A Synergetic Approach for:

Restructuring Regional Telecomms Networks to Safeguard Australia's Comms. IT & Business Security,

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Future-Proofing Telecommunications in Non-Metropolitan Australia,

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Providing a National Broadband Network Infrastructure to Support Future Broadband Customer Access,

and

Replacing the Copper-Based Customer Access Network with Optical Fibre to the Premises (PON FTTP).

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Contents

1. Background

1.1. A Stake in the Ground

In the last century, telecommunications has come a long way in Australia, and it has a long way to go, and I seriously doubt that many people in the mid 1970's could have foreseen the rapid translation into digital, then the rapid acceptance development of Internet and now the need for universal broadband access in the last 35 years. What I am saying is that the target for telecommunication service standards is continually changing and what was acceptable for the public even only five years ago is now totally unacceptable. With this in mind we have to change our belief system from virtually permanent references for telecommunication service standards to accommodate these ever-changing service standards situations. This means that the age-old service standards that we had are no longer a Stake in the Ground, but are now conceptually moving targets. The good news is that telecommunications service standards move in steps, following successive introductions of new technologies.

This concept should not be that hard to comprehend as it has happened several times before with telecommunications technology changes. One analogy is Television, and when it was introduced in about 1957 – it was in black and white, and almost everybody was happy with the standards until colour TV was introduced in about 1973. Everybody raised their expectations and almost everybody was satisfied until about 2002 with the introduction of 'Home Theatre' and DVD technologies. You could forgive a newly wed couple in 2005 for disposing of a wedding gift being a new black and white television.

With Australian telecommunications, the introduction of digital transmission and switching was introduced from about 1980 and finalised about 1992, replacing analogue transmission technologies. These newer technologies were inherently far more stable than the earlier analogue transmission technologies and consequently volume levels on switched calls were stabilised like never before. Accordingly, service standards were raised, and people no longer tolerated faint calls and excessive echo, and most everybody then expected dial-up modems to reliably run at speeds greater than 28 kbits/sec.

In about 1985, optical fibre was introduced and this technology had far superior transmission characteristics compared to twisted pair and coax cable technologies, permitting far longer distances between regeneration equipment. The monetary savings by this technology were immense and this is what caused the prices of long distance calls to implode, and by about 1994 virtually all the inter-exchange network was connected by optical fibre. Accordingly, the service standards were raised and call costs plummeted. People now expect call costs to be minimum – but this did not happen because of excessive competitive business costs.

1.2. Universal Service Standards

In about 1982 the Davidson report came up with a Stake in the Ground that specified what was then considered to be the Universal Service Standard (USS), and it was based around the acceptance that every household should have a voice engineered telephone connection to the national network. This may have been a fair call for then, but 1982 is about (20) years ago compared to 2002 and considering the immense changes in service standards and service expectations in this time frame, the specifications of the USS are now seriously below current acceptable customer expectations, and with the maturation of Internet and the maturation of Broadband access, the USS needs a serious revision as it is totally unacceptable to the public, especially in non-metropolitan areas.

The Davidson report used the USS as the basis for the Universal Service Obligation (USO) to proportion funding to ensure that in a competitive business environment, the public

(customers) living in the non-metropolitan regions would not be disadvantaged compared to voice based telephony services in urban areas. It is an imperative to realise that the USS provides a basic voice telephony service; not a data grade service, and that means that the USS really did not cover dial-up modems and fax machines. As a slight compensation for this change in technology and expected service standards, a late inclusion was to specify that dial-up modems could work down to 1200 bits/sec. As data unfriendly technologies have been removed from service, I now believe that this low-speed data in voice limit has been raised to above 9600 bits/sec.

When the Davidson Report was conceived in 1982, there were little transitional changes with the telecommunications network in Australia, and so to all intents and considerations the specifications for the universal service standard were effectively stagnant – so having a stake in the ground as the reference was acceptable – for then. Since then in the following thirty years, there have been many changes to services and acceptable standards have considerably raised considerably (mainly due to technology improvements), making the USS(1982) very outdated. With this situation now very clearly explained, it is timely to review the USS as defined for 1982, and then translate this into service standards applicable for 2005, 2010 and 2015. This will then be a guideline to work with for now and the future.

1.3. The Lie of the Land

Without getting into the petty argument of who owns what, there are three distinct network topologies that need to be acknowledged as these three all combine to form the Australian telecommunications network.

1.3.1. Customer Premises Networks

In general people live in houses, townhouses, or home units; and businesses usually are usually based in offices – either in separate buildings, factories, building complexes or at peoples homes. It is here at these premises where the customer equipment is usually located, and hence the telecommunications network at these premises is called the Customer Premises Network (CPN). In all cases, the wiring comes into a terminating arrangement of some sort, and this is the network boundary point for the CPN. The user boundary point for the CPN is at the customer premises user equipment; for example telephone, computer, television, alarm panel, fax machine, printer etc. and for simplicities sake this equipment is called Customer Premises Equipment (CPE). Note that items such as telephones, PABXs, (external) Modems, Routers and Hubs, mobiles etc. are all part of the CPN.

1.3.2. Inter-Exchange Networks

Most telephony and data switching equipment, the large majority of Web servers, virtually all transmission terminal and regenerator equipment, and radio and television network relay equipment is located in what are now loosely called ‘Telephone Exchange’ buildings. These buildings are interconnected by transmission links to carry the traffic and the large majority of these links are optical fibre, or copper pair, or point-to-point radio. These transmission links, the buildings, and all directly associated equipment are called the Inter-Exchange Network (IEN). This telecommunications infrastructure manages and transports our electronic based communications its wide forms between urban centres.

1.3.3. Customer Access Networks

There is a third network to consider and this network connects from the IEN to the CPN boundary points and provides customer access to the IEN; hence it is called the Customer Access Network or CAN. For telephony and most Internet the CAN is usually insulated copper pair cable. For mobile phones the CAN is a combination of optical fibre or point-to-point radio from the IEN to the mobile base station and then radio to the customers mobile phones. For free-to-air Radio and Television the CAN is a combination of insulated copper pair cables, optical fibre, coax cable and point-to point radio to transmitters and then radio to

customers' receivers. For Community Access Television (CATV) or Pay-TV and some Broadband Internet the CAN is optical fibre to distributed coax cable headends and the coax cable to premises, alternatively point-to-point radio from an Earth Station to a satellite and then from satellite to satellite receivers at customer premises.

For many years now most major central business districts (CBDs) have optical fibre loops connecting office buildings to the IEN to economically provide wideband telephony based services to major businesses and corporations. More recently trials with passive optical fibre networks from the IEN to customer premises have proved highly successful. With the current climate for massively increased CAN bandwidth for true high speed bi-directional Broadband Internet access, it is painfully obvious that this technology will have to replace the current copper-based voice engineered telephony access network for the majority of all Australian premises in the very near future.

What is not so obvious is that the national structure of the IEN will have to significantly change to support the growth in Broadband Internet usage and this is an across the board change and not just for major urban areas. In fact the biggest changes will have to be in non-metropolitan areas where the IEN is inherently thin. With simplistic strategies (based on competitive business profits) investment in this network infrastructure is unthinkable as looking for a (short term direct) return on investments would be negative. It is therefore necessary to invoke synergetic (not competitive) strategies, as this infrastructure cannot be progressed with a competitive business mindset. It requires an infrastructure mindset!

1.4. The Lie of Competition

For some decades now, there has been a persistent push to 'make telecommunications in Australia efficient', and 'privatise the telecommunications industry', and 'let competitive forces determine the market', and 'regulate competition so that it is fair', and 'drive down costs' this list of euphemisms keeps perpetuating with different fashionable slants with intent to move the Australian telecommunications infrastructure out of Government hands into private hands.

In more deceptive terms, merchant bankers have seen massive amounts of revenue being exchanged to provide this essential telecommunications infrastructure; and if they can convince the Governments of the days to give private (competitive business) industry control of this infrastructure then the merchant banking fraternity is in a position to rake off at least 10% for themselves. This reasoning should explain why these euphemisms have perpetuated, and if competition were ever fair; then there would never be any need for 'regulation'.

Telecommunications in Australia was comparatively inefficient when it was State based because the engineering standards were different in each State; there was a very limited nationally based equipment buying approach; telecommunications essentially had State boundaries; management had State boundaries, and in general there were far too many layers of management.

Telecommunications in Australia was comparatively inefficient before the full implementation of digital switches, optical fibre cables and optically based digital transmission systems. Analogue switches were mechanical and had at least 10 times the required maintenance requirements compared to digital switches. Earlier analogue based transmission equipment was inherently about 20 to 50 times less reliable than digital transmission systems, and required daily checks. Optical fibre can span about 20 times that of coax and twisted pair cable technology before requiring signal boosting – dramatically reducing the amount of equipment required, and maintenance levels.

With natural advances of merging to a fully national body with far less layers of management, with a common engineering standard, national equipment procuring approach, with networks nationally engineered and managed, sales management in Regions, not States, analogue equipment technologies replaced with digitally based equipment and using optical fibre, the telecommunications industry in Australian is comparatively highly efficient compared to how it was 45 years ago (circa 1965). These advances had very little to do with competition and everything to do with advancing technologies, and to compound the issue current competitive business practices are hindering future developments, and syphoning resource funds.

The underlying problem with this dilemma is that the World Trade Organisation (WTO) has, I believe been the catalyst and has pushed both Governments and Oppositions to privatise Telstra over several years or face destabilisation. The prime role of the WTO is, on a global basis; to move government based infrastructures into privately funded corporations so that the shareholding can be traded on the stock exchanges. The fundamental flaw is that an infrastructure business is extremely efficient at providing essential services – where a privatised competitive business is extremely efficient in providing a wide range of products. The agendas of infrastructure businesses and competitive businesses are poles apart – and they need to be kept separate – but they are inter-dependent!

I believe that the WTO is USA controlled and in that, the USA based Utility companies provide many of the essential services in the USA, and these Utility companies are extremely powerful and hungry. There is no such thing as 'fair competition'!

1.5. The National Dilemma

On a competitive business footing, it is simply not a profitable business proposition to provide extra telecommunication services to non-metropolitan areas as these areas will not return immediate revenue well in excess of the investment. By providing handouts in the form of Networking the Nation (NTN), and a wide range of other thinly disguised but poorly understood 'initiatives', massive amounts of committee based work is forced on those that simply do not have the telecommunications knowledge, know-how and engineering expertise, and the funding is totally inadequate. Other ill-conceived schemes that were spawned include the Coordinated Communication Infrastructure Fund (CCIF), the 'Higher Bandwidth Incentive Scheme' and the 'Demand Aggregation (DA) Broker Program' and all these continue to provide piecemeal handouts – but not address the problem. These are competitive approaches to fix infrastructure issues. They will all have positive results but these results pale into insignificance in comparison to an infrastructure business approach that works in synergy (together) and not in competition (against) the national interest of Australia.

Providing funding to support a Universal Standard Service level is commendable, but the over-riding flaw here is that there are competing telecommunications infrastructure businesses now established in Australia and none wants to put anything more than the bare minimum infrastructure into non-metropolitan Australia as this effectively erodes the stock market share prices. This is why Australia's non-metropolitan telecommunications infrastructure is and will never be adequately resourced with a competitive mindset.

Historically, what really happened was that digital transmission, digital switching, and optical fibre technologies were making their impacts and these technologies combined to dramatically drive down operational costs; and this looked as though competitive business consultants had made the telecommunications industry appear very efficient in competitive business terms – but nothing could have been further from the truth!

The Australian telecommunications industry is still basically an efficient infrastructure, but this industry now has an extremely expensive competitive business overhead (advertising, sponsoring, consulting, legal, marketing, dividends etc expenses) that really are driving the costs up and minimising network growth – and that is very inefficient!

The first part of resolving this national dilemma is to separate the commercial business interests out of Telstra and place (leave) that part on the stock exchange. As this is the reselling part, it will no longer be encumbered by the infrastructure part, and its share price will be highly valued, as it will have a continual long-term cash flow from aggregated retail service provision from the infrastructure wholesaler - Telstra. This would then leave the infrastructure part of Telstra to efficiently develop the network infrastructure and provide wholesale telecomms services to all competitive resellers at common wholesale prices.

1.6. Our Federal Responsibility

This is a national infrastructure management issue and it needs to be responsibly managed. The board of Directors for Australia's' infrastructure is the Federal Government, and it has a wide range of Federal Departments with permanent heads and extremely capable people. Unfortunately in the case of telecommunications, some earlier Federal Governments were lobbied to sell off (privatise) the Australian telecommunications infrastructure in the consideration that competition would make this service more efficient. We now know that competition did almost nothing to make this infrastructure business any more efficient that it already was, and several successive Federal Governments have been deceived.

What the Australian Board of Infrastructure Management (Federal Government) was not told was that the measures for calculating efficiency for a competitive business do in no way compare with measures to calculate infrastructure business efficiency.

Infrastructure business efficiency is measured in terms of competitive businesses being able to set up and profit by using the services provided by infrastructure businesses.

Competitive business efficiency is measured in terms of the profit (return on investment) over a relatively short period eg 12 months.

Consequently competitive business efficiency measures for telecommunications infrastructure showed that this infrastructure business appeared to be operating very inefficiently, and external consultants (expert in restructuring competitive businesses) were called in to dismantle what was working very effectively.

2. Current Network Structures

2.1. The Golden Boomerang

In Australia, the large majority of the total population lives on the east and southeast coast, and the major capital cities of Brisbane, Sydney, Melbourne and Adelaide are virtually coastal. The one exception is Canberra, which is not coastal; but is neatly positioned between Sydney and Melbourne. Perth and Darwin are coastal but their relative populations are comparatively far less than the large cities on the east and southeast coasts.

These five major cities geographically form a boomerang shape and it is fair to say that the large majority of telecommunications is between these centres, and for a return on investment – it is 'gold' and hence the term 'Golden Boomerang'!

The major link is between Sydney and Melbourne (via Canberra) and this has always been the case since 1858, and it was cemented with the Melbourne – Sydney coax cable system that

was installed in about 1962, augmented by radio links from about 1970, replaced by the Melbourne – Sydney optical fibre in 1987, duplicated in about 1992 and re-engineered in about 1995 to greatly increase the capacity.

While this was going on the Sydney – Brisbane and Adelaide – Melbourne wire/telephony links were replaced by wideband radio links that were commissioned in about 1970, largely replaced by optical fibre in about 1985 and re-engineered in about 1995 to greatly increase their capacities. Somewhere between 1975 and 1980 the Perth – Adelaide wire/telephony link was replaced by a far superior radio link that was commissioned and this basically linked the major capital cities across the south and east of Australia (including Perth).

Financially (in competitive business terms) this golden boomerang is the profitable area in Australian telecommunications. With this backbone of telecommunications highway, there are several wayside cities that have excellent communications infrastructure for telephony, and that is about where it stops.

2.2. Major City Networks

Major cities have multiple central business districts (CBDs), a large number of housing-based suburbs, and industrial areas. Because the geographic areas are so large these major cities have several 'telephone exchanges' to distribute and manage the telecommunications infrastructure requirements.

2.2.1. Inter-Exchange Structures

My understandings of the networks are that:
Major cities terminate major transmission systems and connect directly into pairs of digital cross-connect switches providing a very high degree of reliability by automatic swap-over, and total route redundancy. These digital cross connects are the feeders for the main trunk switches that then connect to tandem and local switches – which then connect to the local Access Network structures. All this automated telephony switching is controlled through a Common Channel Signalling (CCS) System that is managed by a distributed computer based switching control system through Switching Transfer Points. These major transmission systems include a degree of network management overhead that continually reports on the network service standards

With Internet, this network arrangement is virtually identical with feeds from the pairs of digital cross connect switches feeding to digital route switches which in turn connect with regional Web hosting banks through regional routers which feed local routers through alternate route feeds, providing a very high degree of alternate network redundancy. These local routers form the interfaces to ADSL and Cable Internet through Digital Services Line Access Mux (DSLAM) and Cable Headend Mux equipment respectively.

While the switching, signalling, and Internet structure may look like a series of large management hierarchy charts, the inter-exchange transmission network is usually a series of intersecting optical fibre rings with pairs or quads of optical fibre spurs emanating from those intersections, which are usually at major CBD telephone exchange sites and the spurs usually feed to lesser telephone exchange sites.

This concept is extremely important to understand as it initially appears to conflict with the switching hierarchy. What it really does is provide a number of geographic alternate switch routing paths and this leads to exceptionally good network robustness in major cities. I also believe that it took some years to restructure the existing metropolitan IENs so that they could accommodate relatively low traffic density Internet services using ADSL through DSLAMs in local exchanges.

With the move to Internet Protocol (IP) as the main transmission standard; telephony traffic is reconfigured from long-held calls into data packets for transmission purposes, and these packets are switched as priority data, and reconstituted as voice/data at the other end. As IP is 100% duplex and voice is about 60% simplex (we space our words and we listen while others talk) the network transmission saving is about 300% - which should have reduced call costs by about 70% over the last five years! (But the costs of competitive business swallowed this.)

2.2.2. Access Network Structures

In almost all cases, these access network architecture is a tiered star network, with the local exchange as the nominal local common point and all premises connections on the periphery. Thick traffic access feeds out to geographic intermediate points where the access is thinned out depending on the structure and finally serviced to each premises on an individual basis.

For telephony services using land lines (twisted pair cable), local exchanges are located like cells with nominal radii of about 3.5 km so that the twisted copper pair cable does not exceed 4.2 km as this is the maximum transmission distance with 0.40 mm copper. Local telephone exchanges convert the digital IEN transmission mode to analogue and the inter-exchange network signalling to customer-based line signalling to communicate with telephones.

To reduce costs, remote integrated multiplexers (RIMs) are commonly installed in roadsides. These act as miniature local exchange extensions and connect to the parent exchange by optical fibre or a few copper pairs, then provide from 30 up to 480 customer landlines from that location. Some smaller local exchanges extensively use this technology.

For mobile telephony services using GSM, mobile base stations are geographically located nominally at high points within valleys and occasionally on ridges so that black spots are minimised. These base stations are distributed so that usually at least two (if not three) base stations can service any mobile without dropping out – where the base station receiving the highest radio field strength from the mobile maintains the call. Each mobile base station is connected back to a parent node switch for channel and signalling via optical fibre or point-to-point radio (using small dishes).

For mobile telephony and Internet using CDMA and Wideband CDMA a similar base station topography exists, but because CDMA utilises a spread spectrum for tranceiving, the comparative number of base stations required is much less. With wideband CDMA the data burst rate can be far higher and so even though the comparative power from these base stations may be considerably lower, the comparative number of required of base stations is higher than required for GSM technology.

With three technologies used for mobile phones/Internet, the number of antennas associated with base stations is about three times that required for one mobile technology. Add the fact that this is a competitive network and at least three players are competing to supply duplicated services then this explains why there are a seemingly immense number of mobile base station antennas visible in major cities.

With ISDN the nearest node exchanges translate the digital streams and implement a severely restricted signalling set, and this is digitally transceived with the customers ISDN terminal equipment. 2 Mbit/s ISDN has about a 2.8 km maximum distance of copper pair, and this is an ideal interface for PABX Indial circuits in CBD arrangements.

For Community Access Television (CATV – pay television) / Cable Internet, the headend (usually located at a node exchange) consists of cable multiplex equipment to incorporate the

wideband television downstream and towards the top of the spectrum – nominally about 800 MHz a channel is allocated Broadband Internet interfacing. A Cable Headend Internet Modem effectively interfaces Internet feeds from local routers to appear as a television channel (including a backwards channel to feed data from customers back into the Internet). These feeds extend several kilometres to local partial suburbs via optical fibre where they are then converted onto coax and distributed either under power lines or underground past customer premises, through a series of splitters and amplifiers. This hybrid combination if optical fibre and coax is called HFC, which is short for Hybrid Fibre Coax. Thinner coax cables then connect to customer premises.

As HFC was competitively installed and several corners were cut; premises set back from the front street alignment were in most cases too far away from the coax street feeder to receive a signal strong enough for reliable reception. The alternative for these premises is to use a satellite receiver for CATV. This works; but the number of channels is severely limited and Cable Internet is not available.

For ADSL (Asymmetrical (speed) Digital Services Line) at the local exchange a DSLAM provides the interface to the common Internet feed for the customer landlines connected through this multiplexer. There are major operational problems with ADSL; mainly because customer access copper pair cable is totally unsuitable for Broadband transmission resulting in the transmission loss being very great over relatively short distances and 3.5 km is effectively the physical limit – even with massive line transmit power levels. These transmit levels cause a range of other problems and filters are required to minimise induced noise in shared telephony circuits. Because customer access pairs were not engineered for electronic balance well above the voice frequencies – crosstalk – or induced noise into associated pairs is a major issue limiting universal usage of ADSL in all pairs in any cable.

2.3. Regional City Networks

In regional cities there are usually a few telephone exchanges, and one of these is the main switching centre, and the main transmission path feeds to (and sometimes through) this building, and all (or some) of these transmission capacity feeds the regional inter-exchange structures.

2.3.1. Inter-Exchange Structures

Virtually all regional cities lie on major (or inter-capital) transmission routes, and these routes have a number of wayside telephony and data/Internet channels allocated for switched telephony calls and Internet. Because almost all regional telecommunications networks are based on tiered star topologies; the node (regional) switch is parented by one or two capital city main trunk switches. A high proportion of inter-regional telephony switching is actually switched through major capital city main trunk switches. The transmission path for these circuits is more often then not through common transmission links back to capital cities.

Internet routing has almost the same network structure and data packets are also parented through regional router-switches which in turn are parented through capital city based digital router switches fed from capital city based digital cross connects – and using the same transmission links in a nominal star structure with the nominal centres in capital cities. The problem is that Internet is bandwidth intensive and providing extra bandwidth for regional areas, heavily impinges on current available bandwidth used for telephony. Fortunately VoIP (Voice in Internet Protocol) has the capability of reducing network occupancy by telephony channels by about 70% - so this cannot be implemented fast enough!

Broadband Internet using the minimum (DSLAM and ADSL) are utilising all available IEN network capacity, and the proportion of customers able to get Broadband is considerably less

than for that in capital cities – so this service facility will be comparatively slower and far more difficult to procure than for the city cousins.

2.3.2. Access Network Structures

Virtually all regional cities have the same access network structure as capital cities – as the premises are virtually always less then 4 km from the regional telephone exchange – or one of its 'satellite' suburban telephone exchanges. What is missing is CATV (coax cable under power lines) so these customers cannot get cable television or use cable Internet.

To all intents and purposes these customers have exactly the same service standards as people in capital cities as they are within 4 km of the local telephone exchanges – but that is where the similarity stops! Beyond the nominal 4 km range, refer to the access techniques used for rural and remote customers – below.

Because GSM mobiles work on a narrow radio bandwidth, they are very susceptible in losing connections due to radiated signal cancellations in the path between the mobile base station and mobile phone. This is fine for metropolitan situations where the signal strength is strong and there are several towers, but in rural and remote areas this is unworkable and the CDMA (code division multiple access) technology solution avoids most of these problems because the transmissions are 'spread spectrum'. Unfortunately they (as GSM also) are limited by line of sight – due to the portion of the electromagnetic spectrum that is used, so the maximum usable range is somewhere between 10 and 20 km from the mobile base stations!

2.4. Rural and Remote Regional Networks

Beyond the regional cities are rural and remote local telephone exchanges and these are located in country towns.

2.4.1. Inter-Exchange Structures

The inter-exchange network structure is inherently simple as it is a second tier star network. This second tier starts from the regional exchange and extends to the local exchange – that is it! There is usually no alternate routing to another regional switch and in most cases the transmission path is fully occupied with telephony traffic, so there is no transmission space to include Internet and enable these exchanges to be connected to any form of Broadband Internet (eg ADSL with a DSLAM). In any case, the bandwidth required for Broadband Internet far exceeds the current transmission equipment capability from the regional telephone exchange, so in the current competitive climate these services will never be provided.

2.4.2. Access Network Structures

Apart from there obviously not being any CATV (coax cable under power lines) from these remote telephone exchanges to the customers, very few customers are actually within 4 km of the local telephone exchange, so virtually all customers are on 0.64 mm cable pairs instead of 0.40 mm cable pairs and this reaches as far as 7 km without the need for pair gain systems to further amplify the voice. Beyond this virtually all customer circuits need some form of pair gain system to relay the signalling and amplify the voice. These pair gain systems were never engineered for data/Internet – just voice.

3. A Synergetic Solution

3.1. Infrastructure Crisis Issues

For some decades now the national problem of having a greatly improved telecommunication infrastructure and with far cheaper user costs has been a very frustrating concept.

As shown above, it should be extremely clear that the competitive business approach to solving this concept was doomed at conception because the competitive approach demands that businesses literally fight against one another to provide services and the artillery of commercial (competitive) business is extremely expensive and not associated with the solution for the customers. Merchant bankers have duped successive Governments.

Collateral damage has included the shelling out millions of resource dollars to inform the prospective customers to feel good about a bad situation does not put the equipment in place and alleviate the situation, but wastes the resource money on intensive marketing, expensive advertising, protracted legal battles and the contracting of non-engineering staff to support these wars – and this seriously drains the available resource money away from providing the longer-term infrastructure solution.

Just before this competitive war began raging, technology advances provided the answers to both providing a greatly improved telecommunication infrastructure and with far cheaper user costs, and in the ensuing years these technologies were installed and commissioned along competitive business lines servicing the biggest cities best and leaving the rest of the country in collateral damage mode with an anaemic network.

It is now obvious that better telecommunication services actually came about through a progression of technical advances in digital switching, optical fibres and digital transmission techniques – all infrastructure based, and this had absolutely nothing to do with competition.

Australia now has a telecommunications crisis caused by having virtually all the major network based in a very thin corridor down the east and south (coastal) areas, and if any of the major cities was to suffer a terrorist attack or other major catastrophe, then the whole Australian telecommunications network could well collapse as there is virtually no alternate network routing beyond this thin corridor.

If the Australian telecommunication network structures described above have been understood, then it should be plainly obvious that there are essentially two widely differing network topologies used for the Inter-Exchange Network (IEN). The network topology used in non-metropolitan Australia is not commercially viable, but this infrastructure is basically owned by Telstra (ie. the Australian people through their taxes) it is a nonsense to have Telstra operating as a commercial business and telecommunications infrastructure provider.

In non-metropolitan areas the IEN is basically a thin tiered star network (as a direct follow-on from the earlier analogue structure) virtually all parented from major capital cities and some regional cities on the extremities of the first tier star network, and most local exchanges parented from usually one node. I believe that Internet is squeezed into previous spare capacity and basically the network has no natural growth allowances.

In major capital cities (metropolitan areas) the IEN is basically a mesh network consisting of a number of intersecting rings with local exchanges parented from more than one node, and with Internet feeds from several geographically diverse routers. This network is commercially viable, because of the population density and the alternate (mesh) routing.

It is now obvious that Australia needs an alternate network routing structure that is not based as star networks on capital cities but one that consists of a large number of intersecting rings, and these rings need to pick up all the regional centres to provide them with their future Broadband Internet requirements.

3.2. A National Synergetic Solution

It is very clear that the Universal Service Standards (USS) as described in the Davidson Report in 1982 did not take into account changes in the use, availability and application of telecommunications technology from that time and consequently these service standards are seriously outdated. These USS need to be reviewed on a regular basis for example every five years, and the Australian telecommunications industry would then have a relevant set of minimum services and standards to work from.

The direct consequence for the USS is that it is the gauge for funding to support customers in regional and remote areas, under the Universal Services Obligation (USO) legislation. As the funding for these rural and remote customer services runs at a loss funds are also drawn from competing telecommunications businesses, there is a large amount of angst and bitterness in paying a competitor to maintain competitive customers. Although this legislation was well intended, it is effectively unworkable as this supplementary funding has not fixed the problem; just extended the timeframe with no real resolution.

Regional rural and remote telecommunications is in a no-win situation because part privatisation has caused Australia's telecommunications infrastructure to be run along competitive business lines. Consequently these areas have been shown to be not-profitable so minimum investment in these areas has effectively run down these telecommunications infrastructures; making them even less profitable.

Directly; this lack of telecommunications infrastructure support has prevented regional, rural and remote areas in Australia from growing with the information technology revolution and consequently these areas have been starved of development. This has resulted in most country generations leaving regional cities and towns and moving to capital cities for employment – further starving these regions from developing.

While the major capital cities have exploded in size due to population influx from regional rural and remote areas, the communication network between these major capital cities has become very large also, and if these links were broken or a city devastated, then Australian business would stop – as the communications link (the Golden Boomerang) would be broken.

By changing the structure of the regional inter-exchange networks from tiered star networks based on capital cities, into a series of interconnected regional fibre-optic rings, this provides a geographically wide range of alternate paths for inter-city communications and it provides a wideband regional inter-exchange networks that currently are non-existent but necessary for future Broadband access use.

With these regional fibre-optic regional rings in place, this provides the foundation to provide fibre to the premises (FTTP) in all regional areas, and most remote areas, and provide all the Broadband Internet and CATV services that are necessary so that regional and remote Australia is not starved of information technology facilities.

No short-term thinking competitive business should be involved in funding this. It is the role of the Federal Government as it is the Board of Directors for Australia's Infrastructure management to fund this infrastructure development as a national initiative.

The synergetic plan proposed here will provide four major initiatives and they are:

- The development of a national geographically distributed inter-exchange network utilising intersecting regional optical fibre rings that are fully capable of carrying telephony, Broadband Internet, and television services for the next 30 years.
- This regional inter-exchange network will provide geographic alternate routing for major city communications and through this structure it will provide a degree of network robustness that would prevent national network failure should a major cities communications be taken out.
- The replacement of copper pair based voice grade engineered customer access network limited to nominally 4 km, with a passive optical network (PON) fibre to the premises (FTTP) access network with a metropolitan range exceeding 6 km and a regional/remote range exceeding 60 km.
- The rebuilding of wealth in our geographically regional, rural and remote areas through developing information technology and building businesses there. This type of engineering will provide a sustainable future-proof telecommunications network for non-metropolitan area in Australia and eliminate the ongoing need for USO payments.

With Telstra structurally separated, its infrastructure part can get on with the business of purchasing, installing and commissioning the necessary infrastructure to solve the thin 'golden boomerang' problem and in so doing provide the necessary infrastructure that regional Australia needs for its future IT growth. Telstra's reselling part can competitively resell the wholesale services as a separate entity.

3.2.1. Regional Optical Fibre Rings

This step involves more of a 'helicopter view'! While major capital cities are interconnected with long rings (providing generous geographic diverse path routing in some cases), the regional cities are usually connected on the cusp of a major route or as a spur off a major route, and this is the telecommunications competitive business failure.

Instead of linking as spurs off major capital cities, regional cities need to interconnect with optical fibre rings, and these rings need to intersect to provide the necessary geographic alternate paths and in doing this also provide major capital cities with network robustness. This synergetic infrastructure approach is a win-win situation as it opens up the regional cities to communicate high-density traffic, and it provides alternate capital city routing.

In a similar thought process in regional cities (above) in this case the major towns and cities need to be identified in a region and these then need to be connected with an optical fibre ring, and these rings need to intersect at major regional cities. Various government bodies may already have optical fibre in place with railways, electrical lines, and roads, and Telstra (and Optus and others) may also have optical fibre in place, so it may be a change of mindset from star network structures to closing the ends of the stars and making them into loops. Again it is not important which infrastructure or competitive business owns what, the fact that the infrastructure is not being utilised is criminal.

Some examples of possible regional loops (and many of these may already exist) include:

- Cairns – Atherton – Mareeba – Ravenshoe – Greenvale – Charters Towers – Townsville – Ingham – Innisfail – Cairns
- Townsville – Ayr – Bowen – Mackay – Clermont – Charters Towers – Townsville
- Charters Towers – Clermont – Emerald – Longreach – Boulia – Mt Isa – Cloncurry – Hughenden – Charters Towers
- Longreach – Barcaldine – Blackall – Augathella – Charleville – Quilpie – Windorah – Longreach
- Mackay – Yeppoon – Rockhampton – Blackwater – Emerald – Mackay
- Rockhampton – Gladstone – Bundaberg – Ban Ban Springs – Monto – Biloela – Rockhampton
- Biloela – Moura – Taroom – Miles – Dalby – Kingaroy – Monto – Biloela
- Bundaberg – Maryborough – Gympie – Kingaroy – Goomeri – Gin Gin – Bundaberg
- Gympie – Nambour – Caboolture – Kilcoy – Nanango – Gympie
- Toowoomba – Warwick – Goondiwindi – Moonie – Dalby – Toowoomba
- Miles – Goondiwindi – St George – Cunnamulla – Charleville – Roma – Miles
- Cunnamulla – St George – Moree – Walgett – Brewarrina – Bourke – Cunnamulla
- Bourke – Brewarrina – Byrock – Nyngan – Cobar – Wilcannia – Bourke
- Goondiwindi – Tenterfield – Glen Innes – Inverell – Moree – Goondiwindi
- Toowoomba – Ipswich – Brisbane – Southport – Ballina – Lismore – Tenterfield – Warwick – Toowoomba
- Walgett – Narrabri – Coonabarabran – Gilgandra – Coonamble – Walgett
- Casino – Lismore – Grafton – Glen Innes – Tenterfield – Casino
- Narrabri – Inverell – Glen Innes – Armidale – Tamworth – Gunnedah – Narrabri
- Armidale – Ebor – Grafton – Coffs Harbour – Kempsey – Port Macquarie – Walcha – Uralla – Armidale
- Tamworth – Port Macquarie – Taree – Forster – Raymond Terrace – Maitland – Singleton – Muswellbrook – Scone – Murrurundi – Tamworth
- Dubbo – Mendooran – Coonabarabran – Werris Creek – Murrurundi – Muswellbrook – Merriwa – Dunedoo – Dubbo
- Dubbo – Wellington – Gulgong – Mudgee – Hill End – Lithgow – Bathurst – Orange – Molong – Parkes – Peak Hill – Dubbo
- Broken Hill – Wilcannia – Cobar – Nyngan – Narromine – Dubbo – Parkes – Condobolin – Roto – Ivanhoe – Menindee – Broken Hill
- Cowra – Bathurst – Katoomba – Penrith – Campbelltown – Mittagong – Goulburn – Yass – Boorowa – Cowra
- West Wyalong – Forbes – Cudal – Orange – Blayney – Cowra – Grenfell – West Wyalong
- Griffith – West Wyalong – Cowra – Young – Cootamundra - Temora – Junee – Narrandera – Leeton – Griffith
- Deniliquin – Hay – Griffith – Leeton – Narrandera – Finley – Deniliquin

- Narrandera – Wagga Wagga – Albury – Finley – Jerilderie – Narrandera
- Temora – Cootamundra – Young – Boorowa – Crookwell – Goulburn – Yass – Gundagai – Wagga Wagga – Junee – Temora
- Canberra – Goulburn – Moss Vale – Wollongong – Kiama – Nowra – Milton – Ulladulla – Braidwood – Canberra
- Orbost – Bombala – Cooma – Bredbo – Canberra – Queanbeyan – Bateman's Bay – Moruya – Narooma – Bega – Eden – Cann River – Orbost
- Gawler – Burra – Port Pirie – Peterborough – Mannahill – Broken Hill – Coombah – Wentworth – Mildura – Renmark – Waikerie – Gawler
- Murray Bridge – Renmark – Pinnaroo – Bordertown – Kingston – Murray Bridge
- Bordertown – Horsham – Hamilton – Portland – Mt Gambier – Kingston – Bordertown
- Warrnambool – Hamilton – Ararat – Maryborough – Castlemaine – Ballarat – Geelong – Colac – Warrnambool
- Horsham – Stawell – Ararat – Ballarat – Bendigo – Charlton – Warracknabeal – Dimboola – Horsham
- Mildura – Robinvale – Balranald – Hay – Deniliquin – Echuca – Kerang – Swan Hill – Hattah – Mildura
- Murray Bridge – Victor Harbour – Adelaide – Gawler – Murray Bridge
- Port Pirie – Port Augusta – Whyalla – Port Lincoln – Streaky Bay – Kyancutta – (Port Augusta) – Port Pirie
- Bendigo – Echuca – Shepparton – Benalla – Seymour – Heathcote – Bendigo
- Ballarat – Bacchus Marsh – Melbourne – Healesville – Alexandria – Seymour – Kilmore – Woodend – Ballan – Ballarat
- Healesville – Alexandria – Mansfield – Benalla – Wangaratta – Albury/Wodonga – Tallangatta – Omeo – Bairnsdale – Sale – Warragul – Pakenham – Healesville
- Pakenham – Wonthaggi – Leongatha – Yarram – Sale – Morwell – Warragul – Pakenham
- Hobart – New Norfolk – Queenstown – Burnie – Devonport – Launceston – Campbell Town – Melton – Hobart
- Devonport – Deloraine – Launceston – Scottsdale – Herrick – Waterhouse – Georgetown – Exeter – Latrobe – Devonport
- Launceston – Legerwood – St Helens – St Marys – Avoca – Launceston
- Geraldton – Mullewa – Yalgoo – Mt Magnet – Paynes Find – Wubin – Moora – Eneabba – Dongara – Geraldton
- Mullewa – Morawa – Latham – Coorow – Mingenew – Mullewa
- Armadale – Pinjarra – Bunbury – Busselton – Albany – Katanning – Narrogin – Northam – Armadale
- Northam – Merredin – Kalgoorlie – Esperance – Katanning – Narrogin – Northam

This is a cursory first pass and by no means an exhaustive list but it shows that by changing the structure from capital city based tiered star networks into regional rings, the regional traffic density can be greatly increased without impinging on major inter-capital routes, and further should any of these major inter-capital routes suffer major failures, then because these

regional rings are interconnected, then the traffic flow can be automatically overflowed onto these interconnecting regional rings. So not only is the regional telecommunications infrastructure catered for in the future – but the major inter-capital routes now have alternate path routing in the case of catastrophic failure. This is a great infrastructure synergy.

All these locations (and many un-named) will need to have terminal and/or drop and insert optical fibre transmission equipment installed in their telephone exchanges along with regenerator equipment and system terminal equipment in the regional centres to manage and operate the optical fibre loops. At regional cities, digital cross connect switches will be necessary to join various streams in co-sited optical fibre rings, and it is this technology that will provide the synergetic major capital network alternate routing, and provide non-metropolitan areas with a future-proofed telecommunications network infrastructure that will be equivalent to that available in all major capital cities.

3.2.2. Regional City Optical Fibre Rings

One of the critical success factors for developing positive financial futures in regional cities is to ensure that these cities have excellent telecommunications facilities. The network planning engineering approach described here can be applied to virtually any regional city, and it should identify all the key areas that are associated with information technology (IT) based telecommunications in the future.

The issue here is that to date, other than the regional telephone exchange building, virtually all access communications is currently via insulated copper twisted pair cables, which were engineered for voice grade telecommunications, not Broadband Internet, and definitely not bi-directional high speed video.

This is where the role of infrastructure-based telecommunications network engineering comes to the fore – and this is also where competitive infrastructures are self-defeating. The first step is to look closely at each regional city and identify if and where the basic government and commercial business structures exist. This is no more difficult than locating the following structures, broadly within the 'city and suburban' limits:

- Telephone exchange buildings
- Mobile base stations remote from telephone exchange buildings
- Television Studio sites
- Television Transmission Towers
- The Base Hospital
- Other Major Hospitals
- University Campus
- TAFE Colleges
- Major Secondary Schools
- Industrial Parks
- Commercial Parks
- Central Business Districts
- Local Government Offices
- Regional State Government Offices
- Railway Stations
- Major Electricity Switch Yards

These are the micro geographic areas that will need to have high capacity telecommunications infrastructures in the immediate future, and insulated copper-pair based ‘star’ access networks from local telephone exchanges may be both totally inappropriate and may severely under-resource future infrastructure.

Having identified the locations of these high communication usage areas; it is essential to now identify if there is any optical fibre linking any of these areas, and these actual fibre routes need to be identified. It does not matter who owns this fibre and if it is in use or not, as the longer term plan will be that all these resources will be shared, and the current owners will have a user discount for useful infrastructure.

With this physical data, it is then a relatively easy Network Engineering task to notionally configure optical fibre ‘rings’ that intersects with these micro-geographic areas and where the circumference(s) pass through the major telephone exchange building in that regional city. Alternatively some of these areas may need direct links without alternate path routing afforded by ring architectures – but these are really network engineering issues.

Optical Fibre cable carries several strands, and it is used in pairs for these applications – and data flows can be made to travel in opposite directions in each pair; or travel in both directions with the one strand – depending on the applications. At this point the Network Engineering gets considerably more difficult with educated guesses of initial traffic densities to and from each area, and that in turn starts to ‘flesh out’ the required equipment capacities and their locations.

At each micro-geographic site, provision needs to be made for ‘drop and insert’ equipment – together with power backup and suitable security, and these days most government and business sites include a secure telecommunications room and/or area. Some rings are in fact physically overlayed optical fibre rings (in the same cable) with ‘drop and insert’ equipment for alternate areas so that like users have close common links and backup through other fibres.

We now have a common optical fibre ring structure for all regional cities that can provide high speed data, video, television, radio, Internet, telephony to all the micro-geographic areas broadly in the regional city limits. This transmission ring infrastructure will be similar to what is already in major capital cities and it puts regional cities on a level footing and with tremendous growth prospects. With this infrastructure there is virtually nothing stopping isolated regional cities from supporting a wide range of information based commercial businesses – within that city.

3.2.3. A Full Services Fibre Optic Access Network

Passive Optical Fibre Network to the Premises (PON – FTTP) has been successfully trialled in several locations in Australia and is in common use globally and this is I believe the way of the future. This technology has an optical transceiver in the local exchange and feeds out via optical fibre into the local access area where the cable is optically split up to six times – giving a split loss of about 18 dB (3 dB for each split), so one feed from the local exchange can connect up to 64 premises within a range of about 6 km. As the bandwidth extends beyond 1 Gbit/s, (1,000 Mbit/s) this provides ample bi-directional transmission capabilities for telephony and Internet; and with a different ‘colour’ transmission for CATV, then PON FTTP provides the ideal access for the future – but it requires substantial inter-exchange network infrastructure to make it effective – hence the earlier section in this paper.

It is imperative that this type of access network be installed in the very near future to virtually every premises in Australia; firstly to replace the technologically and physically ageing existing copper pair based access network that was engineered for voice telecommunications

(not Broadband Internet), and to replace the HFC cable television access network; secondly to provide the necessary access infrastructure required by our businesses and people for the next 35 years, and not just in capital cities but in virtually every premises in Australia.

Currently this PON – FTTP can be installed, but its potential will be severely limited as the inter-exchange network infrastructure (especially in non-metropolitan areas) is totally inadequate to provide the necessary bandwidths and alternate routing capabilities that are imperative for this access network topology.

3.2.4. ADSL 2+ Service Issues

The proposed introduction of ADSL 2+ brings with it a range of service issue problems as it uses bandwidth exceeding 2 MHz where ADSL uses only as far as 1.1 MHz, and ADSL 2+ requires twisted pairs to be paralleled up and this will dramatically upset the balance in cables resulting in far greater inter-pair interference. Added to this the fact that ADSL 2+ runs at low power in off times and at full power at operational times, and that full power is substantially higher than for current ADSL, then I believe that these full power bursts will cause Internet based network dropouts; caused by inter-pair interference, and/or that both ADSL and ADSL 2+ will never work anywhere near their full potential when on the same copper based access cable.

In my engineering opinion, all forms of ADSL should be stopped as soon as possible and be replaced with PON FTTP as a matter of commercial and infrastructure sense.

4. Conclusion

It is very clear that the Universal Service Standards (USS) as described in the Davidson Report in 1982 did not take into account changes in the use, availability and application of telecommunications technology from that time and consequently these service standards are seriously outdated. ***These USS need to be reviewed on a regular basis for example every five years, and the Australian telecommunications industry would then have a relevant set of minimum services and standards to work from.***

The direct consequence for the USS is that it is the gauge for funding to support customers in regional and remote areas, under the Universal Services Obligation (USO) legislation. As the funding for these rural and remote customer services runs at a loss funds are also drawn from competing telecommunications businesses, there is a large amount of angst and bitterness in paying a competitor to maintain competitive customers. ***Although the USO legislation was well intended, it is effectively unworkable and supplementary fundings have not fixed the service and infrastructure problems; just extended the timeframe with no real resolution.***

Australian major capital cities have telecommunication infrastructures that are far superior to those in regional centres and non-metropolitan areas; and this is a prime factor that has driven almost all competitive businesses involving any form of information technology (IT) to operate in major capital cities, even though property prices are far higher.

The socio-economic cost to Australia is immense as the population has moved to where (IT) work is available and that has caused our major capital cities to dramatically expand, resulting in extortionately high housing and rental costs; resulting in both partners working, paid child minding, high family separation rates, and consequently very high social support costs.

Over several decades merchant bankers in collusion with economists have duped successive Australian Governments into believing that competition is the panacea for all business inefficiencies, and that the private sector is far more efficient than the Government (public) sector. What has never been admitted was that competitive practices only work for

comparative sized businesses trading similar commodities; infrastructure is not a commodity; ***Governments are the Board of Directors responsible for managing infrastructure; the infrastructure is owned by the people, and; this infrastructure is not for sale.***

It should be painfully obvious that two or more duplicated infrastructures fighting against each other is pitifully inefficient and that any form of infrastructure synergy will bring tremendous efficiencies, with far lower operating costs. ***The Federal Government needs to change the policy concerning competition and in practice this means to remove competition and competitive practices from infrastructure businesses; and replace these policies with synergetic policies and practices for infrastructure businesses.***

It should now be very clear (even to the most inept) that in the last 30 years; technology advances in optical fibre replacing copper, digital switching replacing mechanical switching and digital transmission replacing analogue transmission have themselves created dramatic efficiencies and savings causing the operational prices to implode. ***The costs of competitive wars between telecommunications infrastructure businesses (including at least: sponsoring, advertising, marketing, legal battles, and consulting) have dramatically driven up the operational costs and almost wiped out the efficiencies and savings of technology advances.***

Regional Cities, town, rural and remote telecommunications are in a no-win situation because privatisation has caused Australia's telecommunications infrastructure to be run along competitive business lines. ***As these areas have been shown to be less profitable or non-profitable, so minimum telecommunications infrastructure investment in these areas has effectively run down these areas making them even less profitable.***

There are three conceptually different networks that combine to make the telecommunications infrastructure; the Customer Premises Network (CPN), the Customer Access Network (CAN) and the Inter-Exchange Network (IEN).

In Australia's biggest major cities, the IEN is a mesh, which is in stark contrast to the rest of the IEN in non-metropolitan areas (that is: areas outside Australia's biggest cities), where the IEN is a thin, tiered-star network, lacking alternate routing, and it is this infrastructure that is the 'Achilles Heel' preventing competitive business to develop and grow in these areas. ***To further demonstrate the disparity in infrastructure standards, Broadband Internet is now seen as the essential imperative infrastructure for most competitive businesses as the prime communication medium, and non-metropolitan areas do not have the minimum necessary alternate routing infrastructure to support high bandwidth IEN.***

Between Australia's biggest major cities there is a solid but geographically narrow telecommunications IEN that is susceptible to terrorist attack and/or accidental damage. As there is very limited geographic alternate routing this puts Australian competitive businesses in a very high-risk situation. ***Australia's IEN needs considerable alternate routing, and this can be synergetically engineered by changing the regional IEN structure from tiered-star networks based on major capital cities, into tangential rings inter-linking regional centres.***

The network restructure for regional (non-metropolitan) Australia proposed in this position paper provides the foundations for Regional Cities to develop and grow strong IT based industries. ***This restructuring synergetically provides a high degree of alternate network routing without impinging major capital cities, and for major capital cities a high degree of alternate routing. It is also the synergetic foundations to support IT based businesses.***

With the Regional IEN structured on tangential intersecting optical fibre rings, almost all towns and cities would then have the necessary network bandwidths for businesses and the community requiring high-speed bidirectional Broadband Internet (and the ability to net cast CATV). ***This IEN would then be the synergy structure for Regional Cities, rural areas and remote towns to connect PON FTTP (optical fibre to the premises) access network to almost all premises in Australia, and have high-speed bidirectional Broadband Internet facilities.***

The introduction of Broadband Internet has shown that user bandwidth requirements are well beyond that is capable from the existing copper pair based CAN (that was engineered for voice band – not Internet). ***ADSL is a stopgap technology with major limits in speed and distance.*** The newer proven technology of passive optical fibre network (PON) to the premises (FTTP) has bidirectional bandwidth capabilities ideally suited for Broadband Internet far exceeding the ageing copper pair based CAN, and PON FTTP also has a distance range far exceeding that of copper pairs – making it ideal for direct replacement of copper based CAN including pair gain systems used for voice based customer access in regional and remote areas. ***It is therefore an imperative that PON FTTP needs to be programmed in for replacing the copper based CAN as a very high priority infrastructure replacement.***

The engineering of the Australian telecommunications infrastructure started in 1856 and it has been a continual works-in-progress (WIP) ever since, with the Federal Government being the prime but reluctant Board of Directors of this infrastructure for the large majority of the time. ***It is now time for the Federal Government to responsibly manage this infrastructure by structurally separating Telstra to remove the competitive forces that are in conflict with infrastructure; fund Telstra's infrastructure body to restructure the regional IEN; stop the ADSL rollout and, nationally implement PON FTTP as the new telecommunications standard for Australian competitive businesses and the population.***

I am recommending that this position paper be seriously considered as it contains a visionary framework for a set of national, regional and local infrastructure and commercial synergies that politically and commercially cannot be ignored. ***I see this restructure of our telecommunications infrastructure in Australia as the critically necessary foundation for competitive businesses to grow with for now, and prosper on in the future.***

5. Malcolm Moore JP BE(Elect)

Malcolm Moore was raised in Central NSW, educated at The Kings School, trained as a technician in the PMG, specialising in telecommunications equipment specification, design, construction, installation and commissioning. Advanced through TAFE, senior technician, technical officer ranks with specialist streams in research, radio and broadcasting, transmission systems and computer programming while supervising a technical staff base.

Qualified as an Electrical Engineer (NSWIT/UTS Sydney) and managed several innovative microprocessor-based monitoring equipment projects. Gained experience in Forward Network Planning, Transmission Planning, Switching Planning and Finance and Project Management. Took on leading roles in the national analogue replacement programme. Involved in nationally rationalising maintenance centres and then; because of strong network knowledge and transmission equipment expertise; was head hunted to resolve intractable customer service issues. Identified systematic degraded service standard issues and with HQ cooperation and national teamwork at all levels, all Business Units and most technologies; resolved and mitigated a very wide range of customer impacting service issues.

Managed and nationally steered several specialist Engineer/Technical teams that developed a series of live network monitoring systems, techniques and facilities that pinpointed customer-impacting issues for resolution. Managed the process to align network transmission and switching equipment settings to align with nationally based service standards – completing the links between customer service issues, service standards/specifications, equipment limitations, service training requirements, and equipment life cycles.

Extended significant digital network/optical fibre expertise in NZ as a Project Engineer and as a Project Manager for telephony/data on CATV using HFC in Victoria. As a Bid Manager gained a wealth of corporate relations knowledge as well as extending engineering expertise in several areas including as wide range of IT infrastructures and business models.

Took on the role of the Development Manager for the Australian Seniors Computer Clubs Association, giving it a national focus, championed Broadband for seniors and aligned their course structures in teaching seniors how to use and get the best out of personal computers.

Developed a comprehensive in-depth knowledge of stock exchange technical indicators and through theoretical analysis, created a range of indicators specifically optimised for live data trading. Developing software that monitors, records, analyses and reports on live ASX data.

Malcolm Moore is available to lead and/or guide a vision of telecommunications industry restructure process and develop the necessary Broadband telecommunications infrastructure throughout Australia, as this is the imperative for Australia, if Australia is to continue to be a force in the global competitive business economy.

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