Appendix A

Maximising Australia's Telecommunications Efficiencies

Abstract

Profit margins in the telecommunications sector in Australia are continually falling, and we are witnessing the slow death of what was once touted by world trading pressures to be a good for Australian business. Technically, shares usually follow a trading channel, and Telstra, Optus and others in this sector are all in a downward trend, have been for some years, or have already become 'penny dreadfuls'.

With an ageing copper-based access network engineered for voice telephony, CATV access soon due for major maintenance, ADSL technology providing urban-only minimum Broadband Internet services as a stopgap measure, mobile phone networks multi-duplicated, and marketing in the Australian communications industry in full flight; something has to give.

Competition appeared to work in the mid-1980s due to digital replacing analogue technologies, but the multi-access networks for CATV and mobiles in the 1990s proved to everyone that duplicated networks is the worst-case cost scenario, and this type of competitive farce must never be repeated.

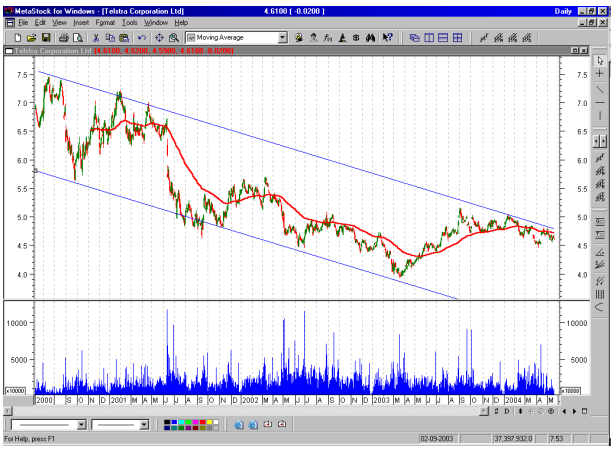
The whole telecommunications industry in Australia requires radical restructuring to make it again efficient, and one radical approach would be to reposition all public telecommunications as infrastructure under a sub-Government commission, with all resellers placed away from engineering. Only when this is done will the prices be really driven down.

The spin-offs for Australia, with its expertise in optical fibre technologies, can then flow on as developments and not just research. PON technology has the potential to resolve all urban, rural and remote service quality issues – including the engineering problems of distance, and provide all Australians with the Broadband access network for the future.

AN ECONOMIC VIEW

Stock Market Truths

Fundamentally, a share price is valued on the estimated total worth of a company, divided by the number of shares allocated; the rest is perception, promulgated by news in several varieties and flavours.



Share prices often follow a trading channel. The associated chart of Telstra shows a negative channel, and spelling 'poor long-term investment'. The 109-day long-term exponential moving average for the vast majority of time has been above the share prices, and is coming back over the average, again saying 'poor long-term investment'.

Either way the share price of any company does reflect how the public view the purpose of the company, the Board of Directors, the executive management, the products that the company sells, and how well these products/services are received.

When large companies are providing infrastructure items, a general consensus is that the prices for these products and services should be inexpensive. This is a fair call considering that economies of scale and the sheer bulk of products and services mandate that manufacturing processes are streamlined to such a degree that these products and services should be inexpensive, and consistently getting cheaper.

With this data translated into information as a stock chart in time, then looking at the historic share price of Telstra, Optus and other telecommunications companies in Australia tells us some frightening realities!

AUSTRALIAN BOARD COMPETENCIES

The value of Telstra, as perceived by the stock market, is falling. The longer-term trend lines help to get a perspective on this. This is embarrassing, as nobody in their right mind would invest in a stock with a general long-term loss (or medium-tem loss), but nonetheless the volume of trades shown at the bottom of the chart is enormous.

The role of all Directors is to mentor and provide wisdom to the long-term running and steering of their company. However these charts speak volumes for the perception of the competence of Board members. In the case of telecommunications industries, the Board members of these companies should have expert long-term wide-ranging experience – but the stock graphs seem to be able to see through the verbiage.

For some decades now the mantra of 'outsource everything' is coming home to haunt most businesses, as the real costs of outsourcing are far more than the money saved – it is knowledge. Many Directors do not have the relevant company floor experience, knowledge and/or expertise, and consequently many Boards call in "Consultants" to do what they should have done. Further, most Consultants are not in-company experienced so their recommendations are often questionable at the best. There is a lot of wisdom in corporate memory and that is extremely valuable.

Crunch Time

The two graphs above are showing that Singapore Telecom (SGT) is in a downward trend, just like Telstra, and that Hutchison/Orange (HTA) on the right, is nowhere.

The Telstra chart is shouting out that the profit margins in the Australian telecommunications industry are continuing to fall, and that at this rate by about 2007 the Telstra will be insolvent. Telstra has a legacy of older infrastructure to continue to manage. Telstra has the rural and remote services (which are not profitable); the lion's share of land based customers (who are not profitable); and some Business and Government services (which are profitable). Internet is a major profit area, but the access arrangements are broadly unacceptable, with ADSL as the apparent Broadband standard (and in my opinion this must be a stopgap technology).

Mobiles are a profit area, but it has taken several years to get the land coverage to acceptable levels and because the land area is limited, and the population stable, this market is now in a shakeout mode where there are already too many mobile service providers, which means that the returns on investment have been severely curtailed because of competition.

In the case of Optus (Singapore Telecom – SGT), this market was never profitable till it finally had a sizable share of the Australian mobile phone market, and until then the share price continued to fall. The price is now encountering a resistance line at about $2.04 and as no new technology is coming in, and as Optus has effectively eliminated its legacy in HFC CATV, the price should flatten out then fall again in line with Telstra. It should be no surprise that both Telstra and Optus should be looking to acquire synergetic companies to improve their core and diverse businesses – in that order.

If these two graphs were added to each other (note the volumes) then the net result would be a continually falling share price for the infrastructure and that agrees with the hypothesis about the share price of businesses due to go broke or about to become infrastructures.

(My hypotheses is that when certain technologies become commonplace, they have everyday use and with several private companies competing for sales, all these companies become unprofitable, because competition causes them to spend on non-core overheads. There is then a shakeout, but as the margins are so low, the few surviving companies are barely lions and their survival is tenuous and unpleasant, and then the choice is that the Government provides 'support funds' or simply takes the failing large scale business over and those technologies then become everyday infrastructure.)

Australian political management is now in the embarrassing position where a very large amount of its telecommunications infrastructure is owned offshore and the Government's (and Opposition's) hands have been compromised because of this.

Something radical has to be done to stop this trend, or the telecommunications industry has to become infrastructure as it was before. This is not palatable, and I propose a radical restructuring that provides for the network to be managed like an infrastructure and the sales and marketing arms to operate competitively, and both areas to operate 'efficiently'!

Australia's Economic Balance

An article "***Electronics as an Economic Catalyst***" by Professor Trevor Cole, in Electronics News August 2003, is clearly embarrassing to the Australian economic forecasters in that this article does not focus on the traditional "mining industry and primary produce" as the future backbone for the ongoing strength in Australia – but points out that the balance of payments is now worse than it has ever been – primarily because of our immense imports of technology. This is so even though we are nationally flush with IT expertise; but we don't use it to our advantage, and have no manufacturing and software development to speak of to export.

In the area of Information Communications and Technology (ICT), according to Professor Cole, we are not even on the map with an almost invisible 0.5% of our Gross Domestic Product (GDP), where the more developed countries have in the order of 8.0% as their GDP. In other words we have to increase our ICT by a factor of at least 16 times (1600%) to normalise our GDP. Only a radical change can assist here.

The answer is plain –it will solve both the balance of payments (BOP) problem, and our Gross Domestic Product (GDP) problem. It is staring us in the face, and when (and if) the Government / Opposition parties wake up to it then it will also solve our lacklustre business in the Information Communications and Technology (ICT) sector, and provide us with a world-class telecommunications infrastructure again.

One of the answers is to engineer and manufacture all our requirements for the National Broadband Customer Access Network using Passive Optical Fibre Network (PON) technology in Australia – with Australian-based companies, utilising Australian labour. This is not a tall order – just a change in mind shift from looking for the cheapest worldwide manufacturer. The simple fact is if we have this (or any) equipment manufactured offshore, then we effectively un-employ people in Australia and that is a poor national business policy for Australia.

This means that Australia would manufacture the optoelectronic interface chips, cable, and other components in Australia, and not import them – even if they cost more to manufacture here. These chips will have a global customer base and they should be required worldwide – not just Australia. Compare that as a commercial possibility to the farcical episode of an Australian company that manufactured a short run of special Fast Fourier Transform (FFT) chips for a radio telescope in Australia.

Professor Cole shows us in his article that our ratio of ICT exports to imports is about 31%, when it should be greater than 100%, and this is a golden opportunity. This situation exemplifies the fact that Australian ICT business needs to manufacture and export more than 300% of what it does now, and to do that we need a radical change in the tendering and manufacturing policies to remove this impediment.

Multinational Trade Forces

The problem is that there are world trade forces with a mind set of 'liberating' infrastructures from Government control, and in this process privatise various infrastructures so that their intrinsic values can be traded on stock exchanges, and/or taken over by multinational corporations (primarily based in the USA). In Australia, there is strong evidence to show that Australian Governments (and Oppositions) over recent decades have been heavily pressured to sell off many infrastructures that the taxpayers have already paid for.

I am sure that both major Australian political powers are concerned that if they nationalise this industry, then those who control the organising of world trade will place such embargos and unfair trade agreements, that Australia will very quickly slip into being a third-world country. Adding this threat that the Government (and Opposition) are under external pressure to sell Telstra to offshore interests, and it is no wonder that the price continues to fall.

For light bedtime reading, there is an excellent book that shows how the USA power industry for more than a century has manipulated US governments, and many governments elsewhere, including Australia. Needless to say, their tentacles extend far into the world trade of energy and other resources – including telecommunications! The book is "Power Play – the fight for world domination of energy resources" by Professor Sharon Beder. It is interesting to note that energy companies organising the sale of options based on future performance initiated the depression about 1930, and that Enron (another 'energy' company based in the USA), almost initiated the same catastrophe in 2001, doing the same reprehensible and fraudulent activity.

Economic Conclusion

There is a fundamental business conflict of interest here in that non-Government (privatised) businesses focus on marketing the target Government business for investors to 'steal by law' what is already paid for by the people's taxes. When stolen, long term planning and preventative maintenance programmes are minimised in favour of extensive advertising, and the creation of 'shelved' or 'holding' companies, which are commonly structured to conceal cash flows away from the original core business to the new 'owners'.

The stable market size, huge overheads and forced competition, in an environment of diminishing returns along with virtually no Australian manufacturing, have combined to almost asphyxiate the life of this essential service to support all other businesses and community lives, and destabilise the Australian economy. The expensive lessons of inappropriate competition seem yet to be learned by our political leaders. Competitive strategies in Australian telecommunications are substantially forcing operating costs, and user charges, up rather than down. The whistles have been blowing, but Government and Oppositions are not listening.

A Competitive View

Competitive Benefits

There is no doubt that competition in its most simple form works. The classic fairy-tale example is when two corner stores are both selling the same lines of goods. However, in practice, as margins are cut, so are maintenance and planning – so too for the Australian-based telecommunications companies. The customer base is finite, so the base cannot be indefinitely increased. Advertising comes off the profit margin. Outsourcing services merely moves the listed workers from the company books to contractor books. Contractors, like brokers, are commission driven, not responsibility driven.

Competitive Example

In Professor Beder's book "Power Play" there is a comparative reference to the cost of lighting a half the Niagara bridge from two electrical power companies – each providing equal power to half the bridge. These comparative rates show that the price from the Canadian Government monopoly electricity provider is about one quarter of that from the USA electricity company. As the analogy between the USA based electricity power companies' business models and the current Australian telecommunications companies' business models is far too close to ignore, then it stands to reason

that with a well run Government enterprise – free from the politically meddling hands of multinationals, Australia's telecommunications service costs would be much less than 50% of what they are now.

By direct comparison, a phone call that currently costs say 20 c, would without competition, cost about 5 c. This cost blowout is due to the comparative inefficiencies of the 'competitive' model that bleed the core industry of its internal funding, compared to a sub-Government commission.

Overhead Expenses

To further compound the issue, each competitive network business will have their own management overheads that naturally raise the operational costs (read: service user costs) and there is the very real cost of competitive advertising, management, shareholders and sponsorship that further voids the competition argument, as these have to be paid by the end user. An efficient sub-Government enterprise has these expenses, but nowhere near the size of a competitive business does.

The current telecommunication competitive model in Australia provides a very wide range of services at both the wholesale and retail market arrangements, but because the current Broadband Access Network does not exist outside some major urban areas, where CATV, ADSL and telephone services are simultaneously available, this exposes further flaws in the actual existence of a current and prospective broadband access network and/or service.

We have all witnessed the 'more competitive' Internet Service Providers, which to make a financial profit of these trading/business models must be running in a state of heavy congestion and have an absolute minimum of face-to-face (telephone call centre) customer response service, and/or else also be providing pop-up advertising.

Government Initiatives

I have no doubt that the Government (and Opposition) have seen the flaws in the competitive model but are too terrified to kill it, in fear that the international backlash will ensure they will no longer be a political power. The current Government has come up with some highly questionable initiatives through what was the National Office of the Information Economy (NOIE), now the Australian Government Information Management Office (AGIMO).

As part of the response to the Regional Telecommunications Inquiry, the so-called National Broadband Strategy was invoked. The first notable advertised program was a 'Demand Aggregation Broker Program' to bring in Brokers to perform the role formerly done by professional Network Planning Engineers. The second notable program was the 'Coordinated Communications Infrastructure Fund' to throw money at geographic areas to encourage their further investment in Broadband initiatives (without the essential engineering knowledge of available infrastructure). The third notable program was the 'Higher Bandwidth Incentive Scheme' to throw money at businesses touting to use high bandwidth Internet outside the major urban cities. None of these initiatives address nationally industry coordinated engineering.

Having read the report of the Inquiry, and seeing that it was thin on engineering know-how, it is of concern because of an earlier attempt with the 'Networking the Nation' project to distribute the problem instead of focussing it. This has resulted in an immense waste of otherwise useful resources that could have gone directly into building and maintaining the network. In all cases each interested group had to provide a bid submission (with their very limited knowledge) and in that, produce a business case to 'justify' their immediate service requirement.

The reports have shown that a portion of successful bids have gone to social clubs and entities that included the almost key word 'communication' but omitted the actual key words 'network' linked with 'telecommunications' so I really doubt the credibility of the judging panel. Further the processes of advertising, lobbying, extensive meetings, document production and presentation, all combine to drain the resources from the essential core; that of providing a highly functional telecommunications network in Australia. Thus ***'Networking the Nation'*** was in my opinion a farcical waste of resources and manpower that maybe was well-intentioned but actually ill-directed – and I believe poorly managed because there seemed to be no industry-wide national engineering plan to co-ordinate and standardise the overall program.

Competitive Plunder

Competitive models are easy pickings for multinationals to plunder, and history has shown that fact for more than 100 years, though the writings are scarce. The scarcity of these writings is no real surprise as multinationals have actively lobbied, sponsored and supported many areas to make sure that their

'spin' on history is always favourable – so that makes the 'facts' much harder to find. Professor Beder's book "*Power Play*" on the Electricity Industry in the USA and now globally has a litany of evidence showing how these multinationals operate to compromise governments, oppositions, courts, executives, Universities and how they have removed and/or significantly altered text books and other documentation to favour their causes.

It should now be obvious that behind the front of 'competition' is the tactical separation of once powerful and well-structured Government-managed service organisations into much smaller sales-focussed businesses lacking engineering processes and spending heavily on advertising, which then become easy prey for internationally-based corporations to plunder at the Australian public's expense.

Further, these competitive businesses drive marketing sales packages that are implicitly confusing to their customers, and considerably more expensive than a simple non-marketed product. It is this reasoning that makes non-Government business the wrong management team for any national infrastructure and the Broadband access infrastructure in particular.

Competition Conclusion

No competitive telecommunications network structure can provide a maximised network usage, and the peripheral costs – advertising, multi-management, legal/lawyers, outsourcing, differing engineering standards and differing technical practices – actually decrease the overall productivity by increasing the total overheads, and inherently limit the networks' capacities.

We already now know that the real reason for introducing competition is to set up business structures that will divert funds from reinvestment in the core product and place these funds with shareholders and foreign owned multinationals. If you still doubt this then read again the stated reference "Power Play" by Professor Sharon Beder.

It has now been proven through the last 20 or so years of experience, that a direct competitive model is only good for those businesses selling the manufactured equipment and not those using and paying for the telecommunication services. Considering that we in Australia effectively now do not manufacture any equipment in major volume – so we import technology – not a 'clever' country policy.

The multiple mobile networks and the dual HFC-CATV are two of several financial disasters for Australian telecommunications, and still the politicians can't seem to come to terms that these extremely expensive capital blowouts could have been relatively easily avoided. No doubt the spectre of competitive Web hosting and multiple parallel optical fibre systems will show similar financial disasters in the near future – all thanks to 'competition' – all in the wrong places.

This competitive case is a very simple application of the law of diminishing returns in that, by maintaining more than one telecommunications network in a common geographic area as a competitive model is self defeating, as each additional competitive network is in effect a redundant network (and each competitive network costs are roughly equivalent to the existing network before competition).

If competition policies had not so acutely interfered with the national telecommunications network plan then the existing broadband structure would be working at, or near its maximum capacity. It therefore stands to reason that if we want the opportunity to maximise the use of the existing broadband, then the governing competition policy has to be totally revised and structurally changed so that a national sub-Government enterprise body must manage the wholesale broadband network – it is that simple! Politically it is almost impossible.

An Engineering View

Physical Network Convergence

In relation to the Senate Hearing into the *Australian Telecommunications Network Inquiry regarding Broadband Competition* about July 2003, I wrote a response covering their five major points as per the Terms of Reference. In this response, I pointed out that the CAN transmission technologies have followed the IEN/IPN transmission technologies and that the lag time is getting much shorter. This phenomenon was also detailed in "Australia's Converging Broadband Networks", which is a sister paper to this one. I am predicting that although currently we have the voiceband engineered copper-based CAN, it will be replaced by a passive optical fibre access network (PON) in the very near future and it will be the infrastructure to provide long distance Broadband in the full sense for all Australians.

Network Development Stages

It was the digital revolution of the mid 1980's that set the foundation for these technology advances, and these advances come in stages or steps:

In this first stage of digital networks, voice channels and their associated signalling shared the same digital streams under the ITU-T G-series recommendations. Video (TV) was also sent on 'virtual containers' in digital streams utilising Plesiochronous Digital Hierarchy (PDH). Digital exchanges switch digital streams at 64 kbit/s and these were multiplexed into nominally 2 Mbit/s and 8 Mbit/s Plesiochronous Digital Hierarchy (PDH) based streams and then connected into digital transmission systems that connect to other exchanges. With this digitally based technology, the ongoing fault rate fell so dramatically that maintenance soon became almost non-existent. It was these digitally based technologies that drove down the operating costs to new stable lows, not competition, not deregulation or 'liberation'.

In the second stage of networks, PDH was transformed into the Synchronous Digital Hierarchy (SDH) along with Common Channel Signalling (CCS7) and integrated Network Management facilities, to remotely report on the health of the network, and remotely restructure the physical networks. Asynchronous Transfer Mode (ATM) was also used with SDH to encapsulate data streams, and soon the manual side of network management became almost non-existent. With this phase of technology introduction, the use of SDH on optical fibres set in physically large (several hundred km) network rings provided self-healing transmission structures. The costs were already minimised and this just made the transmission networks more reliable and to a large degree automated network management functions.

In the third stage of networks, PDH and ATM were largely transferred to the Internet Protocol Suite (TCP/IP); IP switches replaced most of the previous telephony based digital switches. In this 'Data Mode' the network is largely self-repairing and telephony use is rivalled by Internet and other data forms usage. It is now that the Optical Fibre based (and some SDH radio) transmission network is virtually a combination of IP (and some PDH) feeding into ATM or SDH, which is then carrying most of the traffic for voice, Internet, data, vision, and programme in data packets. With the introduction of Voice on Internet Protocol (VoIP), this technology substantially reduces the bearer load for equivalent transmission bearers, causing a few years' halt in the need to increase bearers for voice – but Internet traffic density had dramatically increased, virtually cancelling this temporary halt. IP technology should have heralded a major decrease in telephony usage costs – but the added costs of competition have voided these potential consumer gains.

Wholesale Network

It is my understanding in here that the wholesale network including the IPN/IEN and CAN is in effect the major broadband network, including the following:

- ***Telephony***: switches and multiplexers, high capacity optical fibre digital networks, terminal exchange equipment, and the current customer access networks, including all mobile base stations.
- ***Data/Internet***: IP data switches, routers, digital multiplex equipment, high capacity optical fibre digital networks, and customer data multiplex access networks.
- ***Broadband/Television***: transmission multiplexer and coding equipment, high capacity optical fibre digital networks, cable television distribution networks and terminating equipment.
- ***Network Management***: Metering, Supervision and Monitoring equipment, high capacity optical fibre digital networks, and management/system databases.

Access Engineering

Since the 1940's, almost nothing has changed with the customer access network (CAN) as it has basically continued to be provided by unit twin insulated copper wire. The cable that was manufactured as paper insulated is now manufactured as polyethylene insulated cable. Remote Integrated Multiplexers (RIMs) now replace small rural exchanges and/or extend into the metropolitan customer area, to reduce the average cable length, but still the equipment and cable is engineered for analogue telephony technology.

Customer Access Cable was never engineered for working much above voice frequencies and consequently it is not balanced nearly as well as carrier cable was – so using ADSL is literally asking for extremely difficult engineering problems to surface as the uptake of ADSL increases.

High frequency crosstalk may be a very expensive issue, where situations like the Casualties of Telstra (COT) cases may again resurface, but this time in the Broadband Internet area. Considering the sensitivity of Telstra and their share price, that has never regained value from the $7.40 days, another round of 'COT cases' involving Internet this time could be catastrophic for both Telstra and the prevailing Government (and also the Opposition parties) and multi-national competitive practices in general.

Cable Internet, Coax (CATV) has a short life before it moves into the high maintenance part of its life span and ADSL on twisted copper pairs must be viewed as a stop-gap measure only before Optical Fibre replaces all other CAN technologies en-masse, as soon as financially and technically possible.

As pointed out in the sister paper, I do not see mobile and/or radio as a component of the Broadband CAN, but G3 and G4 mobile radio have a wide band usage and to be effective, the mobile networks need to be aggregated and managed by a sub-government Commission to avoid multiple mobile networks congesting the very limited available bandwidths.

Broadband Access Re-Engineering

It should be profoundly obvious to all but those who have committed to copper-based CAN for broadband that the common technologies used for providing access for telephony are not at all suitable for bi-directional Broadband distribution throughout Australia. This is spelt out in 'Australia's Converging Broadband Networks'. An entirely different customer access network infrastructure is an imperative that must be implemented as a priority, and this is the first and biggest impediment to be overcome: with or without competition.

This same reference has already discussed the process where the inter-exchange bearer / transmission network technologies lead the customer access bearer / transmission technologies by several years, but this time gap is decreasing and the two networks are becoming convergent in bearer / transmission technologies. As shown there, copper twisted pair technology is not suitable for Broadband transmission in the customer access network, just as it became impracticable in the mid 1980s for the inter-exchange networks, when that transmission technology was then replaced en-masse by optical fibres and some radio point-to-point systems. It therefore stands to reason that the Broadband customer access network must also be replaced by Optical Fibre technology as an immediate imperative, if Australia is to become and remain 'clever'.

As Australia follows the ITU-T for industry-based communication standards, and not the USA based company standards, it is essential that we in Australia continue to be actively involved in the initiation and development of these standards within the ITU-T framework, and actively negotiate standards to implement an industry standard Fully Broadband Access network based on Passive Optical Fibre Network (PON) as the national standard.

My guestimation is that in using a PON for urban conditions a single fibre will feed out and be passively split to feed up to 32 premises within a 4.5 km range of the headend/exchange. In rural and remote areas, using a PON with fewer passive splits, the length could be extended up to about 70 km and that totally resolves most remote and rural situations for full Broadband services. Most current telephone metropolitan exchanges handle groups of about 10,000 lines, and PON technology fits very comfortably with this customer grouping, and the footprint should be substantially smaller.

Rural and remote Broadband PON services could be either fed from a centralised headend in major regional centres, or small flat loops from regional centres could provide the bandwidth to small exchange sites, and long feeds could start from there. Non-CBD, urban, rural and remote infrastructure (IEN/IPN) will be the major restriction that will require a national collaborative engineering approach to maximise Broadband facilities.

Competitive proof of concept trial and other pilots have been going on in Australia for some years. The time for full-scale optical fibre customer access network implementation is already overdue, and our telecommunications industry needs a 'shot in the arm' to get it out of its competitive malaise, and back into engineering excellence.

Opportunities to Maximise Broadband

The telecommunications industry is one that can make considerable opportunities to minimise its overheads by near full network utilisation (without network or switch congestion), and that only comes about by effectively planning and long-term (>5 years) managing the whole national network. Not apparently competitive parts of it, as is the case at present!

Before any opportunities to maximise the capacity can be approached and realised, it is imperative that the whole telecommunications network needs to be managed/engineered by one Government-based body in a non-competitive environment so that the communications infrastructure can be fully utilised at will, and only through that will the economies of scale that are required be effective. This is, after-all, one of our main infrastructure assets that private and/or multinational businesses have proven they are incapable of maintaining for more than a few years, for the people, and for all business without unbiased regulation.

Existing Infrastructure Limitations

Beyond our immediate major urban cities, the IEN/IPN transmission infrastructure is essentially 'flat rings' and/or rings based on SDH/ATM with PDH spurs designed primarily for telephony and not for Internet and/or CATV, so even if there was a large uptake in Broadband Internet, the only areas that would immediately benefit would be the greater urban cities.

It is therefore critical that the existing combined competitive IEN/IPN structures be analysed on a national basis and together with the existing switching/routing equipment the combined network be restructured in a combinational manner so that the over-supplied equipment is better positioned to provide a much greater grade of service with minimum effort.

Current technologies allow for interconnected rings of very large bandwidth – for example up to 10 Gbit/s with Dense Wavelength Division Multiplexing (DWDM) for most inter-nodal networks. As most of the non-urban IEN/IPN is basically tiered star networks, there is a huge amount of network infrastructure to be repositioned to give non-urban areas the same (or similar connection bandwidths to that in major urban areas.

Further, to provide minimum delay and speed downloading, a network of mirrored web caches may be required to hold the most recent web information and minimise the long traffic paths that would otherwise drag down the overall networks response times. This facility is near a reality as computers with massive Hard Disk Drives are now relatively inexpensive.

Considering that a Passive Optical Fibre Customers Access Network (PON) will provide the infrastructure for virtually every house in the Australian mainland and surrounding islands to have and use Broadband facilities including Internet, CATV and telephony, the possibilities of a vastly different network structure may be required and with it, facilities to make the response times much faster than they would be if the uptake was virtually 100%.

Engineering Savings

As an example, in the mid 1980s a particularly brilliant Australian theoretician, Dr. John Galloway developed an incredibly smart relational (associational) computer program called Netmap and it was in this case utilised in one application to 'groom' the Telstra network and better utilise existing network structures. I believe that about $1 Bn was saved in a year through this effort, and considering the hefty multiple duplications that exist in our so-called competitive networks today, savings should be in the order of more than $5 Bn per year through minimising unnecessary link / path duplication and utilising links / paths far more effectively.

The economies of scale that would be applicable will virtually stop ongoing purchases of overseas purchased telecommunications equipment for at least a year, and this could save the Australian Government / people about $7 Bn. The heavily duplicated mobile networks that exist could be much better repositioned to properly cover the major city and suburban geographies. Already economies of scale have meant structural changes to Community Access Television (CATV) holdings such that the content is effectively single sourced, and it should follow that the engineering management of this network be brought under one management to minimise overheads, reduce and eventually eliminate duplicated routes, and minimise the overall operating costs.

Engineering Conclusion

We currently have multiple broadband structures that have been outlined here and it is clearly shown that with the exception of Optical Fibre, all other Broadband customer access network technologies should be either severely limited or stopped in the immediate future as these other technologies will not provide an ongoing low maintenance, interoperability and long life that Optical Fibre can provide. That is: any development in the Customer Access Network that is not totally Optical Fibre is a very poor investment.

The Australian Government (and all Opposition parties) need to realise that Optical Fibre is the only suitable transmission medium for the future Broadband Access Network. This means that the Government and Opposition need to make some hard decisions and actually take ownership of the Access Network through a set Government Commission, and through that manage the implementation of the Optical Fibre Broadband Access Network as a high priority.
For several years many of our Universities have excelled in Optical Fibre technologies, but few have been able to transfer this research into business development. This means that the Federal Government and Opposition have to move on local manufacturing Optical Fibre technologies and have the research developed and implemented into this new Broadband Access Network, again as a high priority.

A Future View

Core Business

The core business of Australia's telecommunications infrastructure is to provide an ongoing basic telecommunications service to the public (communities and businesses alike), available to be connected to any premises so that any person or business in Australia can efficiently connect and communicate with any other person or business and conduct communications in a most cost-effective manner. The range and service standards of these products for these telecommunications services should rival the best available in the world.

Defining Efficiency

In competitive / commercial terms, business efficiency is usually based on realised profit divided by effort (investment) expended. What this more brutally means is that if the investment can be minimised and the profit taken out of the business maximised, then those talking the majority of the profit for themselves would see this as an efficient business, and they will do everything to make it happen that way. Most humans are very greedy – it's our human nature.

In competitive / commercial terms, the best way to make an infrastructure look efficient is to minimise the apparent number of people in that infrastructure, and the most common way to do that is to subtly change the accounting laws so that permanent staff are replaced by contractors or part-time people (and in either case they are not counted), remove maintenance and planning functions so that these overheads are eliminated – or contracted out and also not counted. The third subtle move is to import or hire all equipment, so those people and equipment overheads appear to be excluded. The last step in the mirage is to radically increase marketing, advertising, sponsoring and product lines. Again, most of these people and the associated revenues for this last step are also outsourced, so they don't 'appear' on the company books. The wide range of bundled product lines serve to further confuse the customers and that provides the foil to raise the costs.

In infrastructure terms an efficient infrastructure is one that is near fully utilised, well future planned and funded from its use such that it nominally does not run at a profit or loss, as the funds are totally re-invested to replace legacy infrastructure and create more new infrastructure as required.

In infrastructure terms, the best way to make an infrastructure efficient is to engineer the future planning in long term (10-20 years) medium term (5 years) and short term (1 year) such that the growth and replacement phases are highly coordinated. This automatically manages and readily introduces new product lines, and minimises the overhead and infrastructure purchase costs. Because the product lines are essentially simple, marketing, advertising, sponsoring is almost eliminated. People working in infrastructures generally are not contractors with a narrow field of expertise, but usually full-time staff members with a broad range of working skills gained from moving around many associated areas. These people by their experience, have the data, information, knowledge, and wisdom to mentor and most effectively manage the life cycles in the infrastructures.

It should be very obvious from the above paragraphs that commercial and infrastructure derived terminology must never be inferred, compared, or interchanged as the focus and direction of the two groups is entirely separate.

Centres of Excellence

Commercial businesses excel in selling, and they do this through selective advertising and marketing, aiming their products to target audiences. This is their strength and they do it very well. Currently there is a large amount of 'competitive' marketing, advertising, sponsoring and target seeking in many phases of the telecommunications industry and these efforts are in an enclosed market, meaning that a law of diminishing returns comes into place and directly forces the prices of calls and other services up, not down.

Sub-Government Enterprises excel in excellent engineering planing, long-term engineering project management, life cycle management and high maintenance standards. These roles far outweigh a sales drive, a sponsorship deal, and a Government term and in many cases a human lifetime. Currently much of the engineering planning is outsourced to businesses that work on fragmented parts of a network, national engineering coordination has been lost, and to a large degree much of the maintenance work has been outsourced to satisfy an ill directed accountants' dream that it looks much better on the books that way.

National Restructuring

Australia's telecommunication infrastructure is currently fragmented into a few large corporations and a flotilla of small businesses. The whole telecommunications industry needs to be restructured in Australia, so that there will be a strong competitive sales arena, but that arena must not be involved in the engineering and everyday running of the network infrastructure. The infrastructure must not be placed in a competitive mode, but in a collaborative mode, and that is a major turn-around from the current strategies.

I am not aware of any national Australian body that coordinates the installation, use and life cycle of all major telecommunications equipment, as this part of the industry is in a competitive mode and therefore multiple duplicated. The lack of this active body also effectively pushes up call costs, as equipment and network duplication are not being avoided. This body should be a Sub-Government enterprise, and in that, making a profit or loss is not the issue, rather that the equipment is wisely engineered and well maintenanced.

The compromise proposed is that:

- All existing and new customers access networks, and telecommunications infrastructures have the option to become the property of an Australian Commission.
- This Commission would manage the national network's growth, development, maintenance and structure, and provide these services to all retail Telecommunications Service Providers (TSPs) at a wholesale level.
- With this managed by one non-competitive body, the business efficiencies will be much higher than for a competitive situation.
- The Retail Telecommunications Service Providers would package the wholesale services as retail services to their customers, depending on the contracts negotiated at the wholesale level.
- Major Federal and State Governments would form their own wholesale reselling service supply arrangements. Their C&IT departments would manage their communications at the wholesale level, and have full security of their networks.
- Major businesses would form their own wholesale and retail service supply arrangements. This way they would not have to go through a third party to have their services provided at a wholesale level.
- Retail reselling should be through ASX based companies to the general public and businesses
- Government reselling should be through focussed State and Federal Government Departments to their associated Offices, Councils etc.

Initially this body would restructure the total network to utilise all existing equipment in a collaborative manner instead of a competitive manner, and the savings for the Federal Government by doing this should be in the order of $5 Bln per year, possibly much more.

Competition needs to be in place for several reasons, and the first one is political. Australian world trade will be seriously impacted if the telecommunications industry in Australia was to be nationalised. It is sales and marketing that is the competitive area, so it should be that retail (or reselling) area that needs to the cauldron of competition.

In light of the immense costs for installing a new infrastructure in Australia, we have to avoid the serious failures of the simplistic competitive models used in the past and negotiate an economic model that provides the services to everyone that needs them at a very low cost, includes competition for service packages, and eliminates the unnecessary multiple duplication of services that happened with our telephony, CATV, ISPs and mobile networks.

Future Direction

The extremely expensive experiences in having both CATV and mobile phone networks installed, operated and managed under a competitive environment has very clearly shown that competitive management of infrastructure is a worst-case financial scenario for Australia, and it does nothing to drive down operating costs. The lessons of bad national economics through having competition in essential infrastructure have been taught, but have gone unheeded.

The only way to secure a well engineered Broadband Customer Access Network that uses consistent and low maintenance infrastructure for all Australia, is to create this infrastructure through a Federally backed Commission, and engineer, manage and maintain this infrastructure as that, and not as a commercial entity.

With this Commission in place, it would then be in the right place to selectively purchase existing telecommunications network infrastructures and through that the cost-effective approach of managing and developing the whole Australian telecommunications network in a non-competitive environment can then again be realised, with very significant savings to our currently out of control Balance of Payments debits.

It is imperative that this Federally backed Commission be engineering based to team specify and manage to programme a range of projects to create a nationally coordinated Passive Optical Fibre Customer Access Network (PON) for transporting Broadband to all Australian households as a matter of urgency, and provide the telecommunications infrastructure at a wholesale level including ongoing maintenance.

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Glossary

100BaseT	100 Mbit/s based on twisted pair wires
3U	3 * 44.45 mm = 133.35 mm
ADSL	Asymmetrical Digital Subscribers Line
AGIMO	Australian Government Information Management Office
AMPS	Advanced Mobile Phone System
ASX	Australian Stock Exchange
ATM	Asynchronous Transfer Mode
B	64 kbit/s channel
BOP	Balance of Payments
BRI	Basic Rate Interface
C&IT	Communications and IT
CAN	Customer Access Network
CATV	Community Access Television
CBD	Central Business District
CCS7	Common Channel Signalling Number 7
CDMA	Code Division Multiplex Assignment
CEO	Chief Executive Officer
COT	Casualties of Telstra
CPE	Customer Premises Equipment
CWDM	Coarse Wavelength Division Multiplexing
D	16 kbit/s channel
DRCS	Digital Radio Concentrator Systems
DWDM	Dense Wavelength Division Multiplexing
E1	32 time slots at 2.048 Mbit/s
FDM	Frequency Division Multiplex
FFT	Fast Fourier Transform
FTTH	Fibre to the Home
FTTP	Fibre to the Premises
G3	Third Generation Mobile Phones
G4	Fourth Generation Mobile Phones
GDP	Gross Domestic Product
GSM	Groupe Spéciale Mobile
HFC	Hybrid Fibre Coax
IEN	Inter-Exchange Network
IPN	Internet Protocol Network
ISDN	Integrated Digital Service Network
ISP	Internet Service Provider
IT	Information Technology
ITU-T	International Telecommunications Union - Telecommunications
LAN	Local Area Network
LAP-D	Local Area Protocol – Digital
NIU	Network Interface Unit
NOIE	National Office of the Information Economy
NTC	National Telecommunications Commission
PABX	Private Automatic Branch Exchanges
PCN	Premises Customer Network
PDH	Plesiochronous Digital Hierarchy
PGS	Pair Gain System
PON	Passive Optical Network
PRI	Primary Rate Interface
QAM	Quadrature Amplitude Modulation
RCM	Remote Combinational Multiplexer
RIM	Remote Integrated Multiplexer
SDH	Synchronous Digital Hierarchy
SHF	Super High Frequency
SPN	Service Provision Network
TCP/IP	Transmission Control Protocol (through to the) Internet Protocol (suite)
TDM	Time Division Multiplex
TSP	Telecommunications Service Provider
TV	Television
UMTS	Universal Mobile Telephony System
USA	United States of America
VOIP	Voice in Internet Protocol
WiFi	Wireless Local Area Network