Network Products Division managed the inter-exchange network and supplied services to the customer divisions at negotiated wholesale prices and to the competing carriers, Optus and Arena, at regulated or negotiated wholesale and interconnect prices.

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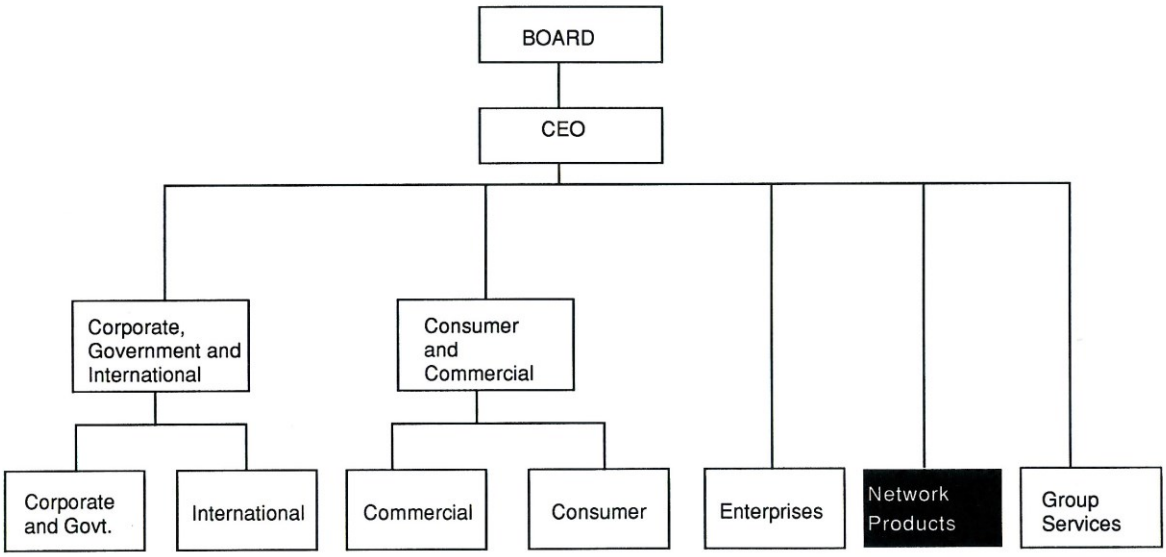

Figure 2. The AOTC Organisation from 1st January 1992

Notes:

- Five retail divisions – four customer divisions and an Enterprises Division – market at retail prices. Network Products Division markets to the retail divisions at wholesale prices and to interconnection carriers at regulated or negotiated interconnect prices.

Network Products Division

Blount assessed that AOTC's most challenging task was to transform the inter-exchange network.

Network Products Division was the business unit in AOTC which owned, planned, developed, constructed and operated the core telecommunications network – the inter-exchange network – comprising about 5,000 exchanges around the nation linked by co-axial cable, optic fibre, radio and satellite networks. Organisationally Network Products did not manage the local loop and was only required to efficiently service the loop from the local exchange. Network Products also managed AOTC's equity share in the overseas transmission links between Australia and other countries, including participating in the network planning, development, construction and operation of the links.

To ensure that the required progress was made and not hindered by other areas, the manager of Network Products reported directly to the CEO.

Network Products was a complex goliath; a new "green field" business built from the network components of Telecom and OTC. In January 1992 the initial estimate of the revenue at wholesale prices was $1.6 billion, of which $60 million was from interconnecting

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carriers. The division comprised about 21% of AOTC's operating expenses at $1.6 billion, 39% of capital expenditure at $1.5 billion, 70% of its research and development costs, and 25% of staff at 18,600. The 18,600 staff were all sourced and relocated from other areas.

The organisation was fully operational by the end of February.

The Objective and Planning Approach for the Network

The overriding objective was to develop a network which was:

- competitive with Optus ahead of Optus' network deployment in contested areas in terms of service range, quality, reliability, service delivery, operating cost structure and capital efficiency; and
- at world parity nationwide in those terms within five years.

To achieve those objectives the immediate imperative was to build:

- a business plan and trading statement within six months which achieved competitiveness with Optus; and
- a business plan and trading statement within twelve months which achieved world parity within five years.

It was already known that the old Telecom network was years behind, but the gaps were not fully defined and actions to bridge the gaps not fully effective or prioritised. Both Telecom and OTC had plans in place and projects in progress, but both fell far short of transformation. With the amount of research and related work needed to be done to build a sound planning data base, business plan and trading statement and the urgency for results, three factors became clear:

- improvement would continue in areas where the need was sufficiently defined and the priority was clear,
- the plan would develop through a series of iterations as more information became available, and meanwhile; and
- a number of "task teams" would "overlay" the formal organisation, the teams working in parallel on specific tasks to produce earlier results and to accelerate progress.

The general approach is outlined in a series of parallel actions.

Action 1: Build a Base Case Trading Statement within One Month

Producing the "base case" numbers for the business was a struggle. For large areas of the networks there was little relevant historical data to use for planning projections. In addition,

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18,600 staff were transferred into the division; about 3,000 from Corporate Customer Division, 3,800 from Residential & Network Services Division, 2,000 from Country Division, 9,600 from Network Engineering Division and a small number from OTC. Many projects and more than 500 staff arrived unexpectedly without supporting funding, common in a public service situation. Additional costs and funding shortfalls continued to emerge from other areas over several months.

The division organisation and staff were operational within the first month, as were "first order" budgets, processes and systems. Operational arrangements with the customer divisions and competing carriers were operational a month or so later.

Table 1: Network Services - "First Order" Trading Projection - 1992-97

		92/93	93/94	94/95	95/96	96/97
		(1991/92 prices)				
Revenue (external)	$m	193	227	318	326	429
Direct Expenses	$m	920	864	863	865	902
Shared Resource Units Expenses	$m	676	676	686	701	715
Total Expenses	$m	1,596	1,540	1,549	1,566	1,617
Direct Contribution	$m	1,403	1,313	1,231	1,240	1,188
Capital Additions	$m	1,479	1,406	1,350	1,355	1,338
Cash Flow	$m	2,882	2,719	2,581	2595	2,576
Staff		16,225	15,392	14,595	14,181	13,818
Ratios Return on Assets	%	15	13	12	11	10
Cash Flow/Assets	%	30	27	24	23	22

Notes:

- External revenue is wholesale revenue from Optus, Arena, and Telecom subsidiaries. At this stage revenue from the AOTC customer divisions was not included as the wholesale prices had yet to be calculated.
- Direct expenses were expenses incurred in supplying services to the customer divisions at transfer prices and interconnected carriers at wholesale prices.
- Shared Resource Units expanses were expenses incurred in using the services of corporate units such as information systems, accommodation etc.

The expenses and capital were projected on a "past rate of improvement" basis. The first attempt was a very crude consolidation with modest and obvious cost savings but, as expected, the scale of improvement was totally unacceptable – see Table 1.

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Action 2: Launch a series of Specialist Teams overlaid on the Formal Organisation for Earlier and Faster results

New "greenfield" organisations take time to be implemented and focus on the task, particularly in a large organisation of some 18,000 people. Results could not be delayed by that time.

A number of specialist teams were formed to immediately tackle urgent and priority tasks. For example:

- the “Peel Off” team ensured that the staff, operating revenue and costs, capital, and assets transferred into the division from other areas were fully funded,
- a "Customer Services" team developed and agreed operational arrangements with the retail divisions and the interconnecting carriers.
- a “Finance and Accounting” team established an entirely new accounting code structure and set of accounts and developed first order, and later final, transfer and wholesale prices to charge the retail customer divisions and the competing networks,
- a “Network Performance Improvement” team produced a “first order plan” to rapidly improve the network performance by June.
- a "Benchmarking" team" obtained world benchmarks for all significant operating areas - including product range and price packaging, service quality and penetration, network operating and construction performance and costs and industry supplier performance and prices. Using these benchmarks, the business plan would be revised to deliver world parity within five years. The results of the benchmarking study are provided later.
- “Process Re-engineering" teams used the process re-engineering technique to achieve transformational changes in key processes such as reducing the downtime of exchanges and reducing times for changes in tariffs.

  In 1992 there were a number of well-known processes for achieving business performance improvement; for example, work study, systems analysis, “Total Quality Management" (TQM), “Just-in-Time”, and “6-Sigma”. Properly implemented, all produced results but usually steadily over years, too slow for a network transformation.

  In 1990 Michael Hammer, a former professor of computer science at the Massachusetts Institute of Technology (MIT) proposed "process re-engineering" for "breakthrough". Process re-engineering aimed to radically restructure the

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organisation by focusing on the ground-up design of the business processes to dramatically improve customer service, cut operating costs, and become world-class competitors. All forms of work that did not add value were eliminated.

"Breakthrough" appeared to be the only way for AOTC to transform the network in five years. Network Products launched a number of "breakthrough" projects which achieved astonishing results – see later.

- a “Systems Strategy” team produced a comprehensive and transformational plan to upgrade the interfaces to the customer systems – service activation, service assurance, charging and billing, and customer support – and the network operational systems,
- an "Incremental Revenue Generation" team produced a plan to increase revenue in the short term beyond current projections – first order” plan by June.

  This included accelerating the introduction and deployment of new services such as high speed, secure data networks, pay TV (when authorised), electronic trading, open learning between schools and universities, image processing and retrieval, electronic mail, geographic information systems, and electronic funds transfer,

  The "final" business plan would inevitably propose a significantly higher capital investment than allowed in the initial January 1992 budget. A higher short term revenue projection would facilitate support for a level of higher investment.
- a “Capital Investment Framework” team developed a process and model for evaluating, prioritising and programming investment proposals, including investments in the domestic network, international networks, and stand-alone domestic opportunities such as Pay TV.
- a "Network Transformation" team was a highly expert team to immediately assess the options for revolutionising the network. The members were instructed to be aggressive, innovative, and unbounded by history or institutional roadblocks.
- a “People Program” team was to produce a plan to drastically improve the customer and business focus and result orientation of the staff, retain the most valuable staff as the workforce was restructured and reduced, manage the unions, and draft enterprise agreements that would achieve transformation.

  Some of the key issues that required negotiation with the unions included national (rather than largely state-based) network management and operation, nationally standardised work practices, larger exchange maintenance groups, and fewer management and staff classifications and levels.

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At the end of the first month the most valuable high-risk staff had been identified, and these people were assured that their contribution would be crucial to the business. More were identified over the next few months.

- an "Industry Strategy" team produced a “first order” industry strategy by September which decided the key suppliers and the related Australian telecommunications industry plan to achieve transformation performance and comply with AOTC’s licence conditions.

Teams only existed for the time needed to complete their task. Some such as the "Peel Off", "Customer Service" and "Financial and Accounting" teams only worked for several months. Some such as the "Process Re-engineering" and "Network Transformation" teams were still operating after 18 months.

Action 3: Define a Base Case for the Network within two months

The data from the Booz Allen Hamilton (BAH) benchmarking conducted in 1991 was supplemented by performance assessments of each element of the network. Some specific areas of underperformance were:

- many of the plans for improving the capabilities and performance of the network developed by Telecom's customer divisions over the previous three years fell short, were not fully resourced and were behind schedule,
- service feature deployment was too thinly spread beyond the central business districts,
- the inter-capital transmission links were only 80% digital (60% on optic fibre).
- implementation of the future network architecture features was too slow; for example, Synchronous Digital Hierarchy (SDH)/Asynchronous Transfer Mode (ATM) which Optus was expected to implement at launch in 1993,
- inter-capital transmission performance was not meeting CCITT (world) specifications – about 10% of inter-capital paths failed to meet the monthly objective,
- while AOTC's signalling (SS7 - World Signalling Standard 7) network was one of the largest, linking 300 switches and data bases in the IN, ISDN and mobile networks across Australia, conformance to the latest CCITT “Red Book” standard was less than 10%. The new standard was crucial to achieve advanced feature connectivity,
- a large proportion of transmission links comprised of analogue or early versions of digital technology and needed to be replaced, the error performance was

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unsatisfactory and there were some single points of failure, mainly due to tele-power systems,

- network operating and management systems were state-based. These needed to be transformed to a nationally managed network from two centres – Melbourne and Sydney – and substantially upgraded for such as traffic management, performance measurement, service quality measurement, maintenance, alarm monitoring, fault detection and repair, and disaster management,
- network loss for local calls, long distance calls and international calls seemed excessive and vulnerable to superior performance by Optus,
- the hardware and software reliability and switch availability of the new computer digital exchanges was below best practice. Node events averaged about 2.5 per month and downtime about 10 minutes per month per node.

Establishing the accounts, collecting the resources and compiling a "first order" business plan for the base case network was a major task, achieved in less than two months. One concern among several senior engineering managers was the major risk in upgrading the operational support systems so quickly, and they emphasised that this needed to be planned carefully. Another concern was the union reaction.

The base case was updated with the results of the benchmarking study three months later – see Action 5.

Action 4: Construct a likely Network Design, Feature Set, Performance and Rollout for the Optus network within two months

The switch that Optus would use for its network – Nortel DMS – was known, as was the related feature set that would be offered. The prediction was that Optus would adopt an aggressive rollout for both the landline and cellular networks with network services assumed to be offered about mid-1993.

AOTC's business plan would cover the Optus feature set well ahead of the predicted rollout in all contested markets from the end of 1992.

Action 5: Obtain World Benchmarks for all key performance measures by June

Cresap, McCormack & Paget (CMP), a world respected consultant specialising in telecommunications benchmarking, was retained to report AOTC's performance against operators in the USA – see later.

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The results were used to upgrade the progress made from the base case (Action 3) and the related business plan.

Actions 6+: Iteratively develop the Network Strategy, Business Plan and Trading Statement as better data became available

The corporate planning requirement was for a budget to be available in April for the following financial year – 1992/93 – and a five year plan for the period 1992/97. Updates were required six months later.

After the base case in March there were a number of planning iterations to attempt to meet AOTC's commercial and financial requirements while battling with the prime task, establishing the business and network transformation. An indication of the iteration process is provided in Table 3 later.

The business plan and related trading statement for building a network to be competitive ahead of the rollout of the anticipated Optus network was achieved in July, 1992 and was named Plan D – see later.

An early plan and statement for a world parity network in five years was produced in early 1993 and was named the Future Mode of Operation (FMO) – see later.

With the market, competition, industry regulation and the key technologies changing so drastically, there was a range of issues to resolve in developing the business plan. For example:

Issue 1: Competitiveness had to be achieved in the Contested Key Markets before 1993

Optus was expected to enter the Australian telecommunications landline and cellular mobile markets market around May 1992, initially as a reseller of AOTC's landline and AMPS mobile networks, and from about June 1993 marketing its own networks.

The Optus landline and mobile networks would be fully digital with Nortel DMS switches offering:

- a "state-of-the-art" product and service range;
- extensive price packaging;
- quick connection, service repair and restoration;
- detailed and flexible billing; and
- prompt and efficient customer support.

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The transmission links between the switches in these markets would be optic fibre with huge capacity, world-standard reliability, and very low operating and maintenance costs.

Operation of the Optus landline network was predicted to begin about June, 1993 in Sydney, Melbourne and Canberra, and progressively extend to Brisbane, the Gold Coast, Adelaide and Perth by December, 1993. The Optus GSM network was expected to be deployed using roughly the same schedule.

AOTC's revenue and profits were strongly centred on Sydney, Melbourne and Brisbane. Sydney alone contributed about 20% of profits, and the golden triangle of Sydney, Melbourne, Canberra and Brisbane generated over 70 % of profits. The gross margin for long distance and international calls approached 80% of sales. The more advanced network services including data, intelligent and enhanced services were marginally profitable at best in the early years, but had high growth rates and served to weld the customers to AOTC's network.

Resale of AOTC's networks from about from about May 1992 to mid-1993, followed by the rollout of the Optus network, was expected to allow Optus to make long distance services available to 65% of Australia's population by the end of 1993, 70% by the end of 1995 and over 90% by the end of 1997. By then Optus might cover over 70% of AOTC's customers with both landline and cellular mobile services.

In addition to the customers attracted through resale, Optus would likely early target the direct connection of large business customers in the capital cities for long distance and international calls, data services and private networks.

Competition was assumed to be intense in the contested areas from mid-1993. Over the next five years Telecom forecast a market share loss of 35% for long distance calls and 41% for international calls.

Arena was expected to become a reseller of AOTC's landline network and of the AMPS network in December 1992; little was known of its plans to compete with its own GSM network, but towards the end of 1993 seemed likely.

The Network Products business plan had to complete full digitisation of switching and transmission in the central business districts and the most vulnerable urban business concentrations in all the targeted cities by the end of 1992, ahead of the Optus roll-out.

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Issue 2: AUSTEL's Regulatory Requirements to create a "Level Playing Field"

As an incentive for Optus and Arena to enter the market, AUSTEL, with the encouragement of the Labor government, made several decisions to provide a "level playing field" to give the incomers an easy, early and significant market share:

- a pre-selection process provided every AOTC customer with the opportunity to use Optus as their preferred carrier for long distance and international calls. During the pre-selection process AOTC and Optus campaigned area by area across Australia to be the preferred carrier for long distance calls. Customers who did not respond remained with AOTC. Those customers who did not choose Optus could still use Optus by dialling a "one" prefix.
- as previously noted, AOTC was required to permit Optus to resell AOTC's landline network services and Optus and Arena to resell AOTC's AMPS network services from January 1992, with wholesale rates to be determined by AUSTEL.

AOTC's network had to be prepared for both programs both technically (one prefix, billing etc) and commercially (service delivery, invoicing, collection etc).

Issue 3: the Uncertainties in Growth in Demand/Traffic over the Planning Period

Providing capacity for telecommunications services required estimates of the volumes of traffic over the planning period – the next five years. Noting the AT&T experience when competition was introduced in the USA, traffic growth would likely be unprecedented, demanding far higher expansion of network capacity.

AT&T's experience was that telephone calls exploded more than six-fold over five years. After pre-selection began in mid-1992 and when network competition began in mid-1993, telephone calls on AOTC's landline network might increase from a steady and predictable 7% pa to more than a factor of three.

The number of mobile calls was rocketing, but was still only 2% of landline calls; in five years mobile calls might reach 30-40% of landline calls.

Data traffic was also accelerating due to such as the emergence of higher rate local loop capacity in homes and businesses, corporate data processing networks, and the early usage of the internet (which emerged in 1992). Another potentially large traffic generator over the next five years was video for services such as for cable TV, which was likely to be introduced

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within three years. While data traffic might only be 10-20% of telephone traffic now, it could overtake telephone traffic within five years.

Issue 4: The Transition from Analogue to Digital Switching and Transmission needed to be greatly accelerated

Digital technologies – such as used for computers, switches and transmission – were superior in almost all respects to the older analogue equipment being replaced. Digital equipment provided a wider range of services, allowed far faster computing and switching, far greater transmission capacities, greater reliability of operation, generated less heat (requiring less cooling), was more compact (requiring less floor space), and offered lower construction and operating costs.

For example:

- digital switches could be programmed to provide a wide range of new services including caller identification, number portability for mobile services, and virtual private networks.
- a digital line could carry all types of traffic simultaneously to the limit of its capacity, while an analogue line could only carry one type of traffic at a time – a telephone call, telex call, or video program.
- a digital switch required less than 10% of the floor area of an analogue switch.

AOTC, with its network monopoly, had been slow to introduce digital switching and was far behind the USA, Canada and the OECD in its deployment.

Telecom had three types of digital switches – Ericsson (AXE), Alcatel (S12), and Nortel (DMS) – which were concentrated in the central business districts of the main capital cities, and four types of analogue switches (SXS, ARK, ARF and ARE). An "overlay" network extended the services of these digital switches to provide a wider range of digital services to a limited wider area around the central districts to meet particular business demand. Outside these areas a large installed base of enhanced analogue ARE exchanges provided functionality to meet the needs of a majority of residential customers. Country exchanges outside the provincial cities and towns were obsolete and posed a problem because of their numbers (over 4,000) and size (more than 3,000 exchanges of less than 400 lines); there were no immediate plans to replace this type of equipment in most areas.

Telecom's 1991 Annual Report claimed that all of the central business district exchanges would be digital (AXE) by 1993. "In the near term" a mixed approach using analogue (ARF ARK) and full digital (AXE) network intelligence (would) be developed to modernise the

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country network. All obsolete analogue step-by-step equipment in urban metropolitan areas and nominated regional areas would be replaced by 1993. This program appeared well behind schedule.

Specific drivers of faster digitisation were:

- the crucial imperative to match the Optus capabilities – service range, service quality, network reliability etc – ahead of the Optus rollout. The timetable for digitisation was now set by the competition.
- digital equipment performance was rising rapidly and prices were falling. Digital networks were less costly to construct and had far lower operating and maintenance costs.
- with the deployment of digital switching and transmission, and the progressive digitisation of the network, the separate analogue telephone, digital telephone, ISDN, digital data and digital packet switched networks would evolve faster towards a single digital network.

These pressures might well cause the 29% level of digitisation in 1991 to be accelerated towards over 90% in year five, 1997, but whatever the rate there were two broad issues. Firstly, the technical (and funding) issue of replacing the analogue switches and links and managing the related operational support systems without affecting the performance of the network. Secondly, the industrial relations issue of maintaining service as the technical workforce was restructured and the numbers of people fell dramatically.

Issue 5: Switch Supplier Performance

As previously noted, there were three suppliers of circuit switch exchanges for the public network – Ericsson, Alcatel, and Nortel. In addition, packet switches were being used for the early packet switched networks.

The performance of Ericsson and Alcatel in supplying digital switching over the previous three years had been poor. Software and the following upgrades were often late, under specification and had operating bugs. One cause was that the Australian market was small and far from the suppliers' headquarters in Sweden and France; the local subsidiaries appeared to have difficulty in obtaining the necessary support from their headquarters. Another cause was that Telecom had introduced a number of "local" requirements for the software which were peculiar to Telecom and differed from the North American and European markets. This complicated and slowed software development and testing which, in turn, increased the risk of failures in installation and operation, delayed revenue from new features, delayed cost savings, and increased construction and operating costs.

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Nortel, the digital switch vendor for Optus' network, was a North American manufacturer well experienced in delivering reliable software which provided advanced features demanded by the US and Canadian markets.

The intent was to remove as many of the "local" specifications as practicable and expect Ericsson and Alcatel to improve performance to reliably deliver feature and performance parity with Nortel and the North American market.

Issue 6: The Deployment of Optic Fibre for Transmission

AOTC had four main types of transmission links in the interexchange network; analogue radio, co-axial cable, digital radio and optical fibre – see Figure 3.

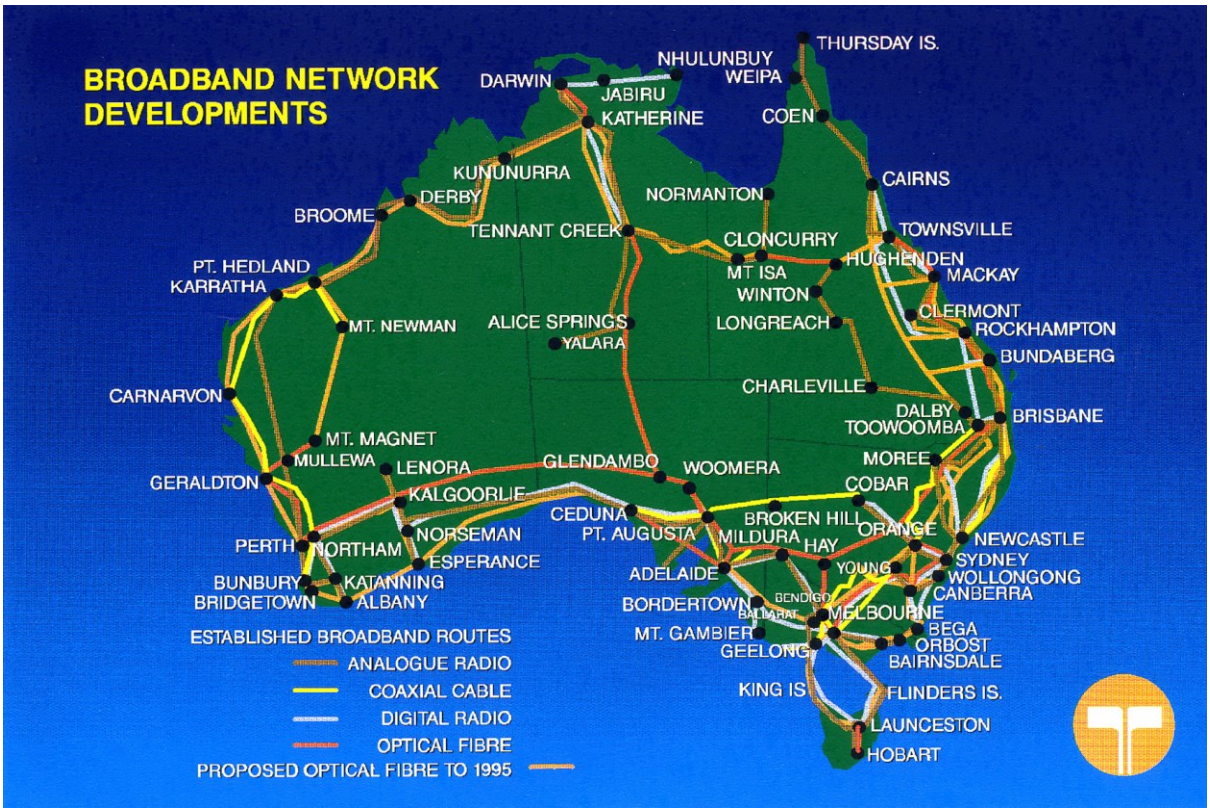

Figure 3. 1991 - The Telecom Broadband Network

The transmission capacity of optical fibre was rocketing; within twelve months 2.5 Gigabit/sec optical fibre capacity was expected to be available, and within four years 10 Gigabit/sec; equivalent to 32,000 calls and 131,000 calls respectively. Optical fibre was rapidly driving down the construction and operating costs of transmission and consequently the cost of long distance calls. Fibre was immune to electrical interference; there was no cross-talk between signals in different cables, and no pickup of environmental “noise”. It was safe to use for protecting communications equipment in high voltage environments, such as power generation facilities or metal communication structures prone to lightning strikes,

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and could be used in environments where explosive fumes were present. Optic fibre cables were superior in every respect to the old transmission systems: wires on open poles, co-axial cable and microwave radio transmission.

The enormous capacity offered by fibre changed the design approach to transmission links. In 1992 the towns of Longreach with only 4,000 residents and Mt Isa with only had a few thousand more, were linked that year by a standard fibre cable with the east coast. Overnight Longreach could make up to about 52,000 simultaneous calls to the outside world, compared to a dozen simultaneous calls on copper wires. If every fibre channel was activated, the capacity was far more than needed to link the whole of outback Queensland simultaneously. The fibres in the cable were such a minor part of these costs that it was uneconomic to install a lower capacity cable. At the same time the technical staff at Longreach was reduced to five; down to a fraction of the several dozen or so linesmen and engineers needed to service the region twenty years before.

By 1992 the main inter-capital routes were linked by optic fibre with some residual coaxial cable and radio links. Fibre also linked a number of the regional towns.

It was crucial to accelerate the fibre deployment to meet the expected higher growth in traffic and to match Optus' network performance, reliability and operating costs.

Issue 7: The Influence of Local & Wide Area Networks

The influence of the emerging LAN and WAN networks was unclear. LAN networks were a conceptual "loop", usually of fibre, linking customers within a relatively limited area such as a building. WAN networks were a "loop" which covered a wider area such as a central business district, commercial or industrial suburb, or a corporate network within a suburb.

While these networks usually didn't provide the range of features of a public network they were often more cost-effective and efficient without them. When they were not connected with the internet, they also provided advantages of privacy and security.

LANs and WANs could be constructed by a competitor or a large business customer.

In the early 1990's it was not clear how important and pervasive these types of networks would be and what effect, if any, they would have on national telecommunications networks, particularly in CBD's and business clusters in metropolitan areas.

Issue 8: The Effect of Wireless Technologies

By the end of 1992 the number of mobile customers on the AMPS mobile network was approaching 400,000 and climbing rapidly. Resale of Telecom's AMPS network by Optus and Arena from about mid-1992 and GSM network competition from about mid 1993 was

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expected to cause growth to rocket, perhaps reaching 3 million in 1996, year five. (In the event it reached 3.6 million).

Digital radio technologies could be used for a far wider range of services including security and remote services, and future technologies would likely hugely increase capacity for a given radio spectrum and potentially reduce access and call costs.

It was speculative how much traffic would enter the landline network through the mobile switching centres and to what extent radio would replace the landline networks.

Issue 9: Local Loop Capacity

A major generator of traffic growth would be the rapid growth in local loop capacity which would accelerate the already rapid demand for data services.

A number of large businesses were already connected by optic fibre over the local loop and, to anticipate the Optus rollout, AOTC would ramp up be the fibre connection of other large and medium businesses over the planning period, and particularly business clusters in the major cities.

Residential and small businesses were also expected to demand the range of new services such as database access with faster response times, faster download speeds, superior graphics, video downloading capability and soon cable TV. Such services would require far higher transmission capacity and digital capability in the local loop. Most of these customers were connected by single or multi-pair copper telephone cables and used data services through data modems, either conventional voice-band modems (such as 56KB/second or 128KB/second) or the emerging ADSL types of modems. ADSL modems were performing at 256 Kb/second and speeds substantially beyond 256kb were already in prospect.

The accelerating demand for data access, the rising capacity of new transmission technologies – HDSL, ADSL, VHADSL and digital radio – and the further deployment of optic fibre in the local loop raised two issues: the technical and commercial viability of Basic Rate and Primary Rate ISDN launched in 1989 which now seemed certain to be obsolete, and the acceleration in the growth of traffic through the local exchange to the network.

Issue 10: Emerging and Transforming Network Technologies

In the early 1980's simple digital and packet switched networks were introduced mainly for private networks, such as those connecting bank ATMs, retail Point-of-Sale terminals and similar services. These were essentially "overlay" networks on the analogue telephone and data networks as previously discussed.

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Towards the late 1980's far more powerful and efficient network concepts began to emerge based on international telecommunications standards such as Asynchronous Transfer Mode (ATM) for switching, Synchronous Digital Hierarchy (SDH) for transmission, and in the early 1990s the Internet Protocol (IP) for deploying the emerging Internet.

ATM was expected to be the switching technology to replace AOTC's existing 64kbit/s circuit-based switches, initially as a high-speed cross-connect function moving towards full narrowband and broadband switching from around 1995.

The IP standard was particularly interesting; every computer on the internet would have a unique IP address allowing a worldwide network of computers and computer networks to conveniently communicate with each other. While in 1991 less than 5% of the information flowing through the telecommunications networks was on "Internet-type" service, it might be that by 2000 this proportion could exceed 50%.

These new technologies offered enormous benefits and were key elements in building a future competitive and world parity network.

Issue 11: The Interface between AOTC's Network and Commercial Operational Systems

The AOTC network interfaced with five conceptual customer service systems for the four business units – sales, installation and repair of customer premises equipment; activation and restoration of network services; billing; and customer service.

The customer systems inherited by AOTC operated within an architecture which bordered on chaotic, and most were at least 10-15 years behind similar large private sector businesses, and were uncompetitive with the systems to be used by Optus and Arena.

A typical model systems architecture, and the model expected to be used by competitors, consisted of one set of customer systems operating with one product/service data base containing the complete product/service range; one customer data base containing all of the customers; and one transaction data base. AOTC operated at least five customer systems and related data bases – the telephone service order system (DCRIS), the telephone billing system (CABS), data services (eg. DDN and AUSTPAC), mobiles and directory publishing.

The telephone and data systems were uncompetitive, having been internally designed, developed and installed over 10 years before and urgently needed to be replaced within two years. The mobile and directory publishing systems had been installed some four years before and would likely be replaced in 3-4 years.

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The network strategy would provide one interface with the current customer systems in the short term but anticipate the requirements of one new comprehensive system to be introduced over the next few years.

Issue 12: Asset Re-valuation of the Network

The AOTC network had been built over decades as a monopoly and was depreciated at leisure.

Network competition would render much of the network obsolete and seriously reduce the asset lives of the remainder. AOTC was now a trading corporation and could not escape the standard commercial asset valuation principles.

A complete and fundamental review of the asset value of the network was required over the next year.

Issue 13: Funding

Transforming AOTC's networks would be expensive and capital intensive.

Table 2 is an indication of the "budget" inherited from Telecom and OTC for purchases of equipment, but was based on the "past rate of improvement".

An accelerated network transformation could increase this budget by more than 20%.

Table 2: AOTC - Initial Estimates of Purchases - 1992/97

	92/93 "Budget"	93/94	94/95	95/96 Projected	96/97
	$ millions (1991/92 prices)				
Domestic Network					
Switching (incl. mobile)	633	601	578	563	551
Transmission	488	440	420	430	410
Customer Access Network	479	506	542	578	641
International Network	138	118	47	144	123
Offshore operations			155	85	94
Network Construction	474	557	525	546	551
Total	2,367	2,307	2,206	2,261	2,276

Notes:

- The figures were consolidated without analysis from Telecom and OTC.
- Mainframe equipment and software for all operations other than the network – commercial, supply, accounting, finance etc – are excluded.
- Network Services was not responsible for the Customer Access Network.

Network Products was due to propose budgets and business plans to the AOTC Board about May and September. Serious "write downs" in the value of the network together with a higher capital program to achieve a network transformation would be proposed. To be credible the business plan had to drive revenue growth and savings in operating costs

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beyond the current "inherited" projections to offset increases in capital investment; that is, the cash flow had to be roughly maintained.

Issue 14: The Network Construction Business

Telstra's Network Construction business was one of the largest businesses of its type in Australia. It built perhaps 80% of Telstra's capital program and employed about 7,200 people. Performance was hindered by the public service culture, obstructive work practices, serious overstaffing, and almost complete unionisation of the work force.

Large and rapid improvements needed to be achieved in construction capacity and flexibility and the quality of customer service, and construction costs reduced, perhaps by more than 20%. It was crucial to realise the potential and substantial savings early to contribute to offsetting increases in capital investment, and drive construction costs to at least at parity with competitors, if not lower. It was likely that this could only be achieved by drastic action, perhaps separation from AOTC and sale of the business.

Issue 15: Satellite Services

In the past satellites had proved useful to Telecom for remote telecommunications and for some broadcasting services. However, satellites did not appear to be as strategically important to AOTC in the competitive market for the next five years.

Developing and Modelling the Business Plan

A “first order” Optus-competitive network transformation plan was to be proposed by July and a World parity plan by the early 1993.

Deciding how to transform the network was challenging enough, but how would operating and financial performance requirements be achieved? How would operating costs be reduced by (say) 30%? How could tariff changes be made within 24 hours?

As indicated in Actions 6+, the “Network Planning Task Force” used an iterative modelling and planning approach. When the “base case” was constructed and as better information became available, a series of more ambitious plans were produced. With each new and better plan the network planners tested their confidence that it was practical, the risk controlled and manageable, and was a reasonable basis for the next better plan.

Plan A was the best guess the team could make about the inherited consolidated plan. The first year estimates for staff and costs continued to move upwards for several months as staff numbers continued to increase due to "offloading" from other areas. By May, 1992, more than 500 staff than expected arrived in Network Services. Even though staff numbers were

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being reduced from the first month, the 1992/93 financial year began with 120 more people than the initial consolidation.

Plan B was the first attempt at achieving improvement above Plan A and the corporate ROE of 18%. The approach was the old Telecom "improvement as usual". The result was not worth noting other than as a guide to how hard the transformation task was.

Plan C aimed to achieve world's best practice in 1997/98 based on the old accounting rules. It showed some improvement but nowhere near enough. This plan was adopted for the budget and business plan for the next financial year, even though it carried a large risk as the implementation plan was not fully completed.

Plan D was available in early July, 1992, was a fundamental review, and was the first encouragement that progress was finally being made. The plan was fully market driven with the requirements of the retail divisions for services and wholesale prices, was competitive with Optus, and achieved a cost reduction over five years of 18%.

Table 3: Network Products – Projected Expenses in Successive Network Plans - 1992/98

		Plan	92/93	93/94	94/95	95/96	96/97	97/98	Change 92/98 (%)	Staff
			$ millions (92/93 prices)							Year 1/Year 5
Feb 92	Inherited consolidation	A	1,651	1,593	1,602	1,620	1,673		+1%	16225/13818
Mar 92	"First Order"	C	1,679	1,583	1,549	1,510	1,514		-10%	15918/12644
July 92		D	1,748	1,730	1,608	1,458	1,542	11,425	-18%	17527/11456
Nov 92	Indicative	FMO	1,748	1,694	1,586	1,484	1,429	1,398	-20%	17527/10474

Note:

- The financials and staff include Network Construction even though the intention was to initially separate and then perhaps sell the business in year 3.
- The financials for 1992/93 show how costs continued to arrive for months after the Division was formed.

Two major factors greatly affecting cost projections were the reductions in values and write-offs for existing equipment and the accelerated rates of depreciation, both driven by competition.

Adopting Plan D for the 1992/93 business plan was a risk; as with Plan C, there were still implementation gaps. Implementation began immediately, ahead of Board approval in October.

While Plan D was now the standard, it was clearly not good enough – see "Plan D" later.

Meanwhile, the Network Planning team moved on to the next iteration, the FMO, which was available in early 1993, and would deliver world parity in market, technical and financial performance by year five.

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Table 3 attempts to show the iterative approach used but is only illustrative. Numbers are only indicative.

Plan D

Plan D was first suggested by the project team in June 1992, some five months after the business was formed. The aims were to:

- maximise AOTC's market share by moving to benchmark and covering Optus' network and service rollout,
- increase the return on assets towards the corporate target of 18%,
- stimulate revenue generation opportunities to at least offset any additional costs and capital requirements,
- assess the true value of the network assets in the new competitive market.

The old Telecom strategy was unfocussed and wasteful of capital; if continued it estimated that it would provide a fully digitised network by 2002 at a capital investment of nearly $3 billion. The network would not be competitive with Optus in some areas for several years after Optus entered the market. There was minimal feature interworking between the domestic fixed network, the mobile network and the international network.

Plan D had two stages and five steps working in parallel and co-ordinated, see Figure 4.

Stage 1 consisted of three steps moving towards digitising the core network.

- **Step 1** accelerated the digitisation and simplification of the core interexchange network. This would be completed in two years.

  All existing analogue switching components would be removed making the core network fully digital one year after Optus began operations. The feature range, service quality and reliability would be competitive and construction and operating costs would be substantially reduced.

- **Step 2** connected all remaining analogue switches in the metropolitan areas to digital switches by optical fibre within the next two years at a cost of less than $40 million.

  Until these switches were replaced they could provide some features available on digital switches. This made feature provision competitive with the Optus network in all vulnerable metropolitan areas, increased revenue and further reduced construction and operating costs.

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- **Step 3** extended the competitiveness and cost benefits of Step 2. It provided more digital functions and features currently available from the connected analogue switches within two years until those switches were replaced.

  This was to be achieved by upgrading the software in analogue switches at a cost of about $20 million over two years, to be completed in three years, and digitising terminal exchanges.

Stage 2 consisted of two steps:

- **Step 4** accelerated the connection by optic fibre of business customers most vulnerable to Optus in the contested areas ahead of the Optus rollout.

  Optic fibre improved the provision and restoration of services, improved call quality and revenue generation, and reduced construction and operating costs.

  There were over 2,500 businesses with 30 telephone lines or more, with only a few connected by optic fibre. Almost all of these would be connected by fibre in the first year and another 1,500 connected in the next year. These customers were to be connected in order of revenue potential and vulnerability to Optus.

  Customers with fewer telephone lines in those areas would be connected opportunistically or after the larger customers in order of revenue potential.

- **Step 5** integrated the service provision and operations across the four "intelligent" digital platforms, the domestic fixed, the mobile and the international networks. The customer features such as 1300 numbers and operational capabilities provided by each platform could then appear the same to customers, and service provision, restoration and billing could be integrated.

  Optus, with one intelligent network platform from one switch vendor, Nortel DMS, would have this capability by mid-1993.

Interworking would increase revenue generation per customer, slow the loss of customers to Optus and reduce operating costs.

Plan D provided a hybrid digital network, not a fully digital network, but apart from this major flaw most of the other requirements of the plan appeared to be met:

- the projected growth in the customer base and the major growth in traffic under competition appeared to be covered,
- the product and service development demanded by the customer divisions would be delivered on schedule and covered the Optus range in the contested areas ahead of the Optus rollout,

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- the network was simplified and fully digitised ahead in the contested areas,
- it even appeared that, with a more focussed investment, improved revenue generation, higher customer retention under competition, and declining operating costs and equipment costs, the business case might move towards cash flow neutral, at least in the first two years where the plan was clearer.
- AOTC was better prepared if the Labor Government relaxed the regulatory rules to further benefit Optus and Arena (later Vodafone), or if a Coalition government brought forward full network deregulation before 1997.

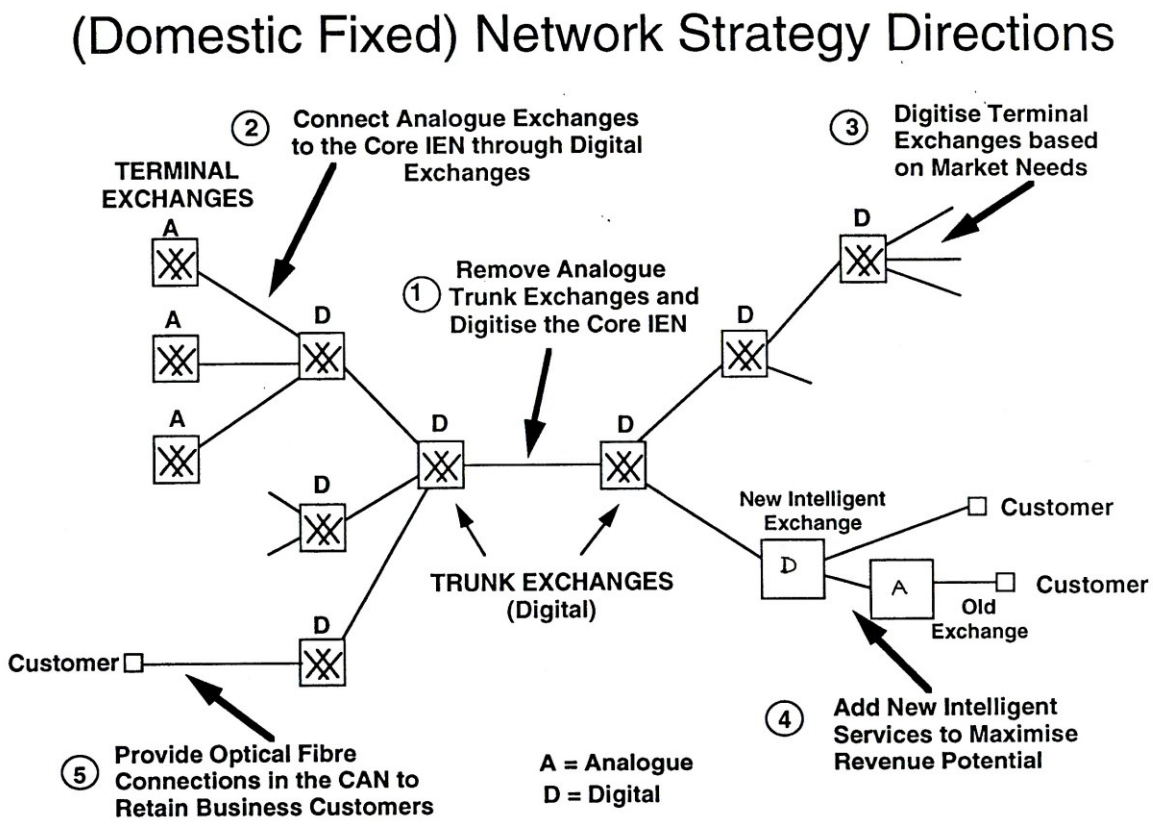

Figure 4. Plan D - A competitive Hybrid Analogue/Digital Network with Two Stages & Five Steps

The shortfalls from benchmark and the main deficiencies against the Optus network were well known and there were still major challenges:

- in the areas yet to be contested charging and billing capabilities and the availability of the range of new services was limited. Apart from service provision being limited it was often inconvenient; a current customer connected to an analogue or stored program exchange who wanted some of the new "non-basic" telephone services had to accept a number change,
- the network management and operating systems still had to be transformed,

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- the information systems for the network and interfaces with the corporate order processing, fault repair and billing had to be almost completely upgraded.
- the network equipment and software suppliers had to considerably improve on past performance,
- it was closer to benchmark network performance but there were still huge gaps,
- operating costs and capital equipment costs had to be reduced further to meet corporate requirements by as yet unknown amount, perhaps more than 15%,
- the unions needed to agree to major changes in the network workforce structure, job specifications, gradings and remuneration, and a reduction over five years of more than 3,000.
- Separate union agreements were needed to outsource more of the network construction work, make the construction business an arm's length subsidiary as a first step to perhaps sell the business and, as a consequence, reduce staff by perhaps 2,000.
- while traumatic change was progressing, the culture of the business technical to be transformed from "public service" and preoccupation to an aggressive focus on customer service, service quality and profit.

Nationally, compared with the Optus network and benchmark, the AOTC network service range, service quality and reliability levels were still markedly lower, operating costs were considerably higher, and consequently the return on assets was lower.

Plan D's competitiveness and the move towards benchmark was an immense relief. For the first time in AOTC the main players, even the engineers, could more fully understand the threat from Optus and how it would be covered. However, the implementation risks were huge.

The Future Mode of Operation

Plan D was intended to cover Optus and approach benchmark performance over the next five years with known technologies but with a limited understanding of how world leaders were tackling the network development task.

The best guess was that, based on the experience and progress in the USA and the benchmarking studies done by BAH in 1991 and CMP in 1992, AOTC was operating in 1992 as an RBOC roughly in a 1986 timeframe. The CMP study also provided an understanding and an indication of likely performance in the USA in five years. AOTC's challenge was to

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achieve the projected US performance in year five within five years. That is, ten years progress in five.

Further, as mentioned, the Plan D network was a hybrid network, not a digital best practice network, and there were a number of crucial factors not achieved by Plan D:

- the network was not fully digital;
- the number of switching technologies were not reduced from five to one or two; and
- the number of transmission technologies would not be reduced towards two – optic fibre and radio. The skills required to design maintain and operate the analogue technologies would not be completely eliminated.

A "first order" network model for 1997 – the FMO – was proposed towards the end of 1992.

Crude representations of the network are provided in Figures 5 and 6. These are early, simple illustrations of the transition from the AOTC network in 1992 to the FMO network in 1997.

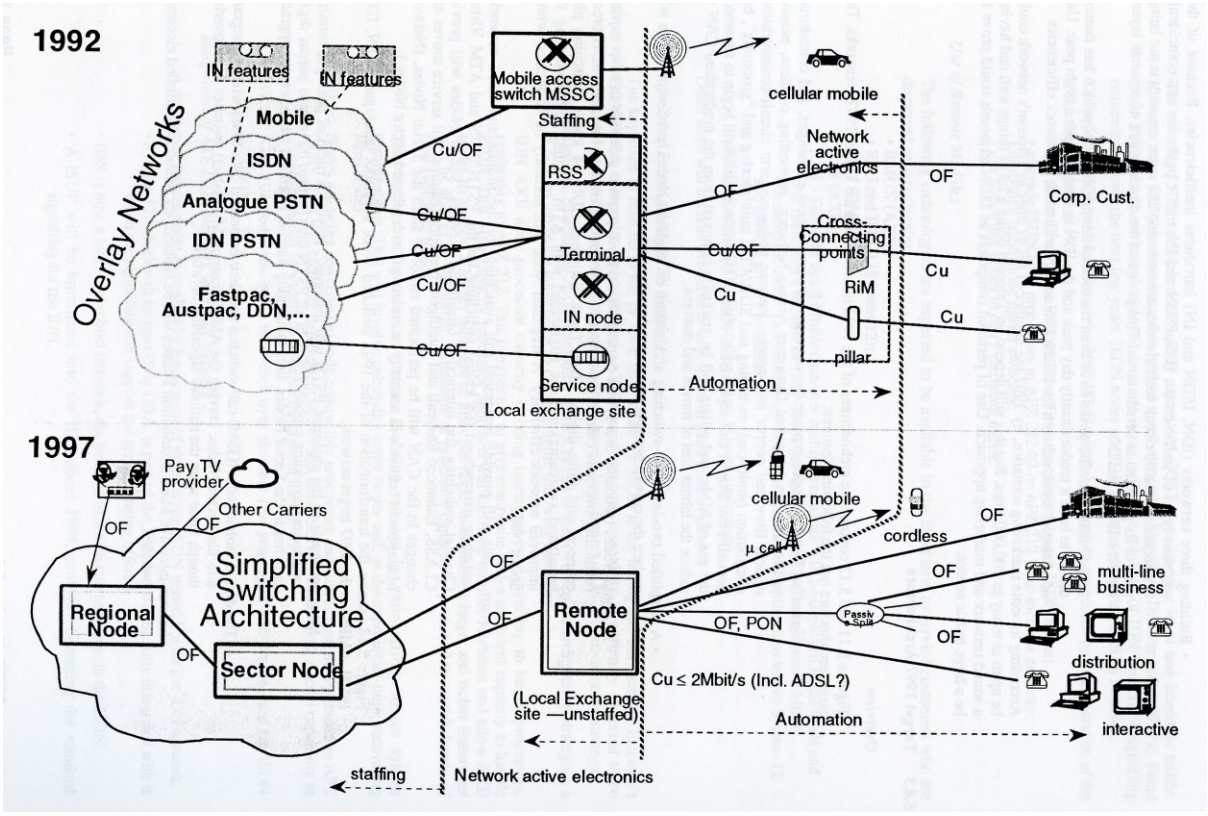

Figure 5. Target Network Architecture - 1992 to 1997

The FMO allowed a range of issues and variables to be examined, such as product and service range; revenue generation; traffic capacity against the expected huge growth in demand; deployment of new technologies such as ATM and SDH; operational systems for network performance and monitoring; cost reduction; benchmark achievement; etc; and the

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model was modified as more became known and confidence developed. By early 1993 the FMO began to clarify sufficiently to suggest broad numbers for a business plan and related trading statement.

Some of the main elements of the FMO network were clear:

- a simple network structure with minimal technology types and locations. The switching architecture appeared to have two levels – Regional nodes and Sector nodes – which would replace the current telephone and overlay networks.
- the Regional nodes – perhaps two to four in each capital city and possibly one in other large cities – would provide gateways to other local and offshore carriers and large service providers.
- A Regional node might be co-located with a Sector node to reduce capital and operating costs.
- Sector nodes would integrate call switching for the mobile and fixed networks including narrowband (64 kbit/s) switching for the PSTN/ISDN and broadband services. Network Management Centres would usually be co-located with selected Sector nodes. All service moves and changes in the CAN would be performed remotely.
- a simpler transmission network and levels of cross connection to increase reliability and redundancy – eventually an all optical fibre and SDH interexchange network,
- Remote nodes, unstaffed, would replace the majority of the current local exchanges to concentrate traffic from the Customer Access Network (CAN). RIMs would be used to increase optic fibre penetration in the CAN although there seemed to be some work needed to ensure feature transparency.
- there would be fully automated processes for all services and no differentiation across market sectors,
- A common set of customer/commercial operational systems would support all business units and products with a single customer data base and customer contact structure – sales, installation, repair, activation, billing and customer service,
- common systems, processes and work centres for managing and operating the network across the fixed, mobile and international infrastructures.

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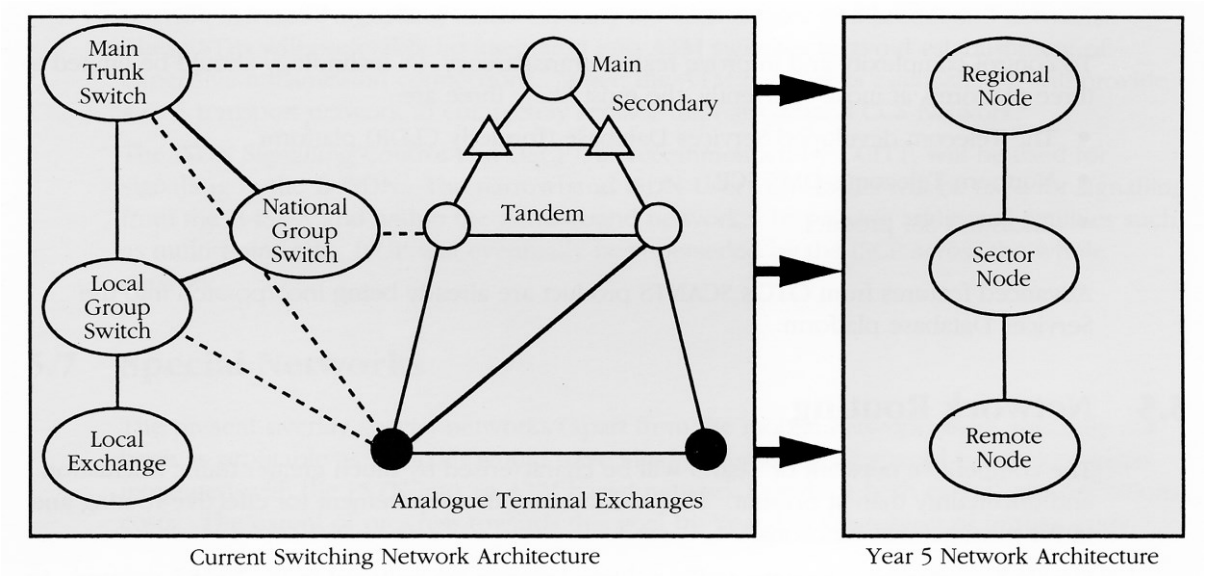

Figure 6. Changes in Switching Network Architecture - 1992 to 1997

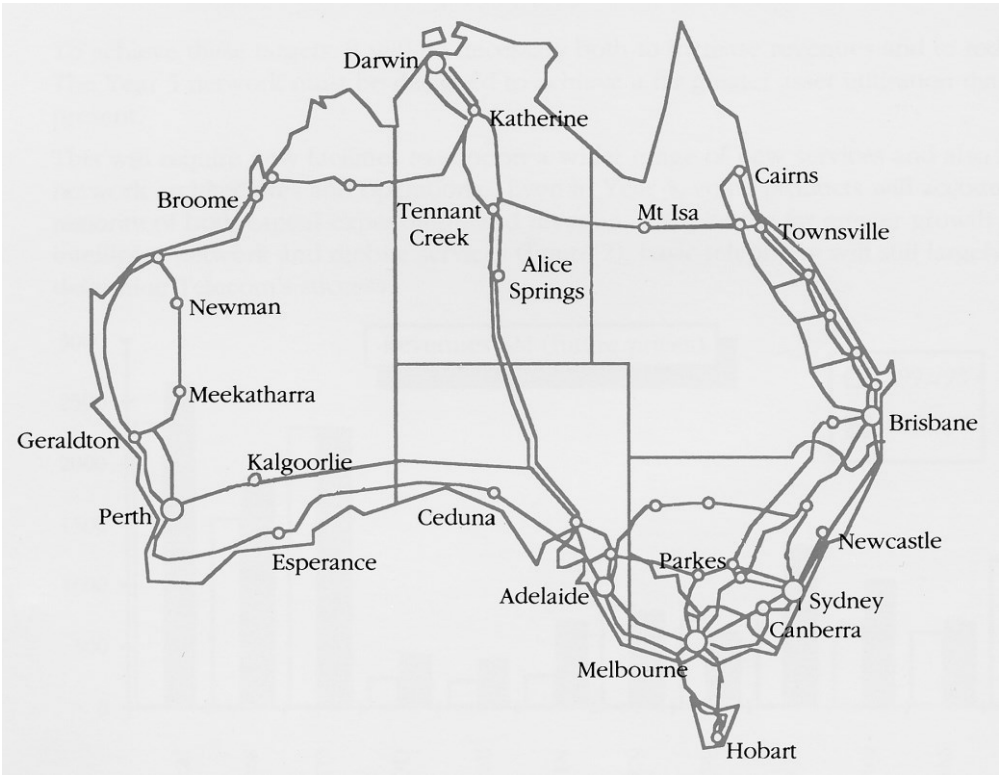

Figure 7. AOTC - Major Optic Fibre Routes planned for 1997

While the theoretical 1997 network was becoming clear, how to get there was still a massive challenge. Three broad options were developed, with different speeds of implementation and risk; the faster the implementation the higher the risk. Some of the factors considered were full digitisation beyond the contested areas; IT evolution; property site shedding; switch vendor reduction; and involuntary redundancy (redundancy in Telecom and Telstra to this stage had been voluntary). The incremental expenses and capital required in the early years

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appeared to be low, less than $30-40 million per year, but the risks were daunting. For example:

- the network management and operating systems had to be rationalised and transformed,
- the information systems for the network and interfaces with the corporate order processing, fault repair and billing had to be almost completely upgraded.
- capital equipment costs had to be reduced by more than historic rates, perhaps more than 15%, to reach cost reduction targets,
- network equipment and software suppliers had to considerably improve on past performance,
- the unions faced unprecedented pressure in the face of staff reductions approaching 8,000 and huge changes in the workforce structure over five years.
- while the workforce was being reshaped and falling, the culture of the business would be forced to change from technical preoccupation and public service ethos to aggressive customer focus, service quality, productivity improvement and cost reduction.

  This would be difficult. BAH had commented in 1991 that, based on the US experience, when responding to competition in the industry, culture change in Telecom was slow; it would be two to six years before real change emerged.

Figures 7 and 8 provide an indication of the some of the thinking in the FMO plan.

Benchmarking and Process Re-engineering

Cresap, McCormack & Paget (CMP), a world-respected consultant specialising in benchmarking in telecommunications, reported AOTC's performance against operators in the USA in June. The results were daunting.

Table 4 provides some of the results. The "1992/93 Target" column shows some of the performance improvements achieved in the early months.

A common claim in Telecom over its 16 years was that the network was "world class". CMP confirmed the 1991 study that, at best, AOTC's domestic network ranked similar to an AT&T regional operating company in the USA about 1986.

The briefing of results of the study by CMP to the Division's senior managers was a sobering experience. As each parameter was raised the managers were asked to consider how they intended to bridge the performance gaps.

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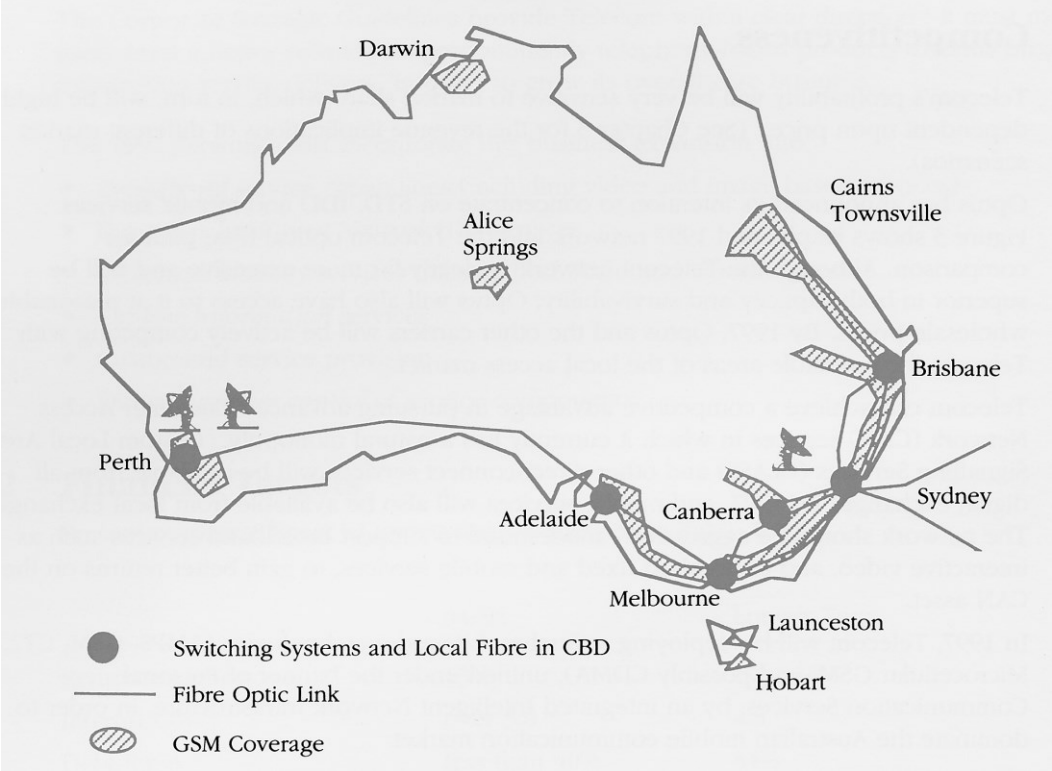

Figure 8. AOTC's predicted Optus deployment in 1997

Table 4: Network Services - Rough Initial Benchmarks as at June 1992

Key Benchmarks		1991/92 Expected	Target	1992/93 Target	WBP Target
Operations	$ per access line	70	65	58	12
Capital	$ per Primary switched end	345	309	200	145
	$ per transmission	1556	1367	1000*	556
2Mb Ports	$ per Operational Fibre km	800	746	700	100
Customer	Downtime at Exchange (AXE) mins per year	116	82	88	28
Technology	Rate of Board Failures				
	(AXE) per 1,000 lines	9.9	5	4.6 (1994)	4.3
	(DMS) per 1,000 line	8.1	5	3.9 (1994)	4.2
Network Congestion		0.5%	0.4%	0.3% (1994)	0.2%
Network Occupancy					
Switching	Metro – AXE	89.6%	90.9%	93% (1995)	3.4%
	Total	91.0%	91.1%	92% (1995)	1%
Cable	(Metro)	63.6%	64.3%	67% (1995)	3.4%
Transmission Performance					
- % of inter-capital paths failing to meet CCITT objectives		10.0%	8.0%	to be determined	
- unavailability of inter-capital paths		5.0%	3.0%		

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Notes:

- "Expected" is the level inherited in the Telecom/OTC business plans for 1991/92.
- 1991/92"Target" was the intent to be achieved in the current financial year after four months operation.
- 1992/93 "Target" was the intent for the next financial year.
- To be confirmed by CMP.

There was some dismay, for example, when the AXE exchange downtime was proposed to fall from 116 minutes per year to 28 minutes over five years but, after some discussion, the responsible managers accepted the challenge. After the meeting, the CMP managing partner observed that while the benchmark in 1992 was 28 minutes, AT&T was expecting 12 minutes for 1997.

The CMP benchmarks were progressively adopted into the business plan as credible implementation plans were developed.

Discussions with the AOTC, Network Products Management and People around Australia

Briefings of the business plan including Plan D and an early outline of the FMO were provided in all states, the first during two weeks in July 1992. The sessions were attended by the Network Products management, staff and union officials and any other AOTC people who were interested. The numbers varied from about 500 in each of Sydney and Melbourne to about 100 in Hobart.

Considering the issues involved all of the meetings were peaceful and even thoughtful. All appeared to understand the need for rapid and sweeping change; perhaps a majority agreed in principle with the plan, but understandably only a minority supported it in practice. A surprising number responded positively with guarded enthusiasm, but some were angry and some bitter. As expected, most were worried and some fearful of the effect on their careers and incomes as a result of drastic changes in technology, workforce structures and work practices, and a serious reduction in the workforce.

There was some bluster from the union officers but it was controlled and did not hinder the discussion of the main points. At several meetings the Australian Telecommunications Employees Association (ATEA) officials and members raised the elephant in the room – the possibility of industrial action to defend their career structures, conditions and jobs as happened in the late 1970's and early 1980's. This option for the union was openly conceded.

The union people were invited to compare those times with the current scene in 1992. The industrial action in 1978 was about introducing technology change just as was being discussed now; the ATEA objected to Telecom's $2 billion plan to introduce stored program computer controlled (SPC) exchanges, and after a nationwide and painful industrial action,

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gained major concessions. ATEA officers were reminded that their ATEA predecessors boasted that "the technology will be settled on our terms, not theirs". A year or so later the ATEA fought for a $20 per week rise, which was substantially won, but this was one reason that AUSSAT, an alternative carrier, was established and the deregulation of the telecommunications market was now taking place.

The telecommunications market in 1992 was vastly different from that in the late 1970's. There were alternative carriers to Telecom – Optus and Arena. Customers now had a choice. Their first chance to make that choice was during pre-selection which would begin shortly, and from June 1993 they would have a second choice when Optus launched its new "state-of-the-art" network.

The industrial action in the late 1970's seriously and permanently damaged any faith that many customers – particularly the large and important business customers – had about the reliability of the Telecom network operated under a monopoly, and soon they would have another option.

The overwhelming argument for change in the network was the known plans of Optus. Optus would have a state-of-the-art network able to deliver a very attractive range of products and services, a high and reliable quality of service, and low construction and operating costs which allowed price packages lower than AOTC would offer. AOTC's market was vulnerable in over 90% of Australia, particularly in the central business districts and business centres of the capital cities where work structures, and practices were the most restrictive.

Industrial action might win short term concessions, but inevitably a heavy price would be paid by all AOTC workers throughout Australia as competition strengthened.

The presentations provided AOTC's staff and unions with the opportunity to assess the plan. The sense was that at least they appreciated candour, understood the rationale, had no illusions about the determination to implement the plan, and understood the consequences.

The AOTC Board

A presentation of Plan D and the emerging FMO was made to the AOTC Board in early October.

The network strategy was the most important issue facing AOTC. Within several months the board would be asked to approve the largest capital investment program the PMG, Telecom and AOTC had faced and this strategy was the broad rationale. There was a short briefing on the interexchange network, the Optus network rollout and its implications, and the performance gaps from benchmark performance provided by CMP.

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Next was the strategy; coverage ahead of the Optus rollout, benchmark performance within five years, direct cost operating reductions exceeding 20% for a far larger network within five years, productivity improvement which would lead to workforce reduction from about 18,000 to about 13,000, about 30% in five years – 8,000 if Network Construction was sold.

The network would be transformed. It would be simpler, far more reliable and efficient, with substantially lower operating costs. The switching would be fully digitised in the areas of competitive risk and almost fully digitised within five years. All analogue links between trunk exchanges would be digitised. New intelligent exchanges would be introduced in high risk and high revenue potential areas to lead competitors and accelerate revenue growth.

The strategy carried enormous technical, supplier and industrial risks which had to be faced. The strategy was still evolving, the aim was for even stronger results, and the risks would be progressively reduced as the plan was clarified and the implications and risks better understood.

The board members accepted the outline without qualification.

The 1993/98 Business Plan

The tables in this section have been drawn from various sources, some of which were compiled at different times, so there is inconsistency between tables. The intention is to indicate processes and broad outcomes.

The 1993/98 business plan, including the outline of the FMO, was approved in March 1993, see Table 5.

This was the first trading statement and plan ever produced inside the PMG, Telecom and Telstra for a network which would be competitive and directed towards world parity.

The huge differences between the "first order" trading statement compiled in February, 1992 (Table 1) and Table 5 compiled in March, 1993 provide some understanding of the difficulty in obtaining a sound planning data base and matching changes in financial projections with a new iteration of the network plan.

There had been satisfactory progress since January 1992 but insufficient:

- the Optus rollout had been covered,
- Plan D was solid with partial transformation across much of the network,
- the FMO, the plan for benchmark parity in five years, seemed credible. There was still considerable detail to be clarified, major decisions to be made, risks assessed and managed, and detailed planning to be completed.

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The trading statement was at future prices. Profit is only shown to keep pressure on revenue and costs; in practice the intent was to "breakeven" and distribute profits to the Telstra retail groups. The business plan includes Network Construction which was intended to be separated within the next year or so and perhaps sold.

Substantial reductions in equipment prices are partly offset by rising wages and redundancies. Major savings were expected in properties due a large reduction in the number of exchanges and smaller footprints for exchange equipment and computers. A substantial fall in the number of motor vehicles was also expected due to usage efficiencies and falling staff levels.

As previously noted, some of the consequences resulting from the new competitive market - asset revaluations, large write-offs, and faster depreciation higher capital investment - masked the large cost reduction projected over the period.

Table 5: Network Products - Business Plan - 1993/98

		92/93 (Est)	93/94	94/95	95/96	96/97	97/98
		$ millions (future prices)					
Revenue	Interconnect	65	222	316	602	709	757
	QPSX	7	11	20	35	51	66
	Internal Revenue	3748	3721	3655	3604	3617	3699
	Total Revenue	3820	3954	3991	4241	4377	4522
Expenses	Direct Internal Expense	1060	1121	1054	1023	994	995
	Redundancy	58	80	59	57	29	30
	SRU	627	705	753	768	797	823
	QPSX	5	8	11	16	26	33
	Total Expenses	1750	1914	1877	1864	1846	1881
Other Expenses	Internal Coms	73	54	52	49	9	49
	Product & SRU	288	321	308	313	328	339
	COGS (asset sales)	255	242	217	182	171	170
	Depreciation	1000	1008	1024	1048	1104	1160
	Total Expenses (excl Int.)	3368	3539	3478	3456	3498	3599
EBIT		454	415	513	785	879	923
Interest		308	347	351	352	348	339
Profit before Tax		146	68	162	433	531	584

Notes:

- Interconnect Revenue is revenue received at regulated or negotiated wholesale prices from other licensed carriers, specifically Optus and Arena. This revenue increased markedly as Optus begins network operations in April 1993, and Arena in November 1993.
- QPSX was a joint venture established between Telecom and a small start-up company, QPSX Communications Pty. Ltd, in 1987
- Internal Revenue is that received from the customer divisions for services provided at wholesale prices. Although the range of services provided increases by over 20% and service volumes almost double over the five year period, revenue falls due declining wholesale prices.
- Direct internal Expenses are expenses incurred within the division.

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- SRU expenses are for services provided by other AOTC areas such as information systems, supply, finance and accounting and human resources.
- Depreciation increases marginally as cost reductions fund a large share of the increase in capital investment.

Table 6: Network Products - Revenue by Customer Segment - 1992/98

	92/93	92/93	93/94	94/95	95/96	96/97	97/98	97/98
	% of Total	Est	$ millions (future prices)					% of Total
Consumer	40	1520	1620	1614	1607	1623	1670	37
Commercial	20	738	570	568	572	591	627	14
Corporate & Government	24	892	954	927	912	904	906	20
Enterprises	10	387	336	314	281	270	267	6
International	1	29	32	32	32	32	34	1
ITG	3	120	208	201	200	198	196	4
Carrier Revenue	2	68	221	316	602	709	757	17
QPSX Sales	0	7	11	20	35	51	66	1
Total Revenue	100	3761	3952	3992	4241	4378	4523	100

Table 7: Network Products - Capital Investment Framework - 1993/98

	92/93 (Est)	93/94	94/95	95/96	96/97	97/98
	$ millions (1992/93 prices)					
Growing revenue						
Growth Basic Services	739	625	605	603	563	525
Growth Advanced Services	107	94	83	82	77	70
Maintenance Revenue						
Network Modernisation Accelerated	160	135	70	7	-	-
Analogue Rationalisation (Plan D)	-	41	16	3	-	-
Number Retention (Plan D)	-	11	22	24	5	-
Network Transformation Post Plan D	-	2	31	88	140	140
AXE Upgrade	13	9	12	-	-	-
SDH Strategic Investment	3	9	29	-	-	-
DSPN Phase 2	-	22	-	-	-	-
Network Performance Improvement	59	16	22	29	24	24
Design Labour	17	23	23	22	22	22
Other Revenue						
Other Communications Plant	-	73	62	52	43	40
Constructed by Others in AOTC	217	45	37	40	40	33
Non-Communications Plant	-	91	68	54	47	47
Total Capital	1,325	1,196	1,081	1,005	961	902

Notes:

- Basic Services include telephone access and calls, operator services.
- Advanced services include Centrex, Virtual Private Networks, ISDN
- The program only includes notional funding of FMO elements.

Table 6 shows the revenue projections for the Telstra retail divisions and the interconnecting carriers. After the first year or so the forecasts were speculative, but the trends were interesting. The Consumer sector projections assume that losses from the pre-selection

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process would be manageable. The Commercial (small and medium business) sector expects a fall in revenue while the Corporate and Government sector plans to hold revenue. These losses are partly offset by the revenue from the interconnecting carriers which moves from 2% of revenue to 17%.

Table 7 illustrates the capital investment framework and provides a very rough outline of the investment program. The figures are very early and tentative and would be considerably refined as the FMO program was further developed and the related investment was clearer.

Table 8: Network Products - Some Business Plan Services and Capability Objectives - 1993/98

	93/94	97/98 Plan D	97/98 FMO
Customer Capability			
CLI Penetration	80%	100%	
CLASS Capable Lines	35%	90%	
Number Retention	0%	90%	
Digital Access	0%	90%	
Ten Digit Numbering	0%	100%	
Electronic Metering	0%	100%	
Key Feature Transparency across Services	0%	100%	
Automatic PSTN Activation	0%	100%	
Network Capability			
Digital Lines	46%	72% (80% metro)	100%(metro)
Core Network Digital	70%	100% (by June, 1995)	
Exchange Sites	4,963	4,650	
Core PSTN Switch Stages	436	200 (220 by June, 1995)	
AXE Variants	9	3 plus GSM	
DMS IN Modes	8	19	
ISDN Nodes	25	44	
Common Channel Signalling	100%	100%	
Operations			
Exchange Operations Regions	16	7	
Lines per EMG	120,000	1 million	
Workforce Classifications	7	3	
Network Management Centres	5	2	
Systems			
Integration between Core & Network Systems	Low	High	
Software Reuse	Low	High	
Standard Interfaces	Low	High	
Network Performance			
AXE Downtime - mins per customer per year	110	25 (95/96)	
AXE Fault Rate - per 100 lines per year	7	1 (97/98)	
Inter-capital Unavailability	4%	2%	
Major Transmission Unplanned Outages - minutes per month	35	10 (97/98)	

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Note:

- These objectives were set in March 1993 and were expected to improve significantly as implementation proceeded with Plan D and with progress in finalising the FMO.

Tables 8 and 9 attempt to provide an idea of the huge transformation of the network. Note that the tables cover different time frames – 1993/98 and 1992/98 – and so are not comparable.

The transformation produces a radically simpler almost totally digital network.

Major savings would be made in switching accommodation; fewer switching and management centres released a significant number of exchange sites for sale, and in the exchange sites that would be retained, the footprint of the new exchange equipment was perhaps 10% of the old, leaving 80-90% of the floor areas unoccupied.

Table 9: AOTC Network Transformation – 1992/98

Year ending June	1992	1995 Plan D	1998 Plan D
Switching Infrastructure			
Main Trunk Exchanges	25	16	-
Network Group Switches	71	71	86
Minor Switching Centres	246		
Metro Tandems	80		
Local Group Switches	186	163	114
Independent Analogue Switches			
Major	722	361	-
Minor	3,347	1,673	-
Transmission Infrastructure			
Direct Analogue -Analogue Circuits	67,310		
Major Trunk Routes	17	19	19
Overlay Switches			
ISDN	25	35	44
IN	8	12	19
Mobile	13	18	18
Competitors' Switches			
Optus	4	9	12
Arena	-	2	4
Other	2	3	?

Note:

- Table 8 was compiled early 1993, while this table was compiled about September 1992 when Plan D was becoming clear.

In Tables 8 and 9 the ISDN component was uncertain. The demand in 1993 was unconvincing, which might require the program to be levelled off and eventually terminated.

Network Products had come a long way in a year as indicated by the successive plans in Table 3. The accounting and planning people in the business made a giant contribution in

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establishing the accounting system, aggregating the revenues, costs, capital and other resources from a large number of sources, validating this data, and building through a series of iterations and network planning refinements this outcome.

The Workforce and Industrial Relations

Table 10 shows the staff projections in the business plan. Staff totals are shown including and excluding Network Construction.

Broadly, including Network Construction, direct staff costs would fall by about 30% at constant prices and 18% at future prices. Staff numbers would fall from about 18,000 to about 12,000, about 6,000 (about 30%). Productivity in terms of Services in Operation (SIOs) would rise about 44%.

Table 10: Network Products Business Plan - Staff Projections - 1992/98

	92/93	93/94	94/95	95/96	96/97	97/98	5 year cumulative
Network Engineering	1750	1623	1519	1377	1312	1226	-30%
Network Operations	7523	7039	6202	5650	5356	5036	-33%
Network Construction	7216	5933	5592	5000	4750	4500	-38%
Other	829	807	787	753	721	694	-16%
Total	17318	15402	14100	12780	12135	11456	34%
Total excluding Construction	10102	9469	8508	8030	7385	6956	31%
Direct Staff Costs (92/93 prices)	1080	1021	901	838	747	715	34%
(future prices)	1080	1060	973	941	879	883	-18%
Staff Productivity (per 000 SIO's)	2.06	1.76	1.56	1 .37	1.26	1.15	-44%

Note:

- Direct Staff Related costs include labour, training, fares and travel allowances.

The huge reduction in staff and the consequent redundancies might seem too callous. In fact, it is a classic case study of the effect of competition on a monopoly which delays or compromises the deployment of new technology over many years.

Over the previous 15 years, Telecom's management and the unions persisted with the leisurely introduction and deployment of new technologies and persisted with inefficient work structures and practices. The result was slower and later delivery of new products and services causing lower revenue growth, a lower quality of service, and higher prices resulting from higher operating and construction costs. The capability and competitiveness of Australia's infrastructure was compromised and Telecom/AOTC was more vulnerable to competition when, inevitably, the market was deregulated.

http://doi.org/10.18080/ajtde.v5n4.123

In Network Operations there were seven technical grades compared to Optus' three. The range of wages was similar. Working hours were 36.75 hours per week compared to Optus, 38 hours. Most AOTC staff were full time, with few casuals.

In Network Construction the average weekly wage of external staff was $485 per week at a weekly employment cost of $564, compared to Optus staff $368 and $444. The average weekly wage of AOTC's more technically qualified internal staff was $688 and a weekly employment cost of $800; Optus equivalents were $600 and $655. Telecom performed almost all of its construction with a dedicated work force. Optus sub-contracted almost all of their construction with flexible work forces and lower travel and accommodation costs.

In the previous three years in Telecom and the first year or so in AOTC redundancies were voluntary, which was unavoidable in the reigning industrial situation in Telecom. The policy was damaging as the best qualified and most valuable people were more motivated to leave, confident that they could build better, more highly paid careers in the new competitive telecommunications market. The redundancy conditions were generous by any standards, but more so for the times; 79 weeks maximum against Optus' 40 weeks.

In both the operations area and construction areas the workforce rundown was thought to be achievable. In operations the network changes and workforce structures were already in action in digital networks in competitive markets in the USA. In the construction area the workforce structure and conditions were intended to be similar to large construction businesses in Australia such as Leighton and Lend Lease.

The intention was that AOTC would negotiate two enterprise agreements – one for each of network operations and network construction – covering the restructure and redeployment of the workforce and the large-scale redundancies.

The Network Operations agreement was expected to increase costs by about $60 million over five years and produce savings of about $220 million. The Network Construction agreement is discussed later.

The task of moving the staff towards customer-first behaviours, best management and working practices, and a performance culture with accountability was daunting. A flatter organisation, mass training in new technology and skills, large scale redeployment, outsourcing for non-core activities, all while implementing a complex and large network restructure, was a huge task.

Network Construction

Telstra's Network Construction (TNC) business was probably the largest and most technically competent of its type in the southern hemisphere. It operated nationwide serving

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both AOTC, government broadcasting policy for radio and television, and the ABC and SBS broadcasting networks. In the future it was capable of serving markets in the private market sector for telecommunications and broadcasting networks and infrastructure. The business employed over 7,000 highly-trained people located across Australia and thousands of items of construction equipment ranging from bulldozers to cranes and vehicles. It built perhaps 80% of Telstra's capital program.

The business was a major problem for AOTC. The quality of customer service and construction flexibility had to be urgently and greatly improved. There was almost complete unionisation of the work force, with unions historically reluctant to allow improvements in productivity. This resulted in large, deeply entrenched, obstructive working practices and serious overstaffing which, together with a public service conditions and culture, inflated operating costs by over 20%. The management skills were largely technical with little business skills and experience.

While operating within AOTC it was unlikely that an enterprise agreement would allow performance and construction costs to become competitive with Optus and others within five years. Further, the scale of cost reductions would not free sufficient savings to assist in funding the expected higher capital investment likely required for transforming the network.

The only way to achieve rapid improvement within (say) two to three years was to move the business away from AOTC and progressively expose the business to open competition. Separating the business from Telstra as a subsidiary was a necessary but not sufficient step. To effectively focus the management and the workforce, allow industry norms for workforce operations and wages, and reduce obstruction by the unions, the business needed to be fully exposed to the market.

This could be achieved in two stages. Firstly, competition could be encouraged by seeking quotes for another (say) 10-20% of the construction work from both TNC and outside contractors over the next two years. This would allow TNC the opportunity to become more competitive, and would be a strong and practical signal to the construction business and others in Network Products that drastic change was expected. Secondly, when TNC's operations were sufficiently commercial and competitive, and with some guarantees of future work, it could be attractive to buyers. By that time there might be no strong rationale for Telstra to continue to own TNC.

Selling the business would fully expose it to the market; the management and the workforce would be more focussed on customers and profits, enterprise agreements which reflected industry norms for workforce operations and wages would be more likely, and obstruction by the unions would be less. Within five years competition between the divested business and

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other construction businesses used by AOTC should ensure that construction costs were at least at parity with competitors.

Table 11 shows the business plan which includes the benefits of separation but not sale.

A huge improvement was projected in productivity – direct expenses to climb from 24% of expenses to 48% – and reduced overheads.

Table 11: Network Construction - Business Plan - 1993/98

	92/93 of Network Services	92/93 Est.	93/94	94/95	95/96	96/97	97/98	Cum Var (%)
			$ millions (1992/93 prices)					
Direct Expenses	24%	276	244	190	189	157	144	48%
SRU Expenses	11%	75	71	70	67	64	61	19%
Total Expenses	19%	351	315	260	256	221	205	42%
Staff	41%	7216	5933	5592	5000	4750	4500	-38%

As previously mentioned, it was intended to attempt to negotiate a construction enterprise agreement to operate after the transfer of TNC into a separately incorporated subsidiary. The new agreement was expected to incur about $120 million in additional costs over five years, mainly redundancy payments, and produce savings of the same order.

So What Happened?

By June 1992, after four months:

- Network Products had been fully operational for three months including operating processes and accounting systems.
- network performance began to markedly improve in a number of areas- - see Table 4 (Target) – and was aggressively projected to continue improving.
- benchmarks from the USA had been established for the network and actions begun to bridge performance gaps.
- Plan D was becoming clear and implementation begun.
- TNC was well on the way to becoming competitive.
- The headquarters was in premises located remotely from AOTC, had full accounting separation, with commercial accounting, estimating and quoting systems, was accounted for as a stand- alone business, and had a manager recruited from the private construction sector.

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- the commercial and technical regulatory arrangements for the pre-selection process were operational for Optus to resell AOTC's landline and mobile network services. Arena appeared to be uninterested in mobile resale at this time.

In September 1992, after nine months:

- Plan D was finalised sufficient to cover the Optus service quality and product and service range ahead of the expected rollout but would not achieve world parity within five years.
- Implementation was proceeding, including the connection of the largest business customers in vulnerable areas by optic fibre.
- the FMO, a largely digital network which would perform at world parity within five years was becoming defined in concept.

By December 1992:

- Plan D was being implemented as quickly as the risks could be managed.
- Almost 2,000 of the 2,500 businesses with 30 telephone lines or more in the CBDs and in most of the metropolitan clusters in Sydney, Melbourne, Brisbane and the Gold Coast, were connected by optic fibre.
- the commercial and technical arrangements for Optus to interconnect with OTC's landline and mobile network services were operational ahead of schedule. Arena (later Vodafone) appeared to be uninterested in discussing interconnection at this time.

In May 1993:

- Optus began marketing of the Optus landline network.
- By this time the Telstra network had full service and feature deployment coverage of the Optus network for at least six months ahead in the CBDs and in most of the metropolitan clusters in Sydney, Melbourne, Brisbane and the Gold Coast.
- The six months margin was higher in other capitals and major regional cities such as Canberra, Geelong, Newcastle and Wollongong.
- All of the 2,500 businesses with 30 lines or more and 1,500 of the next largest in order of revenue potential and vulnerability to Optus were connected by optic fibre. Most of these businesses were located in the CBDs and the business clusters in Sydney, Melbourne, Brisbane and the Gold Coast.

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- Customers with fewer telephone lines in those areas were being connected opportunistically after the larger customers in order of revenue potential and vulnerability to Optus.
- there was full interworking across the four "intelligent" digital platforms – the domestic fixed, the mobile and the international networks – for service provision and operations.
- Customer features such as 1300 numbers and operational capabilities provided by each platform could then appear the same to customers, and service provision, restoration and billing could be integrated. Interworking increased revenue generation per customer, slowed the loss of customers to Optus and reduced operating costs.

In June 1993:

- due to the difficulty in establishing an accurate trading statement, cost savings for the full financial year could not be accurately be determined, but likely exceeded $200 million.
- for the same reason above, revenue had been increased by an unknown amount due to the faster deployment of advanced services and other actions.
- major improvements in performance had been achieved. For example:
  - call failures on local, trunk and international calls were reduced by more than 60%,
  - the number of outages of major exchange fell by 40% to 22 minutes as did their duration,
  - the number of major outages of major transmission links also plummeted; some were caused by the Optus construction crews cutting AOTC's inter-capital optic fibre cables as their own were laid.
- some of the process re-engineering projects had achieved remarkable results.
- One project reduced the time for a national change in call tariffs from approaching one year to initially less than two months. Another reduced the downtime of an AXE exchange from about 116 minutes per year to about 28 minutes per year.
- Staff in Network Products at 30 June, 1993 fell from about 18,600 to about 17,300 a reduction of about 1,300 (7%) as well as the unexpected arrivals of some 500 from other divisions.

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- detailed planning for implementing Plan D was completed.
- The complexity of Plan D was apparent as, for example, analogue links were replaced by optic fibre, the related operational support systems adjusted, and the analogue workforce relocated or run down.
- increasing the amount of construction work to be contracted out through competitive tenders from TNC and other contractors was about to begin. The business would likely be incorporated in about one year with the practicality of sale considered a year later.
- negotiation of enterprise agreements for operations and construction had begun.

There remained a number of major issues to be resolved. For example:

- the full design and detailed planning of the FMO, including the operational support systems and related customer interface systems, would likely be completed within the next 6 months.
- However, progress was sufficiently advanced that implementation had begun.
- hard core industrial relations issues had yet to be resolved. For example, the limit of 30,000 lines per EMG to be lifted to at least 150,000 lines,
- full national, active management of the network from the two national management centres would be operating within several months,
- 10 digit conversion,
- commercial and billing arrangements for network resellers such as AAP, Pacific Star, Qnet and British Telecom,
- completion of a review of exchange and other properties to begin the sale of unused real estate,
- switch vendor performance and rationalisation from three to preferably one vendor.

After September 1993, implementation of the FMO proceeded, but the author has no knowledge of the progress made. Network Construction was not separately incorporated and consequently not sold during the next 10 years.

Conclusion

The story of Telstra's network transformation which lead to Plan D and the FMO is of managers and staff working well beyond their comfort zone. They agreed to accept a task which, on any analysis, was highly challenging and on a scale and complexity that none

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before in the PMG, Telecom or Telstra had faced; transforming the network to be competitive ahead the rollout of an incoming competitor using the latest technology and bridging in five years a network development gap approaching ten years.

Plan D, an analogue/digital hybrid network, was conceived within six months. The plan met the challenge from competition in the contested areas at least six months before competition began. The FMO, an almost fully digital network, was conceived within 12 months which would achieve world parity within five years.

All of the management and staff were from Telecom and OTC except for one person, the new manager of network construction recruited from the private construction sector.

The key people included the market and technology forecasters, Bob James and Peter Gerrand; the manager of product and service development, Leo Tyrrell; the leader of the "Future Network" team, Andrew Day who, with others in Network Products, developed Plan D and the FMO concepts; the strategic and financial modelling and planning team lead by John Stanhope; the network operations manager, Ross Marshall and the network construction manager, Bob Pentecost.

There have been a number of large telecommunications projects in Australia since the launch of the telegraph network in 1854. Such include the completion of the Overland Telegraph in 1872, the deployment of the telephone service from 1880, the consolidation of the colonial telephone and telegraph business into the Post-Master General's Department from 1901, the establishment of Telecom Australia in 1975, the deployment of computer controlled exchanges and optic fibre transmission beginning in the late 1970's, the deployment of the cellular mobile network from 1987, the de-regulation of Australia's telecommunications market from 1992 and the establishment of AOTC, the launch of the Optus networks from 1993, the launch of cable TV from 1995, and lately, the deployment of the National Broadband Network (NBN) from 2009.

In terms of complexity, scale, technical ambition, timetable and risk, and the early, major results achieved by the Network Products team over just 18 months, the FMO arguably ranks with these and was one of the triumphs of telecommunications engineering in Australia.

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Historical paper: The 2004 Proposal for the Structural Separation of Telstra

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Abstract: A comment by Australian Prime Minister Malcolm Turnbull on 23 October 2017 has re-awakened interest in the possibility that lay open in 2004 for the then Coalition government, of which Mr Turnbull was a member, to have preceded New Zealand in reaping the benefits of structural separation of the incumbent carrier. The paper "Revisiting the Structural Separation of Telstra", published in the Spring 2004 issue of the *Telecommunications Journal of Australi*a and republished below, provided not just the policy rationale for structural separation, but also detailed how it could have been achieved.

Keywords: History; Telecommunications; Structural Separation; National Broadband Network; Malcolm Turnbull

Introduction

A curious comment by Australian Prime Minister Malcolm Turnbull on 23 October 2017 has re-awakened interest in the possibility that lay open in 2004 for the then Australian Coalition government to have preceded New Zealand in reaping the benefits of structural separation of the incumbent carrier. After all, the paper "Revisiting the Structural Separation of Telstra", published in the Spring 2004 issue of the *Telecommunications Journal of Australi*a and republished below, provided not just the policy rationale for structural separation, but also spelled out in practical detail how it could be achieved.

Furthermore, this historical paper foreshadowed how a government-owned 'NetCo', formed from Telstra's fixed network wholesale business, would have been able to achieve all that the subsequent NBN Co (2009-) was chartered to do, but with its costs wholly or largely cross-subsidised from NetCo's wholesale business. With a conservatively estimated commencement year of 2007 for NetCo, this paper predicted NetCo would have had a good chance of rolling out a national high-speed broadband network by 2015 – five years ahead of the most optimistic prediction for the completion of the current National Broadband Network (NBN).

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The Big Mistake

On 23 October 2017, Mr Turnbull admitted it was a "big mistake" to set up a new company to build the NBN, claiming that Labor left the Coalition "a calamitous train wreck" (ABC Breaking News, 2017).

Mr Turnbull made this comment during an interview with the ABC, the morning after the ABC's current affairs program *Four Corners* highlighted widespread user dissatisfaction with the NBN. *Four Corners* reported on an almost 160% increase in NBN complaints over the previous financial year and on how the rollout was creating a digital divide across Australia, with many households unable to access the higher Internet speeds they were paying for (ABC Breaking News, 2017).

In the same interview, Mr Turnbull went on to say that Australia should have followed New Zealand's model.

"They [the New Zealand Government] *basically ensured the incumbent telco, the Telstra equivalent, split its network operations away from its retail operations. And then that network company in effect became the NBN.*

"The virtue of that was you actually had a business that knew what it was doing, that was up and running, that had 100 years of experience getting on with the job."

A reminder

In a subsequent blog post, on the Independent Australia website, the author pointed out that it was Mr Turnbull's party, the Liberal Party, that ensured that this far better solution would never happen.

"The Howard Government had this opportunity up until 2005, while it still owned 51 per cent of Telstra. All of the telecoms industry – except for Telstra and its unions – were calling for the structural separation of Telstra prior to its full privatisation. […]

"Instead, the Howard Government – of which Turnbull had been a member since 2004 – opted to close down a Parliamentary inquiry into structural separation. Their overriding objective was to maximise the dollars they could earn in selling off the national carrier — and they succeeded. […]

"In 2007, the fully privatised Telstra declined to roll out an NBN, except on quasi-monopolistic terms with reduced price regulation. The incoming Rudd Government then had little choice but to set up a new company, NBN Co, to design and build the new wholesale network." (Independent Australia, 2017)

Epilogue

In the aftermath of this controversy, Emeritus Professor Trevor Barr suggested to this Journal's Editorial Board that it would be appropriate for the Journal to republish my 2004 paper, which you will find reproduced below, as part of the Journal's History section.

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It gives me considerable satisfaction to have had the policy recommendation I'd made in 2004 confirmed thirteen years later by such an unlikely source.

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The Historical Paper

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Revisiting the Structural Separation of Telstra

Peter Gerrand, Pavana Consulting and University of Melbourne

In this article Peter Gerrand advocates the reopening of the aborted 2003 Parliamentary Inquiry into the structural separation of Telstra, and argues the merits of a government buy-back of Telstra's wholesale fixed network business. The *Journal* sees this as an initial contribution to a wider debate on this topic, and invites further contributions for future issues.

Editor

Peter Gerrand

This paper reviews the arguments for and against the 'vertical' structural separation of Telstra, following the apparent failure of nominal 'accounting separation' as a regulatory means for ensuring fair and equitable provision of Telstra's wholesale pricing to itself and to its competitors.

The paper argues the several national benefits of a government buy-back of Telstra's wholesale fixed network business, and suggests a new solution as to how this might be achieved at affordable cost and without excessive political risk.

The paper also spells out the implications of the opposite eventuality, the complete privatisation of Telstra, and why this would not be in the national interest.

SUMMARY

It is timely to revisit the arguments for and against structural separation of Telstra, and in particular the buy-back of the 'natural monopoly' of Telstra's fixed network into public sector ownership. A rushed inquiry (the 'Telstra Inquiry') by the House of Representatives' Standing Committee on Communications, IT and the Arts on this topic, starting in January 2003, was aborted by the then Minister, Senator Alston, despite – or because of – the receipt of 68 submissions[1], and before the Standing Committee had the opportunity to review them, once the ALP announced they would not push for structural separation because of the potential costs. Since then the Minister's solution of 'accounting separation' to the problem of ensuring equitableness in Telstra's wholesale pricing regime has apparently failed, as it has not enabled the regulator, the ACCC, to determine whether Telstra has abused its position of vertical integration of wholesale and retail functions.

At the time of the Inquiry, the national benefits of such a buy-back appeared to be offset by the prospect of two major electoral liabilities: the anger of minority Telstra shareholders if they lost shareholder value through the process, and the excessive demands on the federal budget in the year of the buy-back – quite possibly pushing it into deficit. Indeed the Federal Government's formal submission to the Telstra Inquiry suggested there are only three means for effecting structural separation: by de-merger, government take-over or force majeure legislation; and stressed the excessive costs and/or risks to government of these solutions. The major innovation of this paper is developing a fourth (hybrid) solution, a two-stage process, whereby both the costs and risks to the government can be significantly minimised.

The paper also summarises the arguments for and against such a buy-back, and the negative consequences to the industry and the national economy if the opposite scenario is implemented (the total privatisation of the existing Telstra). It also warns against two possible flawed implementations of the recommended buy-back of Telstra's wholesale fixed network business.

INTRODUCTION

Australia has a history of cycles in support of market versus publicly funded solutions to meet community needs for essential services, starting with the nationalisation of private telephone companies at Federation. Now, after twenty years of increasing privatisation, the pendulum is currently swinging back in favour of government intervention to meet certain community demands that the 'free market' or

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'competition model' has proven incapable of delivering.

Fortuitously the competition regulator is currently suggesting the structural separation of Telstra along several possible market divides to reduce its anti-competitive behaviour. The ACCC has explicitly urged the 'horizontal separation' of Telstra from its cable (HFC) business and the divestiture of its 50 per cent interest in FoxTel[2]. It has also noted in its recent submission to the Productivity Commission inquiry into national competition policy – and in public statements – that the extensive scope of vertical and horizontal integration in the telecommunications sector means a comprehensive assessment of structural reform is warranted.[3]

This discussion paper takes a second step and argues that a combination of a 'vertical' structural separation and the government buy-back of Telstra's wholesale fixed network **would also solve the problem of inadequate and inequitable national roll-out of advanced telecommunication services to meet community needs.** It would also boost the economy by returning to levels of capital expenditure on advanced telecommunications infrastructure typical of the incumbent prior to privatisation, when its primary goal was the national provision of basic and advanced telecommunications services across Australia.

Several submissions[4] to the short-lived 'Telstra Inquiry' by the House of Representatives Standing Committee on Communications, IT and the Arts in January 2003 argued for structural separation (or active consideration of this option) between Telstra's wholesale network-based business ('NetCo') and its retail service businesses ('ServCo'). They did not however solve the critical tactical problem of how to achieve the structural separation without incurring the major electoral liabilities of:

(a) the anger of the Telstra minority shareholders (if they were to lose shareholder value) or

(b) a federal budget pushed into deficit.

In the body of this paper, the author proposes how the buy-back could be implemented without either of those electoral liabilities. The buy-back can be achieved as a win-win for Telstra's minority shareholders, Telstra's competitors, the economy and the nation – and without driving a future federal government's budget into deficit.

But first this paper will review the arguments for and against such structural separation.

In addition, the diametrically opposite eventuality – the total privatisation of Telstra, driven by the overwhelming short-term budgetary focus of a future federal government managing to win support from the Senate – will be examined for its implications for the Australian telecommunications sector. These implications could well include the withdrawal of any serious infrastructure competition from a market ruthlessly dominated by a totally profit-driven Telstra, despite the best intent of government to tighten industry regulation at the time of the T3 sale.

THE BENEFITS OF STRUCTURAL SEPARATION

(1) Fair competition: dealing with a natural monopoly

The 1981-2 Davidson Inquiry[5] in Australia, reviewing options for delivering telecommunications during a period of intensive lobbying for increased competition, concluded that the fixed CAN (Customer Access Network) was a natural monopoly, and for that reason recommended partition of Telecom Australia into a government-owned national network **owned and managed separately** from the provision of customer equipment and retail services, which could be fully privatised and open to competition. This recommendation was immediately opposed by the ALP (influenced by Telecom's unions) and by the then Country Party (influenced by Telecom's management), and was finally disowned as a lost cause by the Liberal Party, the senior member of the then coalition Federal Government.[6]

Since then the prevailing belief by the national economic managers (the Departments of Treasury and Finance) has been that a level playing field for competition in telecommunications services can be achieved by either industry-specific regulation (as per the *Telecommunications Acts of 1989* and *1991*) or by general economic regulation coupled with telecommunications-specific access regulation (*Telecommunications Act 1997* and the amended *Trade Practices Act 1997*). However many of Telstra's competitors and business customers – and the Productivity Commission – have repeatedly disputed this, e.g. pointing out that by 2002 Telstra had managed to capture over 95% of the profits

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in the entire Australian telecommunications market. Industry lobbying in late 2002 led to Communications Minister Alston initiating (and then aborting) the already mentioned Telstra Inquiry in January 2003.

Having avoided parliamentary analysis of the pros and cons of structural separation, Senator Alston in April 2003 announced a new requirement for Telstra (and the other major infrastructure carriers) to provide enhanced 'accounting separation' of its wholesale and retail services, for analysis by the ACCC through its record keeping rule (RKR) powers.

However it would appear that under the new RKR regime Telstra has been able to limit the definition of its wholesale business to those areas where it has contractual wholesale relationships with other carriers – and need not include the supply of wholesale network capabilities to its own retail services. This asymmetry lies at the centre of concerns by both the industry and the regulator about lack of a level playing field.[7],[8] In addition the attribution of underlying costs to wholesale versus retail products, as required in the RKR, is notoriously arbitrary in telcos unless the businesses are physically separated.

Since accounting separation appears to have proved unmanageable as a regulatory lever, there is good reason to conclude that only physical separation together with separate management and separate accounting of Telstra's wholesale (network-based) and retail businesses will provide a truly level playing field for Telstra and its competitors.

The future monopoly of the fibre-dominant CAN

Twenty years after the Davidson Inquiry, a smart technology solution ('spectrum sharing', a.k.a. 'line sharing') emerged to break the natural monopoly of the copper CAN – at least in theory. Spectrum sharing allows two separate service providers to share a single copper access pair from the local exchange to a household or business premises, one using the lower spectrum for telephony and the other using the higher spectrum for high speed Internet access. In practice this smart technology (the 'xDSL' family, most commonly ADSL) has made only minor inroads into Telstra's dominance in the copper CAN, due to two historical legacies: the limited opportunities for introduction of competitors' equipment in exchange buildings; and the effect of RIM or pair-gain technologies in the copper CAN in blocking the use of xDSL – these latter technologies having been introduced in the 1980s for more cost-effective design of a telephony-only CAN.

However there is potential for an even tighter dominance of the optical CAN by Telstra in future. On the one hand, few of its competitors seem to be able to raise the finance for fibre to the premises (FTTP) solutions, except in medium- to high-density estates (such as the Melbourne Docklands) or in affluent gated communities. This gives Telstra considerable commercial advantage, including the ability to persuade developers to make financial contributions to offset the cost of installing the optical CAN. By adroitly cherry-picking the opportunities with new

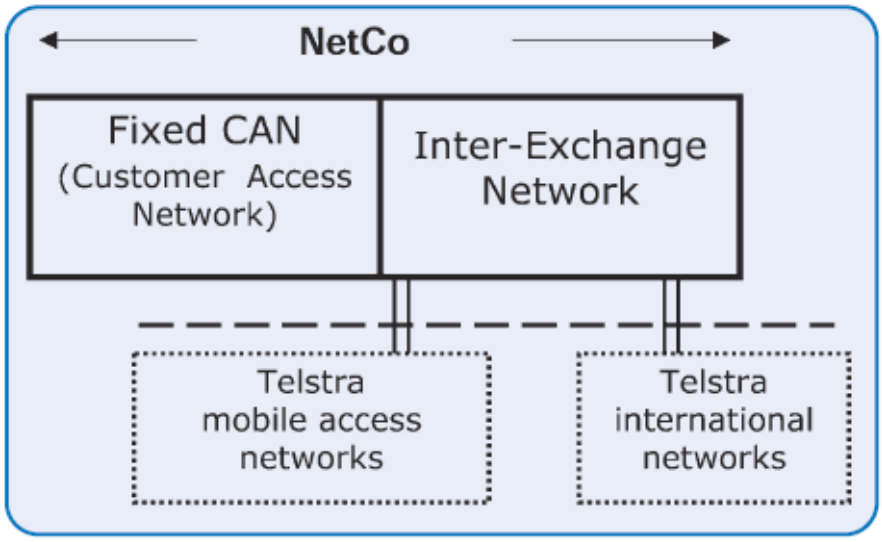

Fig. 1 – Proposed structural separation of the current Telstra national network into the 'NetCo' fixed network infrastructure and the other Telstra networks – as a 'first order' simplification.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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estates, Telstra could slowly roll out FTTP selectively over the next few years, until such time as a new technology break-through (or a 'must have' application) overcomes the cost barrier of FTTP compared to xDSL solutions. It would only be natural if Telstra (given its responsibilities to its shareholders) were to choose FTTP technology solutions that would make it excessively expensive for competitors to obtain direct access to its new CAN infrastructure.

In summary, there is a real prospect of Telstra gaining an effective monopoly over the future optical CAN that would be just as unbreakable as its natural monopoly over the copper CAN seemed in 1981.

Recommended basis for the wholesale-retail separation.

Given that as early as 1994 the then regulator (AUSTEL) found that Telstra no longer dominated the mobile telecoms market, where it now has even more infrastructure competitors (Optus, Vodafone and – to some extent – Hutchison nationally, plus three small Wi-Fi and Wi-Max competitors regionally), there is no good reason to include Telstra's MobileNet in the wholesale network business (NetCo).

On the other hand, it will be important to include Telstra's current inter-exchange network and associated systems in NetCo. NetCo will need sufficient wholesale transmission, signalling and switching capacity between NetCo's fixed CANs to act as a minimum-cost wholesale network provider to all retail service providers (if they so choose), including ISPs and mobile service providers. The proposed first-order structural separation of Telstra's current national network is shown in Figure 1.

The new retail Telstra would not be disadvantaged: it would be able to lease long-distance capacity from NetCo or from any of its infrastructure competitors (SingTel Optus, Nextgen Networks, UeComm, etc) on the same level playing field as its retail competitors. The new Telstra should not be restrained from investing in new infrastructure, any more than any other carrier; its freedom to invest in new network infrastructure will act as one of several brakes on NetCo's wholesale pricing.

Similarly NetCo, while beginning as a 'fixed network' business, should not be constrained from investing in advanced radio (terrestrial or satellite) infrastructure where it can identify a good wholesale business opportunity compatible with its objectives. NetCo's competitive advantage in providing new infrastructure will consist fundamentally of its charter for *long-term investment*.

NetCo's prime goal must be to roll out advanced infrastructure nationally at globally competitive and regionally equitable

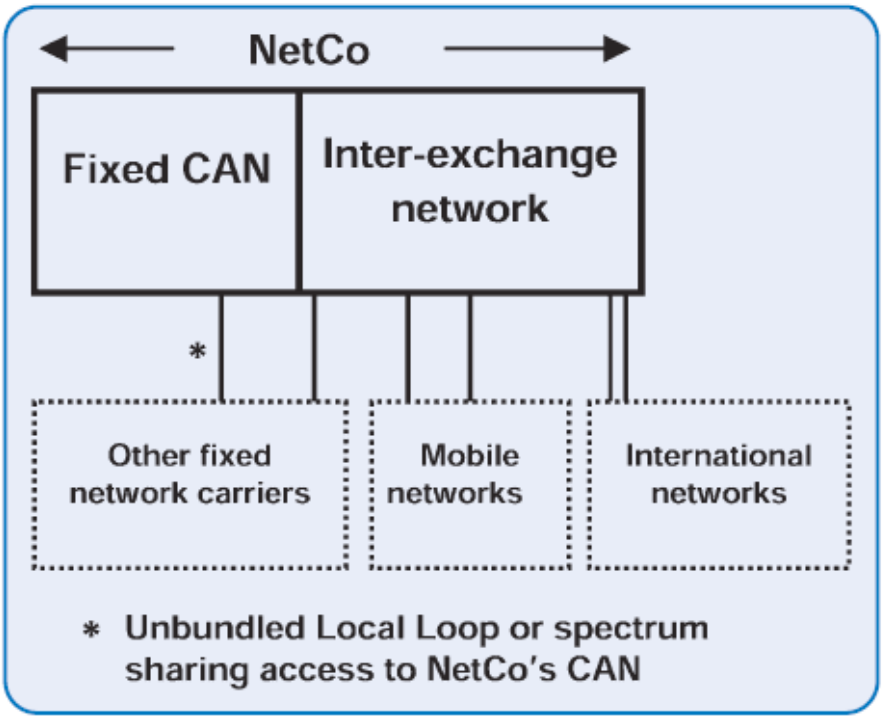

Fig. 2 – Interconnection of NetCo network with other carriers, including the new Telstra.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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wholesale prices, and if it can achieve part of this goal by investing in radio infrastructure, then that should be allowed under its charter. It will need to be subject to price control so that it does not abuse its monopoly position. And it will remain subject to the same access pricing regime, and general competition regime, as applies to Telstra's current wholesale activities. NetCo's relationship to other carriers, including the new Telstra, is shown in Figure 2.

(2) National competitiveness

Industry observers estimate that Australia's penetration of broadband access (less than 10% of households in June 2004[9], compared to 45% in the USA[10]) has slipped to worse than 30th in the world; down from 20th amongst OECD members in June 2002[11] – which do include the highly broadband-endowed Singapore, Taiwan or Hong Kong economies. The most recent OECD figures are shown in Figure 3.

Whereas in the 1980s Telecom Australia was a world leader in its use of advanced telecommunications technologies – whether optical fibre cables, microwave links, solar-cell powered digital rural radio telephony, ISDN, No. 7 signalling, mobile telephony, digital data networks, high speed LAN interconnection etc – Telstra post-privatisation has become risk-averse to new technologies in advance of proven pay-back experience overseas.

For example, after two years of publicly talking down the need to invest in broadband cellular mobile (3G) technology, Telstra has recently chosen to co-invest in Hutchison's existing 3rd generation network, preferring retail competition to infrastructure competition. From a purely commercial point of view, this was smart tactics – but it is indicative of Telstra's reluctance to incur any risk in investing in advanced broadband technologies.

Australia's lag in broadband take-up is serious[12], since it holds back national productivity, especially for the knowledge economy – see box - on page 21 and it

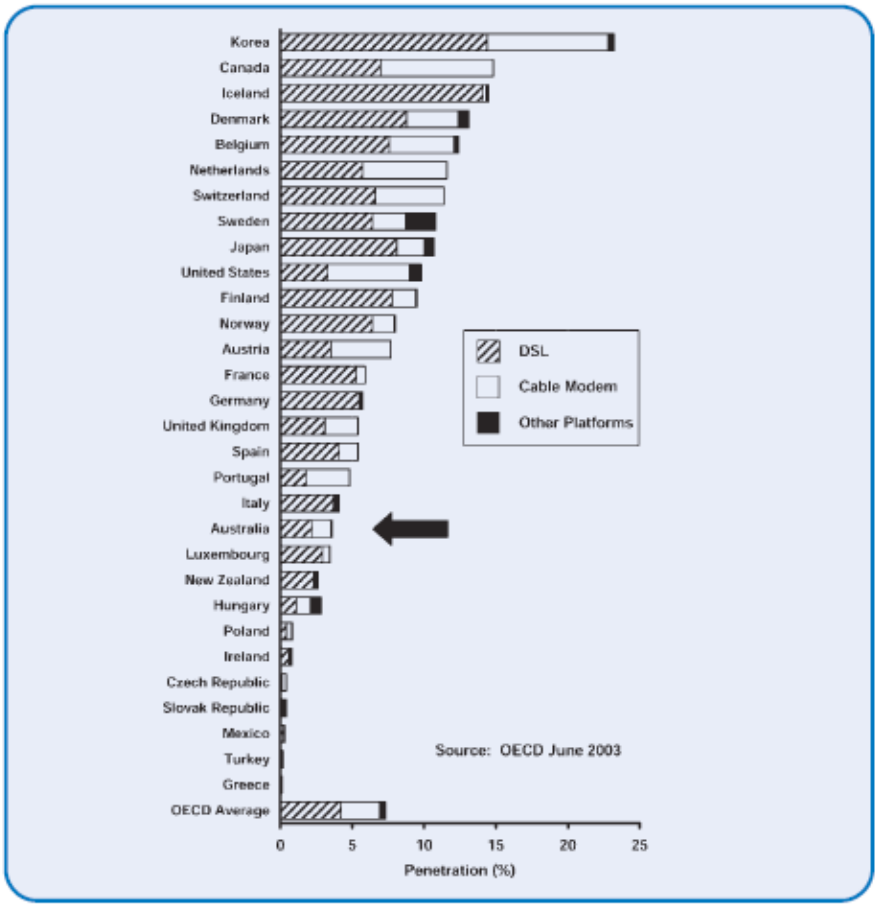

Fig. 3 - International Competitiveness - comparative rollout of broadband access

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disadvantages the micro-economies and educational infrastructure of rural and remote Australia (RURA). In addition, since broadband access is critical in supporting cheap Voice over IP (VoIP) solutions, the limited availability of broadband access will keep a high 'floor' under the cost of voice services, to our national disadvantage.

(3) Regional equity

The public submissions to several national inquiries, most recently the Estens Regional Telecommunications Inquiry (2002) and that of the Broadband Advisory Group (2002/3), have emphasized the social and economic disadvantages suffered in RURA through lack of access to advanced telecommunications services at reasonable cost. Submissions to the Estens and BAG inquiries emphasized the inequities of both the availability and pricing of broadband services outside the capital cities.

The Federal Government's response, as so often in the past, was essentially a short-term fix: to throw some money at the problem, e.g. short-term subsidies to new regional carriers (whose longevity is problematical) and extension of the publicly funded AARNet's capacity into regional university campuses.

This piece-meal approach contrasts with the internally cross-subsidising financial capability of a government-owned carrier to roll out new services into RURA. At its birth as a GBE in 1975 Telecom Australia set itself the goal of providing a telephone in every home by 2000 – and achieved this goal by 1990. A new NetCo could similarly provide affordable broadband access in every home by year 2015 – through a combination of satellite, terrestrial radio, xDSL and FTTP solutions. The high wholesale margins obtained in the densely populated parts of Australian cities could subsidise the rollout of broadband access elsewhere – while still providing satisfactory dividends to the federal government.

(4) The benefit to the national economy

From 1997 (the year of the T1 float) to 2003, Telstra's capital expenditure within Australia – largely devoted to rollout and renovation of its national network – has been reduced from 28.2% to 15.8% of its total revenues. Ever since the listing of Telstra shares in 1997, the Telstra Board and management have been under fierce pressure from institutional investors to maximise Telstra's short-term cash-flow profits, to the detriment of faster rollout of advanced national infrastructure.

A pro-rata return to the network capital expenditure rates of the late 1980s (typically 25%) would inject an estimated additional $2B per year into the national economy from procurement alone. Assuming conservatively that the economic multiplier effect is 3-fold, the national economy would benefit from an additional $6B per year.

(5) Limitations of the competition model

Australia has learned the hard way that competition policy alone cannot provide parity in availability or pricing of telecommunications services to those living in low-density populations such as rural and remote Australia (RURA). Compensatory mechanisms such as the Universal Service Obligation (for the basic telephone service) and the government funding of infrastructure or service subsidies in RURA (e.g. HiBIS subsidies for broadband) have been a feature of the Australian telecommunications market since the introduction of competition in 1991.

What is less well known is that the current competition legislation is unable to deliver a satisfactory outcome to meet the needs of residents of the outer suburbs of Australia's largest capital cities. These communities seek equity in pricing of basic telephone services, and equity in listing in the capital city White Pages, with the rest of their co-urbanites. They have not been able to achieve these equities because:

(1) the *Telecommunications Acts* of 1989, 1991 and 1997 have been careful to preserve the concept of untimed local calls, since this has been a matter of major community sensitivity; and

(2) in order to maintain the status quo in local call benefits prior to the introduction of competition to the incumbent Telecom Australia in 1991, these Acts preserved the local call charging zones prior to 1991 – which were largely defined in 1960 with the introduction of the PMG Department's *Community Telephone Plan*, based on the then radically new Subscriber Trunk Dialling technology.

Needless to say the major capital cities have doubled in population and greatly increased in girth since 1960, leading to inequities in both local call reach and White Pages visibility for those living beyond 50 km from their city's GPO. Considerable lobbying is currently taking place by some of the fringe councils (e.g. the City of Casey in Melbourne's south east, and the City of Penrith in Sydney's west) to rectify this historical anomaly.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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The reason why the market (and the current competition framework) cannot solve this problem is the following: If Telstra were prepared to meet this community need in the simplest manner, by extending the reach of a local call tariff (e.g. by reducing the pricing of the current 25 cent capped Wide Area Call product to the standard 22c local call rate, and extending the radius of a Wide Area Call from the current 50 km to say 80 km) – and thereby foregoing appreciable revenue and profits – it would still have to secure ACCC approval.

Telstra's carrier competitors would hardly be expected to support a change that deprived them of timed-call long distance call tariffs as alternative suppliers of telephone services to those outer city councils beyond 50 km – as they cannot at present economically compete with Telstra on local call rates.

In fact Telstra, following many months of negotiation with the cities of Casey and Penrith, has shown no sign yet of being willing to forgo that extra 3c per call for telephone calls sent over the 50 km Wide Area Call limit. Casey and Penrith councils have reached an impasse.

One of the many advantages of the structural separation proposed in this paper for Telstra is that NetCo can be given the power – under suitable regulatory supervision – to adjust its call charge zones to align them with current demographics, *without disadvantaging any of Telstra's competitors relative to the retail Telstra*. They would all be equally affected by such underlying wholesale changes in the underlying network technology.

Why is broadband important?

In the early 1990s the concept of ***The Clever Country*** *arose as a vision for the 21st Century. This would enable a developed country like Australia to build on the strength of its excellent educational system to grow new export industries through 'knowledge workers'. The concept depends on rapid rollout of broadband telecommunications so that knowledge workers can export their advanced products and services, Negroponte's 'bits not atoms', to the world.*

The Clever Country concept was embraced by the Hawke-Keating government in Canberra and by the Kennett-Stockdale government in Melbourne – as well as by their counterparts in Ireland, Canada, Singapore and several other forward-looking economies. But in Australia it has been undermined since 1996 through cutting funding to tertiary education and research, and since 2001 through systematically reducing community expectations for the rollout of broadband access.

The widespread availability of affordable broadband access remains important to Australia to support its knowledge economy. It is also vital to meet parents' expectations for world-class education for their children. In a modern society, all secondary school children (and increasingly, later-year primary school children) need high-speed Internet access to carry out research for their school projects, since the rate of growth of knowledge far exceeds the ability of any school library to meet their needs through books and videos. And school children, like adults, need high-speed Internet access at home as well as school or work in order to complete their assignments.

ARGUMENTS AGAINST STRUCTURAL SEPARATION

(1) 'Governments can't fund advanced infrastructure'

Given pressures on Australian governments to avoid deficits, it is understandable that many are reluctant to fund major infrastructure developments – such as new freeways or railway lines – that require billions of dollars to be spent on construction for several years before any revenues are obtained.

However the national wholesale telecommunications network is already a highly profitable business, whose extensions and renovations can be achieved without significant curtailment of services or loss of cash flow. Furthermore this network business, in its historical manifestations from PMG's Department to Telecom Australia to AOTC to Telstra Corporation, has a century of track record in demonstrating its ability to fund new network rollouts largely through cross-subsidisation – and through the issuing of government bonds when needed.

The NetCo business, as a government owned business enterprise, would have little difficulty in raising the loans it would periodically need to finance peaks of capital investment that exceeded its ability to pay out of annual cash flow.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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(2) Belief in the power of the access regime

In one of the most cogent of the submissions to the Telstra Inquiry that opposed structural separation, the economist Ian Martin from Macquarie Research Equities argued that continuation (and improvement) of the current access pricing regime is vastly preferable to structural separation[13]. To support this proposition, he argued that telecommunications services are so integrated into networks that 'there is a practical constraint in drawing a line between network and services' [14]. This argument is unlikely to impress an experienced telecommunications engineer. In fact the AUSTEL Interconnection Model (1995) and its ACIF-funded successor[15] demonstrate how telecommunications wholesale services can be conceptually and physically separated from retail services.

The real issue here is the cost, not the *feasibility*, of separation. The flexibility of modern software-controlled network technology makes such separation feasible at relatively low cost. The fact that Telstra has chosen to use a high level of integration between its support systems for both wholesale and retail services does not prevent it from functionally separating out the information systems and equipment needed to manage its numerically much smaller range and quantity of wholesale services from those supporting its large array and vast number of retail services.

(3) Excessive cost of the separation

In its submission[16] Telstra claimed that the cost of separation would include the cost of development of duplicate back-end systems (costing 'in the order of $400 to 500 million') and approximately $80M pa in additional running costs. The running cost figure is plausible (and not large enough to be significant), but the development cost estimate is only credible if the new systems were to be developed from scratch – which is unnecessary. In practice the existing systems – those that actually overlap the NetCo and ServeCo business functions – can be duplicated, and then from each 'clone' the non-relevant data can be expunged: e.g. NetCo can delete retail customers from its CRM databases, and ServeCo can delete wholesale customers from its. There will then be significant new system integration work required, but arguably for less than $50M for each business.

Telstra claimed that its separation costs would amount to a once off cost of 'the order of $2 billion, and the ongoing administrative costs could amount to some $800 million per year'. It calculates the first whopping figure by using as a benchmark the US telecoms company Verizon's estimate that the structural separation of its network and retail business would cost US$800M[17] – but one must be very sceptical of the defensive estimates produced by incumbent carriers, here and abroad.

It would seem that both Telstra and Verizon have assumed worst-case network boundary separations, such as the need to create new interfaces between Telstra's thousands of CAN 'islands' and its inter-exchange networks, rather than the far fewer (less than 70) and much more traditional 'Points of Interconnect' needed to separate Telstra's total fixed and mobile networks as proposed in this paper. Most of these Points of Interconnect are already established, connecting Telstra's fixed network with its competitors; it will become a matter of reconnecting Telstra's mobile networks external to rather than internal to these gateways.

(4) Wholesale pricing will exceed equivalent access pricing

Macquarie Equities Research argued that 'structural separation could well lead to an increase in access pricing'[18], and to support this assertion, 'Long run incremental cost (LRIC) is usually less than long run average cost (LRAC) in this industry. Access pricing is based on LRIC.'[19] [And by implication, wholesale pricing is more likely to be based on LRAC.]

These legitimate but theoretical points are of little practical concern to an industry that knows from hard experience that:

- LRIC is often problematic to evaluate, given fundamental disagreements between economists on how to attribute underlying costs; and
- Telstra has continually used LRIC arguments to justify large access prices, most of which have subsequently been reduced through arbitration by the ACCC using more pragmatic decision-making.

The avoidance of excessive rises in wholesale prices can be achieved by a combination of the current ACCC regulatory powers (over a separated NetCo) with an explicit price control regime on wholesale pricing of essential services – together with the ability of the newly privatised Telstra to invest in new infrastructure wherever it calculates that NetCo's wholesale pricing is excessive.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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(5) Benefits from the economies of greater scope and scale

Telstra argued that the 'economies of scale and scope Telstra secures through integrated operation substantially lower the costs of Universal Service Obligations, substantially increasing their sustainability'[20]. Logically the USO obligations (and subsidies) would need to be reviewed under a new regime where NetCo would have the prime responsibility for rollout of national telecommunications infrastructure under the new arrangements. But a review of USO arrangements would be timely in 2005 in any case, to reassess the community's expectations of a basic telecommunications service.

It seems quite plausible, as argued not only by Telstra but also by the Federal Government and the merchant banks USB Warburg[21] and Macquarie[22], that the integrated Telstra must have better potential for achieving 'economies of scope and scale' than either NetCo or the new Telstra. **But perhaps not all that much better.** In terms of scale of purchasing, NetCo will have the lion's share (and hence most of the scale) of current capital expenditure; and the scope and scale of Telstra's retail products, retail customers and retail income will not be reduced one iota! In terms of the efficiencies of scale of operational expenses, largely staff-related, there does not seem a significant difference between the per capita savings each business can make with a likely staff of between 10,000 and 30,000 compared with the per capita savings possible with the 43,000 in the current Telstra, in accommodating, equipping and managing them – other than the undeniable need for each company to fund its own Board and corporate centre.

The putative superior efficiency benefits of the current integrated organisation have to be weighed against the perception that 80% of these efficiency benefits are currently transmitted to Telstra's owners, not to the greater benefit of its customers or the national economy.

(6) Putative benefits of a fully privatised Telstra

A corollary of the belief in the power of 'the market' to solve all of Australia's telecommunications needs is that structural separation is far inferior to the solution of a totally privatised Telstra. It is worth devoting some space to delineating why the full privatisation of Telstra would be the worst possible outcome for fair competition, for regional equity, for the national economy – and for democratic processes in Australia.

The most predictable result of fully privatising Telstra in its present structure will be an accentuation of its recent pattern of border-line anti-competitive business practices (incurring competition notices from the ACCC), backed up by a budget for litigation that greatly exceeds that of the regulator, let alone Telstra's competitors. These tactics, when challenged, can be fully justified by the Telstra Board as consistent with its obligation to keep increasing shareholder value.

More dangerously, a fully privatised Telstra would be free to *lobby politically*, without any restraint from its government shareholder, to resist any further regulatory or legislative constraints. Its purchase of mass media outlets, such as a major newspaper chain or a national TV network, would be well justified to its shareholders as necessary to protect and expand its Sensis directory revenues through new cross-media dominance; but this would also give it more political power than Kerry Packer or Rupert Murdoch to affect both electoral and legislative outcomes.

Telstra's market dominance has already deterred most financial institutions from major investment in new infrastructure competition to Telstra since 2000, particularly following the commercial failures of both IP1 and Nextgen Networks during 2003.[23] Even the parent companies of AAPT and Singtel Optus, both with deep pockets (through owning large incumbent telcos), have halted any further significant infrastructure expansion by their Australian subsidiaries. The degree of under-investment in the Australian economy due to the deterrence effect of Telstra's dominant position can be conservatively estimated as well over $1B pa – apart from Telstra's own pattern of capital under-investment since 1996/97.

If Telstra were to be fully privatised, it would be expected to use its scale and scope to demolish any serious competitive threats to its margins, and to invest shrewdly in establishing an unassailable new area of market dominance – the all-fibre CAN, complemented by a defensive introduction of OF together with VDSL in the old copper CAN – without fear of competitive investment. Prices for some key residential and business telecommunications services would then be expected to significantly increase.

A fully privatised Telstra, unprotected by Government majority ownership from the most exigent demands by investor institutions for short-term increases in its

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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profitability, will have even less motivation than now to roll out advanced infrastructure – well beyond basic telephony – into short-term unprofitable markets such as RURA.

(7) Excessive cost and risk to the Government

The combined submission[24] by the Department of Finance and the Department of Communications, IT and the Arts to the January 2003 *Telstra Inquiry* analysed three possible processes for structural separation of Telstra:

- a de-merger under the Corporations Act;
- a take-over of all Telstra shares by the Federal Government; or
- new legislation.

The de-merger route was ruled out because of its excessive costs and uncertainty: specifically the perceived requirement to achieve full support from the Telstra Board and management. (Of course a single-minded Government, like a private sector controlling entity, would simply change the directors and if necessary the senior management, to achieve the majority shareholder's goals). The costs of the de-merger process were estimated to be an 'order of magnitude' greater than that of WMC's 2002 de-merger ($125M).

The take-over option was ruled out as being prohibitively costly, requiring an outlay of an estimated $39B (including a $9B premium on the then market value of the aggregate minority shareholding – i.e. a 30% premium) with advisory costs of $100M for the take-over and additional costs of c. $200M[25] for the subsequent sale of one or both of the separated entities.

The Finance/CITA submission warned against the legislative solution to separation, not on costs but on the grounds of sovereign risk[26], forecasting:

(a) a negative impact on the Telstra share price, and

(b) a negative impact on the general capital market in Australia, as a likely consequence of government intervention.

A counter to these would be that

(a) a short-term anticipatory fall in the Telstra share price could be reversed by a commitment to a process that gave it added value, and

(b) the risk to the Australian capital market could be closely circumscribed; indeed the change of structure from the current highly regulated Telstra (with abnormally restrictive ownership conditions) to an unleashed fully privatised new Telstra (with no such restrictions) could be managed in such a way as to satisfy the capital market's concerns. Many investors could be persuaded to see such a Telstra transformation as a satisfactory finale to a hitherto highly flawed process.

It is rather striking that the Finance/CITA submission sees the potential national benefits of structural separation only in terms of 'the argument that it has the benefit to provide greater and fairer retail competition'[27]. Economic rationalism remains pure in the policy engine rooms of the Federal Government.

A WIN-WIN SCENARIO

Structural and corporate separation of Telstra

The following scenario would lead to the separation of a 100% government-owned wholesale network infrastructure business from Telstra to ensure equitable and optimum national rollout of FTTH and other advanced infrastructure. It would represent a win-win for the community, the economy, Telstra's minority shareholders and Telstra's competitors – and would not push the federal budget into deficit. Such a scenario is however likely to be resisted by Telstra's management and unions, and by those in Federal Government putting highest priority on the short-term cash benefits of a complete sale of Telstra.

Step 1.

Following continued lobbying by the ACCC and Telstra's carrier competitors, a federal government in 2005 uses its Ministerial powers under the *Telecommunications Act 1997* and *Trade Practices Act* Section XIB powers (under section 151BUAA and related sections) to require Telstra to separately account for its *national wholesale fixed network business*[28] (NetCo) and its retail (and other, including offshore) *businesses*, as a preliminary move towards functional separation of NetCo. (Telstra's *mobile network* is not considered by the ACCC to be market dominant, and its role as a wholesaler to other carriers is assumed to be negligible. Telstra's mobile network would therefore not be included in NetCo.) The accounting separation would need to be subject to due diligence by the government to ensure that NetCo is not disproportionately loaded up with Telstra's corporate overheads, especially retail-oriented corporate marketing and sponsorship.

While primarily motivated to immediately providing a more level playing field for Telstra's competitors in achieving equitable

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access to wholesale pricing, Step 1 will enable the independent valuation of Telstra's national wholesale fixed network business versus the rest of its domestic and offshore businesses. For the sake of argument, let us suppose conservatively that the NetCo is valued at $40B, and the rest of the current Telstra assets at $20B.[29] (The wholesale business, being essentially a monopoly, is prima facie assumed to be more valuable than the rest.) Let us call the NetCo valuation the *Reference Valuation*.

Step 2.

Following continued lobbying by the ACCC and Telstra's competitors that despite accounting separation Telstra is able to maintain too dominant a market position through the collaboration of its wholesale and retail divisions in bundling services, a Federal Government in 2006 passes legislation to enforce structural separation of Telstra's national wholesale fixed network and related operating (including wholesale billing) systems from the rest of its network and business assets. This is required to be carried out at Telstra's expense.

During this period there might well be a temporary negative impact on Telstra's share price owing to market uncertainties surrounding the future of Telstra, as well as the disappearance of the 'mystery' value in Telstra's business integration, once this becomes transparent. To allay market disquiet, it is important that the Federal Government commits to buying the NetCo business on the basis of the previously assessed values of Telstra's wholesale and other businesses, which we assume are still $40B and $20B respectively (the exact numbers are not crucial). The new legislation would contain a trigger, enabling the Federal Government to purchase Telstra's NetCo business at a price above the Reference Valuation once this is agreed by a majority of the minority shareholders' shares in Telstra. (The ASX rules for 'related transactions' would not allow the Government as majority shareholder to vote on this issue.)

The Federal Government would then offer to buy from Telstra its wholesale fixed network business at a premium, e.g. for $43B, as a combination of its 50.1% equity in Telstra (worth $30B) plus cash and government bonds ($13B)[30]. This would leave the minority shareholders, previously owning an asset worth $30B (49.9% of $60B), with an asset worth $33B (100% of an asset worth $20B for the new Telstra business plus $14B in cash and bonds, much of which could immediately be distributed to shareholders). The minority shareholder's position would have immediately improved by 3/30 = 10%. The use of government bonds to provide attractive but deferred payments to the minority shareholders avoids the Federal Government having to take too great a hit on its budget in the year of the buy-back.

The issuing of government bonds to fund say $10B of the expected $43B (rough estimate) purchase of the current Telstra national wholesale fixed network business will provide investors with an attractive fixed-interest alternative to property and equities, and could be done in such a way as to avoid excessive cash demands on the Federal Budget in the year of the buy-back. (The rest of the purchase would be via $3B in cash and $30B in released equity.) The pricing of the wholesale network products, already set at high margins by Telstra, should provide a long-term revenue stream ample to provide the dividends on the government bonds as well as ongoing dividends to the Federal Government and repayment of the interest on any loans needed by the new 'NetCo' to finance its accelerated national roll out of advanced telecommunications infrastructure.

But the immediate 10% return is only the direct and most certain component of the value that the Federal Government can provide to the consenting minority shareholders to ensure their agreement. The Federal Government can further motivate the minority shareholders to agree to this transaction by adding greater value to their shares. It can do this by including in the legislation clauses which, triggered by the agreement of a majority of the Telstra minority shareholding to the deal, would remove the current 5% restriction on foreign owned parcels of Telstra shares.[31] This would be expected to increase the share value by an additional 10 to 20%, and this expectation should ensure sufficient minority shareholder support. (The USB Warburg submission considered a shareholder premium of c. 30% to be the average accepted in recent non-hostile Australian company take-overs.[32]) Financial institutions would be highly motivated to invest in the new Telstra, knowing the potential of the fully privatised Telstra to boost its multimedia/database advertising revenues through participating full-bloodedly in cross-media ownership.

This scenario therefore becomes a win-win for the minority shareholders, the community, the economy (through faster roll-out of advanced infrastructure) and the rest of the telecommunications industry.

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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Once back in full government ownership, the new national wholesale network monopoly NetCo should be legislatively price-controlled, restricted to selling its telecommunications services to other licensed carriers only (i.e. excluded from a retail role), and set the goals of:

(1) meeting the national USO obligations for access infrastructure, currently defined for the basic telephone service, but subject to periodic review of the basic service definition, which might be upgraded to include entry-level broadband;

(2) implementing an aggressive roll-out of internationally benchmarked (and nationally equitable) telecommunications wholesale infrastructure, including OF/VDSL and FTTP, funded by cross-subsidising and borrowing as required; and

(3) providing a dividend stream adequate to fund the Federal Government's bonds sold to buy back the wholesale network carrier, as well as providing an annual surplus (although the Government may need to forgo that surplus in the first two years in order to accelerate national broadband rollout).

Implications of the emergence of a government owned wholesale network and a totally privatised 'retail' Telstra

The timing of the structural separation scenario outlined in the previous section could not realistically be accomplished before 2007 at the earliest, even if it received bipartisan support.

The impact of such a split would be to greatly improve access by Telstra's competitors to the fixed network infrastructure in all regions, at equable wholesale pricing, and would see a faster roll-out of advanced infrastructure across the nation. Thus one would expect a competition-driven improvement not just in the pricing of services in the major business districts, but also in the *pricing and availability* of advanced services in regional centres and outer metropolitan areas.

SAFEGUARDS TO AVOID UNDESIRABLE OUTCOMES

Avoiding early privatisation of the wholesale carrier

A future federal government would be tempted to privatise the wholesale carrier, to receive another major short-term cash injection (at the expense of a strong future dividend stream). Such a sale would place NetCo under the same short-term pressures from the financial institutions for maximum profitability that have deterred Telstra from adequately investing in roll-out of network infrastructure since its initial privatisation in 1997. This would be counterproductive to the national interest – until NetCo has achieved a worthy national target, such as providing an affordable broadband access network capability within reach of 99% of Australian residences. At that time NetCo will have served its initial strategic purpose, and its privatisation could be reviewed.

Regulation of wholesale pricing

It would be prudent to institute a price control regime on NetCo's wholesale services analogous to the retail pricing regime currently imposed on Telstra. DCITA could be requested to recommend a suitable regulatory regime, after holding an independent public inquiry into the options.

Avoiding early discontinuities in use of the wholesale network

The current Telstra has made investment decisions on all the components of its fixed network business, whose longevities can be independently assessed from the depreciation periods allowed by the ATO. The internal transfer pricing set within Telstra for wholesale pricing to its retail product divisions should logically reflect those depreciation periods, which reflect periods of commitment to use of those capital investments – except where new disruptive technologies arise (e.g. VoIP) which might cause a write-off of particular legacy networks or systems (e.g. the conventional circuit switches within the PSTN).

However a fully privatised retail Telstra might be tempted to take a different view of those fixed network assets, post-separation. It might, for example, decide to purchase either SingTel Optus' or Nextgen Networks' long haul optical fibre network – which interconnect most of the mainland capital cities – and 'turbo-charge' it with higher capacity transmission systems, thus freeing itself from the need to lease NetCo's inter-capital city network – and greatly reducing the revenues available to NetCo. There are many such tactics open to a gamekeeper turned poacher.

To avoid any such tactical or strategic discontinuities in Telstra's approach to its current network assets post-separation, it would be essential for the terms of separation to include the setting of firm contracts for the continuing use of that infrastructure. The appropriate periods of these contracts could match the depreciation

Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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periods currently used by Telstra for writing off the underlying costs of the relevant major pieces of its network infrastructure – with fair and equitable exit clauses.

Avoiding cost blowouts in the wholesale monopoly

The co-operation of Telstra's principal trade union (CEPU) would be advantageous in moving to Step 2 of the structural separation scenario. The Federal Government as owner of NetCo would be wise to negotiate an advance agreement on capping salary and wage demands within reasonable limits, so as to maintain an improved ratio of Capex to Opex within the new wholesale price control regime.

If such an agreement cannot be negotiated, the management of significant parts of the wholesale national network should be regularly tendered out, to ensure ongoing benchmarking of labour costs for the desired operational performance targets.

CONCLUSIONS

The second half of 2004 provides a timely opportunity to revisit the public policy benefits of structural separation of Telstra, returning the national wholesale fixed network business into 100% public ownership, and allowing full privatisation of the rest of Telstra's business.

Why is the timing opportune? Because for once the pendulum of community concerns about inequities in telecommunications services is in alignment with the economic regulator's (and the rest of the telecommunications industry's) concern that Telstra is too big to be regulated effectively, and has gained unfair advantages through its integration of monopoly wholesale and dominant retail businesses.

This paper spells out the many benefits for the national economy, the community and the rest of the telecommunications industry that can be achieved by a government buy-back of Telstra's current fixed national network. It suggests a solution to the network buy-back that would avert the two major areas of political risk: an adverse reaction from Telstra's minority shareholders, and the necessity to push the federal budget into deficit to finance the buy-back.

It would be a considerable political challenge for any incoming federal government to 'put the genie back into the bottle', without being sure of widespread community support. A safe first step would be to reconvene the aborted 2003 parliamentary inquiry into structural separation, and at least let all the arguments, for and against, have the benefit of a full public policy review.

NOTES & REFERENCES

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[8]. 'Telstra has hundreds of competitors, but it still has the huge advantage of owning that copper wire network and charging its competitors, who in turn are also clients, to use it. That continuing stranglehold is a major focus for the ACCC. Commissioner, Ed Willett, says the separation of Telstra's infrastructure from its business is a matter of survival for competitors.' Transcript ABC's PM program, 23 July 2004 – available on http://www.abc.net.au/pm/content/2004/s1162224.htm

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Australian Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 5 Number 4 December 2017

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[19]. ibid

[20]. Telstra, Submission no. 59, op. cit., p.9.

[21]. USB Warburg, Submission no. 53 to the Telstra Inquiry, Jan. 2003

[22]. Macquarie Research Equities, op. cit.

[23]. The exception is Unwired Australia, which raised an additional $100M in November 2003.

[24]. Finance/CITA (Dept of Communications, IT and the Arts & Dept of Finance), Submission No. 58 to the House of Representatives Telstra Inquiry, Jan. 2003

[25]. 'in the order of .... $259M and $169M respectively'. ibid, p.19.

[26]. 'Sovereign risk' is the risk that a government will impose regulations that reduce or negate the value of a commercial agreement, e.g. by changing the foreign exchange rate, or defaulting on a loan.

[27]. Finance/CITA, Submission no. 58, op.cit., p. 21.

[28]. as distinct from separate accounting for Telstra's self-defined wholesale and retail products, as required at present.

[29]. Telstra's current market capitalisation, representing 49.9% of its total asset value, is c. $30B.

[30]. This is $25B cheaper than the total takeover option analysed by Finance/CITA in Submission 58.

[31]. There would no longer be a political imperative to avoid foreign control of Telstra, since it is the fixed network – not the Telstra brand name – that is the major national asset requiring protection, and this would stay in Australian ownership via the government buy-back.

[32]. USB Warburg, op.cit.

THE AUTHOR

Peter Gerrand **is a company director, academic and independent consultant in ICT strategy and business innovation. He was awarded the Charles Todd Medal by ATUG in 1998 'for outstanding contributions to the telecommunications industry', a Centenary Medal in 2003 'for outstanding service to science and technology particularly to public science policy', and Life Membership by the TSA in 2003.**

Amongst career highlights he has been a general manager in Telecom/Telstra successively leading network research, product development, planning and network strategy (until 1993); and subsequently a professor of telecommunications at two universities (RMIT and Melbourne) and the founding CEO of a publicly listed company (Melbourne IT: 1996 to 2000). From 1993 to 2003 he was Chairman of the Telecommunication Society of Australia Ltd, and since 1994 has chaired the Editorial Board of this Journal (TJA).

Many issues of national importance have been raised in this article by Peter Gerrand. The Journal seeks always to be a forum for the expression of serious thought and opinion on industry issues. We would welcome articles that address these issues and suggest solutions for inclusion in future editions of the Journal. The deadline for receipt of correspondence for the Summer Issue is 15 November 2004.

– Blair Feenaghty, Executive Editor

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Tony Newstead (1923-2017)

Mark Newstead, Clemens Pratt, John Burke and Peter Gerrand
Telecommunications Association

Abstract: Tony Newstead, who died on 6 November 2017, was a pioneering figure in Australian and worldwide telecommunications network planning, as well as in Australian trad jazz as both a trumpeter and early bandleader. This obituary attempts to do justice to his career in both fields. In an Attachment, Dr Clemens Pratt provides a short memoir in appreciation of Tony's role as his career mentor and colleague, and John Burke provides an appreciation of Tony's innovatory role in pioneering open planning in Australian telecommunications.

Keywords: Tony Newstead, telecommunications network planning, trad jazz, Australia, World Bank

Tony Newstead (born Isidore Anthony Newstead) is most famous within the Australian telecommunications industry for his leadership in producing 'Telecom 2000' and for his contributions to the Australian PMG Department's Community Telephony Plan (1960). However, he gained contemporary fame for his contributions as a planning expert to the International Telecommunications Union (c. 1964-1972); on secondment to the World Bank (1970-73); as Chief Engineer of the Hong Kong Telephone Company (1976-83); and as founding Managing Director of Vistel, the Victorian Government's telecommunications network (1987). From 190-99 he lectured on telecommunications to MBA course at Monash University, and chaired the Advanced Data Networks Group, a Co-operative Research Centre between Monash University, Siemens and Telstra. In a parallel career, starting in his late teens, he became an acclaimed jazz trumpeter and, in the decade after WW2, a notable trad jazz bandleader in Melbourne.

Childhood and youth (1923-1942)

Tony enjoyed a happy childhood with elder brother Gordon and sister Aida. Tony's father Julius had begun a law degree when World War I erupted and then enlisted and found himself serving at Gallipoli. There he contracted dysentery, and in his hospitalisation he met and later married an English nurse from Kent, who became Tony's mother. Tony grew up in a large house in Stanhope St, Malvern (in Melbourne, Australia), complete with an imported Pierce Arrow, the American equivalent of a Rolls Royce. The car came with a young driver,

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William, who lived in separate quarters above the garage. William was his boyhood hero and Tony would pester him endlessly about cars and in his own words, "gossip of the adult world".

Figure 1. Mr Tony Newstead

Music was strongly imprinted into his early childhood. His father was a good classical pianist who played for relaxation the more popular works of Beethoven, Chopin and Liszt. From 1924 Melbourne had regular radio broadcasts, and their radio ran non-stop every day from 7am to 11pm. This indelibly impressed into Tony's memory the great popular composers of the Gershwin and Rodgers & Hart eras. The combined influence of family members and daily radio undoubtedly provided the foundation for a later intense love of both classical and jazz music and his lifetime participation in the later.

Neither football nor cricket were his forte, but long periods of being outside hitting a tennis ball against the garage wall, often to avoid household chores, enabled him to become a very good tennis player, playing at pennant grade. Indeed, he could claim that he beat Frank Sedgman, a former Wimbledon champion player when Tony was 17 in an Under 18 pennant tournament – although as Tony admits, Frank was then only 14! Tony played tennis until he "retired" aged 90.

University and war experience

Tony's work was easily the most spectacular and fulfilling part of his life. But there were temptations from the jazz world. While studying mathematics and economics at the University of Melbourne, he played cornet and trumpet in trad jazz bands. Before the end of WW2 there were slim opportunities for musicians to make a living, although the Graeme Bell Band had toured Europe in the 1930s to great success. However 1942 saw the beginning of a career plan for Tony with the Commonwealth Public Service, initially with work placements in Customs.

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Tony decided to join the war effort, and he planned to follow his best friend to become an RAAF pilot who had joined a year earlier. But the week before he was due to enlist, Tony got word that Allister had been shot down and killed over the English Channel. His rational and objective side won out, taking into account his distraught mother's pleas not to become a pilot, and so he chose to enlist for a ground staff role in RAAF Radar, that being a new area and closest to telecommunications, which had begun to interest him.

Although experiencing a one hundred plane Japanese raid in his first days on duty at Port Moresby, he was stationed shortly afterwards with an American forces unit in the north of Papua New Guinea at Goroka. This involved being seconded to the US armed forces' anti-aircraft radar division. There he had to install a radar antenna, by using leg irons to shimmy up and bolt the heavy radar dish into the top of a tall palm tree, 100 feet above the ground in fifty degree heat 90% humidity. Back on the ground, it proved to be a great opportunity to mix with servicemen who enjoyed jazz, and there was time to play the trumpet (or cornet) in the hours when there was downtime. He took advantage of the opportunity to meet and mingle with black serviceman, who were assigned to segregated units, and to hear about jazz artists these guys had seen first-hand.

In 1946 Tony re-enrolled for his science studies at Melbourne University and soon after, he managed to get the PMG (Post Master General's department) engineering cadetship that had been his original goal before the war intervened.

This cadetship exposed him to a wide range of internal training, with time off to attend university and complete degrees in Arts (mathematics) and Economics. He valued the exposure the PMG gave him to installing telephones at premises and businesses, and to hauling cables and working in muddy cable trenches. Decades later, as Chief Engineer of the Hong Kong Telephone Company, he made a point of regularly spending at least two days annually in the field with the installation gangs.

In 1949 he married Pauline Tacey who was a journalist and subeditor for *House and Garden* magazine. By 1950 Tony had completed his cadetship and became an engineer in the PMG. Mark was born first and then Steven in 1952. Tony and Pauline's family were settling into their new house in Glen Iris, with a large sunroom designed to accommodate the many jazz parties that were to come.

Network planning experience, leading up to the 1960 Australian Community Telephone Plan

In 1957 Tony was fortunate to get a Commonwealth Government scholarship for overseas studies in Network Planning, and used this to complete a postgraduate diploma in

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probability and statistics, applied to telecommunications, at Imperial College London. His thesis supervisor was the renowned telecommunications expert Professor Colin Cherry.

On returning to Melbourne in 1959 he was promoted to the PMG's Headquarters Planning Branch, in time to work on the celebrated 1960 Australian Community Telephone Plan, which underpinned the introduction of totally integrated automatic subscriber trunk dialling (STD) across Australia, and the introduction of STD area codes based upon rational planning principles. Ann Moyal, in her magisterial history of Australian telecommunications (Moyal, 1984), refers to "the 'young Turks', E.R.Banks and I.A. Newstead," who contributed to the national network planning at that time (Moyal, 1984, p.224).

The 1960 Australian Community Telephone Plan was well received and adopted by other countries, being a more efficient design than the only other country with a number plan at that stage, the USA. The Australian plan distributed the traffic load on exchanges across classes of density of population and projected demand in the network. Indeed the International Telecommunications Union, the oldest agency of the United Nations, adopted the plan in the 1960s when Tony represented Australia at their international Study Group on Worldwide Subscriber Dialling. By 1967 the General Assembly of the UN adopted the principles of the Australian plan and Tony was elected to Chair that Study Group for the next 3 years. This involved him in much international travel, with four regular meetings per year, held variously in Mexico City, New York, London, Sydney and Mar del Plata (Argentina) as well as at annual four week plenary sessions in Geneva.

Working for the World Bank

The World Bank in Washington DC then made overtures, inviting Tony to come to Washington to discuss the possibility of joining their recently formed Telecommunications Group. They negotiated with the Australian government, and the Post Master General Alan Hulme agreed to Tony's secondment to work at the Bank. The job entailed appraisal of loans being requested by third world governments to build telecommunications infrastructure and involved travel to the countries he was assigned to, from the largest borrowers India, Iran and Thailand to the smallest including Fiji and Costa Rica.

After the death of Pauline, Tony met the Indonesian engineer Njoman (Soe) Soelaksmi, who worked as an electric engineer at the PMG's Radio Transmission department. Sue was a Colombo Plan Graduate in electrical engineering, the first female to graduate in that discipline from Monash University.

They married in 1970 and decided that they would move to Washington DC to start their own married life together. Mark elected to stay at home and maintain residency in Stanhope St,

http://doi.org/10.18080/ajtde.v5n4.135

as he was starting a much appreciated opportunity to work in commercial radio at station 3AK. Younger brother Steven went with Tony and Soe to Washington DC, where he attended a Junior College in suburban Maryland, living with a local family.

Soe and Tony had their first child, Astini, born in Washington DC. Apart from its being Tony's base for substantial travel on World Bank business, Washington was also their formative family home. Additionally, Tony enjoyed access to many jazz clubs and venues there, and soon found a niche for his talents, as evidenced by the fact that he played on more jazz records released in the US than he ever did in Australia.

The development of the Telecom 2000 report

On his return to Melbourne in 1973, Tony was invited to head up a special task force, the National Telecommunications Planning team, that had as its reference a wider view of the economic and social implications of new technologies. This 18-strong task force included professionals covering the disciplines of telecommunications research and engineering, economics and finance, social psychology, history of science, political science and journalism (Newstead, 2000)[1]. The culmination of their work, report projected to a 25 year time frame, was published in December 1975 as 'Telecom 2000'. (Newstead, 1975)

A major innovation of the Telecom 2000 report was its use of 'open planning': extensive consultation with a wide range of stakeholders across Australia, as well as extensive interchanges with telecommunications planning groups in Belgium, Canada, France, Germany, Holland, Japan, Sweden, Switzerland, the UK and the USA. The NTP team commissioned a large number of studies by external expert consultants across Australia, as well as many studies within the PMG. In addition to making projections on the growth of a range of current and future telecommunications services up until the year 2000, it devoted a whole chapter to 'Open Planning', and an even braver chapter on 'The Future Role of the Telecommunications Authority'.

Many in the Australian telecommunications industry and in academia regard this report as being the crowning achievement of his work. It used new multi-disciplinary approaches to arrive at its recommendations. It was widely and well received and was used for a long time as a teaching and reference tool in many countries and academic courses. However, while open planning was warmly endorsed by the Whitlam Government (1972-75), it ceased to receive support from the senior bureaucracy under the subsequent Fraser Government (1975-83).

In year 2000, Tony was persuaded to write an article for the Telecommunications Journal of Australia providing an overview of Telecom 2000, and reviewing the extent of its success in

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predicting the take-up of a range of telecommunications services 25 years into the future.

We reproduce below the famous Table 1 – Forecast Growth of Telecommunications Services from that paper (Newstead, 2000), in which the quantitative estimates in December 1975 for seven classes of services are compared with the estimates for June 2000, based on the Australian Bureau of Statistics most recent data (1998-99). What is striking is how close the estimates were in four of the seven classes of the services: telephony, facsimile, Data/Internet and Cable TV. The poor predictions were for mobile services (which barely existed in 1975); for telex, which was rendered obsolete by digital data services, email and text messages (SMS) in the 1990s; and for the videophone, much promoted by Bell Labs in the 1970s but which never came to fruition in its own right, having become subsumed by ISDN-based videoconferencing in the 1990s (and later, after 2007, by the invention of the iPhone and other smart phones, using broadband mobile connections).

Table 1 – Forecast Growth of Telecommunications Services

Network Service	1975 level	2000 Forecast Lower Bound	2000 Forecast Upper Bound	Actual Services at June 2000*
Telephone	3.7 million	8 million	10.8 million	10.2 million
Mobile Telephone	7,000	80,000	800,000	7.5 million
Facsimile	In-house only	600,000	1.3 million	1.2 million
Telex	16,000	50,000	300,000	<5,000
Data/Internet	In-house only	500,000	3 million	4.8 million
Videophone	Nil	9,000	200,000	Nil
Cable TV	Nil	260,000	1.1 million	1.2 million

*Estimates based on 1998-99 statistics of the Australian Bureau of Statistics and Australian Communications Commission.

Career moves: Hong Kong and then Monash University

On 1 July 1975, a few months before publication of the Telecom 2000 report, the telecommunications functions and staff of the PMG were spun off as Telecom Australia, an arms-length government-owned business enterprise, undergoing a major re-organisation. Because of the Telecom 2000 report's call for open planning, there was some internal political unease at this recommendation and it was widely believed at the time amongst Tony's colleagues that this counted against Tony for selection to the top planning job at Telecom, for which he was an obvious contender.

Coincidentally, he received intelligence that the wholly private Hong Kong Telephone Company was quietly searching for a new Chief Engineer. Tony and Soe were invited to Hong Kong for discussions and just a month later they returned there, to start a new chapter in their life. He served two 3-year terms, whilst still on secondment from Telecom Australia.

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Back in Australia in 1984 he decided he could set up a consultancy which addressed a suite of opportunities that had more clearly emerged since the Telecom 2000 report. To start with, the HK Telephone Company had asked him to do two months' work each year for them, and the World Bank was looking for outside help. In addition he soon garnered work from the Victorian and NSW State governments, and later in the 1990s he was invited to head up the Victorian Government-owned new telecommunications company, VISTEL.

Always mindful of the social implications of the technology changes, he joined with Professors Alan Fels and Henry Ergas at a new research unit MONICT (Monash Information and Communications Technology) at Monash University in Melbourne. By 1990, MONICT lost its primary sponsor Telstra, so Tony continued on a part-time basis at Monash as the sole telecommunications advisor in the Business Faculty. He developed two elective units in their MBA programme, which up until then had little content that addressed the coming information society.

Retirement from telecommunications

In 1999, at age 76, he finally retired from active professional work and enjoyed a further 18 years of retirement, with tennis, jazz and life with five grandchildren (Laura, Alister, Ryland, Oscar and Millie) and their parents. He and Soe used to escape the more acutely felt cold of Melbourne's winter at Soe's family compound at Bali's Sanur Beach.

He also enjoyed reliving his early childhood visits to Sorrento beach, where he and Soe established a holiday house that was shared generously with guests. However, he could never fully give up his routine of Saturday morning overalls and house maintenance chores, accompanied by jazz on the radio.

The telecommunications industry can celebrate Tony Newstead's full life, richly enjoyed and generously shared with so many.

Other sources

Those interested in Tony's parallel jazz career and in the history of trad jazz in Australia can check out the second list of references provided below.

In addition, Dr Clemens Pratt has kindly contributed his own short memoir on Tony's valuable role as a colleague and mentor to him, which we have published in full as Attachment A to this paper.

John Burke provides the valuable perspective of an external collaborator of Tony in producing the Telecom 200 report, in Attachment B.

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Attachment A: Memories of Tony Newstead by Clemens Pratt

At the time of my going to London in 1961 to undertake PhD studies, Tony had recently returned from London where he had undertaken a diploma course at Imperial College under Professor of Telecommunications Colin Cherry.

He had attended the second International Teletraffic Congress (ITC) in The Hague in 1958, and with the third ITC in prospect in Paris in September 1961, he asked me to present a paper there on his behalf. That fitted in with my travel plans: Sitmar Line ship ***Fairsky*** from Brisbane to Naples, train to Paris, and after the Congress, train and Channel ferry across to England for the beginning of the academic year in October 1961. This helped to establish Tony's standing in the ITC, and he was subsequently invited to join the ITC's governing body, the International Advisory Council as Australia's representative.

[Returning to Melbourne from London in late 1963, I was assigned to Internal Plant Planning in the Victorian administration, where I spent two years planning telephone exchange extensions for the south eastern part of Melbourne.]

When I moved from Victorian Metropolitan Planning Section to Headquarters Traffic Engineering Section (headed by Norm Smith) in 1966, Tony was Norm's boss as ADG Fundamental Planning reporting to SADG Planning Ron Turnbull. Tony and Norm supported me in specifying data recorders for use by State administrations in their regular traffic measurement programmes, on which network planning depended. Also Tony particularly sponsored my development of the first two-week residential course on a technical subject within the PMG, ie. traffic engineering.

During these years Tony represented Australia at CCITT meetings at various locations around the world (it was only later that all such meetings had to be held in Geneva for reasons of economy), and there is a story of Tony attending such a meeting in New York. As part of the social program, delegates took a boat trip around Manhattan Island, with a jazz band on board for entertainment. Tony, who had his trumpet with him, offered to play along with the band. The MC made a patronising condescending announcement about this player from down under; however the attitude changed markedly once he started to play. Tony was a superb jazz trumpeter who frequented the jazz venues in Greenwich Village, where he was well known and accepted whenever he visited.

I recall going to a pub near the Richmond station to hear Tony play – he was very good; his trumpet was placed on his coffin at his funeral.

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With Tony's move to the World Bank in 1970, he relinquished his position as Australia's representative on the International Advisory Council of the ITCs, and advocated for me to replace him, a role I held for 35 years.

Tony was also instrumental in initiating my regular attendances at the Traffic Engineering Working Party of the CCITT in Geneva between 1970 and 1975.

I have much to thank Tony for, and have great admiration for his abilities and achievements.

Clemens Pratt, 5 December 2017

Attachment B: John Burke's recollections

While clearly an expert telecommunications engineer, and maintaining a necessary commercial focus, Tony had a strong interest in how telecommunications could benefit individuals and society. The Telecom 2000 project demonstrated this with its emphasis on open planning, pursued in practice through a range of seminars and other contributions. Tony welcomed conceptual challenges from the community organisation, Malvern Learning Exchange, with which I was then involved, inviting continued participation. I well remember, when we were putting together an outline of the Telecom 2000 project in our monthly newspaper in late 1974, Tony accepting an invitation to review the copy and joining us on a Sunday afternoon in a back room in Malvern. Years later, after his corporate career, Tony maintained this interest, seeking to understand the necessary characteristics of telecommunication service innovations to be successful, concluding they had to be: useful, easy-to-use, cost-effective, socially acceptable and psychologically acceptable – a simple but stimulating structure. Tony documented his research in a report to Telecom Business Planning in the early 1990s, which was subsequently published by CIRCIT (Centre for International Research on Communication and Information Technologies). Tony became a research associate of CIRCIT and a strong supporter of its activities.

John Burke was Group Manager, Business Planning, Corporate Strategy in Telecom/AOTC/Telstra in the early 1990s, and later Director of CIRCIT.

Endnotes

[1] Amongst the junior members of this multidisciplinary team were Dr Terry Cutler, later to become Head of Corporate Strategy for Telstra in the late 1980s and subsequently founding principal of the consulting company Cutler & Co; and Dr Judith Brett, now an Emeritus Professor of Political Science at La Trobe University, and the writer of political biographies of Australian Prime Ministers Alfred Deakin, Robert Menzies and John Howard.

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An Introduction to Telecommunications Policy in Canada

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Abstract: This paper provides an introduction to telecommunications policy in Canada, outlining the regulatory and legislative environment governing the provision of telecommunications services in the country and describing basic characteristics of its retail telecommunications services market. It was written in 2017 as one in a series of papers describing international telecommunications policies and markets published in the *Australian Journal of Telecommunications and the Digital Economy* in 2016 and 2017. Drawing primarily from regulatory and policy documents, the discussion focuses on broad trends, central policy objectives and major players involved in building and operating Canada's telecommunications infrastructure. The paper is descriptive rather than evaluative, and does not offer an exhaustive discussion of all telecommunications policy issues, markets and providers in Canada.

Keywords: Policy; Telecommunications; Canada

Introduction

In 2017, Canada's population was estimated to be above 36.5 million people (Statistics Canada, 2017). Although Canada has a large land mass and low population density, more than 80% of Canadians[i] live in urban areas, the majority in close proximity to the border with the United States (Central Intelligence Agency, 2017). Telecommunications services are easily accessible for most, but not all, Canadians. Those in lower-income brackets and/or living in rural and remote areas are less likely to subscribe to telecommunications services than people in urban areas or with higher incomes, and high-quality mobile and Internet services are simply not available in some parts of the country (CRTC, 2017a). On average, Canadian households spend more than $200 (CAD)[ii] per month to access mobile phone, Internet, television and landline phone services (2015 data, cited in CRTC, 2017a).

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Legislation governing the provision of telecommunications services in Canada

The provision of telecommunications services in Canada is governed by the Telecommunications Act/Loi sur les télécommunications (Canada, 1993). (Laws, regulations and policy documents are published in both of Canada's official languages.) Spectrum licensing and regulation of radio apparatus for telecommunications services are governed by the Radiocommunication Act/Loi sur la radiocommunication (Canada, 1985b).[iii] The Telecommunications Act defines various duties for the Canadian Radio-television and Telecommunications Commission (CRTC, which has been Canada's telecommunications regulator since 1976), notes the powers of the Minister of Industry[iv] and the Governor in Council[v] in matters of telecommunications policy, and establishes requirements for operating telecommunications services in Canada and internationally. "Eligibility to operate" rules require that telecommunications carriers operating in Canada be Canadian-owned and controlled. Since 2012, new entrants (companies generating telecommunications revenues in Canada that are less than 10% of Canada's total telecommunications revenues) are exempt from these Canadian ownership and control requirements (Canada, 2012a). In the 2017 budget (Canada, 2017) the Government of Canada announced that it intends to "review and modernize" the Telecommunications Act and the Broadcasting Act, with details of the review to be announced at a later date.

Telecommunications policy objectives

The Telecommunications Act affirms that telecommunications "performs an essential role in the maintenance of Canada's identity and sovereignty," and can "safeguard, enrich and strengthen the social and economic fabric of Canada and its regions" (Canada, 1993, 7 (a)). Among other objectives, the Telecommunications Act calls for telecommunications policy in Canada to "render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada" and to encourage increased reliance on market forces (i.e. competition) rather than on regulation to deliver telecommunications services (see Section 7 of the Act for the complete list of objectives). The Telecommunications Act states that where regulation is required it is to be "efficient and effective." Given the policy objective of relying upon market forces in the provision of telecommunications services, the provision of retail telecommunications services is not regulated across most of the country. Regulation does apply to retail Internet services provided in parts of Canada's north (CRTC, 2015c).

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Government departments involved in telecommunications policy

From 1969 to 1993[vi] the federal Department of Communications was responsible for developing broadcasting and telecommunications policy, industry regulation, and advancing the availability of broadcasting and telecommunications services across the country (Telecommunications Policy Review Panel, 2006). In 1993 the Department of Canadian Heritage assumed responsibility for broadcasting and cultural policy (Canada, 1995) and it is through the Minister of Heritage that the CRTC reports to the federal Parliament (CRTC, 2017c). At the same time, the Department of Industry (now Innovation, Science and Economic Development or ISED) assumed responsibility for telecommunications policy, including spectrum regulation and licensing. When the current ISED Minister was appointed in 2015, the Prime Minister indicated that one of the Minister's top priorities was to "Increase high-speed broadband coverage and work to support competition, choice and availability of services, and foster a strong investment environment for telecommunications services to keep Canada at the leading edge of the digital economy" (Office of the Prime Minister, 2015). Actions by the Minister, other levels of government, or by the regulator are called for when the market (as created by the telecommunications services providers discussed below) fails to deliver reliable, affordable, high-quality telecommunications services.

Canada's telecommunications regulator

Canada's telecommunications (and broadcasting) system is regulated by the Canadian Radio-television and Telecommunications Commission. The CRTC is an administrative tribunal with a mandate to serve the public interest, operating according to the terms of the CRTC Act/Loi sur le conseil de la radiodiffusion et des télécommunications canadiennes (Canada, 1985a), the Bell Canada Act/Loi sur Bell Canada (Canada, 1987), the Broadcasting Act/Loi sur la radiodiffusion (Canada, 1991) and the Telecommunications Act (Canada, 1993). It functions at arm's length from the federal government to "develop, implement and enforce regulatory policies on the Canadian communications system" (CRTC, 2017c, p. 1), with a mission of ensuring Canadians have access to a "world-class" communication system.

The CRTC outlines its anticipated priorities and provides advanced notice of proposed public consultations in a rolling three-year plan, updated annually (CRTC, 2017c).[vii] It publishes an annual report on the communications market, providing a comprehensive overview of telecommunications services pricing and availability across the country and describing the competitive landscape (CRTC, 2017a).

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The CRTC consults with stakeholders and gathers evidence to inform its policy decisions, guided by formal rules of practice and procedure (Canada, 2015). In recent years, the CRTC has expanded the ways in which Canadians can interact with the Commission in response to its notices of consultation. In addition to soliciting written submissions, the CRTC has collected opinions through online channels, accepted submissions in sign language, and enabled participation in public hearings through video-conferencing (Blais, 2016). For each policy proceeding, the Commission deliberates over the evidence on the record and in due course publishes a decision (in both official languages). The consultation process can generate enormous volumes of evidence from a wide variety of stakeholders including telecommunications services providers, public interest advocacy groups, academics, individual citizens and others (e.g. see Rajabiun & Middleton, 2015, for a discussion of the interveners in a consultation examining wholesale access to telecom services). For complex matters, the entire process can take many months to reach a conclusion (for instance, a consultation on Basic Telecommunications Services was initiated in April 2015 and the resulting policy decision was announced in December 2016, see CRTC, 2015d).

Policies are also developed in response to applications requesting consideration of issues not covered in a notice of consultation. "Part 1" applications can be filed by anyone and are open to public comment and applicant response. Decisions (including decisions to take no action) are based on these written submissions (CRTC, 2015b). Additionally, the CRTC must respond to orders from the Governor in Council (Forsey, 2006) regarding telecommunications policy objectives (Canada, 1993, 8). Policy decisions can be reviewed, varied or rescinded by the CRTC as outlined in the Telecommunications Act (Canada, 1993, 62) or challenged in court. The Governor in Council, acting in response to a petition (Mackwood, 2016), or on the advice of the federal cabinet (e.g. Privy Council, 2017), may also vary or overturn decisions, or return them to the CRTC for reconsideration (Canada, 1993, 12 (1)).

The competition regulator

Canada's Competition Bureau[viii] administers the Competition Act, the federal law governing most business activities in Canada. A recommendation from the 2006 Telecommunications Policy Review Panel (Telecommunications Policy Review Panel, 2006) to establish a Telecommunications Competition Tribunal to facilitate the application of competition law to the telecommunications sector has not been implemented. Agreements between the CRTC and the Competition Bureau (Competition Bureau, 2001; CRTC & Competition Bureau, 2013) outline the jurisdiction of each agency, acknowledge that each agency has an

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important role to play in Canada's telecommunications and broadcasting industries, and commit the agencies to cooperate with each other wherever possible.

The Competition Bureau investigates complaints and has the power to impose penalties regarding competitive practices of companies in the telecommunications sector (e.g. Competition Bureau, 2015b; Competition Bureau, 2015c, 2016a). It also has the authority to review mergers and acquisitions (Competition Bureau, 2011, 2015a). Telecommunications industry transactions involving foreign companies are also subject to review by the CRTC to ensure compliance with Canadian ownership regulations as set out in the Telecommunications Act. In recent years, the Competition Bureau has invoked its role as "an advocate for the benefits of competition" (Competition Bureau, 2013) to intervene in CRTC consultations on fixed and mobile wholesale markets (Competition Bureau, 2014a, 2014b), the development of the Wireless Code of Conduct (Competition Bureau, 2013), and differential pricing of Internet services (Competition Bureau, 2016b).

The evolution of telecommunications markets in Canada

Babe (1990) and Winseck (1998) offer comprehensive descriptions of the development and evolution of telephone services in Canada. As they note, from the very early days of telephony, there were multiple telephone companies operating in Canada. Over time, the ownership of various telephone companies shifted back and forth between provincial governments and the private sector, with different ownership patterns in different regions. By the early 1990s however, government ownership was on the decline and Canada was moving towards a liberalised telecommunications market, in which competition was to play a more central role.

A 1989 Supreme Court decision had determined that Canada's major telephone companies would be subject to federal regulation (prior to this decision some companies were regulated provincially), facilitating the development of the federal 1993 Telecommunications Act (Janisch, 1993). The Act provided the CRTC the power to forbear from regulation. The CRTC's 1994 regulatory framework review outlined criteria to be used in determining which markets were deemed to be sufficiently competitive and eligible for regulatory forbearance (CRTC, 1994). Competition was introduced to the long distance telephone market in 1992 (CRTC, 1992) and local telecommunications markets in 1997 (CRTC, 1997b), setting the stage for a converged environment in which telephone companies would enter the television market and vice versa (CRTC, 1995). Mobile phone services were launched in the mid-1980s, with spectrum licences granted to regional telephone companies and to a competing company called Cantel (partially owned by cable operator Rogers Communications). Two additional national competitors entered the mobile market in 1995 when awarded licences to

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operate PCS networks (Industry Canada, 2010).

In the late 1990s Canada's telephone and cable companies were among the first in the world to roll out DSL and cable broadband Internet services (Lie, 2003), establishing the practice of facilities-based competition that continues to this day. The CRTC also requires facilities-based operators to provide wholesale access to their networks to allow market entrants to offer competitive services, and increase provider choice for Canadians (CRTC, 2008b, 2010a, 2015f).

The evolution of Canada's telecommunications markets and regulatory environment was examined in a 2005-2006 review of telecommunication policy. The review panel recommended "significant changes" and offered a number of detailed recommendations to ensure that all Canadians would have access to affordable telecommunications services, to enhance the efficiency of telecommunications markets and to enhance social well-being and inclusiveness. The panel recommended the separation of policy making and regulation, calling for Industry Canada (now ISED) to transfer its regulatory responsibilities (e.g. spectrum regulation) to the CRTC, but this has not happened. The panel also recommended strengthening the policy making capacity of Industry Canada, and encouraged the government to be more proactive in setting policy by means of Governor in Council orders (Telecommunications Policy Review Panel, 2006). In response to the panel's recommendations, in 2006 the federal government issued a policy directive requiring the CRTC to rely on market forces "to the maximum extent feasible" when developing telecommunications policy. In instances where regulation is deemed to be necessary it must be "efficient and proportionate" (Privy Council, 2006). The CRTC developed several action plans to review its regulatory measures following this directive (CRTC, 2007b, 2008c, 2010b).

While the guiding principle for achieving Canada's telecommunications policy objectives is to encourage competitors to provide the affordable, high quality communications services Canadians need, the CRTC does intervene when it determines that market forces alone are insufficient to achieve policy objectives. In recent years, regulation has addressed issues like defining basic telecommunications services (CRTC, 2016e), developing competitive wholesale markets for the provision of fixed and mobile telecommunications services (CRTC, 2015e, 2015f, 2017e), developing a policy framework for network neutrality (CRTC, 2017g), and advancing awareness of consumer rights (CRTC, 2013b, 2017h).

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Telecommunications service providers in Canada

Fixed line services

In Canada, fixed line telecommunications infrastructure for telephone and Internet services is owned by different providers in different parts of the country. Each geographic market is served by a monopoly telephone network operator (telco) and a monopoly cable network operator (cableco), with no single telco or cableco offering service across the entire country. While these technology-centric descriptors are becoming obsolete as both cablecos and telcos upgrade their legacy networks to extend the reach of fibre-optical infrastructure, they do help to explain the evolution of the market. Telcos operated copper telephone networks and continue to deliver services using this infrastructure. Cablecos operated cable television networks and were the primary distributors of television services. They entered the telecommunications market in the 1990s,[ix] offering broadband Internet services over their hybrid-fibre coaxial (HFC) cable infrastructure. Cablecos also offer telephone services in competition with the telcos.[x] Telcos now compete with cablecos to provide television service, with telcos delivering television via Internet protocol (IPTV) or satellite. Additional competition in provision of television services comes from online content providers (CRTC, 2017b). In regulatory documents, the CRTC calls former telco monopolies "incumbent providers" and former cable monopolies "cable-based carriers" (CRTC, 2017a, Appendix 8) and this terminology is used here.

In 2017 the incumbent provider in the provinces of British Columbia and Alberta (western Canada) is TELUS. In Saskatchewan, the incumbent provider is SaskTel, which is the sole Crown corporation (i.e. government-owned company) remaining among Canada's large incumbent providers.[xi] Manitoba's incumbent provider, Manitoba Telecom Services (MTS), was acquired by Bell in 2017 and now operates as Bell MTS (BCE, 2017). Bell is the incumbent in Ontario. Bell and its subsidiary Télébec are the incumbent providers in Québec (with Télébec offering services to smaller communities). Bell is also the incumbent in Atlantic Canada, where it operates as Bell Aliant. Bell subsidiary Northwestel is the incumbent in Canada's North. There are a few small incumbent providers serving small geographic areas scattered across the country, including municipally-owned or co-operative providers, but the vast majority of Canadians are served by the large incumbent providers.

Canada's dominant cable-based carriers are Shaw (serving British Columbia, Alberta, Saskatchewan and Manitoba), Rogers and Cogeco (serving Ontario but not in competition with each other), Vidéotron (owned by Québecor and serving Québec) and Eastlink (owned by Bragg Communications and serving Atlantic Canada). The cable-based carriers' operating

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territories are not as neatly divided as those of the incumbent providers (e.g. Eastlink and Shaw serve some communities in Ontario, and Cogeco offers service in parts of Québec) but cable-based carriers do not compete with each other.

Most Canadian households can choose to purchase their fixed line telecommunications services from an incumbent provider or a cable-based carrier (CRTC, 2017a, p. 278). These companies compete directly with each other within their operating territories (e.g. Bell competes with Rogers in Ontario; TELUS competes with Shaw in Alberta). The incumbent providers and cable-based carriers collectively dominate the market, with the largest five incumbent providers earning 59% of retail telecommunications revenues in 2016, and the five largest cable-based carriers earning a further 35% (CRTC, 2017a, p. 222).[xii] While some consumers buy services from both the incumbent provider and the cable-based carrier (e.g. demonstrating a preference for the reliability of a copper telephone line, but wanting the speed of cable Internet), the majority of Canadians choose to purchase their telecom services in bundles from a single provider (getting at least two of landline, internet and television services from either the cableco or the telco, CRTC, 2017a, p. 45).

With mandated wholesale network access (CRTC, 2015f) providers who do not own their own facilities are able to offer retail services over existing copper, cable and fibre networks. In 2016 almost 50% of wholesale broadband Internet connections used cable-based carriers' networks (CRTC, 2017a, p. 345), reflecting a different market dynamic than in most other countries where wholesale access to cable networks is not mandated (Hou, Valcke, & Stevens, 2013).

While some rural households have access to fibre to the home (typically provided by small local providers),[xiii] about a third of rural households in Canada have no access to any type of fixed line broadband Internet service and are served by fixed wireless providers (CRTC, 2017a, p. 281). Some fixed wireless providers hold licences to deliver services over unused television broadcasting spectrum, operating what are known as Remote Rural Broadband Systems (RRBS). Although RRBS operators offer high quality affordable service, they cannot operate within 121 kilometres of the US border or close to major urban centres (thereby excluding much of the Canadian population from their potential customer base). There is a moratorium on new RRBS licences while decisions are pending as to the repurposing of the 600 MHz spectrum band (Industry Canada, 2015), and the number of operators and customers is in decline (Taylor, 2017).

A company called Xplornet offers Internet and telephone services by fixed wireless and direct-to-home satellite and advertises that it can provide service "everywhere in Canada" (Xplornet, 2017). Satellite services are also available through a community aggregator model,

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in which a satellite connection is made to an earth station in a community and services are delivered using a local distribution network. In some communities a local provider offers satellite services, others are served by companies like Bell Aliant or NorthwestTel (CRTC, 2014). Local providers can offer services specifically tailored to the needs of community members. For instance, K-Net, a First Nations owned and operated company, offers mobile phone services and online community applications (video-conferencing, tele-medicine) using satellite connectivity (Beaton, Burnard, Linden, & O'Donnell, 2015). About 1.5% of Canadian households get Internet service through a satellite provider (CRTC, 2017a, p. 281).

Availability of gigabit networks

Gigabit networks offer broadband Internet services at download speeds of at least one gigabit per second (Gbps, 1 Gbps is equal to 1000 Mbps). These speeds can be offered over fibre-optical networks or upgraded cable networks. Enabling access to gigabit connectivity is a policy objective in some countries and regions, as a means of ensuring the full economic and social benefits of digital society can be realised (European Commission, 2016; Government Offices of Sweden, 2016; iN2015 Steering Committee, 2006; Ministry of Business Innovation & Employment & Crown Fibre Holdings, 2017). There is no policy explicitly calling for gigabit connectivity to be made available to Canadians. The 2016 universal service decision (CRTC, 2016e, discussed below) calls for broadband Internet services offering download speeds of 50 Mbps and upload speeds of 10 Mbps to be available to all. While noting that networks that can provide these speeds are "generally scalable" to gigabit speeds, the CRTC does not mandate provision of gigabit speeds as a basic service. As of 2016 however, 83% of Canadian households could access broadband networks offering 100 Mbps or higher Internet speeds, although fewer than 20% of Internet users chose to subscribe to services at these speeds (CRTC, 2017a, p. 282 and p. 271).

The large incumbent providers are rolling out fibre across their networks (as detailed in their annual reports, e.g. BCE Inc., 2016; TELUS, 2016), allowing them to compete with the cable-based carriers offering gigabit services using DOCSIS 3.1 technology (e.g. Rogers Communications Inc., 2017). As a result, many Canadian households will eventually have access to two gigabit networks, and will have additional choice in service providers once wholesale access to these networks is available. The CRTC mandated wholesale access to fibre networks in 2015, using a phased implementation approach (CRTC, 2015f). At the time of writing, interim access provisions are in place in Ontario and Québec (CRTC, 2017f) but no service providers are offering gigabit speeds using wholesale access to cable or fibre networks as yet.

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A small number of Canadian households now have access to gigabit-capable broadband Internet from a provider other than an incumbent provider or cable-based carrier. For instance, residents of Olds, Alberta, have access to a fibre network, O-Net, that is owned by the community. Residents in some condominiums in Vancouver and Toronto can get fibre from new entrants (e.g. Beanfield in Toronto and Urbanfibre in Vancouver), and some utility companies are building fibre to the home networks (e.g. Lakeland Networks in the Muskoka region in Ontario). Some Canadians who live in parts of the country where competition between incumbents and cable-based carriers is unlikely to deliver gigabit service may get access to gigabit speeds through projects developed within their communities and funded through the Government of Canada's Connect to Innovate program (Innovation, Science and Economic Development Canada, 2017a; Matawa First Nations, 2017) or the CRTC's broadband funding regime (CRTC, 2016b, described below). Gigabit connectivity will also be enabled by projects like the SWIFT network (http://swiftnetwork.ca), which is extending a fibre backbone network into Southwestern Ontario, through a partnership funded by the federal, provincial and municipal levels of government.

Wireless services

The market for wireless services (mobile voice, SMS and data products, i.e. mobile Internet) in Canada is dominated by the "Big Three" mobile network operators (Bell, Rogers and TELUS).[xiv] Mobile network operator Freedom (formerly WIND Mobile) was purchased by Shaw Communications in 2016 and offers wireless services in major cities in British Columbia, Alberta and Ontario. SaskTel competes with the Big Three in Saskatchewan as does Vidéotron in Québec. The recent Bell MTS merger in Manitoba removed MTS as a competitor to the Big Three but as a condition of the merger a new entrant to the wireless market, rural broadband Internet provider Xplornet, is to begin offering wireless services in the province by 2018 (Competition Tribunal, 2017). Eastlink offers wireless services in Atlantic Canada.

4G LTE coverage is available to 98.5% of the population, with LTE-Advanced available to 83% (CRTC, 2017a, p. 328). There are however vast regions of the country with very low population densities and minimal network coverage. Nevertheless, most Canadians do have a choice of four mobile network operators, and have an additional choice as to whether to subscribe to an MNO's primary brand (e.g. Bell, Rogers, TELUS) or to subscribe to a "flanker" brand (e.g. Virgin, Fido or Koodo). Flanker brands offer service using the primary brand's network infrastructure with different marketing and lower pricing (CRTC, 2017a, p. 58). Wireless services are also offered by other resellers, but wholesale access to mobile

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networks is not mandated (CRTC, 2015e). There are very few mobile virtual network operators (MVNOs) in the Canadian consumer market (CRTC, 2016a).

In 2012, the CRTC declared that the market for wireless telecommunications services was competitive and did not require regulation, but decided that consumers would benefit from a better understanding of service contracts (CRTC, 2012). After a public consultation, the CRTC implemented the Wireless Code of Conduct in 2013. The Code is intended to bring greater clarity to consumers as they negotiate their service contracts, and to encourage a more dynamic market (CRTC, 2013b). A 2017 update to the Code requires that new wireless devices provided by mobile network operators in Canada be unlocked (meaning that such devices can be used on any mobile operator's network) and that customers' devices locked prior to the Code update be unlocked free of charge upon request (CRTC, 2017h). The Code is administered by the Commissioner for Complaints for Telecommunications-Television Services (CCTS), as discussed below.

Canada's universal service obligation

Telecom Regulatory Policy CRTC 2016-496 (CRTC, 2016e) establishes the universal service objective that "Canadians, in urban areas as well as in rural and remote areas, have access to voice services and broadband Internet access services, on both fixed and mobile wireless networks." The policy indicates that the "broadband portion" of the universal service objective will be achieved when fixed broadband Internet services offering minimum 50 Mbps (download) and 10 Mbps (upload) speeds and including an option for unlimited data are available to all Canadian premises, and when "the latest generally deployed mobile wireless technology" is available to premises and as many major roads and highways as possible. The CRTC expects fixed broadband services meeting these criteria will be available to 90% of premises by 2021, and to the remainder of premises "within 10 to 15 years," and as part of the implementation process for this policy, the CRTC will establish metrics and methods to assess network quality of service.

The policy also calls for the focus of regulatory action to become broadband-centric rather than voice-centric. The CRTC will phase out subsidies[xv] for providing access to voice services (although it retains the obligation for incumbent providers to provide voice service) and establish a new broadband funding mechanism with mandatory contributions from telecommunications services providers. To access this funding, applicants must invest in the project themselves and have funding from a government entity. The fund will allocate no more than $750 million in its first five years, with up to 10% reserved to meet the needs of satellite-dependent communities (CRTC, 2016b). The CRTC decision explicitly notes that this new funding mechanism is a complement to investments by the private sector and

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governments, and observes that "The widespread availability and adoption of broadband Internet access services are issues that cannot be solved by the Commission alone." At the time of writing a consultation was underway to determine how this fund will operate (CRTC, 2017d). While the decision addressed funding to extend broadband networks, it does not offer any direct mechanisms to address the affordability of retail telecommunications services.

The policy establishing the new universal service obligation directs mobile network operators to offer service packages that meet the needs of Canadians with disabilities and to publicise these packages on their websites. Canada's major telecommunications service providers must also file a report with the Commission outlining their plans to invest in improving the accessibility of telecommunications services. Additionally, providers offering fixed broadband Internet access must ensure that their service contracts are written in plain language, offer information on how much data is used by common online activities and provide tools for data consumption monitoring. These actions are designed to ensure inclusive access to communication systems, and align with similar requirements for mobile broadband Internet providers established in the Wireless Code.

The state of competition in Canada's telecommunications markets

In various decisions, the CRTC has ruled that retail markets for telecommunications services in Canada are competitive, and it forbears from regulating them. There are however concerns, expressed by government ministers (Bains, 2017a; Joly & Bains, 2017), the head of Canada's Competition Bureau (Pecman, 2017), citizens and public interest advocacy groups (see for example the records of the CRTC consultations on Basic telecommunications services[xvi] and the Review of the Wireless Code of Conduct[xvii]), and a former CRTC chair (Blais, 2017), that Canadian consumers have not seen the full benefits expected to result from competition, for instance the development of innovative products and lowering of prices.

In the fixed line Internet market, incumbent providers (the operators of the copper telephone network) told the CRTC that they would reduce or delay investment in fibre networks if they were required to provide wholesale access to these networks (see the record of the 2013-2014 Review of wholesale services[xviii] and Bell's petition to the Governor in Council (Bell Canada, 2015) requesting that the CRTC's decision to impose access requirements be overturned). The decision to mandate access was not overturned (Bains, 2016) and incumbents are now increasing investment in fibre to the home connectivity.

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While access to fibre networks was not mandated until 2015 (CRTC, 2015f), a wholesale regime has been in place for decades to "facilitate competition in retail markets to provide Canadians with increased choice" (CRTC, 2013a). As of 2016, 13% of fixed Internet subscribers got service from providers other than incumbent telcos or cable-based carriers (CRTC, 2017a, p. 258). These alternative providers (resellers) generally offer more affordable services (Nordicity, 2017).

In the wireless market, successive federal governments have tried to increase competition to Canada's Big Three carriers (Klass, 2015, discusses these efforts). Set-asides were used to allow new entrants to purchase spectrum in a 2008 auction (Industry Canada, 2007), the market was opened to foreign investors in 2012 (Canada, 2012b) and spectrum caps were applied to the 2014 700 MHz and 2500 MHz spectrum auctions (Industry Canada, 2012). While spectrum set-asides did facilitate market entry, the three new entrants not affiliated with existing telecommunications providers (Mobilicity, Public Mobile and WIND Mobile) struggled to establish themselves as strong competitors after purchasing spectrum in 2008. By 2015, Mobilicity and Public Mobile had been acquired by Big Three carriers and only WIND remained as an independent competitor, operating in three provinces (Alberta, British Columbia and Ontario). With cable-based carriers Eastlink and Vidéotron offering wireless services in their home territories (Atlantic Canada and Québec respectively) and provincial incumbent carriers SaskTel and MTS also operating wireless services, most Canadians had a choice of four carriers, which was the federal government's desired outcome. Nevertheless, the Big Three's market share remained at 89% in 2016 (CRTC, 2017a, p. 301), down just 5% from 2007 (CRTC, 2008a, p. 227).

In its 2017 investigation of Big Three carrier Bell's proposed merger with Manitoba's incumbent carrier MTS, the Competition Bureau found that "as a result of coordinated behaviour among Bell, TELUS and Rogers, mobile wireless prices in Canada are higher in regions where Bell, TELUS and Rogers do not face competition from a strong regional competitor" (Competition Bureau, 2017). It is difficult to reconcile this conclusion with the government's statement, upon approving the merger (with a condition that a new entrant with no experience providing mobile services would enter the Manitoba market), that the deal would increase choice and bring about more competitive prices in the province (Innovation, Science and Economic Development, 2017b). Elsewhere in the country however, regional competitors Vidéotron, Eastlink and Freedom Mobile (formerly WIND, and now owned by cable-based carrier Shaw) are challenging the Big Three with more competitive pricing, and Freedom Mobile is strengthening its competitiveness by upgrading its LTE-Advanced network.

http://doi.org/10.18080/ajtde.v5n4.129

As indicated by the discussion above and the earlier description of Canada's fixed line and wireless telecommunications markets, Canadians do have some choice of service providers. But Canada's market is strongly vertically and diagonally integrated, and prices for many communications services in Canada are higher than in other G7 countries (Nordicity, 2017). In 2016, 94% of telecommunications revenues (from the sale of voice, data, Internet and wireless services) were generated by the top 5 incumbent providers and the top 5 cable-based carriers. The CRTC observed that "that companies which operated in multiple sectors continue to have clear competitive advantages relative to those who are less integrated" (CRTC, 2017a, p. 222). Vertical integration is "extremely high" in Canada, as compared to other countries and has increased over time, with Canada's dominant telecommunications providers also owning all the private television networks (Canadian Media Concentration Research Project, 2017).

Diagonal integration refers to the ownership of distribution networks. In Canada, the dominant telecommunications providers own the Internet networks, wireless networks and television distribution networks. All mobile network operators are affiliated with a cable-based carrier or incumbent service provider. There are few resellers and large international MVNOs (mobile virtual network operators) common in other countries do not operate in Canada. At the government's request however, the CRTC is currently reconsidering a decision that could allow mobile operators to provide service using a combination of Wi-Fi and roaming access to existing mobile networks (CRTC, 2017e). Citing a similar approach in the US, the government believes enabling a "Wi-Fi first" model would increase choice and affordability (Bains, 2017a). The government is also consulting on the rules for the upcoming 600 MHz spectrum auction, and has proposed a set-aside for regional carriers to ensure that their efforts to obtain more spectrum are not blocked by the Big Three (Innovation, Science and Economic Development Canada, 2017c). In their responses to this consultation, the Big Three make the case that set-asides are ineffective and increase the price of spectrum (Bell Mobility Inc., 2017; Rogers Communications Canada Inc., 2017; TELUS Communications Inc., 2017). The release of millimetre wave spectrum for 5G mobile services provides another opportunity to support increased competition in the wireless market, as noted by ISED in a 2017 consultation paper on this issue (Innovation, Science and Economic Development Canada, 2017d).

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Protecting and Advocating for Consumers

Network Neutrality

Canada's Telecommunications Act states that no Canadian carrier shall "unjustly discriminate or give an undue or unreasonable preference toward any person, including itself, or subject any person to an undue or unreasonable disadvantage" when it is providing a telecommunications service (Canada, 1993, 27 (2)). The CRTC has established network neutrality rules to interpret this provision of the Act and to counter vertical and diagonal integration in the Canada telecommunications market.

The Internet traffic management practices (ITMP) framework (CRTC, 2009) requires Internet service providers to be transparent when applying any traffic management practices. It encourages investment in network capacity as the primary remedy for network congestion issues and favours the use of economic practices (e.g. consumption-based pricing) rather than technical ones (e.g. managing congestion by slowing down certain types of traffic – peer-to-peer file transfers being one example). Where traffic management practices are applied they must address a defined need and be carefully designed to avoid incurring unjust discrimination.

The 2015 mobile television decision (CRTC, 2015a; upheld by the Federal Court of Appeal, 2016) determined that mobile network operators could not exempt their mobile television offerings from data charges. Following additional complaints about differential pricing practices (e.g. "zero-rating" traffic by not counting it against a consumer's data cap, or discounting certain types of data), the Commission determined that these practices generally have a negative impact on competition and their continued application would not benefit consumers (CRTC, 2017g). The evaluation framework for differential pricing practices (on a complaints-based, ex post basis) will rely primarily upon whether data is treated agnostically (noting that zero-rating is "likely" to raise concerns whereas pricing based on time-of-day is not), but will also consider whether an offering is exclusive, whether there is financial compensation involved and whether a practice creates barriers to entry for content providers or reduces innovation. The framework does not apply to services offered on Internet service providers' (ISPs) managed Internet protocol networks (e.g. Internet of Things products used by businesses).

In the CRTC's view, the best approach to achieve Canada's telecommunication policy objectives and to ensure competition in the provision of retail Internet services is for "ISPs [to] compete and differentiate their services based on their networks and the attributes of the services on those networks, such as price, speed, volume, coverage, and the quality of their

http://doi.org/10.18080/ajtde.v5n4.129

networks" (CRTC, 2017g, 46). Following the United States Federal Communications Commission 2017 decision to overturn US network neutrality rules (Federal Communications Commission, 2017), the Canadian government and opposition parties reiterated their support for Canada's network neutrality regime (Bains, 2017b; Singh, 2017; Stone, 2018).

The Commissioner for Complaints for Telecom-Television Services

The 2006 Telecommunications Policy Review Panel recommended the creation of an agency to handle consumer complaints about telecommunications services (Telecommunications Policy Review Panel, 2006, Recommendation 6-3). The Commissioner for Complaints for Telecommunications Services (CCTS)[xix] was established by the telecommunications industry in 2007 as a federal not-for-profit corporation (Commissioner for Complaints for Telecommunications Services, 2016). The CCTS operates as a self-funding independent body, with its mandate and structure subject to approval by the CRTC. All telecommunications services providers are required to participate in the CCTS (as per conditions set out in CRTC, 2016c).

The CCTS investigates and resolves consumer complaints about telecommunications services within its mandate,[xx] through a "fair, impartial and independent review" of issues (Commissioner for Complaints for Telecommunications Services, 2010). Its annual reports offer a detailed review of complaints received in the previous year, noting the most common issues faced by consumers and profiling the performance of service providers in responding to complaints (Commissioner for Complaints for Telecommunications Services, 2017). The CCTS reported that it was able to resolve 91% of complaints received in 2016-17, but research commissioned by the CRTC indicates that most Canadians do not take their complaints to the CCTS because they do not know it exists (TNS Canada, 2016).

The CCTS is responsible for administering the Wireless Code of Conduct, which was created by the CRTC in 2013 to "make it easier for individual and small business consumers to get information about their contracts with wireless service providers and about their associated rights and responsibilities, establish standards for industry behaviour, and contribute to a more dynamic marketplace" (CRTC, 2013b). In 2017, the CCTS also assumed responsibility for dealing with complaints relating to television services, as administrator of the Television Service Provider Code of Conduct (CRTC, 2016d) and is now called the Commission for Complaints for Telecom-Television Services.

http://doi.org/10.18080/ajtde.v5n4.129

Consumer advocacy organizations

There are a number of non-profit organizations in Canada that champion consumer interests in the telecommunications sector. The Public Interest Advocacy Centre (PIAC, http://www.piac.ca) has worked to advance affordable access to high quality telecommunications services since 1976 (Public Interest Advocacy Centre, 2001). PIAC intervenes in regulatory consultations and produces policy briefs and research reports (see for example Bishop & Lau, 2016; De Santis, 2010; Janigan, 2010; Lawford & Lau, 2015) "to ensure that government and the private sector consider the public interest, consumer rights, as well as values like diversity and equal opportunity, when making decisions about public services that are vital to participation in society" (Public Interest Advocacy Centre, 2016). PIAC acted as counsel for a group of consumer interest organizations that formed the "Affordable Access Coalition" to participate in the CRTC's consultation on basic telecommunications services.

The Union des consommateurs (http://uniondesconsommateurs.ca) "represent[s] and defend[s] the rights of consumers, with special emphasis on the interests of low-income households" (Union des consommateurs, 2015a, p. 4). Priority issues for the Union des consommateurs' (UC) research, action and advocacy work include telephone, television and Internet access. The UC participated in CRTC consultations on basic telecommunications services and the development of a Wireless Code of Conduct, and has produced many reports offering recommendations on how to improve the provision of telecommunications services for Canadian consumers (Union des consommateurs, 2013, 2014, 2015a, 2015b). These reports, as well as the reports by PIAC noted above were funded by the Government of Canada's Office of Consumer Affairs Contributions Program, established to enable the production of "high quality, independent and timely research on consumer issues" (Office of Consumer Affairs, 2016, p. 3). Canada's Internet registry authority, CIRA, also funds research and community projects that contribute to a "a stronger, safer and more accessible Internet for all Canadians" through its Community Investment Program (https://cira.ca/community-investment-program).

Numerous other non-profit organizations are working to make telecommunications services more accessible to Canadians, through interventions to the CRTC[xxi] and publication of independent research. These include OpenMedia ("a community-driven organization that works to keep the Internet open, affordable, and surveillance-free", https://openmedia.org/en/how-we-work), Media Access Canada (representing disability organizations and advocating for fully accessible media and communication services, Media Access Canada, 2016, http://www.mediac.ca/), and the First Mile Connectivity Consortium

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(which works to develop evidence-based policies to meet the telecommunications needs of First Nations communities in rural and remote Canada, http://firstmile.ca/fmcc-2). Representatives of "a group or a class of subscribers" interested in the outcome of a consultation can apply for reimbursement of the costs of participating in the consultation. The CRTC assesses cost applications according to the criteria set out in its Rules of Practice and Procedure (Canada, 2015) and determines the share of the award to be paid by each cost respondent (cost respondents are the telecommunications services providers who have actively participated in the consultation and have a significant interest in its outcome).

Summary of Key Policy Approaches

This paper describes the policy environment in which telecommunications services were provided to Canadians in 2017. While this paper does not evaluate policy decisions, the upcoming review of the Telecommunications and Broadcasting Acts will provide an opportunity for assessment of the effectiveness of Canada's telecommunications policy approach, with changes likely to be incorporated into updated legislation. At present, telecommunications policy in Canada is to rely upon market forces to create a competitive environment in which providers will offer reliable, affordable, high quality services. In circumstances where market forces do not deliver these outcomes and regulation is warranted, it must be efficient and effective. The 2016 universal service objective calls for all Canadians to have access to fixed and mobile wireless voice and Internet services, and sets a target for fixed Internet speeds of 50 Mbps (download) and 10 Mbps (upload). It is recognised that ongoing investment is needed from multiple levels of government to ensure that these services are available in rural and remote Canada. A scheme is being established in which telecommunications services providers will be mandated to contribute a portion of their revenues to a fund to extend broadband networks.

The retail markets for fixed and wireless service are generally forborne from regulation. Facilities-based competition dominates, with the majority of consumers having a choice between two fixed line service providers (one being the incumbent provider, or former telephone company, the other being the cable-based carrier). Competition in the fixed line market is regionally based, whereas competition for wireless services is national. Most Canadians have a choice among four mobile network operators with regional mobile network operators now providing some competitive discipline to the Big Three. Despite ongoing efforts to increase competition for wireless services and to reduce prices, the market is still strongly concentrated and further policy action to encourage competition is possible (e.g. there may be a set-aside of spectrum in an upcoming auction for regional competitors).

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Wholesale access to fixed broadband networks is mandated, with cable broadband serving close to half of the wholesale market. Wholesale access to fibre networks was granted in 2015, but access seekers have not yet launched services using fibre. Wholesale access to wireless networks is not mandated, and there are very few mobile virtual network operators (MNVOs) operating in Canada. Foreign control of telecommunications service providers in Canada was not allowed prior to 2012, and there are no international companies operating mobile networks in Canada. A network neutrality framework governs Canada's telecommunications service providers, and the practice of zero-rating certain types of data is generally considered discriminatory and therefore disallowed.

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Canada's telecommunications policy environment is complex, with many regulatory nuances. The information provided in this paper is drawn from the original source documents as referenced throughout, and is offered to provide a high-level overview of the policy environment. Any errors and omissions in interpretation are the responsibility of the author. Original source documents provide definitive guidance on Canada's telecommunications policy regime.

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Endnotes

[i] Note the term "Canadians" is used throughout this paper to refer to people living in Canada regardless of their citizenship.

[ii] At the time of writing the Canadian dollar was trading slightly higher than the Australian dollar, and worth about $0.78 USD. https://www.bankofcanada.ca/rates/exchange/monthly-exchange-rates/

[iii] Official publications regarding spectrum management and telecommunications in Canada are posted online at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01841.html.

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Radiocommunications publications are online at https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01847.html.

[iv] In 2015 the Government of Canada changed the name of Industry Canada to Innovation, Science and Economic Development (ISED) but the Telecommunications Act continues to refer to the Minister of Industry.

[v] Canada's Governor General is the Governor in Council, and acts in this capacity on the advice of federal Cabinet (Parliament of Canada, 2017).

[vi] The political decision to dissolve Canada's Department of Communications was made in 1993 but the legislation to enact the change was not in force until 1996 (Innovation, Science and Economic Development Canada, 2017e).

[vii] See archived plans at http://crtc.gc.ca/eng/publications/

[viii] http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/home

[ix] See CRTC (1995, 1997a) for discussion of changes to the policy environment intended to facilitate competition between facilities-based providers.

[x] For instance, Rogers was the first cable company in North America to offer a broadband service, launching service in 1995 (Rogers, 2016). It launched a telephone service in 2005.

[xi] In 2017, the Saskatchewan government passed a bill allowing it to sell up to 49% of its Crown corporations, and has considered the impact of selling a portion of SaskTel (CBC News, 2017).

[xii] Note that these figures include revenues from wireless services, which now make up more than 50% of retail revenues.

[xiii] For instance there are several such providers in Southwestern Ontario, including Quadro Communications Co-op and Hay Communications.

[xiv] Regarding terminology describing Canada's wireless industry, the CRTC generally refers to the "mobile wireless" market. Mobile network operators are referred to as Wireless Service Providers or WSPs and are also known in the industry as wireless carriers.

[xv] Telecommunications service providers generating more than $10 million in annual revenues contribute a small portion of their revenues to the National Contribution Fund, which subsidises the provision of telephone service in high-cost serving areas (CRTC, 2007a). In 2016, the subsidies totalled $105 million (CRTC, 2017a, p. 231).

[xvi] CRTC Notice of Consultation 2015-134. https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?lang=eng&YA=2015&S=C&PA=t&PT=nc&PST=a&_ga=2.195174244.977489263.1509156492-289795852.1503252536 - 2015-134

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[xvii] CRTC Notice of Consultation 2016-293. https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?lang=eng&YA=2016&S=C&PA=t&PT=nc&PST=a - 2016-293

[xviii] CRTC Notice of Consultation 2013-551. https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?lang=eng&YA=2013&S=C&PA=t&PT=nc&PST=a - 2013-551

[xix] https://www.ccts-cprst.ca/

[xx] http://www.ccts-cprst.ca/about-ccts/mandate/

[xxi] See for example the interventions regarding the CRTC's Review of Basic Telecommunications Services, at https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?lang=eng&YA=2015&S=C&PA=t&PT=nc&PST=a - 2015-134

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The Potential for Immersive Technology combined with Online Dating

How will Immersive Technology change the online dating paradigm?

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Abstract: While online dating has been a method of meeting prospective partners for several years; immersive technologies are relatively new to this type of interaction. The first forays into immersive VR online dating have only just being made in the past year. The degree this type of technology will change the way that we date is potentially quite different from the current way that online dates are conducted. The way the technology works could make virtual dates seem as real as a physical date. Understanding how immersive technology functions gives some new perspectives into the future of online dating and also the impact on the digital economy.

Keywords: Virtual Reality, immersive technology, online dating, dating, digital economy.

Introduction

Online dating is not new, in fact, in 1994 Andrew Conru, a graduate of Stanford University, claims the distinction of starting the first online dating site (Sayej, 2017) aptly named Web Personals. It accrued around 120,000 signups, but the very next year it was overtaken by Match.com, which still exists today and currently has around 75 million profiles (Rainey, 2017). Match.com is but one of a number of what might now be termed traditional online dating sites. Traditional in the sense that they have a well-recognised and common way of working as far as their clients are concerned. Their modus operandi encourages those who are eager to participate in the dating experience, to load up their profile and then find prospective dates from the profiles on offer, quite often also for a fee. After all, the business of dating is also a business for many online companies that facilitate it. Once contact is established between the two parties dating activity usually proceeds through email type of correspondence or messenger like apps and possibly telephone or video conversations and which then

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eventually leads to a face to face meeting (Couch & Liamputtong, 2008). This event in the progress of a date might be termed the pinch point of the dating experience where each party is hoping that the actual physical date lives up to the preamble that has taken place in the virtual world. The question is usually then whether the physical date actually does then fulfil the dater's expectations. A study (Sharabi & Caughlin, 2017) into this very significant factor has indicated that there is a drop off in attraction following the first face-to-face date after an initial online set of encounters. This reduction in attraction can be mitigated to some degree by more disclosures and more communication during the online phase of the relationship. Thus far in time, the created paradigm of online dating holds to the point of being almost formulaic. It has done so since the inception of the online dating phenomenon which is now a commonplace occurrence, and something one might be able to say is in the mainstream of the dating world with other applications such as Tinder, Second Life and even Facebook facilitating the forming of relationships.

However, the onset of immersive virtual technology into the mix could potentially alter this paradigm. The difference is that participants will feel as if they are actually meeting together, in person, albeit via a virtual rendition of themselves in the form of an avatar in an immersive environment. How could this crucial difference affect the world of online dating and is it already doing so? This paper asks and examines these questions.

The Factor of Presence

It seems almost expected that a graduate of Stanford University invented the first online dating site because the university itself has been involved in virtual reality research since the 1990's. Jeremy Bailenson is one of the main proponents of the department that investigates the psychological aspects of VR. The term 'presence' is one that Bailenson has defined in a lecture in 2013; he says that it is "feeling like you are in the virtual world and forgetting that you are in the physical world" (Bailenson & Gurley, 2013, 4:43). Presence is particularly applied when using immersive technologies such as the HTC Vive or the Oculus Rift which seemingly place the user in a virtual 360-degree environment. In other words, he describes a psychological change within the person experiencing the immersive VR that would be akin to having been teleported elsewhere while still remaining in the same physical space. The effect of presence is strange at first but the longer that one remains within the immersive environment, the more real it becomes.

Dating which takes place within an immersive virtual environment is something one might assume, based on Bailenson's discussion of the factor of presence above, will be different from screen-based dating encounters. The two-people involved, represented as avatars, will experience a perception and spatial shift which places them together in a virtual world. That

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world may or may not like the physical one they know. Interestingly, one only has to observe for oneself videos of participants in the online game VR Dating to note that they adapt almost seamlessly to a VR environment that may be completely different to their own. The key point is that the two people are very likely to feel as if they are actually meeting each other face to face. Thus, the points about physical attraction dropping off that were raised in Sharabi's study may no longer be pertinent.

How could Immersive VR change the way we date?

The meeting of two people in VR for the purposes of dating may be the equivalent of a physical meeting. In the first instance the factor of presence, as discussed, will make them feel almost as if they are in the same room together. However, at this point in time, the physical sensations of touching may not be present. Technology is catching up with this deficiency and various haptic (sensation providing) devices are already on the market which include those that facilitate sexual sensation. For example, a study earlier this year (Chinello, Pacchierotti, Malvezzi & Prattichizzo, 2017) experimented with a device that stretches the skin on the hand giving the sensation of touching. As described in a science article (Hutson, 2017) this device enables users to feel as if they are touching virtual objects and are thus able to manipulate them with some accuracy. For vibration sensation such as that felt in games, a body suit (Carman, 2017) is being developed by NullSpace, although this is not the first bodysuit in development for VR. Another body vest by bHaptics (Lai, 2017) called the TactSuit has 87 feedback points and has already been successful tried by nearly 50,000 people in a gaming environment. This particular suit gives sensations all the way down the sleeves. In a further development still, there are full body suits which provide touch feedback and also temperature such as that developed by AxonVR ("AxonVR", 2017). This suit will allow the wearer to experience the sensation of walking, climbing stairs in VR and touching virtual objects and at the same time gain sensations all over their body. Teslasuit is another full body suit that provides full body feedback, with a range of sensation and temperature controls provided by the suit and accompanying software (Rigg, 2017). With the tactile issues solved dating within immersive VR would potentially also thus take on the feeling and sensations of a physical date. To move on from this is a small step to an immersive virtual sexual encounter. The term for VR sex-aids is 'teledildonics', which as the word implies allows them to be remotely controlled. This was coined in 1974 by Theodore Nelson (Nelson, 1974) and thence slipped onwards into wider use (Liberati, 2016). According to Liberati these devices range from the simulation of kissing through the simulation of intercourse in various forms. Obviously, the marriage of these devices and immersive technologies would lead to the assumption of the act being akin to real-life sexual encounter. Indeed, as she concludes, "the fictional world of virtual reality can become actual" (Liberati, 2016, p 820). The problem of online dating prior to the advent

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of such technologies has always been that a relationship could not be exactly consummated online. However, now that this is no longer the case then perhaps individuals may determine that there is no necessity to meet at all other than in cyberspace. The sex scene or virtual coupling in The Lawnmower Man (Leonard, 1992) which, at the time, dominated press coverage of the film, may become in some form an actuality. Could we, by dint of these enabled affordances that allow touching and more, in VR, be heading for some dystopic version of existence where isolation from each other punctuated only by virtual contact is the norm? Such an existence is that described in a story early on in the 20th century by E.M Forster (Forster, n.d.), The Machine Stops, where humans live in hexagonal cubicles and contact each other through television style globes, and a machine caters for all of their needs. These are pertinent questions to ask, but the long-term future of virtual dating and relationships is one which is subject rather to extrapolation than purely solid evidence at this time. The advent of immersive VR has only become a reality in 2016 and has yet to reach the heights of a mainstream technology such as the smartphone. Should it finally become the technology of everyday use then by the same token it is likely that immersive virtual dating will also have come of age.

Current Ventures into Immersive Dating

There have been a number of initiatives in this area. One of the most prominent being a dating show (Feltham, 2017) collaboration between Facebook and Conde Naste entitled Virtually Dating. It is a version of blind date using an HTC Vive. A blind date in the sense that the participants are unknown to each other before the actual VR date. The premise of the show places two people as scanned avatars in the same space physically but unable to see each other except through the immersive VR. The difference between this and a usual online type of dating scenario is that they are in the same room and thus able to touch each other in a physical way that would not normally be possible. The software is also prone to glitches, and the avatars can end up having their feet facing the wrong way, or arms going through their bodies at odd angles for example. The participants interact through the virtual environment and are placed in different scenarios such as a bar, or the moon. They use the Vive hand controllers for further interaction with each other or objects in the space. Once the date is concluded, the participants are placed either side of a screen and revealed to each other in the flesh. Having already seen a fair representation of the other person in 3D this 'reveal' should be less surprising to them than the usual blind date scenario where the couple has no idea what each other looks like. The participants are then asked if they want a second date. It seems that some of the participants do want to continue although what happens after that is not known or at least we are not told. The purpose of this show seems to be more than a gimmick than serious application, but it is noteworthy that the participants, by dint of their interaction, do appear to experience the phenomena of presence while in the virtual space. Presence contributes to

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the dating experience being and feeling more real it seems and would appear to have a positive outcome on their interaction. It is also worth noting that to date these types of current ventures into immersive online dating are predominantly outside of experimental research studies.

Other, somewhat unconventional uses of immersive dating have appeared with a Japanese gaming company (Miley, 2017) offering men the chance to marry their favourite character from the game. The marriage takes place in a physical chapel while the participant wears an immersive headset. A facilitator uses props to give certain physical sensations to the participant such as that of kissing their new wife who is an anime character from the game. The popularity of this pastime might suggest there could be some acceptance of virtual relationships in certain cultures and that VR may be starting to challenge the accepted norms of relationships in the 21st century. More cultural specific and cross-cultural research will hopefully investigate this in the future.

Another company datinglessonsvr.com ("Dating Lessons", 2017) offers dating lessons using immersive VR. The participant is presented with an avatar who is their dating coach. The coach then offers them advice (Hayden, 2017) on various aspects of dating which they can then try out on avatars of women in the dating app who will respond favourably or not depending upon the participant saying or doing the right things. The virtue of this approach is that the participant feels as if they are talking to a real person, even though it is, in fact, a computer controlled avatar. This website which is aimed primarily at men wanting to date women has been rightly criticised as sexist (Lindsay, 2017) not only because of this but also due to the content and dating techniques that it portrays. However, it illustrates another facet of application of VR technology to dating and the fact that the technology is becoming more accepted in this field.

The Future of Virtual Dating

Although there are no actual dating sites using immersive technology so far, it is likely that these will not be far behind the ventures mentioned above, and they may be already in development. Whether immersive or perhaps even augmented technology will change the face of dating may be unknown at this time, but it is possible to dwell upon the potential of this new form of interaction. The immersive date will be one in which the participants feel as if they really are together and with the increasing developments of haptic touch-based accoutrements the physical content of the date will also be augmented to feel more real. How participants respond to this type of dating is an interesting question and one which it is not possible to fully answer at this time. Even a cursory examination of current video evidence of people engaging in immersive VR activity shows that their reactions are predominantly positive towards it. The figures for the use of VR based material from Pornhub which are now

http://doi.org/10.18080/ajtde.v5n4.130

hitting 500,000 per day ("Virtual Reality Porn – Pornhub Insights", 2017) also indicate that VR and human sexuality are becoming more entwined at least in that area. Up until this point, the idea of dating in VR has also only been discussed in the context of two humans posing as avatars. However, what of dating a computer-generated avatar? This would perhaps have been less likely until the advent of immersive technology. Coupling immersive VR with the increasingly sophisticated technological, personal assistants such as Alexa on the Amazon Echo means that computer-generated avatar dating could be available in a very short time. Once an AI simulation can pass the Turing test and is not distinguishable from a human counterpart, it is likely that humans will start seriously dating computer generated personas. In VR parlance, these are known as 'agents'. Perhaps the bigger question is then, how will you know if the person is real or just computer generated? If a date or relationship only occurs in the digital realm, then the fact that the other party is just a computer simulation may never be discovered. Perhaps for some, this is a desirable scenario with a biddable, programmable partner who is always available when you want them and doesn't complain when you are not around. This outcome could also be considered somewhat dystopic, but it is definitely within the realms of future possibility.

In a more prosaic prediction, it is likely that the first immersive VR dating sites will soon begin to appear as well as new iterations of virtual worlds such as Second Life which will cater for immersive participation. Sites like Second Life are already known for engendering virtual and online screen based relationships, so for them, it is a small step into the world of immersion. For the most part, it is likely that development of these types of sites will 'follow the money', and thus participation and usage will drive the proliferation of VR dating sites.

The impact on Digital Economy

The question can and should be posed as to how virtual dating and immersive technology impacts the use of telecommunications and the internet. A basic understanding of how server-based VR actually works is necessary to answer that question. Unlike video conferencing, VR does not transmit all the information from the transmitter to the receiver and vice-versa. The antecedents of VR are multiplayer online games where numerous characters interact in a virtual world. The server contains only such information as is necessary to determine the position and certain characteristics of those characters, the graphical information is built and constructed by the client computer. With server-based VR immersive or otherwise, this is equally true. To explain more clearly, this means that each person involved in the immersive date will have the graphics mainly constructed by the software on their own computer, the server will simply relay information between their computers to enable this to happen. Thus, the amount of individual traffic required is vastly reduced. Were it the case that all the

http://doi.org/10.18080/ajtde.v5n4.130

graphical content was constantly updating over the telecommunications network only the fastest networks would be able to handle it competently. The increased use of the internet for virtual dating will contribute to the traffic and faster backbones, and fibre networks will most likely win out over older technologies in this regard. According to Cisco's internet traffic predictions ("Here's how much IP traffic will be video by 2021", 2017), AR and VR traffic will increase 20-fold by 2021.

One equally as important sector that has already seen an increase in high specification hardware is that of the computer industry. Machines that are capable of efficiently running and processing the complex 3D graphics required for immersive technologies such as the Oculus and Vive are resource hungry. Typically, they require a heavy-duty graphics card, a processor that is I5 or I7 and something on the order of 16 GB of RAM or more (Hunt, 2017). This type of hardware is generally expensive and thus could be considered at the high end of the scale of the cost of computing. Lesser technologies such as Samsung Gear enable phones to be used, and developments are in progress at Oculus to produce a self-contained VR headset (Robertson, 2017). However, the cost of these compared to the computing power needed for a Vive or Oculus, may or may not be comparable depending upon developments in the hardware arena.

The sales of VR hardware itself in 2016 (Ergurel, 2017) were not as high as perhaps industry pundits had hoped at the start of that year. Around 6.3 million headsets being shipped netting $1.8 billion in revenue. Five million of these were Samsung Gear headsets which is an immersive system based on a Samsung smartphone. Google Cardboard is likely to have shipped between 8 to 10 million units since the start of 2016 and is marketing to the smartphone user base at a low cost, hence the higher sales figures. According to predictions (Roettgers, 2017), the revenue for VR technology overall will increase to around $7 billion in 2017 and after that increase dramatically year on year to around $75 billion in 2021. The applications of immersive technology are ranging far and wide, but immersive dating could make a significant contribution should it take off. With around 40 million users of online dating America alone (Broussard, 2017) were that translated into VR immersive hardware it would make a potentially a significant amount of sales. For proponents of online dating and for those who supply industries that can support VR immersive technology there is the potential that this could be a 'cash cow' for some technology companies while the market is ramping up to its full potential. Figures for 2017 are not yet available, although it is known that VR headset sales broke the 1 million mark for the first time for quarter three of that year (Matney, 2018). Until the full figures are released for 2017, it is not possible to confirm whether the sales predictions for that year have been well founded.

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Conclusions

Immersive dating is in its infancy but perhaps another 12 months ought to see some significant movement in this field with regards to sites offering this kind of dating experience. In January 2018, for example, an immersive VR app named VRChat on Steam unexpectedly went from 400,000 installations to over two million in one month (Hayden, 2018). While this is not a dating app per se, it nevertheless opens up immersive social interaction to an increasing number of people should that trend continue. A rise of this magnitude could also signal more buy-in of immersive hardware, but this conjecture is unlikely to be substantiated by figures until towards the end of 2018. Immersive technology is, however, becoming more commonplace, but it is not known when it will start to hit a threshold where it can be considered as mainstream. It could, for example, be just two or three years or it could take longer. What will dictate this are apps such as VRChat increasing their take up of users in such numbers as to fuel a high-volume change in hardware sales and usage. It is easy to argue that having bought a VR headset for one app, a person will explore further uses and immersive applications. In the meantime, developments in the VR field are not standing still, and various offerings in augmented reality field may add yet another dimension to be considered. Late in 2017 Magic Leap finally revealed a first look at the production models of their augmented reality headset which the company says will make virtual objects appear almost as 'real' as physical objects within view (Robertson, 2017). Magic Leap is due for release in 2018 and until then the consequences upon the market are not predictable. The impact of immersive technology upon human interaction also isn't entirely predictable, and until it becomes as prevalent as the smartphone with broadly used applications such as Facebook, we probably won't know. The example of VRChat above, though significant is still too early to conjecture across a wider sphere. What can be said is that human and dating interaction, in particular, will change as this technology becomes more commonplace within society. Being aware of the potential either as an individual or a business puts us one step ahead. The real pitfall is not being aware and not rising to the challenges that this new technology brings. If we are to remain masters of our own dating destiny, then understanding the new face of that paradigm is essential for the future.

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