Public Submission to the

Select Committee

on the

National Broadband Network

By

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Dear Secretary

The intent of this submission is to prevent Australia wasting $44,000,000,000

Following the determinisation for the privatisation of telecommunications industry in Australia in 1982; I believe this process was totally botched by creating competitive infrastructures instead of creating competitive wholesale reselling retailers. Many Select Senate Inquiries to date have not identified and/or reported how to fix this structure. Consequently, these failed inquiries have cost us Australians very dearly.

Through 1995 to 2008, Federal Governments initiated more than 10 failed and rather poorly-considered "initiatives" or quick-fixes to make the telecommunications look apparently "more available" / "up to scratch" to foster full privatisation at any expense.

Since 2007, there were three successively larger and more expensive versions of a National Broadband Network (NBN) infrastructure to partially replace what had been pirated, misplaced and uneconomically rolled out by competitive infrastructures.

In late 2103 we have seen reported and estimated costings for various versions of the National Broadband Network in the realms of $22 Bn, $43 Bn, and over $73 Bn. Concurrently, Australia is now in deep debit and apparently all considerations are open to minimising this debit, including the future (or not) of the NBN rollout.

The intended outcomes of this Select Senate Inquiry into the NBN are stipulated in Paragraphs 1, c, d, and e of the Terms of Reference. This submission is in direct relation to these paragraph excerpts.

- **The Cost of Alternative Equipment**
- **Alternate NBN Revenue Scenarios**
- **Construction Requirements**
- **Access to Telstra's Copper Network**
- **Government's Cost Benefit Analysis**
- **Availability of Broadband in Australia**
- **Any Related Matter**

As a practical and professional Australian telecommunications industry expert, I have provided several submissions to Select Senate and similar Inquiries spelling out the problems and providing answers to maximise telecommunications productivity, while minimising regulation and minimising financial waste. **Very little has been heeded.**

We are now talking in multiples of $11,000,000,000 ($11 Bn) in waste.

It seems to me that only the most simplistic comments are heard and transcribed into these Select Senate Committee Reports. Virtually all the background historical and engineering data, information and knowledge leading to wise strategic decisions to go into these Reports are totally omitted because it is not taught in Economics.

Although I fully appreciate the need for the Australian Stock Exchange (ASX) to have a telecomms sector, I believe telecomms privatisation was botched on a monumental scale causing the ASX telecomms sector to be substantially lower than it would be and will stay that way until the Australian telecomms industry is correctly restructured.

Broadly, the internal costs of competitive telecomms infrastructures in Australia have grossly oversupplied unnecessary multi-duplicated infrastructures in the capital cities and grossly under-supplied necessary infrastructures outside the State capital cities.

The external costs have: introduced very expensive regulation, crippled business productivity everywhere in Australia; and is now costing the Federal Government considerable revenue to properly fund the very-delayed full NBN rollout.

Since telecommunications equipment manufacture was Globalised (circa 1985-1990) Telecomms Boards have stepped away from long term engineering and focussed on maximised Return on Investment (ROI) through Retail Reselling in select markets and select geographic areas. These Boards are now totally controlled by Sales and Marketing, and Funds Managers, who all are pushing to maximise short-term profits for their shareholders, and (of course) their personal incomes.

Aligned with this change of guard in the Board Rooms, the timeframe of this thinking is now less than a year, as it is totally focussed on the Retail products and not on the long-term rollout of infrastructure on a national basis which is measured in decades.

In a similar fashion, the Governments / Oppositions members are also thinking in less than a three year span to ensure re-election. This situation goes a very long way to explain why Select Senate Reports and the like generally have very little strategic focus beyond the immediate.

"*Rome cannot be built in a day!*" but I believe that "**Australian Telecommunications Industry can be totally restructured within a few months!**"

The simple direction is: **Save wasting at least $44,000,000,000 by significantly restructuring to the whole Australian telecommunications industry.**

Please do not hesitate to contact me.

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Some Background Information

Before Privatisation

The Federal Government's Post Master General's Department[1] (PMG) was formed at Federation in 1901 to manage Australia's Posts and Telecommunications. The PMG also administered / licensed radio broadcasting. In 1927, the National Broadcasting Service (NBS) was established by the Federal Government and in July 1932, the NBS merged with the Australian Broadcasting Company (ABC) to become the Australian Broadcasting Commission[2] (ABC). In July 1983 the name changed to became the Australian Broadcasting Corporation (ABC).

The Federal Government established the Overseas Telecommunications Commission[3] (OTC) in August 1946, with what I believe its prime focus to provide international telecommunications connectivity to and from Australia with the rest of the world. This commission seemed to work very well in virtual isolation to the PMG but the technicians in the OTC, the PMG and the ABC all trained at the same facilities until the 1980s, as most of the techniques and equipment were common!

In mid-1975 most of the PMG's Department was split into two major commissions; the Australian Postal Commission (APO) and the Australian Telecommunications Commission (ATC; more commonly known as Telecom Australia).

One of the prime reasons for splitting most of the PMG into separate Commissions was that all financial decisions had to go through the Federal Government as Acts of Law.

This split from being a Federal Department gave immediate autonomy so that Telecom Australia could purchase and sell real estate, equipment, vehicles equipment etc. without having everything going through the lower and upper houses of Federal Parliament for approval, as this process was extremely inefficient.

Another prime reason for separating these PMG functions into separate Commissions was that functionally, the Posts were seen at a rather high executive management level to be very different than Telecomms.

What the Politicians didn't comprehend was that in the mid-1970s computer automation techniques were being developed (particularly for letter sorting) and a proportion of highly skilled PMG technicians and engineers were working on creating rather advanced automated letter sorting equipment in Australia.

The PMG/APO was developing world's first electronic / computerised letter sorting and most of this engineering work was being done by Engineers and Technicians that would later be transferred into Telecom Australia!

[1] http://en.wikipedia.org/wiki/Postmaster-General's_Department

[2] http://en.wikipedia.org/wiki/Australian_Broadcasting_Corporation

[3] http://en.wikipedia.org/wiki/Overseas_Telecommunications_Commission

Going Digital in Australia

Concurrently as the digital world was taking off, other highly skilled PMG Engineers and Technicians researched highly productive digital switching and transmission technologies to replace mechanical switching and analogue transmission equipment.

With technology advances[4], printed circuit board assembly was commonplace by 1975, and by 1980 most telecommunications equipment manufacturing was being controlled by multi-national telecommunications manufacturers like Siemens, STC, Marconi-Marelli, Nortel, LM Ericsson, NEC etc. at that time.

As digital equipment was purchased to replace analogue equipment from 1980 onwards, the Australian telecommunications manufacturing industry was either swallowed up or closed down with names such as AWA, STC-Australia, Philips-Australia, JN Almgren, Trimax and several other being either merged into multi-nationals or pushed out of existence.

Telecom Australia went through a massive equipment rebuild of its Inter-Exchange Network (also known in USA slang as the “Backhaul Network”) to change over from analogue into digital. This process started in 1979/1980 and was complete in 1993, taking about 13 years, but even then the older analogue equipment was not totally removed until about 2000. The Customer Access Network (CAN) remained very substantially analogue with pair copper wire as the main transmission medium.

Single Mode Optical Fibre

There was a second digital telecommunications revolution that started in mid 1985 with the development of Single Mode Optical Fibre (SMOF) and at that time, Australia through the Telecom Research Laboratories (part of Telecom Australia) was leading the world in research in this area!

Single Mode Optical Fibre:

- Is extremely inexpensive to manufacture compared to pair copper or coaxial cable technologies.
- Is very reliable compared to pair cable, coax cable, Satellite / point-to-point radio communications systems.
- Is very thin, compared to quad cable, coax cable, pair cable
- Connects over long distances (typically 90 km) with very little degradation in the signal group delay, which is considerably better than for radio / satellite and/or coax cable long-haul systems.
- Has a very wide bandwidth compared to coax cable (which was renowned for its bandwidth in it’s time).

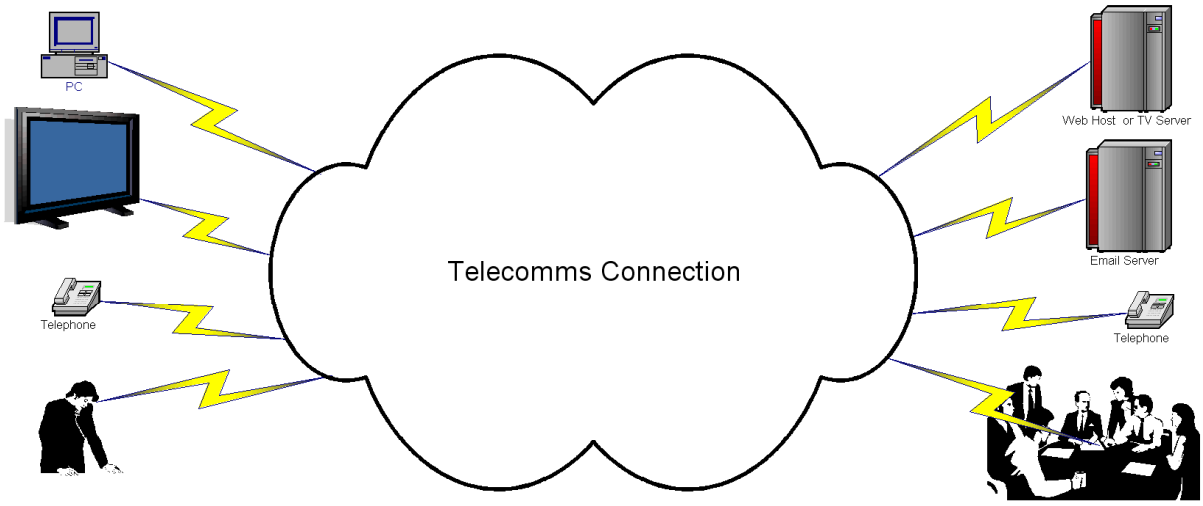
From 1986 to 1993, literally (almost) all the Inter-Exchange Network (Backhaul Network) in Australia was replaced by SMOF, and this facilitated the swift change to digital technologies in less than 15 years.

[4] Refer to the Appendix of this submission: “The Silicon Technology Revolution”

The Basics of End-to-End Connectivity

The pictures below[5] were two of several presented and later submitted to the Select Committee on the NBN (2009) to start at a common low-level rung and work up very slightly in complexity to demonstrate how the CAN and IEN must through-connect to make an effective end-to-end connection.

Simplified End-to-End Telecomms Network Overview



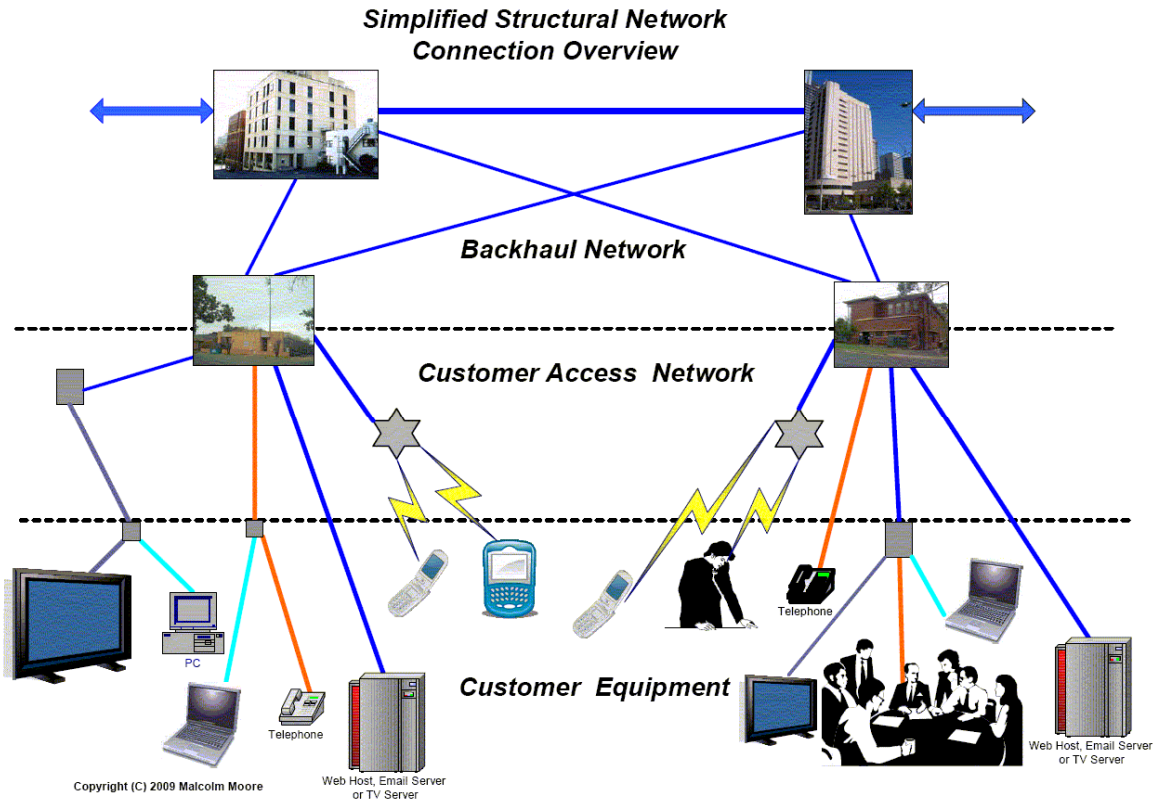
This picture above shows in very simplistic comic form that the telecommunications network has a through connection (from any to any) where any of the devices can be made to connect with any of the other devices around the conceptual cloud of the telecommunications infrastructure.

For example: a database (on the right) can send a movie through to a TV, or a computer or onto a mobile phone. A (mobile) Telephone can connect to a hands-free telephone on a desk in a meeting. A database can automatically interrogate another database elsewhere in the world.

The picture below shows more schematically the essential paths of end-to-end connections through the telecomms infrastructure network. For an end-to-end connection the path must go through the Customer Access network at the local end, then **must also transit through the Inter-Exchange (Backhaul) Network** (IEN), and then to and through the other end's Customer Access Network to connect the customer equipment at each end.

The below picture was deliberately "colour keyed": **orange** represents Cat 3 pair copper, **cyan** represents Cat 5 or Cat 6 pair copper, the **yellow** (lightning) represents radio (with the star representing a radio base station), **grey** representing coaxial cable, and **blue** representing single mode optical fibre (SMOF).

[5] The presentation was submitted as 45a to the **Select Senate Committee on the NBN** (2009) and a copy of that document is available at http://www.moore.org.au/senh/2009/2009_NBN2.htm



The central Inter-Exchange Network ("Backhaul Network" in USA slang) component is essentially a very large mesh of long distance communications equipment in switched layers – much like a road grid of local streets and junctions, main streets, highways and freeways. No customers are connected to the Inter-Exchange Network. The customers connect off the Customer Access Network.

These IEN switched transmission layers are linking Local exchange sites to District exchange sites; then District exchange sites to Regional exchange sites, then Regional exchange sites to Main / National sites. Above this there is another level of Competitive / Gateway switches Competitive Gateways that link to each other.

Towards the bottom of the picture is the Customer Access Network (CAN). This is the network that connects from the Customers' premises / building / mobile device to the Local Exchange. The CAN has no switches in it apart from time shared access in some cases like GPON, and usually the CAN is a relatively short distance network.

Typically G3 / G4 radio has a distance limit of less than 5 km, urban pair-copper has a distance limit of about 4.1 km, urban FTTP GPON has a distance limit of about 10 km, and non-urban FTTP GPON has a nominal distance limit of about 60 km.

All end-to-end connections must pass through the CAN at each end and must through the Inter-Exchange Network in the middle.

Almost all the transmission and switching in the IEN these days is done with the Internet Protocol (IP), and almost always using Single Mode Optical Fibre (SMOF) as the industry standard transmission medium.

It should now be reasonably obvious that the large proportion of all end-to-end connections is through SMOF. Also, all telecommunications connections must pass through the IEN / Backhaul Network to make every end-to-end connection, be it

telephony, mobiles, Internet, Pay TV, interactive Apps, Cloud Computing, ATM / Card transactions and a range of interactive "Apps" etc.

The Need for Broadband Internet

There was a third telecomms revolution (Internet) that started in 1983 in Australia, but never really got traction until the mid 1990s. Data transfer and Internet Protocol (IP) are cousins of the same family, whereas telephony is a comparative distant family.

The problem was that the Telecom Australia infrastructure – like all the other telecomms infrastructures everywhere else in the whole world – was fundamentally engineered for "narrowband" Voice Frequency Telephony.

In 1985 I was engineering the connectivity structure and capacity usage for the first Melbourne – Sydney Single Mode Optical Fibre (SMOF) network, including the entire wayside (country cities and towns) on the way and nearby.

While working out the projected usage in future years (5, 10, 25 year forecasts) I was surprised to see the estimated data content rising at a much faster rate than the telephony content. My then estimation was that by the year 2000 that data would be bigger than voice telephony! ***This surprising prediction proved correct (as Internet was barely a tiny baby at that time).***

This SMOF backbone network / path is still central to the "Golden Boomerang" of high capacity connectivity between Brisbane – Sydney – Melbourne – Adelaide. At that time most of the digital transmission equipment to be used on this major SMOF route was engineered around replacing telephone connectivity and TV channels from the ageing Melbourne - Sydney Coax Cable that was installed in 1957.

Since 1987 the original (same) SMOF cable is still in place and being used with newer, much wider bandwidth digital transmission equipment, capable of transporting and carrying the much larger throughput in the "Golden Boomerang". This route is now multi-duplicated to transport far more throughput, and competitive infrastructures also use the same / similar geographic path.

More Industry Restructuring

After the push to split up the PMG's Department in 1975, there was a concerted effort to privatise these commissions and have them on the Australia Stock Exchange (ASX) so that superannuation funds and the like could trade / invest in these stocks.

The problem was most of the then executive management in the then PMG and Politics were from the Depression era, and had gone through the horrors of WW2. These people generally had a very conservative / benevolent mindset to keep people employed instead of letting them go; and to not let anything go to waste.

In other words, the PMG and other Government bodies actively employed people (often in menial jobs) rather than put these people onto pensions with no active life involvement or future. Many of these Government Departments including the Public Service[6] were in effect "sheltered workshops" for decades after WW2.

To compound the telecommunications problem, most of the then equipment was analogue and mechanical, which meant high maintenance (and low profits).

[6] This submission in 2008 "Building the World's Best Public Service" went into another Committee and the Report simply disappeared without trace!
http://www.moore.org.au/senh/2009/20091020%20Public%20Service%20Reform.pdf

Nevertheless there was heavy and persistent pressure from the private sector (and I very strongly believe the IMF / WTO were behind all this) to have the new Telecom Australia privatised for the commercial / financial interests of the USA private sector.

Only one year after digital switches started to be rolled out into the Inter-Exchange Network (Backhaul Network) in 1980, the Davidson Inquiry was set up in 1981 to "recommend the liberalisation of telecommunications, including the unrestricted use and resale of Telecom Australia's capacity, and the establishment of independent networks, with interconnection permitted between leased networks and Telecom Australia's [Public] Switched Network".[7]

Personally, I believe the **privatisation process** of the telecommunications industry in Australia **was botched on a monumental scale**. This process served its immediate purpose and that was to establish a telecommunications sector on the Australian Stock Exchange (ASX), irrespective of the (even then) rather obvious consequences!

Only a small part of this botched privatisation process is being accounted for in costing the NBN Mk 2 rollout, in multiples of $11,000,000,000.

The current Liberal Federal Government is really struggling to come to terms with funding the NBN Mk 2 and a range of other infrastructure capital investments.

The previous Labor Federal Government totally ran down Australia's reserve funds to provide very questionable / ill-advised social support and infrastructure programs.

Previous to that, the then Liberal Federal Government deliberately avoided investing in national infrastructures, but instead stashed several $ Bn of reserve funds into "future funds" (for the financial sector), effectively crippling Australia's 10 – 15 year (mid-term) future competitive business development and growth.

[7] More detail on this topic is in www.tja.org.au/index.php/tja/article/view/70/95

The Cost of Alternative Equipment

Paragraph 1/b/2 specifically raises the Cost of Alternative Equipment

The NBN Strategic Review 2013 produced for the Liberal Federal Government considered a small range of commercially available equipment rollout scenarios to provide Broadband connectivity in the Customer Access Network (CAN).

Approximating Access Lines and Mobile Device Accounts

- In round figures there are about 10 M (10,000,000) pair copper phone lines (or if you like: "premises") in Australia,
- Using the Parito 80/20 rule, about 80% (8,000,000) are in the metropolitan area and 20 % (2,000,000) are in the non-metropolitan area.
- Considering the metropolitan area, the maximum length is nominally 4.1 km and the average length is nominally about 2.9 km.
- The urban / non-urban demographics roughly follow the Parito 80/20 rule, so about 1,600,000 lines / premises are in country cities.
- The remaining 400,000 lines / premises towns, villages and non-urban situations.
- About 320,000 lines will be in towns and the remaining 80,000 lines are villages or homesteads.
- Similarly for Personal Mobile Devices; there are about 25,000,000 people in Australia and roughly, there are about 25,000,000 Mobile Device accounts in Australia.
- Using the Parito 80/20 rule, about 80% (20,000,000) accounts are in the metro areas, about 5,000,000 would be non-metro.
- Of the 5,000,000 non-metro accounts about 80% (4,000,000) will be in the regional cities, 800,000 will be in the towns and about 200,000 will be in villages and in homesteads.
- The chart of Mobile only customers[8] (no physical line) indicates that by December 2013 this figure will be about 4,000,000 and this is about 16% of the Mobile account base numbers.

Scenario 1: Continue rolling out FTTP as per NBN Mk 3

Telstra Fighting with the NBN Co

Apart from the obvious endless bargaining and negotiating between Telstra and the NBN Co, in particular about rights to footpath conduits, pits, exchange floor space, power, air-conditioning, site access, existing and proposed radio towers and a range of other conflicting issues; both Telstra and the NBN Co are effectively fighting each other at every level.

The cost and stupidity of this fighting and infighting is astounding, as Telstra is both an infrastructure businesses (at least the part of Telstra that connects with the NBN Co CAN is), and the other part of Telstra is a competitive business, and this is the area that is causing all the financial problems.

[8] While it is interesting that part of the community is moving to purely G3 / G4 Access connectivity (at a premium price) it is also interesting that there are more mobile accounts than people in Australia!

http://www.itnews.com.au/News/349061,one-in-five-australians-ditch-fixed-line-phones.aspx

As if these problems could not be worse, competitively, the NBN Co. CAN connects through a "Point of Interconnect" (POI) into the Telstra IEN / Backhaul Network. This connection is at a high level in the IEN infrastructure, so when a Regional, Rural or Remote connection is made to a POI, it is common to have a long tail, sometimes several hundred km to connect into the nearest POI. This is an immense and totally unnecessary waste of resources.

The Very Expensive Covert Revolt

- Telstra and Optus seem to be covertly stifling the NBN Co FTTP rollout by overtly promoting 3G / 4G Broadband Radio Customer Access Network (CAN) connectivity, particularly in metropolitan areas.
- I am sure the intent is to move these consumers[9] off pair copper (ADSL) and onto 3G / 4G before the NBN Co requests the pair copper line to be replaced by a FTTH alternative.
- It seems the intended outcome is that these consumers would be locked into the vertically linked infrastructures to bypass the wholesale pricing of the NBN Co CAN infrastructure, which may impact on shareholder profits.
- By covertly stifling the NBN Co rollout, I believe the intended strategy is to then discredit the NBN Co costing and take ownership of the FTTH infrastructure in closing the NBN Co.
- Instead of providing Consumers with FTTP to replace ageing pair copper consumer access services, the first (and often only) choice is consistently 3G or 4G, even though HFC passes[10] these premises but is not connected.
- Where HFC is connected to provide Pay TV connectivity, consumers are actively not given the option of Cable Internet on this same Broadband connection and offered 3G / 4G or ADSL instead.
- Telstra has covertly stifled the NBN rollout by successfully arguing against the NBN Co using just 6 POIs in Australia, located in the capital cities.
- The NBN Co. has had to completely re-design their entire network infrastructure to use far more POIs than originally planned.
- This enforced network redesign took several months to re-engineer, setting back the NBN roll out by upwards of 6 months.
- A mere 6 POIs would have allowed the NBN Co effectively and inexpensively bypass most of the existing thin Inter-Exchange (Backhaul) Network currently owned and operated by Telstra, particularly beyond the metropolitan areas where this infrastructure is too thin.
- Having far more POIs has caused the NBN Broadband Network to be far more complex than it would have been, and probably far more expensive too.
- These extra POIs cause the signal path to "trombone" up to several hundred km causing the delay to be considerably more than with capital city POIs.

[9] IT News 05-Jul-2013 "Shift to Mobile Broadband also Grows" – Juhe Saarienen
http://www.itnews.com.au/News/349061,one-in-five-australians-ditch-fixed-line-phones.aspx

[10] In 2013, a friend in Turramurra NSW, tried to get HFC Internet in place of ADSL and every ploy to stop it has been tried; including "it cannot be installed", "you can't afford a coax amplifier", "asbestos is in the (plastic) conduit", to prevent him connecting to HFC, but the G4 solution is being very heavily pushed! He still, after three months of trying does not have the HFC Internet connection.

- Unless there is a radical increase of Inter-Exchange (Backhaul) Network infrastructure these extra POIs will be the cause of significant network congestion (as the telephony-caused Inter-Exchange Network (IEN) congestion was with the inland telephony network (1945 – 1990).

Scenario 2: Radically change the FTTP rollout techniques.

The full heading of this section was to "**Radically change the FTTP rollout techniques to maximise productivity**".

Radically Increase Productivity by Utilising TQM

- Total Quality Management (TQM) has an inherent continuous improvement programme that involves all levels from the front line workers, contractors through and including the Directors and CEO.
- TQM is the most efficient management program ever devised to re-engineer and/or continually improve process to continually maximise profitability.
- TQM was dropped by Australian industry (circa 1995) and replaced with the ISO 9001/2 Quality Management Assurance System and the ISO 14001 environmental Management system.
- The prime reason for replacing TQM with ISO 9001/2 and ISO 14001 was so that Company Directors and Senior Executives could isolate themselves from any form of litigation, and force all blame on the front line work force wherever and whenever possible.
- This change to ISO 9001/2 and ISO 14001 now produces huge amounts of non-productive Red and Green Tape; and provides a very fertile breeding place for workplace unionism.

Utilise Cable Blowing to Accelerate the FTTx Cable Rollout

- Installation and Commissioning of FTTP for consumers is a new process, and several trial locations were tried to identify and iron out the problems.
- The relatively new technique of "blowing" a SMOF cable through a conduit / pipe shows strong potential to very significantly reduce the installation time of threading a fibre to a distant location.
- "Blowing" SMOF cables to distant locations could be incorporated into the existing FTTP / FTTB rollout plan and very significantly reduce installation costs, making the notion of FTTN a very expensive consideration. Rodding and roping SMOF cables through conduits and pipes has a high propensity to stretch the cables, causing micro-cracks in the fibres which results in the fibres breaking or have a severely shortened low-loss life.
- The technique used for "blowing" fibre trough existing conduits is a developing installation practice that has still yet to be fully developed.
- "Blowing" SMOF cables to premises through existing conduits may prove to be and extremely fast and inexpensive installation practice with the right techniques and equipment.
- When better developed, "blowing" access fibres to premises should make a very significant productivity improvement by substantially reducing the time to thread fibre cables through existing conduits to premises.
- Recent studies show that SMOF cables can be quickly "blown" through conduits well over 2500 m long.

- "Blowing" SMOF cables to distant locations could be incorporated into the future FTTP / FTTB rollout plan and very significantly reduce installation costs, making the notion of active FTTN/FTTC a very expensive consideration.
- Considering that a very high proportion of existing larger Telstra conduits under the footpaths were constructed with asbestos cement (pre 1982) these larger (100 mm dia) conduits may be immediately unsuitable for "blowing".

The above two cable "Blowing" machines / tools[11] are examples of this relatively new technique. The much larger unit (above left) is for main/thick SMOF cables through large conduits and the one on the right is for FTTH in much smaller conduits, ie into houses, home units, factories from the street. The equipment shown here may not be optimised for Australian cable and conduit dimensions.

This equipment can blow SMOF cables through existing under-footpath conduits as far as 3500 m and at up to 100 m/minute. **In other words to blow a SMOF cable from a passive node into a building site down the street would typically take about a minute. This potential productivity cannot be ignored.**

Impervious Inner-coat Asbestos Cement Conduits / Pits

- It may be highly practicable and extremely inexpensive to "pull-through / paint" the internal wall of these (100 mm dia) asbestos cement conduits with a thick resin/epoxy paint or a hot thermo-plastic (eg polyethylene) to seal the internal wall, so these conduits can be utilised for safely blowing SMOF cables.
- There should be virtually no risk of asbestoses by blowing SMOF cables to premises through 20 mm dia (plastic) conduits connecting to premises.
- Currently the majority of multi-premises are being "passed" by NBN and not "connected" to give the appearance of connectivity in just the same manner as was done with the extremely expensive[12] competitive HFC rollout.
- There is a very significant productivity gain to be capitalised on through economy of scale practices in mass production by installing (blowing) SMOF cables to all buildings (single or shared).
- These SMOF cables can then be terminated / connected either immediately or at a later date with an absolute minimum of expensive rework.

[11] The above examples of cable blowing were from http://www.fiberblowingmachines.com/ this is one of many international businesses now making and selling this equipment.

[12] Refer to the Appendix "**The Metropolitan Competitive HFC Rollout**" on page 65.

Scenario 3: Utilise FTTN into home unit blocks.

Introduce Standard Installation Plans

- The McKinsey Report was highly based on work practices and building structures common to the USA / Canada and Europe – not Australia.
- The McKinsey Report (NBN Mk 3) incorrectly assumed that all home unit blocks / apartments / town houses etc could be SMOF rewired as per those in the USA, but the building codes are significantly different.
- Most older, low rise home unit blocks in Australian urban areas are difficult and expensive to rewire with fibre because there are usually very limited common access cavities, and/or the existing wiring is stuck in thin conduits.
- Most newer Australian home unit blocks / townhouses have plenty of common communications gantries and common access, making the internal connectivity of coax, Cat 5, Cat 6, or SMOF rather straightforward and relatively inexpensive.
- Because Lawyers have to a very large degree replaced Engineers in the Australian telecomms industry, most of the Standard Engineering Practices have been over-complicated by pedantic over-tightly specifying what were functional / practical descriptions of FTTN, FTTC, FTTH, FTTP etc..
- The legal entanglements on how Broadband SMOF terminates / connects into the building site equipment is now is unnecessarily over-complicated!
- The intent was to provide FTTP be it single / shared or a “non-premises”, to deliver the SMOF cable end to the main site building / communications room.
- Following the pedantic nature / use of tight-specificity nomenclature (“Lawyer-Language” into a practical engineering environment), FTTP to multi-premises (and multi non-premises) buildings / structures; in these cases FTTP could be renamed as FTTdp (Fibre to the Distribution Point).
- A simple set of “Standard Installation Plans” similar to that used pre-1980 for Customer Installation of phone connections would resolve this expensive impasse.

Introduce ITU-T G.fast for Multi-Dwellings

- The technology of fast and short (< 200 m) twisted pair connectivity from a common (communications room) or similar in a shared living complex is still being developed in the Broadband Industry.
- Technologies as per recommendation ITU-T G.fast[13] and the Vectored VDSL2 standards could be ideal for connecting Broadband to shared common building arrangements effectively providing Fibre to the Building, but not necessarily connecting FTTP.
- The NBN should be rolling out fibre cables to all common building sites so that all these sites can be connected by SMOF and the premises connected as per the Body Corporate, Company Title or other agreements as determined.
- The NBN should be proactively communicating with all multi-dwelling bodies to manage / oversee / install / contract the FTTx connectivity to all dwellings.

[13] From recent news on ITU G.Fast Dec-2013, it appears this recommendation will be mature before July 2014

http://www.itu.int/net/pressoffice/press_releases/2013/74.aspx

Scenario 4: HFC in HFC Footprint

Over $10,000,000,000 in Hidden HFC Costs

- Rolling out all the "committed" FTTP really means rolling out the FTTP that has already been purchased on the existing specific supply contract, then stopping the future FTTP rollout. **This is expensive short-term thinking.**
- HFC in HFC Footprint means to connect HFC cable (available only in the metropolitan areas) to premises not then connected with FTTP after being "committed". **This again is expensive short-term thinking.**
- In my professional opinion, HFC (Pay TV / Internet) has already reached its' "use by" date, so **plans should be in place to remove this HFC network equipment** in the next few years – **not install more HFC equipment.**
- Currently the Telstra (and I also believe the Optus) HFC is scarcely advertised and far from being fully fleshed out as the extra Broadband Routers, Cable Line Amplifiers, Drop Coax and in-premises wiring **is very expensive**.
- The HFC Internet is only part of this infrastructure that would need to be considered. **If the NBN is to roll with the HFC the entire Inter-Exchange Network, plus the main switches plus the national HFC/Internet Access database structure (in Waymouth Exchange) has to all be included**. Refer to "**Why Telstra's CAN is not "The Network**" (Page 61)
- **HFC partial augmentation restructuring cost Telstra about $2,800,000,000 in 2006/7 and I believe that at least another $1,500,000,000 is required before Scenario 4, 5, 6 could be considered at all!**
- **At this stage the wasted Optus HFC infrastructure** (Street cables, Headends, Coax Amplifiers / Splitters, Broadband Routers, Power Equipment, Edge Routers, Inter-Exchange Optical Fibre, Modem Database Management, Competitive switches etc) **has not been considered or included!**
- Conservatively there are about 5.76 million HFC Internet premises to be connected, (80 m coax, 6 x F connectors, mounting box, 4 way splitter, in-ceiling wiring) costing **about $550 each premises, so this will cost at least $3,168,000,000 that has to be accounted for.**
- As more HFC consumers (**particularly battle axe premises** which are now not connected because of logistical extra internal costs, **say $550 each**) are connected to the existing then about 35% of the nominal Cable infrastructure, the **additional extra cost is about $1,155,000,000. FTTP is less expensive.**

Adding up these costs which will be "hidden" we have:

Broadband Routers, Edge Routers, Main Switches, Inter-Exchange Network Fibre, Main / Gateway Switches, IT National Access database for HFC (and others see later).	$2,500,000,000
Broadband Router Buildout for all capital cities except Melbourne	$1,500,000,000
Fully Fleshing out HFC street infrastructure	$3,168,000,000
Premises wiring with Coax Cable	$1,155,000,000
Premises Cable Modems ($250 each in bulk)	$1,440,000,000
Very conservative total	**$9,763,000,000**

- **Before considering rolling out HFC in place of FTTP, consider there is at least $10,000,000,000 that will have to be spent in HFC infrastructure, and this HFC associated equipment is not future-proofed.**

- **Far more than $44,000,000,000 can be saved by merging the Telstra, Optus telecommunications HFC and associated Inter-Exchange Network infrastructures together with the NBN Co infrastructure, under the Australian Broadband Telecomms Commission banner.**
- While it may seem to be prudent to stop the continuing FTTP rollout and finalise with HFC in missing outlying areas not covered by FTTP and install FTTN technology elsewhere for "short loop" areas, **I seriously doubt it**.
- **Pay TV on HFC is the hidden technology that could very easily be moved to FTTx**, **clearing the way for Australia to save more than $44,000,000,000**

Cutting $5,000,000,000 off the HFC Mistake

Scenario 4 can be performed more efficiently / economically if engineering reasoning is used to identify and address these expensive flaws is as follows:

- The "long loop" areas are those metropolitan customers with a pair copper line distance of 2 km and more from the local exchange.
- These "long loop" consumers constitute about 72% of the total metropolitan customer base, or nominally about 5,747,000 pair copper lines. (Refer to "Approximating Access Lines and Mobile Device Accounts".)
- My professional estimation of the Telstra fully fleshed out HFC Internet **and associated IEN** capability is about 6,000,000 consumers. So the HFC Internet equipment would have to be fully fleshed out (fully equipped) to manage this **many consumers for the next few years**.(**Not future proofed!**)
- The "short loop" areas are those metropolitan consumers with a pair copper line distance less than 2.0 km from the local exchange.
- These "short loop" consumers constitute about 28% of the total metropolitan customer base, or nominally about 2,235,000 pair copper lines. (Refer to "Approximating Access Lines and Mobile Device Accounts".)
- Pair copper fault rates roughly correlate with distance ^1.5, so fault rates for this temporarily remaining 28% "short loop" pair copper, should drop to about 15% of the total current metropolitan pair copper fault rate.
- These "short loop" consumers have at least 16 Mb/s download capability from existing ADSL services from the local exchange DSLAM equipment.
- There already is ample DSLAM equipment already installed at these local exchange sites.
- This DSLAM equipment is extremely uneconomical because it is in a "competitive infrastructure" business mindset[14] and POIs (see "Why Points of Interconnect are so Expensive").
- As the NBN FTTx rollout proceeds, the DSLAM equipment in local metropolitan exchange sites will become baggage as the alternate Internet Service Providers (ISPs) will move to the more profitable Retail Reselling of FTTx and not competitive infrastructure together with Retail Reselling.

[14] In 2005 I provided a submission to the **ACCC Inquiry into the Performance of the Australian Telecommunications Regulation Regime**, listing many of the diametrically different economic mindsets with Infrastructure Business and Competitive Business (Pages 17-18 of that submission).

None of this vital knowledge was comprehended / understood by the ACCC so it was totally omitted from their Report, costing Australia very dearly as we see now.

- This DSLAM equipment needs to be rationalised, reallocated, relocated, removed and/or discarded, and there are several non-metropolitan locations that could benefit from reusing DSLAMS when they are relocated.
- The problem with relocating DSLAM equipment to areas where the internal ROI (Cost benefit) is low is that the external ROI (cost benefit) is very high, but these financial figures are not recorded[15] by competitive business.

This (above) is a typical installation of several racks[16] of (iiNet) DSLAM equipment all in physical competition with Telstra, Optus and other DSLAM equipment, all in the one in a (Telstra) metropolitan exchange site, and separate Points of Interconnect.

The legal tautology and physical problems for co-siteing competing infrastructures **is immensely expensive** in overhead and operational costs, but quaintly this is **heavily avoided when it comes to competitive (regime) business economics**.

- Competitive DSLAM equipment is back-connected through a nearby (if possible) “Point of Interconnect” (POI).
- A POI back-connects through a separate long haul transmission path in separate Inter-Exchange (Backhaul) Network infrastructure to the Competitive Gateway switch’s physical location.
- The various POIs terminate at the physical location of the Competitive Gateway switch and from there connect to the greater Internet infrastructure.
- There are massive productivities that can be gained by merging the telecomms infrastructure, so that the POIs are not required and the DSLAM equipment can then back-connect as per the HFC Broadband Routers do into distributed high capacity IEN Switch/Routers.
- The HFC Broadband Routers now located in the Telstra metropolitan local exchange sites (since 2006/7) are already back-connected to high capacity Router pairs that are co-located in these local exchange sites.

[15] In 2009, I provided a submission for the **Select Senate Committee on the NBN**. Following on from being a Witness, the **Addendum Submission provided a simple example of an external Cost Benefit Analysis (CBA) worth about $14,000 pa per Broadband connection.**

This CBA is far more than in the metropolitan cases, clearly demonstrating that CBAs for metropolitan consumers are totally inappropriate and far greater than for non-metropolitan situations, as those CBAs are considerably less in metropolitan areas.

This simple CBA and Network structure was obviously far too complex for the Select Committee on the NBN (2009) to comprehend, as absolutely none of this reached their Report.

[16] These pictures are from http://www.iinet.net.au/iinetwork/dslam-installation.html showing these costly inefficiencies of multi-duplicated and un-coordinated competitive infrastructures.

- This non-POI strategy can be utilised to create massive productivities[17] (**greater than $5,000,000,000 pa**) by rolling in other technologies such as ADSL, 3G / 4G etc into a common Australian telecomms infrastructure.
- These high capacity Router pairs (on the "edge" of the Inter-Exchange (Backhaul) Network in the metropolitan cities are already back connected with a very substantial fully duplicated/ redundant SMOF mesh network (2006/7) to the POI cross connect fully redundant router/switches in these capital cities.
- All the ex-Telstra and now co-operating DSLAM equipment can now be back-connected into the dual high capacity routers in the local exchange sites.
- The SMOF mesh networks can be very inexpensively brought up from 1 Gb/s to 10 Gb/s by replacing the GBIC interfaces in the high capacity routers. **This slight restructure will increase the IEN throughput by about 500%.**
- It is then practicable **and very inexpensive** to back-connect the NBN Co. Optical Line Termination (OLT) units located in most metropolitan exchange sites to the already existing dual high capacity routers, with their now-high capacity SMOF backhaul mesh network structure.
- The massive savings made through this thought-through engineering strategy then make it highly economical to replace all the "short loop" pair copper services in the near future by directly replacing these pair copper ADSL services with FTTP and its variants to all buildings / sites.

Scenario 5: FTTN and HFC (no demobilisation)

How to Waste More than $5,000,000,000 pa

- Rolling out any infrastructure to a piece-time standard is considerably more expensive than rolling out any infrastructure to a piece-Quality standard (refer to TQM for the real meaning of Quality).
- The duplicated HFC footprint covers about 95% of the total metropolitan area, including most of the outlying areas (ie those areas most distant from local exchange sites). **The HFC take up rollout is very expensive.**
- As HFC services are connected a significant amount of ADSL (DSLAM exchange equipment) will become immediately redundant.
- Block-connecting HFC instead of FTTP is a rather thoughtless and expensive option because a good 25% of the existing metropolitan areas are within 2 km of local exchange sites.
- Consumer sites within 2 km of the local exchange having DSLAM equipment means that these consumers already have ADSL with a download speed >16 Mb/s and don't need to be immediately transferred to HFC, and later to FTTP.
- The premises within 2 km of exchange sites can / do already have ADSL connectivity using a small portion of the aged pair copper cables, and do not

[17] In 2003, I provided a detailed submission into the **Senate Inquiry into Broadband Competition References Committee**. This Submission showed how the CAN technologies follow the IEN technologies and that FTTP was the already too-late future; warned on the ageing pair copper CAN; warned on the extreme costs of competitive infrastructures; warned that infrastructure competition was good only for the equipment manufacturers; warned against vertical integration.

This submission showed then how to save $7,000,000,000 in 2003 and make similar savings in the following years by economic rationalisation of the competing infrastructures. None of this Submission made it into that Report, so far costing Australia about $77,000,000,000.

need to be immediately replaced with HFC. This topic is already answered in the response in Scenario 4 above.

- In the metropolitan areas, the outlying consumers (ie customer on pair copper lines > 2 km) connected with ADSL are the slowest current Broadband connections.
- The response for Scenario 4 above totally covers the flaws in the not thought-through Scenarios 4 and 5, and provides a **significant financial savings[18] amounting to about $5,000,000,000 pa can be made here as outlined**.

Scenario 6: Optimised Multi-Technology Mix

How to Save More Than $10,000,000,000

- Because of the physical construction of pair copper cable in Australia, this cable produces a significant amount of Far End Cross Talk (FEXT) which in turn very significantly negatively impacts on the performance of ADSL speeds as the distance is increased.
- Although ADSL 2+ is capable of 24 Mb/s download speeds, by 2 km this speed is degraded to about 16 Mb/s (depending on the condition of the cable and the amount of concurrent ADSL users on that cable).
- The nominal number of metropolitan premises further than 2 km from the local exchange sites is about 5,760,000 on pair Copper to the Premises (CTTP)
- For metropolitan areas, the least expensive (short term thinking) rollout is to prioritise FTTP/FTTH or HFC to premises / buildings further than 2.0 km from local exchange sites and get these premises / buildings off ADSL / CTTP.
- Far more detail on this is provided in the answers in Scenario 4.
- The strategy in Scenario 4 will totally negate the need for expensive active FTTN to be implemented in any metropolitan area (apart from the existing HFC which already has remote active nodes).
- When fully configured, I believe the Telstra, HFC Broadband infrastructure is capable of connecting 6,000,000 premises nationally for the next few years.
- I understand the Optus HFC infrastructure could be capable of supporting upwards of 3,000,000 premises nationally.
- If these two metropolitan HFC infrastructures were merged into the NBN, then the maintenance costs would be more than halved, and the HFC infrastructure would be able to connect upwards of 4,000,000 premises at virtually zero cost (apart for premises connections). **This should save over $10,000,000,000.**
- This scenario leaves in the order of 1,600,000 outlying metropolitan premises on CTTP to be connected to FTTP as a priority.
- The existing ADSL on CTTP (< 2 km) are the next priority, where 2,540,000 metropolitan consumers are to be moved to FTTP in the next stage when the processes are optimised.

[18] In 2008, I provided a submission to the **Expert Committee on Telecommunications about the NBN**. In the submission I put forward several recommendations and most of these were totally ignored. Telstra and Optus are not physically split, and the **Competition Regime is still wasting about $5,000,000,000 every year in unnecessary and expensive legal and network overheads**. **Since 2008 this wasteful cost is now about $30,000,000,000 and continually rising!**

A copy of this submission can be found at http://www.moore.org.au/senh/2008/2008_NBN1.htm

- This then leaves a nominal 4,000,000 metropolitan consumers on HFC to be later moved to FTTP in a few years time, and the HFC infrastructure then to be entirely removed, as it too will be obsolete by about 2020.

Cost Effective Non-Metropolitan Broadband

- The McKinsey Report (NBN Mk 2) came out with a set of Broadband technologies that were well-suited for the Northern Hemisphere urban geography, but not at all suited for the non-urban Australian geography.
- It seems that those in the NBN, DBCDE, DComms have a "limited" experience in non-metropolitan telecommunications infrastructure beyond the global telecomms infrastructure providers, which are northern hemisphere based.
- In Australia the building demographics are significantly different than in Europe / Canada / USA where almost all non-metropolitan buildings are in close towns
- Australian inland cities, towns are spaced significantly further (typically 40, 80, 100 - 120 km apart) than they are in Europe / Canada / USA (6 - 10 km apart).
- Australia has a significant number of Homesteads that are set back at least 400 m from the public road and several km from each other.
- In Europe, almost all Homesteads and farm sheds are in the towns.
- In Canada / Northern USA most Homesteads are in the towns or near the towns and right on the edge of the road.

The housing / homestead demographics in Europe / Canada / North USA really suit commercial urban technologies as promoted by the McKinsey Report; similarly, those buildings "outside" the North Hemisphere metropolitan demographics can be "picked up by Radio or Satellite".

It is very embarrassing for Australia that nobody in the Government bodies questioned (or even knew enough to know how to question) these rather simple Northern Hemisphere commercial product sales lines.

In the case of the New England area (Armidale / Uralla), this was a perfect ground for rolling out the (not commercialised) CSIRO Ngara Broadband Radio system[19].

In another glaring omission in the McKinsey Report, the FTTH was limited to 10 km as an urban limit. In fact the GPON FTTP has a physical (timing) limit of 60 km.

This far longer economic CAN distance radically changes coverage by SMOF to almost all Homesteads with relatively small cost that is more than covered by a suitable (Engineer-created) Cost Benefit Analysis (CBA).

Again Cost Benefit Analyses for non-metropolitan areas are now not readily available because experienced Engineers have been systematically removed from the privatised telecoms businesses in the past 15 to 20 years.

This non-urban FTTH strategy requires considerable engineering experience and knowledge to implement effectively and economically – something that Privatisation and Globalisation has all but wiped out at enormous expense to the Federal Government and Australia.

[19] Refer in the Appendix to "Need Long Distance Radio CAN"

Implementing Non-Urban FTTH – Real NBN

- A high proportion of Australian farms have SMOF cable trenched-in passing through these farm paddocks, near the Homesteads.
- This SMOF cable is currently being almost entirely used for Inter-Exchange (Backhaul) Network uses.
- Coarse Wavelength Division Multiplex (CWDM) equipment is becoming significantly less expensive, opening up several long distance connectivity opportunities.
- Gigabit Passive Optical Network (GPON) technology has a physical limit of about 60 km with less optical splitting. The length limit is timing delay, not optical attenuation limit.
- Non-urban FTTP variants[20] could provide extremely cost-effective fast and secure Broadband to homesteads and villages utilising GPON, typically within 40 km of a country town or city with Optical Line Termination (OLT) equipment installed in the local exchange site.
- By standardising on 144 strand SMOF cables the (purchasing) economy of scale will make Non-Urban FTTP a very inexpensive and highly practical non-urban CAN technology.
- Most communications satellites in the Northern Hemisphere have small intense footprints. The satellite(s) over Australia have large low-level footprints and are far more subject to weather disturbances and far more network congestion than their Northern Hemisphere counterparts.
- The use of Satellites is very expensive and all the revenue goes overseas.
- Satellites have a time-limited life (of about 5 to 7 years) before very expensive refuelling to keep them geo-stationary positioned relative to the earth's rotation and tilt.
- Non-urban FTTP is extremely reliable in all weather conditions, even in bushfires, where all forms of radio are highly susceptible.

[20] A simple explanatory document to show how inexpensive Non-Urban FTTP can be structured is shown in http://www.moore.org.au/comms/20130412%20Inexpensive%20Non-Urban%20FTTP.pdf

Alternate NBN Revenue Scenarios

Paragraph 1/b/2 specifically raises the revenues of the NBN under alternative scenarios.

3G / 4G Mobile (Device) CAN Connectivity

- Both Telstra and Optus have been covertly rolling out Broadband under the guise of 3G and 3G Mobile Services in strong preference to connecting Cable (HFC[21]) Broadband or ADSL connectivity in (non-metropolitan areas).
- These Radio Base Stations (as remote nodes) are usually connected by SMOF cables to the local/district exchange site located routers on the edge of the Inter-Exchange (Backhaul) Network.
- If 144 strand SMOF cables were installed for use by Remote Radio Base Stations would / should have several dozens of spare fibres that could be very readily used for CAN GPON FTTP/H services at a minimum of extra cost.
- The move to 3G and 4G is a high revenue stream because it usually is the younger generations that “live in their mobiles” and consequently have very high monthly telecomms bills.
- In comparison, Internet connectivity using ADSL / HFC is considerably less expensive to the end user than 3G / 4G; so it is in the interests of the Telstra / Optus Sales / Marketing / Boards etc push the sales of 3G / 4G Internet connectivity to maximise revenue on investment (ROI) for their shareholders.
- In ideal situations 3G and 4G Radio has the bandwidth and geographic volume that allows relatively inexpensive Broadband connectivity.
- There is a relatively small Geographic / Bandwidth limit that impacts on Broadband speed as the number of customers in that geographic area increases. This is a major problem in sports arenas and other event sites, office blocks, train and bus stations, in public / private transport.

Competitive Mobile Device Radio Infrastructures

- In the metropolitan areas, as the use of 3G / 4G increases, this will lead to early onset radio network congestion.
- Because the infrastructures are in competition with each other, instead of maximally utilising the available geographic cell bandwidths, competing cells will result in a far less than optimum use of the geographic spectrums.
- One of the knock-on effects is the need for even more bandwidth for competitive use by competitive telecomms infrastructures.
- Already we have seen is the call for more spectrum allocation for the mobile (device) network.
- The so called “Digital Dividend” [22] was all about auctioning spectrum space[23] to competing telecomms infrastructure service providers.

[21] In 2013, a friend in Turramurra NSW, tried to get HFC Internet in place of ADSL and every ploy to stop it has been tried; including “it cannot be installed”, “you can’t afford a coax amplifier”, “asbestos is in the (plastic) conduit”, to prevent him connecting to HFC, but the G4 solution is being very heavily pushed! After three months, he still does not have the HFC Internet cable connection.

[22] In 2010, I produced a substantial submission in response to the **DBCDE call for papers on the Digital Dividend**. None of my professional expertise was taken on board by that Committee and included in that Report. A copy of my submission is at http://www.moore.org.au/senh/2010/20100109%20Digital%20Dividend%20Submisison.pdf

- As a direct consequence of the push, the top end of the Digital TV band was transposed across to be used for communicating with mobile devices.
- As best I understand it, this upper-end TV bands are best suited for non-urban situations, (because the marked spectrum is below the nominal mobile radio spectrum) and it travels further than the higher frequency spectrum area.
- Apparently this “Digital Dividend” spectrum will be maximally used in urban situations.

Using 3G/4G Modem Routers Wi-Fi on LANs

- More recent personal mobile devices have included in them a Wi-Fi facility operating in the 2.8 GHz and/or 5.6 GHz spectrum bands, and have a physical radius of about 50 m to connect with a router/modem.
- This Wi-Fi connectivity is parented through a modem/router on Broadband Internet (3G / 4G / ADSL / HFC / FTTH) so mobile device telephony calls can bypass the standard telephony network and totally avoid the now expensive mobile telephony connection fees.
- Similarly, most people that use personal mobile devices, deliberately Text instead of Talking because the telephony call costs are comparatively so high (and it is conceptually “cool” to text and not talk)!
- Phone calls made over the Internet (using Wi-Fi to connect into 3G / 4G CAN to the Internet) attract a much lower end user cost than by directly connecting through the 3G / 4G telephony network.
- People are slowly waking up to the realisation that by automatically connecting their personal mobile devices to the Local Area Network using Wi-Fi instead of the 3G / 4G customer access network, then substantial savings in telecommunications expenses can be made.
- Irrespective if the 3G / 4G Customer Access Network is used for the Internet / Internet telephony, texting, video or for physical telephony with or without Wi-Fi connectivity the spectrum space in the 3G / 4G radio bands will become physically congested.
- This congestion will be particularly noticeable in metropolitan areas as more spectrum is not available and probably cannot be made available unless the TV UHF Bans is used.
- In a similar vein, Wi-Fi LAN connected 3G / 4G Modem/Routers are covertly being pushed on sales by Telstra and Optus to get Broadband Internet consumers off (pair copper) ADSL and keep these customers from being involved with the NBN FTTH rollout.
- It is therefore logical to limit the amount of 3G / 4G modem/routers providing premises Wi-Fi connectivity, and direct the large majority of CAN connectivity to FTTH, or HFC or ADSL in that order.

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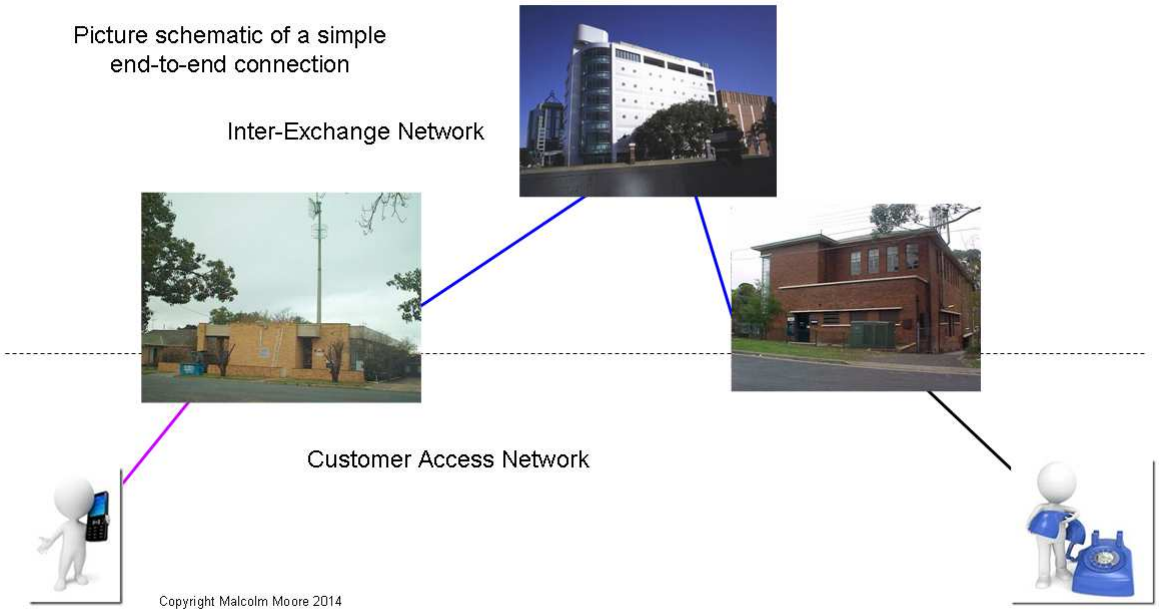
[23] The concept of “Auctioning Spectrum” space originated in the USA because the USA Federal Government is essentially bankrupt and they sought methods to tax the large utility companies (who obviously were not paying anywhere near enough tax).

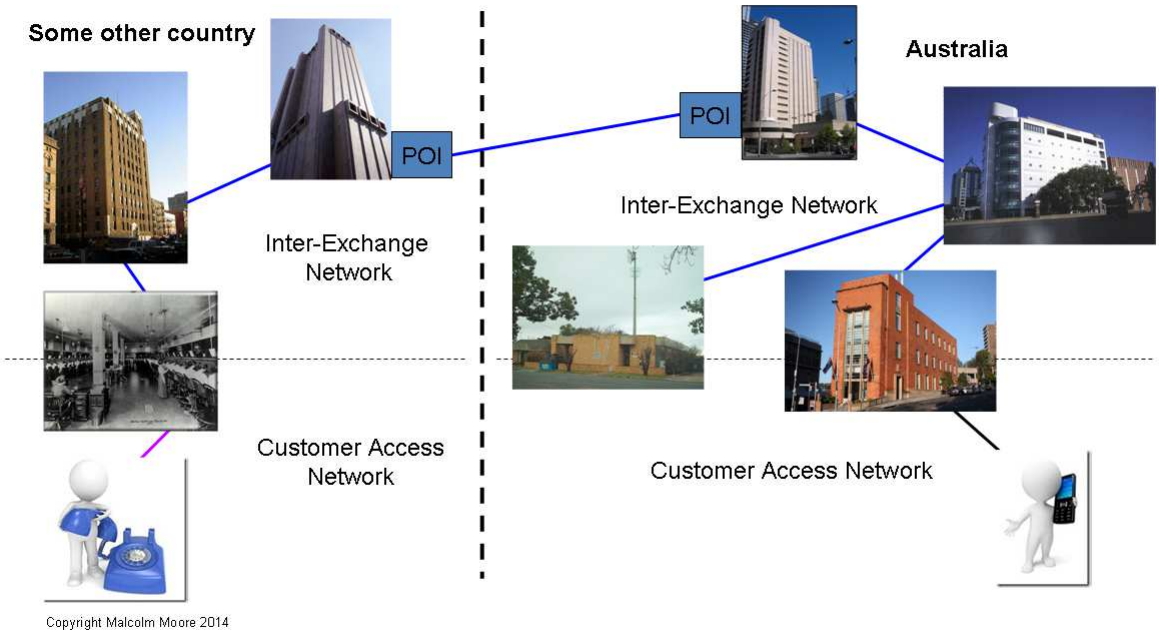
The end user ultimately pays far more for this, directly impacting on call charges, therefore lowering the country’s living standards.

Why Points Of Interconnect are so Expensive

This little picture below shows the typical path of a connection from a mobile phone (lower-left) through a Customer Access Network (CAN) radio base station in this Local / District exchange then switched to go through the Inter-Exchange Network (IEN) via SMOF cable to the Regional exchange site (top) then down to the District / Local exchange on the right and through pair copper cable CAN to the "B" end customer.



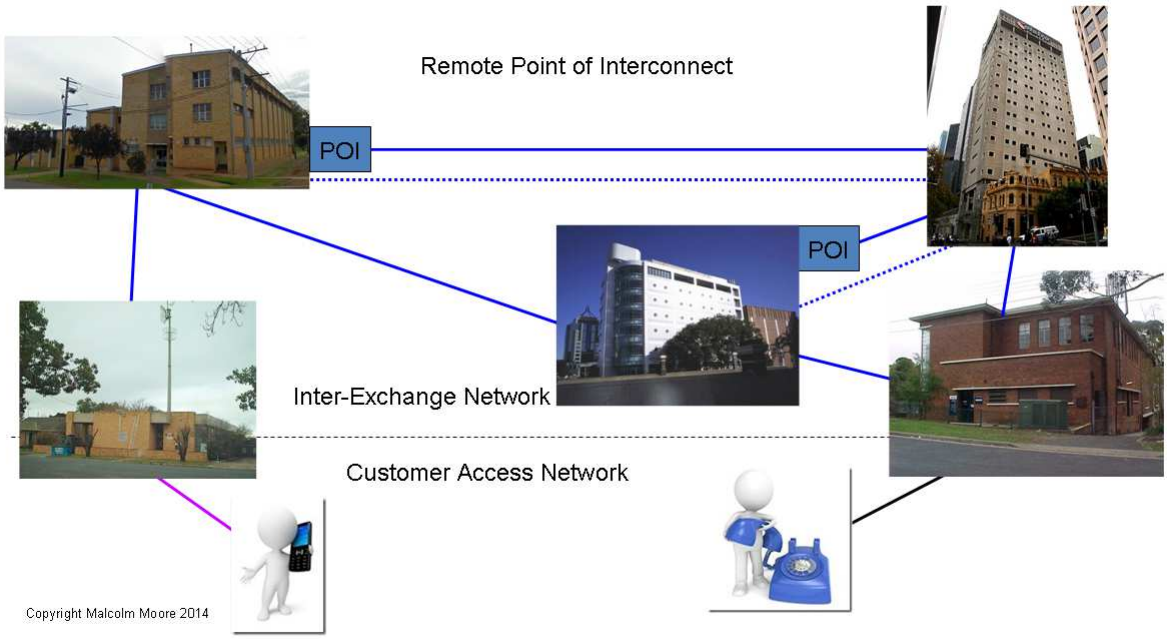
With traditional telephony switching, the only way to connect to an Australian competitive, or overseas telecommunications infrastructure was to path the call through the Inter-Exchange (Backhaul) Network (IEN) and then connect the call through the Gateway / Competitive Carrier switch as shown below:



In this case there is a Point of Interconnect (POI) at each of the Gateway switches to facilitate connectivity between the different telecommunications service providers (be it telephony, Internet etc.).

When network (infrastructure) competition was introduced inside Australia, this made the Inter-Exchange Network considerably more complex, more congested, more regulated, and far more expensive.

The problem was aggravated with Telstra having to provide several remote Points of Interconnect (POIs), in some cases over 1000 km from a Gateway switch. The picture schematic shows the typical transmission paths and network switches required together with remote POIs to make a call through a competitive network.



Although this "facilitated competition" this enforced competition is extremely wasteful of expensive telecomms infrastructure. While this POI concept sounds elegant, it is a nightmare of inefficiency on every level of the scale.

This picture above is in direct comparison to the previous picture. The caller on the left connects through the Customer Access Network (CAN) via the Radio Base station in the Local / District exchange and the call is analysed at the District switch level to show this caller uses the competitor's IEN facilities.

So the connection is switched to the POI and then through a separate (often parallel) transmission link connecting to the Competitive-Gateway switch in the capital city then the competitive network.

The connection is then passed through the competitor's transmission and switched network to the to the next Gateway Competitive switch, which may be the same switch if in the same Australian State, or another Competitive Gateway switch if in another Australian State. The above picture was really simplified.

At the distant end the connection then leaves the Competitive Gateway switch and passes through a transmission link to the POI nearest the District / Local switch where the connection then is connected and switched through the District / Local exchange switches before finally connecting on the right and through pair copper cable CAN to the "B" end customer.

There are network path duplications everywhere, multiple complex switching and very poor use of the total infrastructure – <u>but we have "competition"!</u> (No matter how much it costs to purchase from the equipment suppliers.)

If this is a “local” (country) call, then the telephony call path has to then “trombone” all the way back to the same district (city / town) to create an end-to-end connection.

Considering that the non-metropolitan Inter-Exchange (Backhaul) Network is still very thin, then several of these concurrent “trombone” connections will congest the network in the country areas.

- These POIs are effectively isolated dedicated IEN highway paths connecting back to the nearest Competitive Gateway switch
- In Australia, the nearest Competitive Gateway switch could be over 1000 km from the POI connection location.
- POIs provide an “efficient” competitive connection point, in that these points of interconnect can be made relatively local.
- The POI telecommunications equipment infrastructure is expensive and is an enormous waste of capital caused by competitive infrastructures.

With Broadband Internet the sequence is very similar, but the current saving grace is that a high proportion of Website hosting in not in Australia so these calls switch overseas through the Competitive Gateway switch and associated high capacity transmission networks.

This is an enormous waste of infrastructure capital, particularly with POIs being used to provide remote connectivity to the rather expensive Competitive Gateway switches, and Australia’s comparative very low population density.

How to Save More Than $2,000,000,000 pa

To the best of my knowledge, the competitive DSLAM and NBN CAN infrastructure equipment is back-connected works in exactly the same manner as the telephony switching, with the POIs being extended in virtually separate IEN infrastructure, sometimes upwards of 1000 km.

This POIs utilisation strategy is very wasteful and a far more economic engineering solution is readily available as below:

- With the HFC / Cable Internet infrastructure, each modem is individually recognised by it’s MAC address and this is related back to a Telstra national database (which was / is located in Adelaide).
- The MAC address is representative of the end user in direct relation to the Internet Retail Service Provider.
- This network structure works for any number of competitive Retail Resellers.
- No Points of Interconnect (POIs) are required at all.
- No duplicated / isolated IEN / Backhaul Network is required at all.
- DSLAMs and Mobile (Device) Radio Base Stations could use the same Inter-Exchange (Backhaul) Network (IEN) as used by the HFC infrastructure and Database for all competitive Retail Resellers.
- The NBN could very economically utilise some ADSL as an interim stopgap (as described in my options in Scenario 4, 5 and 6 in this submission).
- The NBN could use FTTx in this same highly economic infrastructure (as described in my options in Scenario 4, 5 and 6 in this submission).

- The Australian telecoms network is then far more economically utilised.
- **This strategy should save far more than $2,000,000,000 annually.**
- POIs now become totally irrelevant and can be totally removed.
- The IEN dedicated to the previous POIs can be economically reused.
- This bandwidth use on Inter-Exchange Network routes will now be continuous (not broken up into smaller dedicated channels that are far more subject to underuse and congestion) so the route occupancy far more cost effective.

How to Create More Than $2,000,000,000 pa

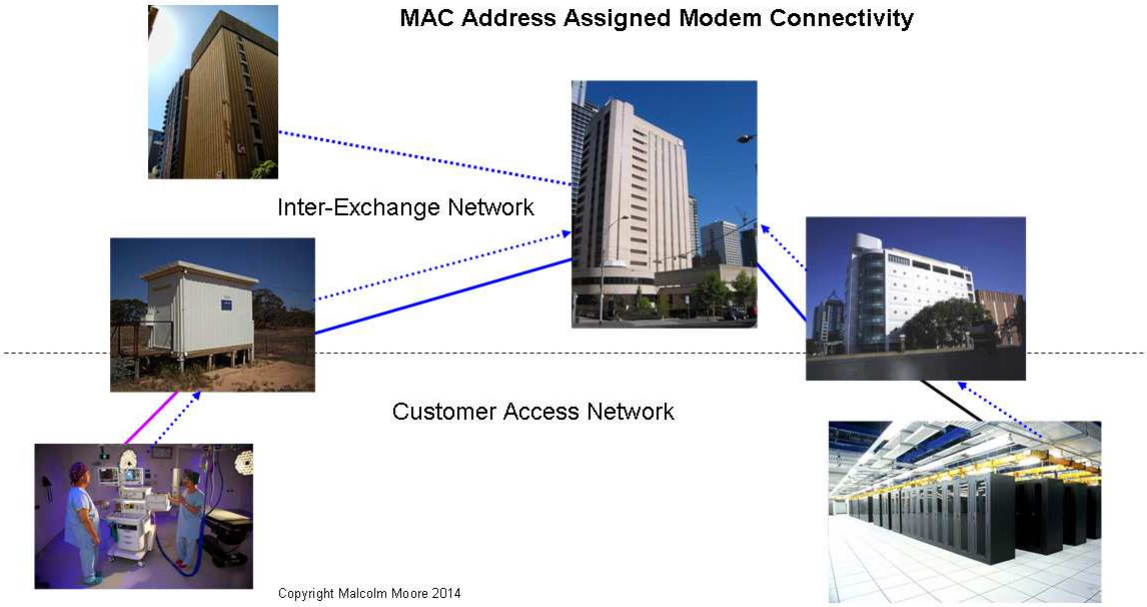
There are a number of substantial knock-on efficiencies that come from using a centralised database management system to replace the much older physical POI strategy of duplicate infrastructures.

- As Australia develops more high usage Websites (and mirrors overseas Websites), the Webhosting in Australia will dramatically increase.
- The use of POIs together with Competitive Gateway switches will cause a large amount of congestion in these switches, and in the IEN network.
- Concurrently with POIs, the long-haul high capacity transmission links will be multi-trombone connecting local end users causing network congestion.
- Upgrading (making bigger) these Competitive Gateway switches is a very expensive option. This is wasted export revenue we do not need to spend.
- A massive saving can be made after the competitive telecomms infrastructure networks are converged into one infrastructure and the end-user modems are directly associated to individual Internet Service Providers at the Retail level by wholesale association.
- The propensity for “tromboning” is totally removed with the POIs removed.
- Wholesale management (metering, throttling, customer preferencing) is significantly simplified.
- Retail charging is radically simplified as the metering records can be conformal and individually aligned to the end user modem.
- The requirement for POIs is no longer required and can be removed.

This removal of POIs brings with it a range of economies only dreamed about!

This little picture below shows the elegance of connecting directly through the Inter-Exchange Network (IEN), where POIs are deliberately removed and modem MAC addresses are identified and associated (blue dotted lines) with the Retail Resellers in a national common database. In this example the Internet call is from a country town hospital to a medical records database in another city.

- The solid blue lines represents transmission path through the Local / District / Regional / Main switch/routers in the Inter-Exchange Network (IEN).
- The dotted blue lines represent the control data being exchanged with the common database through the Inter-Exchange Network.
- In the CAN the hospital has a high speed connection from the local exchange.
- At the data centre that CAN has a FTTH connection to the local exchange switch.



This network structure is particularly elegant as it can be very inexpensively managed with considerable ease, there are no extra duplicated transmission paths and the Inter-Exchange Network can be optimally structured with considerable savings as there are no POI connections.

The national modem MAC address database register allows the end-user (modems) being physically moved about and always connected irrespective of location. Metering of end-user data is automatically presented to the Retail Reseller as part of the wholesale product, so the end user can be billed as per their Retail Agreement.

All telecomms maintenance issues are for the national broadband telecomms commission (the sole infrastructure provider) to manage on behalf of a range of Retail Resellers' product packages specified maintenance standards. That leaves the focus on the Retail Reseller to competitively bundle the retail products for their maximised ROI no matter where the end users are located.

The Vision of Broadband Wealth for Inland Australia

- The long-haul transmission links specifically used for POI connectivity can be reallocated for full use capacities to significantly reduce network congestion.
- The DSLAMs, OLTs, and HFC-Broadband Routers can all connect directly onto the local/district exchange site Edge Switch Routers, really simplifying the network structure.
- The simplified network structure can be made far more robust (particularly in the non-metropolitan areas where the expected mesh IEN is really a tiered Star network) that runs in congestion, slowing end-user connectivity speeds.
- In having a far more robust (non-metropolitan) IEN, the propensity for inland network congestion is dramatically reduced.
- With a much simplified IEN structure, this lends itself to being considerably augmented – particularly in the inland areas.

- This inland IEN augmentation[24] would now be very inexpensive because the structure is considerably simplified without POIs.
- The augmented Inland IEN infrastructure then provides a very economic platform for dramatically increasing Broadband business well beyond the metropolitan areas.
- The augmented Inland IEN infrastructure provides a realistic and inexpensive high capacity bypass for the metropolitan areas minimising the problems of relayed network congestion in one area affecting other areas.
- Inexpensive inland High Capacity Webhosting now becomes an economic, business and financial reality.
- Inland Towns and Cities could become the new Data Centres of Australia and for mirrored Web hosting overseas sites.
- The amount of overseas data traffic could then substantially decrease, considerably reducing Australia's data balance of payments – or even make this positive as an export industry.
- Highly reliable and very fast Non-Urban FTTP now becomes extremely attractive because most farms will have ("available") fibre ploughed in passing through these farms, near the homesteads – even in the real outback!
- The CSIRO's Ngara Broadband radio CAN can provide inexpensive connectivity for the "last 100 km" in a small percentage of inland / isolated cases; particularly where SMOF does not go too near some remote locations.

[24] In 2008 I provided a submission to the **Expert Committee on Telecommunications About the NBN**; In part of that submission I referred to the Missing Inland Backhaul Backbone, which is a visionary structure to provide a pair of inexpensive high capacity SMOF backbones through the eastern States, SA, WA, NT to open up the inland. **None of my submission was included in any of their Report.**

In 2010, I provided a submission to the **Department of Broadband and the Digital Economy** for the "Practical Business Case for the NBN". (NBN Version 2) The submission included a first round detailed geographic plan and costing for the Inland SMOF Backbone infrastructure; estimated to be about 22,735 km and costing about $749.8 M. **None of this was included in any of their Report.**

Construction Requirements

Paragraph 1/b/2 specifically raises the Construction Requirements.

Why Competitive DSLAMs Are Extremely Inefficient

The standard efficient practice for infrastructure businesses is to roll out a standard platform of infrastructure across a nation and use economies of scale to maximise the delivery at a minimum of cost.

The standard practice for a competitive business is to identify the areas that will give the greatest return on investment (ROI) and priority target these areas to minimise the outlay and maximise the ROI.

With “Unbundled CAN”, the competitive businesses have targeted the metropolitan area as a priority to roll out their DSLAMs in the local exchanges and then connect as many customers as possible through pair copper CAN that is “Unbundled”.

The smaller ISPs have charged into Telstra local exchange sites and installed DSLAMs and then individually connected their prize customers. Likewise, Telstra has also installed their DSLAM equipment at the same exchange sites, and then also individually connected their prize customers to ADSL.

Simplistic Economists would give this process the “two thumbs up” and walk away believing that all is well in competition land, nut nothing could be further from the truth.

Apart from the DSLAM equipment costing in the order of 40% more than it could have cost if an economy of scale approach had been applied; the installation process is extremely slow, expensive and fault prone.

The standard rewiring process is that once the DSLAM equipment is installed and commissioned, one set of cross connect cabling (from the customer cable appearances) on the MDF would be directly wired (with new jumper pairs) to a vertical holding the DSLAM customer side appearances. The mating jumper pair would then be wired to the Switch side of the DSLAM vertical appearances.

A couple of competent Field Techs could install in the order of over 200 ADSL lines per day if the economy of scale (infrastructure business) strategy was used. Using the competitive business strategy, these two people would be pushing to connect 20 ADSL circuits and include travel to more than one exchange site.

In conspicuous economy of scale using mass production is that with all the customer lines connected to ADSL, the installation and maintenance cost is considerably less than with “Unbundled” DSLAM connections.

Further, the ADSL services can be wholesale allocated to any competing retail reseller of ADSL connectivity, and each line can be individually controlled from a common point. Further, individual customer line control can be passed to the retail reseller, as can metering data for customer charging.

Putting the point more bluntly – every customer line would have immediate ADSL facilities if required. To get ADSL facilitated it would be as simple as contacting the desired reseller and let them throw the switches. In two minutes ADSL is served!

What we have now in Australia is a disjointed system where certain ISPs refuse to have lines tested because it costs them their profits against Telstra. Most DSLAMs are not fully connected, and these DSLAMs cost considerably more than they could have.

Further the upgrade path for early model DSLAMs is slow and far more expensive that is would have been if the infrastructure business strategy (without "Unbundled" pairs) was thought out fully – instead of a "get rich quickly" scheme for those pushing private (equity) busineses.

Need to Connect Premises - Not Pass Premises

HFC Connections and Economies of Scale

In the late 1990s, when the HFC was very rush-rolled out[25] in all State Capital Cities and their suburbs, the marketing catch cry was to report on the number of homes passed, making the inference that every home that was passed was also connected.

In general the public and the pollies fell for the deliberate misrepresentation of facts, but fairly soon it became apparent that the take up was not 100% but more like 10% to 20% and these numbers are poles apart from 100%.

Although it appears much more time consuming to connect every premises as the street cable is rolled out, there are massive "economies of scale" that really kick in that really save on overall expenditure. These savings include at least: minimised transport requirements, all expertise readily available, all testing equipment on hand, personal customer service, immediate supervisor support, no delay for spare parts, forward alert time minimised, optimised rescheduling with minimum lost time.

Because HFC, lead-in cable installation to a premises is rather intricate it can take up to six man-hours (typically less than two man-hours), but with teams working in near proximity, much of this time can be minimised, such that an economy of scale in the order of 70% should be readily achievable.

This means that if the take-up were to be in the order of 30% for Pay TV, then the tipping point would be reached at 30% take-up, and the mass production (infrastructure business mindset) strategy of connecting every premises passed as the rollout is being done would turn out to be less expensive than individually connecting premises after the initial rollout.

The economic spinoff is that the end take-up will naturally be significantly higher with the infrastructure business mindset, because the connection is already there. So, with a take-up rate of say 45% instead of 30% the competitive businesses that would profit through selling Pay TV content would substantially increase too.

This infrastructure was specifically structured so that many Internet Service Providers (ISPs) could provide Cable Internet Broadband without having to install any equipment, as follows. Because the premises modems all log-in through a common national gateway database and because the MAC address of each individual Cable Modem is unique, each Modem can be related to a specific ISP.

[25] No real surprise that this is now a dead link!
http://transition.accc.gov.au/content/item.phtml?itemId=690305&nodeId=e6d85a5da5875697ff0b57c2ff03a63e&fn=Chap+6+Hybrid+Fibre+Coax+(HFC)+Network.pdf

So, massive efficiencies can be gained by "economies of scale" and many competitive retailers can compete for providing Cable Broadband Internet services off the one Cable infrastructure.

ADSL Connections and Economies of Scale

With a competitive ADSL rollout with a number of Internet Service Providers (ISPs), each ISP provides its own DSLAM equipment at each local exchange and each customer that requests ADSL services then has a choice of which ISP to choose from. We have been taught that economically, this competition drives down the end user prices, but in reality, nothing could be further from the truth.

Each of these DSLAM equipment is generally not 100 % utilised. Each DSLAM needs to have its own Backhaul Network (SMOF cable etc) connection to a Point of Interconnect (POI), and each POI needs to have separate powering, alarming, floor-space rental, (including air-conditioning costs, site entry management etc.). All these separate infrastructure components involve a lot of overhead and they all add enormously to the gross inefficiencies of competitive infrastructures.

As described with the "economy of scale" HFC Broadband Internet rollout scenario; if all the customer pair copper lines were wired to a common DSLAM as a mass production, instead of individually wiring each line through the DSLAM on separate request; the comparative installation cost savings is in the order of 88%.

This is a massive "economy of scale" that has a tremendous upside, because there are other issues like improved equipment and wiring integrity, performance, stability and far longer Mean Time to Failure (MTTF) because the wiring and equipment is not moved many times.

Put this another way around, the tipping point for rolling out a mass production of full connectivity through DSLAMs for every phone line would be at 12% take-up of ADSL. This of course did not happen and we have the most expensive (least economic) situation in place where the really big winners are the equipment manufacturers.

FTTP Connections and Economies of Scale

Rolling out FTTP is in the similar work bracket as rolling out HFC or ADSL, but the advantage of FTTP is that it can be "blown" through existing phone line conduits into premises, so the "wiring to the premises portion" of the overall connection can be quite quick in comparison to HFC.

If a conservative figure of say 30% take-up of FTTP was considered, then this would mean that three in 10 premises owners would connect. Initial reports on Kiama (NSW) are showing an excess of a 50% take-up and I believe that in a few years this figure will well exceed 70%.

It therefore makes commercial and economic sense to use the "economy of scale" (mass production) approach and connect every passed premises with FTTP, whether the connection is wanted or not. Within a few years the (new) owners of these premises will want to connect with FTTP and the take-up will be in the order of 100%.

Access to Telstra's Copper Network

Paragraph 1/b/2 specifically raises the access to Telstra's Copper Network.

In my extensive and long-term professional telecommunications expert opinion, this "**Access to Telstra's Copper Network**" strategy is immensely flawed for several economic, commercial and infrastructure reasons. Before those reasons are spelt out, the political/historical information and knowledge has to be recognised and well understood.

Why Unbundling Became Law

In 1997, there was an immense push from the USA-based telecomms retail busineses to "Unbundle" the Copper Customer Access Network (CAN) in Australia.

One reason behind this immense push to "Unbundle" was that the privatised telecommunications businesses in the USA had substantial surplus funds following the then recent enforced split-up and privatisation of the ("Ma") Bell Corporation into seven smaller (but still comparative to Australia, very large) privatised businesses.

Concurrent to "Unbundling the CAN", the technology of Asynchronous (directional speed) Digital Service Line (ADSL) was new, and needed pair-copper.

- ADSL provided a very inexpensive bridge from Dial-Up technology to Broadband technology,
- ADSL provides a much wider / faster bandwidth for faster Internet connectivity,
- ADSL uses existing pair copper cables as for telephony,
- ADSL uses the previously unused spectrum bandwidth well above the Voiceband (4 kHz),
- ADSL can be left running 24/7 to provide immediate Internet connectivity,
- ADSL allows concurrent telephony and Internet connectivity on the one pair copper line.

The engineering problem was how to connect the Local Exchange (Central Office[26] in USA terminology) pair-copper end with suitable DSLAM line interfacing equipment so that an ADSL modem could be connected at the customer premises.

Business entrepreneurs could "see value" (pirate what is not theirs) by changing the business conditions so that the telecommunications companies would have to allow some of the pairs in pair copper cables (providing pair copper communications access between the customer premises and the local exchange). The snake oil sales / business terminology was called "Unbundling"!

The Federal Government Act of "Unbundling" made it allowable for alternate Internet Service Providers (ISPs) to install Digital Services Line Access Multiplexer (DSLAM) telecommunications equipment in local exchanges and ruined the high productivity mass production wiring/maintenance structure on the Main Distribution Frame (MDF) in the local Telstra infrastructure exchange sites.

[26] The term "Central Office" came from a conictation of two terms "Central Battery" and "Post Office", as the Local Exchange was usually located in/behind the Post Office and the Local Exchange uses a "Central Battery" of about -52.6 V to provide signalling and speech power over copper pairs to phones.

Why "Unbundling" Proved to be Extremely Expensive

In my professional opinion, the process of "Unbundling" was clearly not thought through with any vigour beyond immediate greed and consequently this random act of piracy / commercial need became extremely expensive for Australia. Here is why:

The prime intent of "Unbundling" was to lock intending Broadband customers into an alternate Internet Service Provider (ISP) and not the incumbent telecomms service provider so that the money flow from Internet connectivity is then diverted into private (equity) busineses to maximise these profits.

This short-thinking "get rich scheme" was to utilise existing pair copper connectivity between customer premises at select local exchange sites so that Broadband connectivity could be put in place using ADSL technology and select these customers become locked in.

The longer-term cost to Australia for allowing "Unbundling" was immense, with even more immense follow-on costs, now being questioned in the cost of the NBN rollout!

When competitive infrastructures are introduced, they bring with them an immense financial / business wastage caused by several factors including but not limited to:

- Several smaller providers purchase equipment at a premium cost.
- Multiple installation projects are rushed in costing considerably more.
- The (red-tape) documentation overhead is substantially increased.
- Massive savings through Economies of Scale in a full rollout are totally lost.
- Ongoing reliability is considerably compromised.
- Equipment is selectively installed resulting service availability confusion.
- Metropolitan areas are over-supplied and under-utilised.
- Non-metropolitan areas are severely under-supplied.
- The associated Inter-Exchange Network Infrastructure is either very over-utilised causing network congestion or under-utilised[27] causing an immensely reduced ROI; either way resulting in business failures.

Economies of purchasing scale would not be implemented so the DSLAM units cost considerably more than they would have been if a full-scale national purchase had been made, and the delivery is then on the manufactures side not the purchaser.

From first-hand experience, I know that a large purchase (say for 6 M lines of DSLAM equipment) would have then carried a price discount of over 40% and the delivery would be prioritised; and the equipment would be pre-set for immediate installation and commissioning. Purchases of less than say 1M lines would never any significant discount, no delivery priority and no presetting facility.

The dot points above give a simple insight into some of the massive economic inefficiencies caused through introducing competition into what is essentially an infrastructure business.

[27] While attending the **Broadband World Conference in 2008**, a Session openly discussed competition with infrastructure. The general agreement was that there are many gross economic flaws that are not covered in the texts that make infrastructure competition extremely risky, extremely expensive and usually is a very poor economic outcome for all the competitors.

In this case, the introduction of “Unbundling” opened a Pandora’s box of immense waste that then compounded on the previous immense waste that had been ineptly introduced by creating infrastructure competition in Australian telecommunications.

With the determination by the then Federal Government to agree with “Unbundling” the CAN to apparently improve telecommunications efficiencies, this Act performed exactly the opposite in that:

- CAN Documentation / Records were at a rather low level but worked extremely well and very inexpensively.
- To facilitate “Unbundling” the then existing CAN Documentation had to be substantially increased at considerable (and unnecessary) cost to Telstra.
- Telstra had to then pass on these additional costs to the competing infrastructure users just to break even on this new Red Tape.
- This local exchange site floor space is limited and is in direct confrontation with proposed Telstra equipment rollouts.
- Competing ISPs now required use of scarce floor space in local exchange sites and the provision of extra: power, air conditioning, alarming and remote control of their DSLAM (local exchange end ADSL) equipment.
- In many cases because of floor space limitations caused by competitive ISP requirements, DSLSM equipment has had to be located further away from the MDF and local telephony switches impacting on logical floor layouts.
- Telstra could then not inexpensively roll out a full ADSL service to all telephony lines because the “Unbundling” of competing infrastructures had broken up the service standard continuity, so savings in using mass production techniques are ruined.
- Piece-wise line labour installation costs are typically $70 per line plus transport time, compared to mass production total exchange conversions which would have cost about $0.70 per line including transport.
- The competing infrastructure-based ISPs also require substantial Inter-Exchange Network (IEN) connectivity from their DSLAM equipment back to a higher level switch and back to a Point of Interconnect (POI).
- Points of Interconnect (POIs) are connected at the inter-carrier gateway switch, meaning that now; multiple high-capacity links are required to be run from local exchange sites to these Gateway / Competitive network switches.
- Even with Multiple Language Switching Protocol (MLSP) used on these transmission links, this extra burden eats into the available bandwidth, compromising network connectivity – particularly in non-metropolitan areas.
- In the non-metropolitan areas, because the ROI is low, the IEN is thin and a few generations behind the metropolitan IEN, so the network bandwidth is really limited
- In the non-metropolitan areas, network congestion is a major concern that is aggravated by having to include POIs.

The Very Expensive Costs of Facilitated Competition

A very expensive knock-on effect was caused by many people having a serious lack of appreciation of telecommunications and IT engineering (including those in Select Committees, ACCC, Productivity Commission etc. and most telecomms commercial business advisors) ***incorrectly assuming that the total telecomms network is copper and is in the under-footpath ducting.***

- This incorrect assumption comes from the incorrect thinking that "Unbundling" the network meant to them the entire telecommunications (copper) network.
- "Unbundling" referred to strictly just the Customer Access Network and strictly not the Inter-Exchange (Backhaul) Network (IEN).
- Most people (even in the telecomms industry) are innocently ignorant of the existence of the Inter-Exchange Network and its imperative purpose.
- This ignorance was initiated during and after the "block privatising" of the Australian telecommunications industry (circa 1980-82 – Davidson Report[28]).
- When the Davidson Inquiry took place (1980 / 1981), the entire telecommunications network in Australia was analogue and copper / radio.
- During the 1980's there were massive technology advances that were entirely due silicon. **See Appendix for detail**.
- The technology of Silicon was in its infancy in 1970 and took over 15 years to really kick in.
- Digital switching and digital transmission started in 1980 and took until at least 1995 to be rolled out (using highly efficient mass production methods).
- Commercial Personal Computers did not become readily available until 1984.
- Optical Fibre did not exist until 1985 and took a decade to roll out (using highly efficient mass production methods).

During this time of tremendous technology changes, most people were totally fooled into thinking that privatisation had made telecomms in Australia highly efficient.

- The massive productivity increases in the telecomms competitive businesses (in Australia) was entirely due to technical advances[29] in Silicon and associated technologies combining to make the telecommunications infrastructure business far more economic / productive than ever before.
- Concurrently, most people were justifiably totally and innocently in ignorance that the Inter-Exchange Network (IEN) ever existed!
- This IEN is the long-distance network that infrastructure that connects through the local exchange switches to the much smaller Customer Access Networks (CANs). This IEN was now digital, and the transmission now almost entirely in Optical Fibre and extremely low maintenance!

[28] A copy of this report can be found at http://www.moore.org.au/senh/1982/1982_Davidson.htm

[29] In my 2008 submission to the **Expert Committee on Telecommunications about the NBN**, in the Appendix pages 31-33 shows that while the purchase costs and increased bandwidths combined to drop the infrastructure costs by more than 75% in a recent decade, the end user costs barely dropped at all, because of massively increased inefficiencies and overheads caused by competition.

The really expensive sticking problem was that those behind making wise political decisions about this telecommunications infrastructure have a "limited" knowledge and I believe were rather poorly advised.

- The notion to split Telstra is not a new philosophy. Several people including myself have put this forward as from about 1988.
- One of the requests in privatising Telstra was the structural splitting of Telstra such that the Wholesale price to be openly available.
- The Wholesale price is associated with providing customer services via the Customer Access Network (CAN) – **but this price must include the overhead cost of the Inter-Exchange (Backhaul) Network and all of its associated infrastructure!**
- After a decade of Telstra continually feeding shareholders large dividends, and the various Federal Governments trying more than 10 "quick fix" initiatives to boost the non-urban / non-metro telecomms standards, something had to give.
- The Liberal Government introduced a plan for a skeleton National Broadband Network (NBN Mk 0) for the non-metropolitan areas, primarily based on Point-to-Point Radio and Broadband CAN technologies in some country cities.
- This proposed Broadband network caused Telstra to panic and roll out a metropolitan-based distributed headend HFC Cable Internet in 2006/7 as a quick and dirty Broadband network solution.
- The following Labor Government recognised that the non-metropolitan skeleton NBN was far too thin to be viable and proposed a considerably larger pair-copper FTTN (ADSL / Radio) based NBN Mk 1.
- On advice from many experts[30] the then Labor Federal Government was strongly advised that the pair-copper was well past its use-by date and that FTTH was the most favoured technology.
- The second version of the NBN was again more expensive, but it was primarily FTTH based with Radio / satellite as the backup out of towns.
- This NBN Mk 2 was costed at about $43 Bn which was substantially more than before, but it had a future-proof of several decades.
- The $43 Bn is easily worked out: Eight years to roll out a network costing about $5.5 Bn per year = $44 Bn give or take!

The commercial "Unbundling the CAN" push blindsided most people into innocently and incorrectly believing that the CAN is the Copper Network and that the Copper Network is "The Network". (Refer to the Appendix).

The NBN infrastructure is essentially just the CAN component – totally missing out on the Inter-Exchange (Backhaul) Network infrastructure of long distance SMOF transmission, all the exchange sites, mobile (device) radio base stations, and a whole lot more related with all of this.

Now, the financial disaster!

[30] This is well documented in my submission to the "**Expert Committee on Telecommunications about the NBN**" 2008, on pages 3-6 and it also covers many other CAN technologies. A copy of this submission is at: http://www.moore.org.au/senh/2008/2008To%20Expert%20Committee.pdf

(In my opinion) the most inept, least telecomms infrastructure experienced and least knowledgeable about the telecommunications network made an extremely stupid decision to "rent / buy the Telstra copper/duct network"!

Even then, the decision was made **to actually pay Telstra not $2 Bn, not $3 Bn but an almighty $11,000,000,000 for what is effectively nothing!** No wonder the share price of TLS has doubled in 2012-2013 and is still climbing.

This $11,000,000,000 needs to be recouped immediately!

As I best understand it, Telstra has not moved at all to structurally spit along the lines I believe to be practically incorrect; isolating the (Copper) Customer Access Network (CAN) from the rest of its business operations. This structural split borders on the stupidity borne out of the ignorance of not comprehending the consequences of "Unbundling" the CAN part of the telecoms network.

Every end-to-end connection, be it telephony, mobiles, Internet, Pay TV, interactive Apps, Cloud Computing, Card transactions etc. they all use an immense amount of **Inter-Exchange Network** infrastructure to connect.

This situation then begs the question as to why would those that signed off on behalf of the NBN to purchase/rent the under-footpath conduits and copper be of any use, without also having total ownership, access and control of all the exchange sites and all the Inter-Exchange Network too?

How to Split, Merge and Save $44,000,000,000

- My proposed structural splitting of Telstra must be between the wholesale infrastructure and Retail Reselling, and must not be as it currently is: between the CAN infrastructure and everything else.
- The Structural Split must become a total Physical Split as a matter of urgency.
- The Telstra Board will be totally focussed on Retail Reselling and Shareholders. (No real change here – but a very clear focus.)
- The Telstra Board will be removed from Infrastructure.
- The $11,000,000,000 is "infrastructure" and totally stays with Ex-Telstra Infrastructure.
- The $11,000,000,000 is not to be distributed or diluted in any form or method.
- The NBN Co and the ex-Telstra Infrastructure is to immediately and totally merge to form the Australian Broadband Telecommunications Commission (ABTC), reporting to the Federal Government Department of Communications.
- The ABTC is to operate as an Infrastructure Business and not as a Commercial Business[31].
- The ABTC will be able to hire / fire / contract staff and consultants at will.
- The $11,000,000,000 is to be now immediately absolved as this payment is now entirely internal.

[31] This reference gives an insight into what Infrastructure Business is and how it works hand in hand with (but with a diametrically different mindset than) Competitive Business. This is available at: http://www.moore.org.au/busn/01/Competitive%20Business%20and%20Infrastructure%20Business.pdf

- All leasing / renting contracts now internal to the ABTC are to be immediately absolved and the now unnecessary staff re-allocated / let go.
- Another $11,000,000,000 will be saved by reduced legal / staff overheads.
- The ABTC is to manage the long-term rollout of telecommunications and IT infrastructure in Australia.
- Another $11,000,000,000 will be saved through merged infrastructures and merged standard practices.
- The ABTC is to contract the sale of wholesale Broadband and IT services in Australia and to overseas wholesale interfaces to Telecomms Retail Resellers.
- The ABTC is to correlate / standardise on a common set of installation, commissioning, operation and documentation standards, primarily based on Ex-Telstra Infrastructure.
- The Foxtel – Telstra agreement is not to be bound by or include any infrastructure as this agreement really a content provision agreement.
- Telstra has an excellent billing system that will be directly connected to the ABTC metering system.
- Because the Telstra Retail Reselling Business and Board are now tightly focussed on providing excellent retail products, the TLS and other share prices in the telecomms sector should substantially rise.
- Funds investors will see financial sense in investing into Retail Reselling (competitive business) and not investing into infrastructure businesses.
- Because the ABTC is tightly focussed on maximising wholesale Broadband services and excellent service Quality, this commission will roll out the Broadband connectivity with a minimum of process issues.
- The ABTC will roll out the inland SMOF cable routes to provide a mat of high capacity IEN infrastructure, for about $750,000,000 making the Australian Inter-Exchange Network very robust and very fast.
- This mat of inland SMOF (predominantly shared CAN and IEN cable) will facilitate very inexpensive Broadband connectivity beyond the Metropolitan areas, to cities, towns, villages and thousands of homesteads.
- The savings created by rolling out this inland mat of SMOF and associated infrastructure will save more than $11,000,000,000 and create thousands of “high tech jobs in the bush”.
- The low Wholesale price of Broadband from the ABTC will make it more profitable for Optus and other Service Providers to buy Wholesale from ABTC than to provide this itself.
- Optus will then agree to hand over (fire sale) its entire infrastructure and engineering staff to the ACTB so that it can focus on competitive retail reselling.
- Other ISPs will very quickly follow suit and hand over (fire sale) their infrastructures and engineering staff to remain competitive with Optus and Telstra.
- With this larger Economy of Scale, the ABTC will be able to provide even lower wholesale prices, with an overall faster Broadband connectivity for far more wholesale arrangements all including in the non-metropolitan areas.

- As this Economy of Scale is increased the requirement for legal contracts for rented floor space in exchange sites will dramatically decrease, creating another immense saving in legal overheads.

Put bluntly, the action of physically splitting Telstra along the Retail Reselling and Infrastructure lines will save Australians more than $44,000,000,000 in the short-medium term, and create at least $44,000,000,000 again through re-generating Australia as the high-technology research and development country of choice to build and focus our Australian future.

Government's Cost Benefit Analysis

Paragraph 1c specifically raises detail about the Cost Benefit Analysis.

The term "Cost Benefit Analysis" (CBA) has two diametrically different meanings, depending on the business mindset, that is if the business being operated is a commercial competitive business, or if the business being operated is an infrastructure business which provides an essential service.

Calculating a Commercial / Competitive CBA

The steps to calculate a commercial CBA are very straightforward.

1 How much does the equipment cost?

2 How much is the maintenance and overhead running costs?

3 How many customers are attached?

4 What is the cost per customer?

5 Can this money be recouped inside 12 months?

The strategic thinking does not take very much thought and most commercial CBAs can be done on the back of a beer coaster in most cases.

It is all too easy to be working in a metropolitan environment and calculating commercial CBAs for telecomms services. The answers always come out the same and it comes down to a common figure that then spells out the pain value for potential customers to pay out when they require what is really an essential service.

The problem is that when working in non-metropolitan environments, the big mistake is to use the same metropolitan figures in a non-metropolitan situation. As the infrastructure costs go up, various services very quickly fall off the radar – because they are "too expensive" to install and operate.

In other words, these telecomms infrastructures will not make a reasonable ROI for commercial purposes, which as rule is a nominal 20% pa or greater.

The fact is that many farmers and graziers operate with multi-million dollar annual budgets and would welcome paying extra to have excellent telecommunications connectivity. The business blindness of metropolitan commercial business people have long shut the door and gone metro.

Calculating an Infrastructure CBA

The steps to calculate an infrastructure CBA are also very straightforward.

1 How much does the equipment cost?

2 How much is the maintenance and overhead running costs?

3 How many customers are attached?

4 What is the cost per customer/family?

5 What personal value does the customer gain by having this infrastructure?

6 What ancillary services can be decreased by providing this infrastructure?

7 What other family and commercial business costs are reduced by providing this service?

8 How much are all these family and commercial values worth?

9 How long does it take to match the infrastructure cost with the family and commercial value increase?

10 Can this value be recouped inside 60 months?

It is fairly clear that the Infrastructure CBA takes a little more working out than a commercial CBA, but in reality it is quite easy when you put yourself "in their shoes" and see the problem form their side, but with your own knowledge in hand.

How to Calculate Non-Metropolitan Cost Benefits

In 2009, I provided a submission[32] for the Select Senate Committee on the NBN. As a Witness for that Inquiry, I provided an elegant solution to the intended rhetoric question from by Senator Ian MacDonald (Qld) "How would I provide Broadband to Birdsville?" This answer demonstrated how to very inexpensively provide Broadband to Birdsville and also about 250,000 sq km east of Birdsville for about $5 M.

Inexpensive Broadband to Birdsville

The Addendum Submission[33] provided a simple example of the first round strategic engineering for **Senator Ian MacDonald (Qld)** to extend an existing SMOF cable by about 107 km, so that a relatively high capacity SMOF transmission system can sit on this from Longreach and enable the very long (1000 km?) Radio system from Emerald to be split about two thirds along the path (at Galway Downs).

This split would allow the Radio system to be broken into nominal 330 km lengths, cutting the traffic density by about 70% (or increasing the transmissions capability by about 230%).

Considering the nominal bearer has a capacity of 34 Mb/s (PDH), if this were telephony only, the number of end connections would have been about 480 and this would have been fully occupied. Consider that VoIP is being used for voice carriage

[32] This 2009 Submission to the **Select Senate Committee on the NBN** was primarily focussed on splitting Telstra to get the NBN rolled into one infrastructure Business. The contents of that submission is at http://www.moore.org.au/senh/2009/20090627%20NBN%20Submission%20a1.pdf More detail this inquiry is at http://www.moore.org.au/senh/2009/2009_NBN2.htm

[33] The Addendum submission following the **2009 witness stand for the Select Senate Inquiry** on the NBN is located here http://www.moore.org.au/senh/2009/NBN2%20Sub45a%20Moore.pdf

and this occupancy drops to about 40% under long held calls and the whole spectrum is open.

If the end users were cut in three ie 160 end users per radio section, then the occupancy would be about 0.33 E * 0.4 = 0.13 E, leaving about 0.87 E for Broadband, or about 29.5 Mb/s for Broadband between say 160 end users.

Considering the nominal Broadband occupancy is say 5%, then this equates to about eight full time users at 29.5 Mb/s or nominally 3.6 Mb/s in the busy time and up to 29 Mb/s in the quiet time. This is considerably faster than 56 kb/s dial up.

If the nominal bearer capacity is 140 Mb/s (PDH) for telephony only, then the same maths will apply but the count will be about 2100 end users on the full system, or about 718 end users per third radio length. All these end-users will have a busy hour Internet speed of about 3.6 Mb/s and a quiet time Broadband speed exceeding 24 Mb/s which is the top limit for ADSL 2+

A direct extract from the Addendum Submission shows the first-round costing:

"Here is a quick ball-park guesstimation of the proposed system:

Optical Fibre Longreach – Galway Downs

Engineering evaluation with a walk through and detailed designs	*$50,000*
107 km of Optical Fibre at $30,000/km	*$3,210,000*
*5 *1 Gb/s Routers at $20,000*	*$100,000*
*4 * Power Packs and Batteries at $10,000*	*$40,000*
Install and Commission Network Equipment	*$15,000*
Sub total	***$3,415,000***

Radio Galway Downs – Birdsville

Engineering evaluation with a walk through and detailed designs	*$50,000*
3 Routers and ancillary equipment $20,000	*$60,000*
*8 *5.7 GHZ point-point radio systems $20,000*	*$160,000*
*8 * Power Packs and Batteries at $10,000*	*$80,000*
Install and Commission Network Equipment	*$65,000*
Sub total	***$415,000***

Assuming that these locations do not have ADSL, but do now have the capability for Broadband, with a broad-brush approach, wire all physicals (direct pair copper) through mini-DSLAMs and connect the DSLAM backhaul side to the upgraded backhaul via the routers positioned as regenerators / amplifiers:

Install DSLAMs at regenerator sites to all physical CAN circuits Birdsville – Longreach / Charleville (west sides)

Engineering evaluation with a walk through and detailed designs	*$70,000*
*15 * 48 Channel DSLAMS ancillary equipment $50,000*	*$720,000*
*15 * Power Packs and Batteries at $10,000*	*$150,000*
Install and Commission Network	*$144,000*
Sub total	***$1,084,000***

So this would connect about 720 premises with Broadband using ADSL for a very rough guess totalling about $4.9 M (or about say $6,800 per premises). The fact is

the take-up will really be about 70% because the first guess will not align with the premises so the more real cost is towards $10,000 per premises. And this CAN needs to connect with solid backhaul:"

So now we are up to stage 4 and we know the end user cost is about $6,800 per family. This is where the metropolitan based marketing city folk get cold feet and closes the books, as this cost is well over the nominal $1,200 maximum (or whatever it is as a nominal metropolitan limit).

Evaluating the Infrastructure Cost Benefit Analysis

Following on from Senator Ian MacDonald (Qld), the question from Senator Nick Minchin (SA) was highly critical of the "huge end user cost" that could never be justified (with a commercial competitive business mindset)!

If a 34 Mb/s radio system then the per end user cost is $4,900,000 / 480 = $10,200, and if a 140 Mb/s radio system then the per user cost is $4,900,000 / 2100 = $2,333

The following extract from Addendum submission 45 has the infrastructure business mindset answer on how to do the basics of a Cost Benefit Analysis (CBA)

"Taking the above case (Birdsville Broadband) that was raised by Senator Ian MacDonald. Assuming that this infrastructure cost came out as $10,000 per premises, then the external accounting P&L process would move in and look at many issues like:

Medical eHealth savings through customers using BB Internet	*$500*
Unemployment social service cost reductions	*$2,000*
Saving in Petrol and Oil products	*$3,650*
Improved Education	*$5,000*
Trading from the Farm	*$3,000*
Short List Sub-total (per premises, per year)	***$14,150***

So using the External Accounting P&L approach as used in the infrastructure regime, this infrastructure would have paid for itself in less than 9 months, and we have not even asked the shareholders about the profits (because the government and opposition are the shareholders), and the government overheads on Social Security and Health / Medical are significantly dropped, while these people will be paying bigger taxes!

The obvious argument is that these external accounting P&L figures are far too optimistic, so if these figures were heavily discounted by say 75% then we will get:

Medical eHealth savings through customers using BB Internet	*$125*
Unemployment social service cost reductions	*$500*
Saving in Petrol and Oil products	*$912*
Improved Education	*$1,250*
Trading from the Farm	*$750*
Short List Sub-total (per premises, per year)	***$3,537***

Keeping this external P&L accounting in line with a typical competitive business case, then it should break even over three years (neglecting interest). These heavily discounted figures clearly show that the payback to the government for putting in this

infrastructure is more than $10,500 over three years making this infrastructure business case extremely compelling."

This simple CBA and Network structure was obviously far too complex for the Select Committee on the NBN (2009) to grasp and comprehend, as absolutely none of this knowledge and expertise reached this Select Committee Report.

In 2010, a political storm erupted over some months over a serious lack of a **Cost Benefit Analysis of then $43,000,000,000 NBN**. This storm could have been quickly absolved if the then Select Senate Committee had comprehended and acted on **the gravity of my submission**, as this section clearly demonstrated how the concept of an infrastructure business Cost Benefit Analysis is calculated and utilised.

Availability of Broadband in Australia

Paragraph 1c specifically raises the Government survey of the availability of broadband in Australia.

As frequently mentioned in this submission, it is rather pointless having a fast Customer Access Network (CAN) infrastructure if the associated Inter-Exchange Network infrastructure is running in congestion.

The Real Geographic Digital Divide

While the selling off vital Australian telecomms infrastructure was going on in the 1990s, it became blatantly obvious that only the metropolitan areas (the state capital cities and their suburbs) were getting significantly better telecomms service standards at the expense of everywhere else in Australia.

- Even then, the vast majority of significantly improved service standards came from newer generation technologies installed as a priority in metropolitan areas only.
- Effectively, it was commercial competition that drove in the wedge that created the Digital Divide of differential service standards.
- The Davidson Report (1982) recognised this differential services problem and instigated the Universal Services Obligation (USO) to hide the problem.
- Multiple Select Senate Inquiries, Regional Reviews and similar Inquiries all steered well clear of identifying the Competition Regime as being the cause of the problem that has now has **festered into a $70,000,000,000 black hole**.

The metropolitan areas have the lions' share of commercial profits from telecomms infrastructure investment and that is where the competitive telecomms (infrastructure) service providers have very heavily focussed their finances, to maximise their return on investment (ROI) for their shareholders.

- The "competitive carriers" have deliberately avoided rolling out any infrastructure outside the state capital cities, leaving as much to Telstra as possible.
- Telstra has also avoided renewing any digital infrastructure outside the metropolitan areas, unless it literally falls into total disrepair, or can't be swap-repaired to minimise the overhead costs.

This financial ROI differential has resulted in a Geographic "Digital Divide" like that where the older human generations who use of computers and personal

telecommunications is far less than the younger generations, with an age-based "Digital Divide" with personal computers and mobile devices.

The Geographic "Digital Divide" is where the metropolitan areas have an over-abundance of Inter-Exchange Network (Backhaul Network) mesh connectivity, and an over-abundance Customer Access Network (CAN) connectivity.

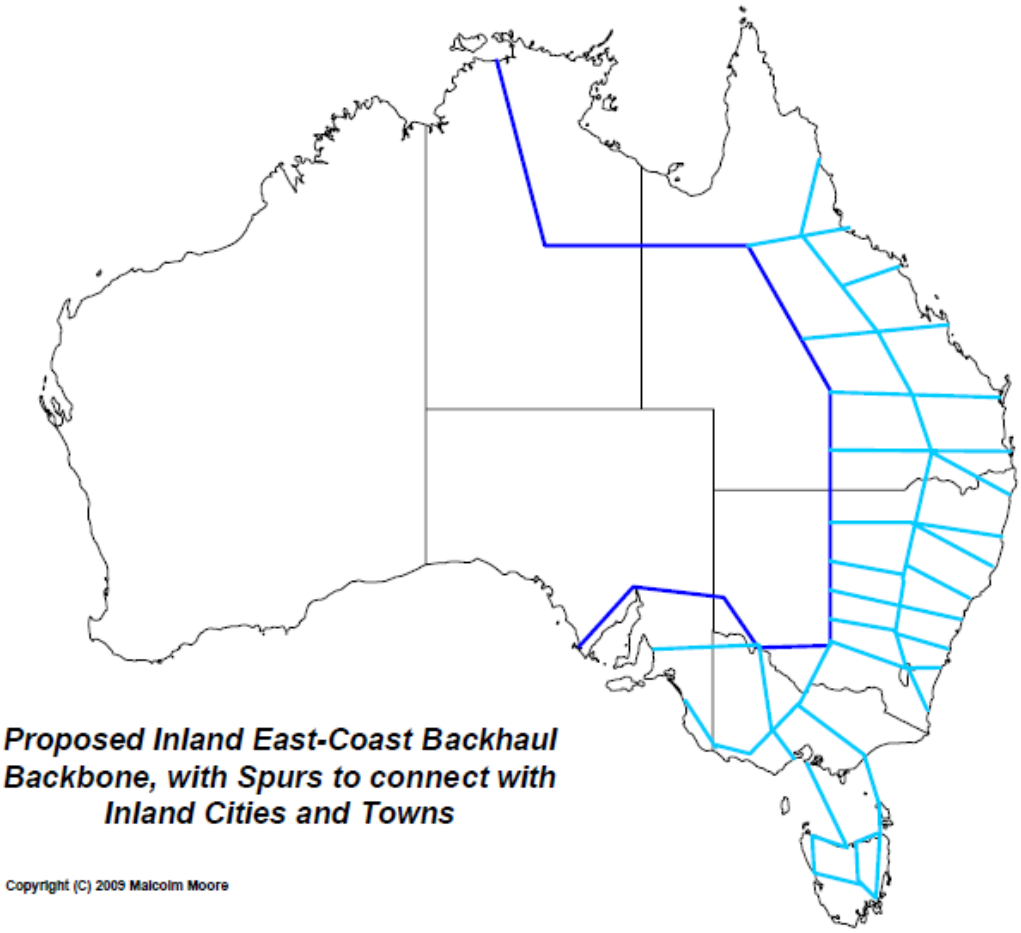
- In the capital cities and their suburbs (the metropolitan area), where a good 80% of the population is, the IEN / Backhaul Network is a thick mesh of SMOF cables connecting to geographically diverse main network switches to provide a very wide range of connectivity to all local exchange sites.
- The country cities, towns, villages and homesteads (ie the non-metropolitan areas) generally have a very thin "Tiered-Star" Inter-Exchange Network that runs in virtual full time congestion, without network path diversity, and is usually parented back to the state capital city for inter-regional switching.
- The metropolitan areas have an over-abundance of mobile device access connectivity, a fully duplicated Hybrid Fibre Coax (HFC) CAN connectivity for pay TV and Broadband Internet, and a choice of competitive infrastructures providing ADSL on pair copper.
- All metropolitan CBDs have SMOF available for businesses services.
- Very few non-metropolitan cities could support a Web-hosting business because the associated IEN is incapable of handling the traffic.
- Very few non-metropolitan cities could support a FTTH / FTTP services because the associated IEN is incapable of handling the traffic.
- Very few non-metropolitan CBDs include SMOF connectivity to businesses because the associated IEN is incapable of handling the traffic.
- There is no HFC Cable outside the metropolitan areas.
- Mobile device access is limited to country cities, towns and main highways.
- The analogue Customer Access Network is "OK" in most country towns and cities as it an identical structure as in metropolitan cities.
- All non-metropolitan cities and most towns now have ADSL connectivity, but the IEN is speed-limited by network congestion and lack of diverse routing paths, severely impacting on Broadband connectivity.
- Homesteads are a major sticking point as these are the country business offices, but their business connectivity is usually appalling.
- By "design" the physical analogue line for Homesteads is at its limit for switch-hook signalling, at its limit for maximum attenuation and at its limit for frequency response.
- A very high proportion of Homestead connecting physical CAN includes "Pair Gain" equipment to get the connection (just) within specification.
- For most Homesteads, ADSL digital connectivity is impossible because of the long line length and/or the inclusion of "Pair Gain" equipment.
- Radio 2G / 3G connectivity is optimised for the local towns so Homesteads are often shaded out by hills.

This "Geographic Digital Divide" was really accelerated by introducing financial competition into the Australian telecommunications infrastructure way back in 1982.

Need for a High-Capacity Eastern Inland Backbone

The NBN Co infrastructure is strictly just the CAN component of the overall end-to-end connectivity structure, and in reality the non-metropolitan NBN CAN infrastructure really needs a really high throughput mesh Inter-Exchange Network to back-connect with.

So, the NBN CAN in country areas is (and will be) virtually isolated unless there happens to be a very thick IEN / Backhaul connectivity nearby. In almost all country areas, there is no thick IEN / Backhaul Network at all. In realising this problem several years ago, I came up with the conception of an Eastern Inland Backbone shown below as royal blue, running from Darwin – Mt Isa – Shepparton – Broken Hill – Whyalla, and then put spurs / mesh towards to coast, as shown above in sky blue.



This Eastern Inland Backbone[34] and its associated spurs totals about 27,000 km of cable and would cost in the order of $750 M including transmission equipment. It is this IEN Backbone that will really make the NBN CAN has the IEN throughput connectivity it desperately needs for it to be economical for Australians.

[34] In 2008 I provided a submission to the **Expert Group on Telecommunications for the NBN** that included several items, one of which is the Missing Inland Backhaul Backbone, which is a visionary structure to provide inexpensive high capacity SMOF IEN backbones through the eastern States, SA, WA, NT to open up the inland. **None of my submission was included in any of their Report.**

In 2010, I provided a submission to the **Department of Broadband and the Digital Economy** for the "Practical Business Case for the NBN". (NBN Version 2) The submission included a first round detailed geographic plan and costing for the Inland SMOF Backbone infrastructure; estimated to be about 22,735 km and costing about $749.8 M. **None of this was included in any of their Report.** A copy is at http://www.moore.org.au/senh/2010/NBN%20Business%20Case%202.pdf

Now, when this (27,000 km) length of Inter-Exchange Network SMOF cable and its associated equipment is compared to the NBN Mk 1 (Optus / Elders proposal), it should be extremely clear why the NBN Mk 1 was so woefully inadequate. It should be obvious that this extensive inland country Inter-Exchange Network is imperative to make the NBN Mk 3 practical for high speed through connectivity.

Consider the relatively small cost of this SMOF Inter-Exchange Network (IEN) infrastructure (about $750,000,000) that would then provide a mat / mesh of IEN that covers almost all the missing areas deliberately avoided by the Competition Regime's quest for maximised profits.

Now take out the congested POI infrastructure and replace that with a simple national database that associates end-user modems with retail reseller services; then transfer the POI infrastructure onto a continuum of inland IEN mesh to provide an even greater IEN Broadband throughput.

This inexpensive SMOF IEN infrastructure now sets the platform for high-tech inland businesses to develop Web-hosing almost anywhere in any country town or city!

The added spinoff is that by using standard 144 strand SMOF in bulk purchasing, this cable can also be shared as non-urban FTTH (Homestead), providing very fast, highly reliable and very secure Broadband Internet connectivity to almost any Homestead, almost anywhere in Australia.

Need Shared SMOF IEN and CAN Cables

The next massive problem is that the two infrastructure components (CAN and IEN / Backhaul Network) are in reality both using SMOF cables, but are being rolled out in total isolation of each other, and this is a real big "lose – lose" situation; particularly in regional, rural and remote areas. Because these inland cable paths are almost always identical for CAN and IEN, then there are massive "economy of scale" savings can be made by sharing the cable usage for both CAN and IEN functionality.

Compounding this "lose-lose" situation above is the very short-sighted (Mc Kinsey's / NBN) strategy to use Passive Optical Network (PON) technology with a strictly urban philosophy maximum length limit of 10 km, when the maximum physical distance limit is 60 km, with less fan-out in the passive optical splitters.

If the minimum size SMOF cable laid were 144 strands instead of 12 or 24 strand, then the overall cost difference in cable trenching/laying is usually less than about 7% extra. Consider the backbone and associated infrastructure above and the costs move from about $750 M to $803 M, which in the overall picture is no really big deal, particularly when the financial advantages of cost sharing are included.

The synergetic advantage is that in almost all cases these cables will be passing very close to homesteads, and/or through villages and small towns. In virtually all cases these locations will be closer than 60 km from a larger town that will have Optical Line Termination (OLT) equipment installed in the local exchange. Using this synergetic strategy, inexpensive non-urban FTTP[35] could be very economically rolled

[35] This short document goes a long way to describe how and where inexpensive non-urban FTTH can be rolled out in country areas; and how the IEN needs to be standardised to 144 strand SMOF to maximise the future inland telecomms infrastructure
http://www.moore.org.au/comms/20130412%20Inexpensive%20Non-Urban%20FTTP.pdf

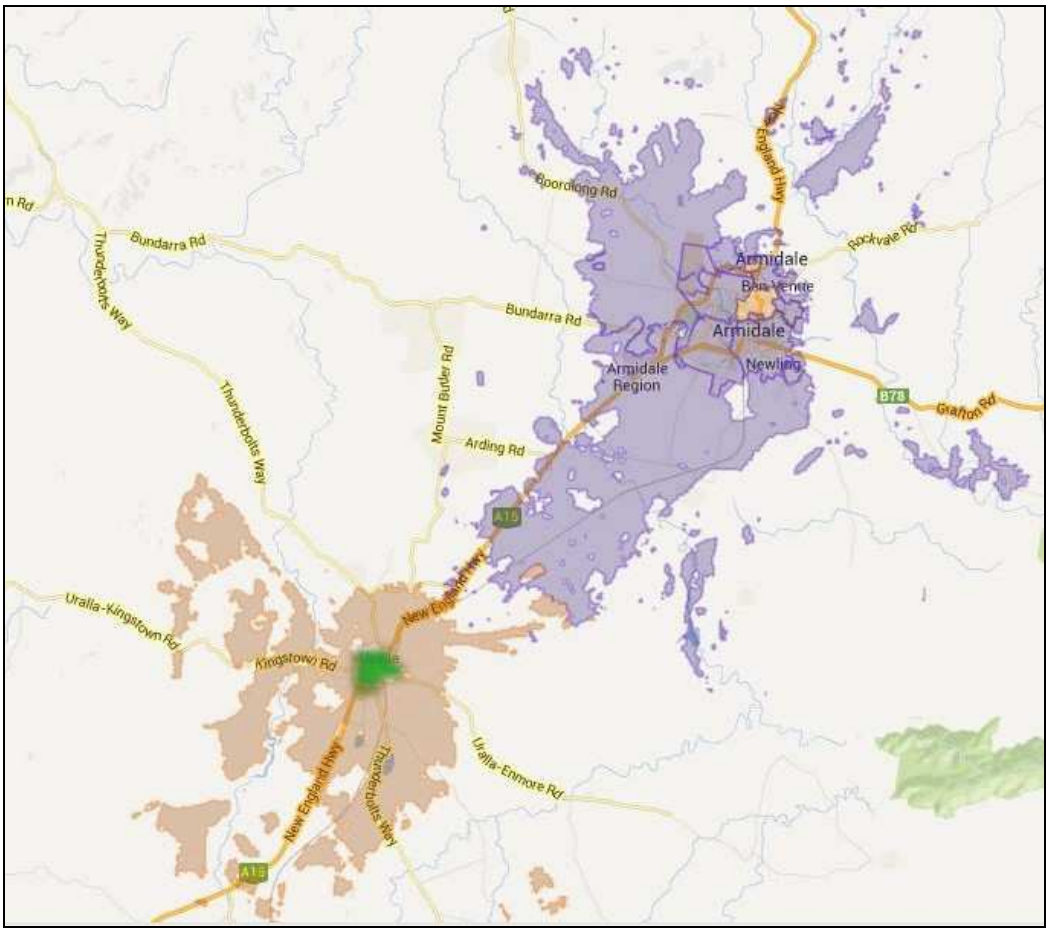
out to most homesteads, most villages and most towns from larger country centres, typically less than 40 km away. The design limit is 60 km.

The IEN / CAN synergy of the shared cable technology is that the CAN component would pay for the IEN component and the IEN component would be much heavier utilised, making it an infrastructure business viable concern. Further, this inland high capacity IEN / Backhaul network will become the high capacity internal bypass for the capital cities on the east coast, giving the overall network a very solid robustness that it never would otherwise have.

Need Long Distance Radio CAN

The next problem to resolve is one of limited Radio connectivity with rural and remote areas, where the McKinsey's Report has specified the use of well developed commercially available technologies. Much line Urban PON technologies, GHz based radio systems are commercially available, and really have their use for short range connectivity (typically less than 5 km), which commercially matches the larger urban market.

While GHz radio may be highly practical and profitable to connect to the premises of small towns and villages (that cannot connect with inexpensive non-urban FTTP), rural homesteads off the main roads, (where the majority of shared CAN / IEN SMOF cables would be run) are also out of range with most GHz radio because they are out of line of sight because most radio towers are located in towns, where the majority of people are, and most towns are physically located on river banks, in valleys.



The picture above shows the NBN connectivity using GHz radio in Armidale and Uralla. Considering that the distance between Armidale and Uralla is about 23 km then most of the farms have no Broadband connectivity.

To provide radio connectivity to these homesteads, the planning has to include a range of non-commercial, non-competitive scenario strategies. The transmitting frequency has to come well down from the GHz range so that the distance is not so much line of sight but more the curvature of the earth.

Using the lower UHF band and / or the now vacant VHF band is practical as the distance can be upwards of 70 km, not about 5 to 10 km. Using an existing TV antenna mast is highly practical and inexpensive as these already exist. Using an unused TV channel for connection provides a wideband connection capable of very fast Broadband connectivity.

The problem is that this equipment is not commercially available and the McKinsey's Report specifies only commercially available equipment. In 2010/2011 the CSIRO researched this technology and came up with a prototype system called Ngara[36], which to date has still not been developed and commercialised.

This Ngara Broadband long distance Access radio system has the capability of providing Broadband connectivity to rural and remote homesteads and villages where SMOF cable would otherwise never go.

Looking at the map above and realising that by positioning an antenna on a hill, some 5 km to 10 km south-west of Armidale, then ***all the farms / Homesteads on this map (and some beyond)*** could all be connected with fast Broadband Internet, not just the town and the immediate near area.

The intrinsic problem is that the CSIRO is a research facility that is really floundering when it comes to commercial development and commercialisation (but that is a whole other issue that could be very easily solved with a sister sub-government commission to develop and then commercialise an immense range of Australian research and inventions). *(Ex - GM, ex - Ford assembly plants come to mind!)*

Synergies Created with Economies of Scale

With my proposed inland Backbone thick (high capacity) Inter-Exchange Network SMOF cable being cross-connected with a number of SMOF cable spurs leading towards large coastal towns / cities – this provides the necessary high capacity Inter-Exchange Network grid that the proposed NBN M3 can readily connect into.

By actively utilising inexpensive non-urban FTTP on these routes, and further by utilising existing CAN / IEN routes for inexpensive non-urban FTTP technologies, then most of the rural and remote areas, including most homesteads can be connected with inexpensive non-urban FTTP technologies.

For those Homesteads and remote locations outside these fibre paths, the CSIRO's Ngara[37] Access wideband radio system could / would inexpensively provide reliable Broadband connectivity up to 70 km from existing TV / Radio / Mobile Phone masts using their special antenna and associated infrastructure.

[36] The CSIRO did some excellent research work on developing a long-distance TV band Radio CAN ideal for inland situations, but the development before commercialisation is sorely lacking. http://www.csiro.au/en/Organisation-Structure/Divisions/ICT-Centre/Ngara-Smithton-trial-report.aspx

[37] This reference shows some of the excellent research that was done on the Ngara Radio system. http://www.csiro.au/Outcomes/ICT-and-Services/Broadband-to-the-bush.aspx

The infrastructure part of Telstra needs to work very closely with the NBN Co, without the interference of the commercial side of Telstra and its' Board.

Does Australia Really Need Satellites?

Back in 1981 (at about the same time that the Davidson Inquiry was triggered into action), a new Federal Government-owned business called Aussat Pty Ltd[38] was established on the pretence to deliver remote communications, in particular Television to outback Australia.

- The first satellite launched for Aussat was the Hughes[39] 376 and it started official broadcasting in 1985.
- It was extremely puzzling that OTC would not be launching / managing this satellite because it could very easily be used for international connectivity.
- Considering that the ABC managed all international broadcasts it was also extremely puzzling why the ABC was excluded.
- Similarly, Telecom Australia was managing all the internal telecommunications and clearly this satellite would be extremely expensive considering the extremely tiny market in the inland of Australia.

I am still extremely suspicious that this satellite and probably another one with it were launched in tandem as military surveillance / interception satellites of Australia for and by the USA / CIA but using the cover of Aussat and "competition" as the business front to hide these satellites from public scrutiny or general knowledge.

- With the enforced introduction of Optus (1990) as a telecommunications infrastructure competition, the Aussat satellite was included in the deal.
- This $300,000,000 fire sale gave all of the Aussat satellite and business to Optus, but this satellite infrastructure was running at a financial loss.
- The ABC television distribution network (previously on SMOF) was ripped out of Telstra and put through the Aussat satellite to make the service "profitable" at the expense of Telstra (and the ABC and the Australian public).
- The geostationary satellite connection introduces a considerable transmission latency, which causes live programming problems.

If the rather inexpensive SMOF backbone / grid that I have proposed some years ago was rolled out, then this Inter-Exchange Network / CAN infrastructure has the potential to very economically connect almost everywhere in non-metropolitan Australia to virtually negate the requirement for any Broadband communications satellites as these satellites are rather expensive.

An inclusion of the CSIRO's Ngara Broadband radio CAN could provide inexpensive connectivity for the "last 100 km" in a small percentage of inland / isolated cases; particularly where SMOF does not go too near some remote locations.

[38] This is a brief history of Optus http://en.wikipedia.org/wiki/Optus

[39] There is a really strong suspicion that the USA-CIA was / is working very covertly under the Hughes Corp. banner to spy against Australian politics and against Australian business interests. http://www.mail-archive.com/ctrl@listserv.aol.com/msg00909.html

Any Related Matter

Stop Wasting Another $88,000,000,000

The Two Diametric Business Mindsets

In the current telecommunications business (after Globalisation in 1985), there are effectively two main areas:

- Retail Marketing / Reselling
- Network / Technology Engineering

The economics of Retail Marketing / Reselling is a very well understood topic that fits extremely well under the economic banner of "competitive business".

The mantra of "competitive business" is:

- Taught in all schools / universities where economics is taught / lectured.
- Blindly accepted strategy as the "only form of business" in western economics.
- Totally the wrong economic strategy for Network / Technology Engineering.
- Totally the right economic strategy for Retail Marketing / Reselling.

The economics of Network / Technology Engineering is a subject that is not at all well understood by those in the standard "competitive business" world.

The Cinderella story is a matching analogy where:

- The Glass Slipper represents the Telecommunications Infrastructure,
- The Ugly Sisters represent Competitive Business mindset and
- Cinderella represents the Infrastructure Business mindset.
- The brutal and ruthless Ugly Sisters fight each other in a race to "force fit" the Glass Slipper to themselves – but
- The Glass Slipper is a perfect fit for Cinderella.

The economics of Network / Technology Engineering fits very comfortably under the "Infrastructure Business[40]" economic banner.

The mantra of "infrastructure business" is:

- Not taught in any school / university where economics is taught / lectured.
- Blindly refused as the "wrong form of business" in USA economics.
- Totally the right economic strategy for Network / Technology Engineering.
- Totally the wrong economic strategy for Retail Marketing / Reselling.

It should be now very clearly understood that these two forms of economic management are poles apart from each other, but rely very heavily on each other so they can both be very efficient in their own right (their own definition of efficient).

[40] A short paper describing the diametric business mindset differences between Competitive Business and Infrastructure Business is at http://www.moore.org.au/busn/01/Competitive%20Business%20and%20Infrastructure%20Business.pdf

When Essential Infrastructure is Privatised

The problem is that when an infrastructure is privatised, a new Board comes with direction to add shareholder value.

In this privatised infrastructure case, both "infrastructure business" and "competitive business" mindsets cannot operate efficiently under the one Board, and very soon the Competitive Business mindset people ruthlessly remove the Infrastructure Business mindset people.

- The next stage is the Competitive Business mindset Board then focuses on Shareholder value (ie maximised return on investment and as fast as possible).
- In time, the Board direction then grossly oversupplies the high value customers and high value geographic areas with telecommunications equipment.
- Concurrently, Board direction then grossly undersupplies low value customers and low value geographic areas with telecommunications equipment.
- The Board sees value in reducing staff, minimising maintenance practices, losing long-term corporate memory, and outsourcing what it sees as non-core business.
- These activities increase the book value of the privatised infrastructure for some years (maybe even as long as a decade).
- There is public dissent about at least a few of the following: lack of service facilities, high service costs and fees, low reliability, geographic isolation, negative impact on competitive businesses and/or communities; and other issues.
- Federal and State level Government Inquiries are set up to identify and address specific problems – except problems caused by Privatisation.
- Virtually everything is usually addressed and resolved for a couple of years.

Public dissent again surfaces and the last three points follow sequence in a never-ending sequence, because the "Privatised Infrastructure" problem has not been addressed and resolved. Australian Telecomms is a classic example!

Australian Telecomms Business History

The very abbreviated / approximated history shown here, relates to the business structures leading up to a series of ineffective and very expensive inquiries.

1974 USA controlled IMF "strongly advises" all western economic countries to get a telecomms sector on their stock exchanges, or face the dire trade and financial consequences as metered out to Chile.

1975 Australia dissects the Post Master Generals Department to make a number of Commissions including the Australian Telecommunications Commission (ATC).

1980 Davidson Inquiry established to "totally privatise" Australia's telecommunications (1982) and set up at least one large vertically integrated competing telecomms business against Telecom Australia, on the ASX.

1985 Telecom Australia restructured from State Management to Regional Management together with fast growing Retail Sales and Marketing Business Units focussed on maximised return on investment.

1992 Optus established as a prime second telecommunications competitive infrastructure in Australia at the expense of Telecom Australia and OTC.

1993 Telecom Australia changed name to Telstra. Telstra's Regional Management dissolved and replaced with Consumer Business Unit.

1996 Stronger focus is now on maximised ROI in State capital cities (metropolitan areas) at the expense of everywhere else.

1997 **Inquiry** "Networking the Nation" – totally unsuccessful, very expensive, and undid the work that is done by the remaining telecomms engineers.

1998 **Inquiry** "National Bandwidth" – totally useless as this topic was really well known and in hand by telecomms engineers but not at all understood and very poorly managed by competitive business Sales and Marketing.

2002 **Inquiry** "Australian Telecomms Network" – totally unsuccessful and channelled funding into metropolitan areas only where it was not required.

2002 **Inquiry** "Regional and Remote Network Capacity" – totally unsuccessful as no practical outcome

2003 **Inquiry** "Broadband Competition" – very expensive outcome with cowboy operators given a free reign with inefficient partial Broadband structures.

2005 **Inquiry** "Proposed ACMA" to manage the problems of competing privatised telecomms infrastructures that would be a non-event if these infrastructure businesses were not competing.

2006 **Inquiry** "Telecommunications Regulatory Regime" to manage the problems of competing privatised telecomms infrastructures that would be a non-event if these infrastructure businesses were not competing.

2007 **Inquiry** "Regional Telecomms Review" really a "junket" trip headed by Medical Dr Bill Glasson, with no definitive direction, expertise or results.

2008 **Inquiry** "NBN Mk 1" by a panel of (questionable) experts to do what should have been done by any telecomms engineers in the infrastructure business and immediately discards NBN Mk 1.

2009 **Inquiry** "NBN Mk 2" another expensive process that essentially resolved nothing other than to approve the mistakes made by the expert panel in creating a partial telecomms network infrastructure.

2010 **Inquiry** "Rural and Regional Communities" an NSW panel of amateurs had an inquiry that was not their business – as it is a Federal issue.

2010 **Inquiry** "Transition to the NBN" by a panel to transfer obvious services and the USO into the NBN rollout. Again this is part of telecomms engineering that would have been part of the infrastructure business.

2010 **Inquiry** "Digital Dividend" to justify taking spectrum space from the upper UHF band to be inefficiently used by competing infrastructure businesses.

2011 **Inquiry** "Cost Benefit of NBN Mk 2" to rubber-stamp the consultants McKinsey Report on the proposed structure of the NBN, albeit with urban technologies.

2013 **Inquiry** "Cost of NBN Mk 2" to identify the current roll-out state of the NBN and see what corners can be cut to make the NBN substantially less expensive (without addressing the privatisation issue).

It is very obvious that since about 1996, the number of inquiries is high, repetitive and has increased with time. Similarly, the end-costs for fixing the problem caused by privatisation had rapidly risen rising past $43,000,000,000.

This $43,000,000,000 is the immediate missing infrastructure cost that has failed to be put in since privatisation was initiated in 1982. At least another $43,000,000,000 is in lost productivity; particularly from the non-metropolitan areas since the botched privatisation process in 1982. So the real cost of the botched privatisation process is far more like $86,000,000,000.

Now, looking at this another way, **the cost of each of the fifteen Select Senate Inquiries and associated Reports** that failed to fix up the botched privatisation debacle has **cost Australia at least $5,720,000,000** plus the normal costs of each inquiry and associated report.

Since about 2000, several western economic countries have seen the futility of operating essential infrastructures as competitive businesses, and they have nationalised these infrastructures back to operating under sub-Government commissions with considerable economic benefits brought about by preventing competition between infrastructures and realising the available economies of scale.

The only way to achieve real competitive business efficiency, real infrastructure efficiency and stop wasting yet another $44,000,000,000 is to:

- **physically split all the telecomms operators in Australia and**
- **merge all the telecomms infrastructures so that these work as one combined low overhead national infrastructure.**

This strategy will provide more efficient and inexpensive wholesale products on a much larger geographic area than now.

The then competitive business Telecomms Resellers will operators will have fewer overheads from a lower overall Wholesale price, and the market will be larger so the retail reselling profits will be larger.

Knowledge Wisdom and Expertise Lost on Select Committees

- Competition for the sales and marketing of discretionary items is economic rationalism and this is where competition is correctly positioned.
- Competition for the provision of essential infrastructure is economic madness as this type of competition is extremely wasteful of Australia's limited financial / revenue resources.
- In response to the **Select Senate Inquiry into the Australian Telecommunications Network 2002**, I provided a submission[41] in 2002[42] advocating how to save immense amounts of Government revenue with the merging all of Telstra's and Optus' etc CAN and Inter-Exchange Network infrastructure into one highly cooperating national telecommunications broadband sub-Government Commission.
- In this submission, I also advocated that the Federal Government should openly support Telecomms specialist competitive businesses to be the Retail Resellers of the wholesale infrastructure.
- In that Report, note 53 did allude to moving the entire Telstra inland infrastructure component to a sub-Government Commission. **No action was taken.**
- Considering the savings in economies of scale, mass production rollouts, and a minimum of legal wrangling, this would have saved the Australia, the telecoms industry and knock-on other business productivity losses in Australia adding up to **at least $5,000,000,000 per year**.
- In the past 12 years this amounts to over **$60,000,000,000 of ongoing revenue lost because by not taking action from my 2002 submission.**
- In 2005 the Australian Consumer and Competition and Commission (ACCC) set up an inquiry to (self) promote the increase of competition in the telecommunications sector.
- My submission[43] to the ACCC showed how to make massive cost cuttings and enormous efficiencies through co-operation and economies of scale in the Australian Telecommunications industry **worth several $Bn annually**.
- The ACCC Report promoted increased competition as the way to bring down end user costs in a then virtual monopoly (very high competition) situation.
- War is the competition level above an economic monopoly situation.
- War is extremely expensive as the prizes are price and product control, and the stakes are mind control, anarchy, torture, looting, and physical death.
- There is a severe lack of education and knowledge about the Infrastructure Regime and/or about the Theory of the Second Best (any form of co-operation is far more cost-effective than any form of competition).

[41] The strategy of merging the entire Australian telecomms infrastructure to make massive savings on revenue were provided by me to the **Select Senate Committee on the Australian Telecommunications Network in 2002**, but virtually omitted in their Report.

[42] My 2002 submission is at http://www.moore.org.au/senh/2002/Aust_Telecomms_Network_01.pdf

[43] My 2005 submission to the ACCC is located at http://www.moore.org.au/senh/2005/ACMA_Bill_Response_Short.pdf

- In response to the **Regional Telecommunications Review** (2007), I provided an engineering-oriented submission[44] advocating FTTH for most premises up to 15 km from exchange sites (in country areas). This GPON physical limit is now 60 km[45], ***dramatically increasing country Broadband connectivity***.
- In that RTR Submission (2007), I also provided a wide range of data and associated information proving that Competition Regime strategies fail in low ROI areas (non-metropolitan areas) because the of very expensive inherent overheads that come with the competition Regime.
- This failed RTR Review was also complicit in adding to the overall cost of the telecomms blowout by not addressing / correcting the botched privatisation as initiated by the Davidson Inquiry and following Report back in 1982.
- Consider that improved telecomms technologies (most based from silicon) have brought with it **immense productivities[46] that can be counted in lumps of at least $5,000,000,000 pa in Australia.**
- Since 2000, the knock-on productivities created by silicon technologies can be truthfully put down to a generational change where a range of (short term) retail reselling commercial products are focussed on mobile personal devices.
- So the telecomms business focus is now firmly on the Retail Reselling market, with a short term timeframe of about 12 months, based on bundled products.

[44] In 2007 my submission to the **Regional Telecommunications Review 2007** is located at http://www.moore.org.au/senh/2007/2007_RTR_Response.pdf

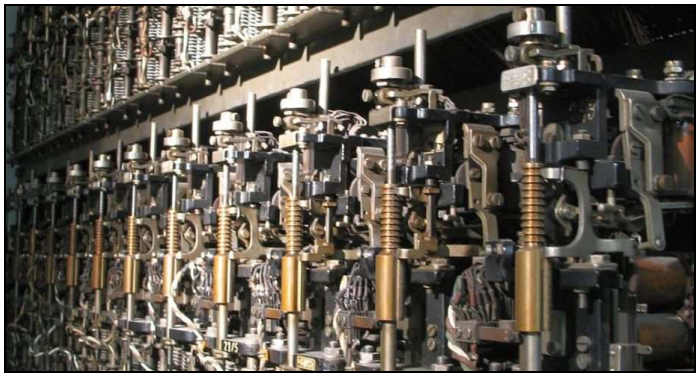
[45] This short document goes a long way to describe the strategy for **inexpensive non-urban FTTH** to be rolled out in most country areas; and how the IEN needs to be standardised to 144 strand SMOF to synergetically and inexpensively maximise the future inland telecomms infrastructure http://www.moore.org.au/comms/20130412%20Inexpensive%20Non-Urban%20FTTP.pdf

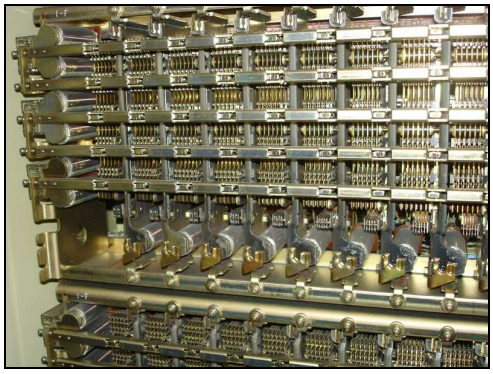
[46] In 2008, my submission to the **Expert Panel on Broadband Telecommunications for the NBN** included three pages of detail, showing over the past few decades some of the telecommunications productivity improvements and how these had dramatically driven down the operating costs /and increasing the available bandwidths while the retail prices remained virtually constant.

Appendix

Technology that Created Productivity

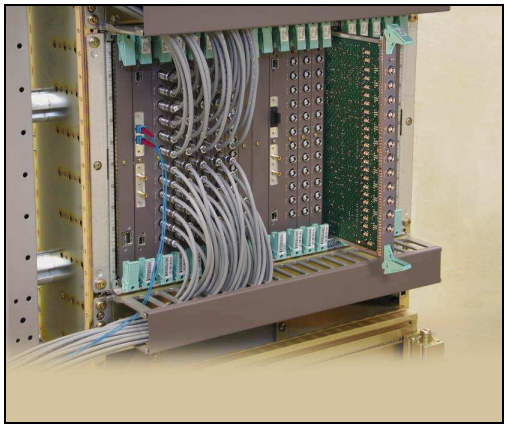
With massive advances with silicon technologies in the 1970s, these technology advances in turn created amazing increases in productivity. These productivity advances were hindered by the huge (but well hidden and disguised) overheads of privatisation that almost "killed the goose that laid the golden eggs".





Digital and Optical Fibre Technologies

- 1970 Switches are **mechanical** Step by Step, Crossbar (**high maintenance**)
- Analogue Transmission Systems valve or transistor (**high maintenance**)
- Long distance usually radio point to point (**unreliable, high maintenance**)
- Switchboard Operators (**manual, labour intensive, work all hours**)
- STD practicable but not in other countries particularly in Europe or USA
- Managed by Engineers, **not** Sales and Marketing (**stable and long term**)
- **Australia had one of the best Telecomms networks in the World**
- Very little Sales and Marketing (**very limited range of products**)
- Post Office is the front Sales point (**suited a small range of products**).



New Silicon Technologies (analogue ICs, digital ICs, optical fibre)

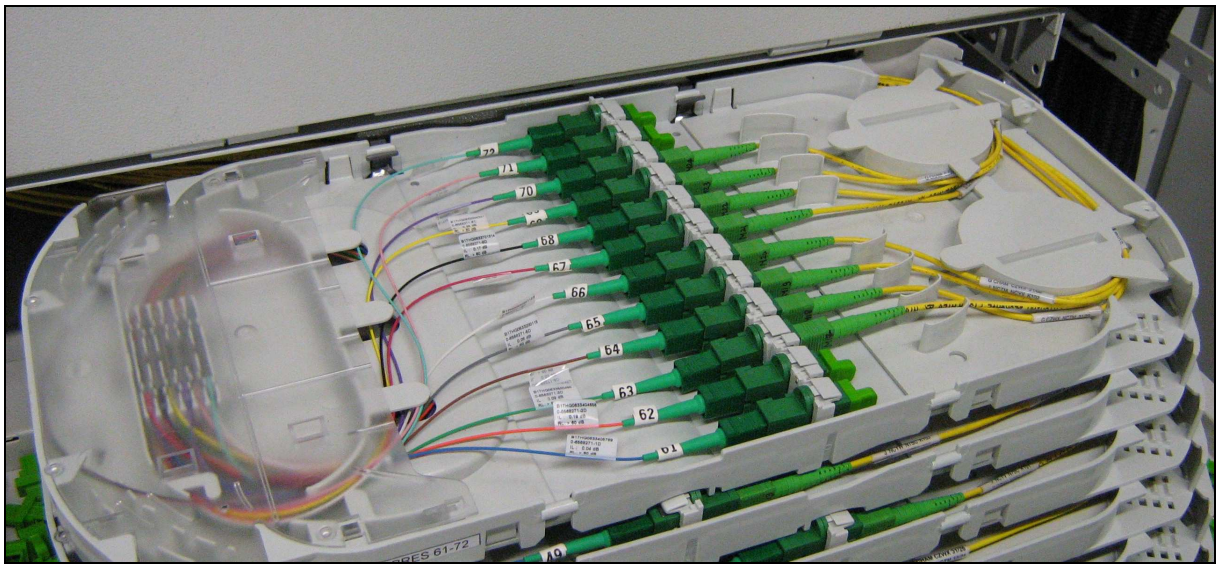
- 1965 Printed Circuit Boards – **Inexpensive Manufacture**
- 1966 Analogue and Digital ICs – **Low Maintenance**
- 1971 Microprocessors – birth – **New Generation Technology**
- 1974 Altair S100 mini computer– **Inexpensive programming**
- 1980 **Digital Switching** (Ericsson) – New Generation Technology
- 1980 / 1983 Personal Computers and TCP/IP - birth
- 1980 **Digital Transmission** – **Low Maintenance**
- 1985 Long Distance **Optical Fibre** (SYD-MEL 1987) – **Low Maintenance**
- 1988 Mobile phones, Fax machines – **New Generation Technology**,
- 1988 Electronic metering / billing – **Very high productivity**
- 1988 Windows Operating System (Win 3.1) – Using TCP/IP
- 1990 Commercial Internet Protocol uses in Business – Websites
- 1990 Synchronous Digital Hierarchy transmission – **Very Low Maintenance**
- 1995 Optical Amplifiers, Wi-Fi **– Australia Inventions**
- 2000 MPLS and IP switching – Network Efficiencies
- 2010 Inexpensive Data Warehousing – Network Efficiencies
- 2013 DWDM Switching – **Australian Invention**

Australian Telecomms After Digital and After Optical Fibre Technologies

- 1990 Switches are **almost** all Digital (some still analogue – country)
- Optical Fibre fast rolled out – **very inexpensive, very high capacity**
- All Exchanges becoming Unmanned – **low maintenance high productivity**
- Centralised / Offshore Call Centres – **low wages, high productivity**
- Centralised Maintenance Operations Centre – **high productivity, reliability**
- Far Larger Bandwidths on Existing Optical Fibre **1 Gb/s replacing 0.14 Gb/s**
- Far Larger Bandwidths now possible: **40 Gb/s on old fibre**

- Digital technologies provide a wide range of commercial products
  - Computerised billing – **low maintenance, high diversity**
  - Commander, Fax, PABX, Mobile and Fixed Phone bundled plans
  - Sales & Marketing Business Units Control Telstra Board – **big Mistake**
  - Engineers replaced by Outsourced Equipment Providers – **big Mistake**
  - Timeframes for Rollouts become much shorter – **Modular Equipment**
  - Infrastructure rollouts steered by Retail Business Units – **big Mistake**
  - Government and Enterprise CAN becomes FTTP – **Big ROI**
  - Business & Consumer CAN remains Pair Copper **and in bad repair**

- Sales & Marketing **control** Infrastructure budgets and rollouts – **big Mistake**



An optical tray where strands of fibre on the left are connected to patch leads (connecting equipment) on the right side of this picture.

Why Telstra's CAN is not "The Network"

When the Post Master General's Department (PMG) was deliberately and sensibly split up (circa 1975) the telecommunications component was largely moved into Telecom Australia as the Australian Telecommunications Commission (ATC).

- By 1965 much of the Customer Access Network was not Open Copper Wire.
- By 1970 most of the Customer Access Network was in pair copper cable.
- Before 1980 the Inter-Exchange Network was all Mechanically Switched.
- Before 1980 the Inter-Exchange Network was entirely analogue transmission.
- Digital Switching in the IEN started to be rolled out in 1980.
- Digital Transmission in the IEN started to be rolled out in 1980.
- Digital Switching and Digital Transmission took about 15 years to fully roll out.
- Single Mode Optical Fibre (SMOF) did not exist before mid 1985.
- Mobile phones started to be on the public consumer scene in 1885.
- Mobile phones connect through the CAN via SMOF to a Radio Base Station.
- By 1995 virtually all the Inter-Exchange Network was SMOF.
- By 1995 virtually all Consumer Access Network was still analogue pair copper Cable.
- By 1995 only Enterprise and Government had Fibre to the Business (FTTB).
- By 2005, the Mobile Phone Protocol (GSM) went through several engineering changes, to decrease the Quantisation Distortion (improve speech legibility), decrease the speech delay and increase the data bandwidth.
- By 2010 Mobile Personal Devices had transformed with more data bandwidth to change into a social interface with colour, a touch screen, camera and personal "Apps".
- GSM-3 is 3G, and GSM-4 is 4G

- By 2010, 4G technology (which has a wider radio channel bandwidth then 3G) is being overtly pushed by Retail Resellers as a CAN alternative to ADSL, HFC, and FTTH to covertly bypass the NBN CAN infrastructure.

So, between 1960 and 1995 Telstra was in a transition state where copper cables and point-to-point radio was being removed and replaced by optical fibre – but concurrently, the analogue / ADSL pair copper to the consumers stayed in the same under-footpath street conduits that now carry a high proportion of SMOF cables.

- All End-to-End connections including at least those in any combination for: Mobile Personal Devices, Telephony, Internet, "the Cloud", Radio and TV broadcasting, etc. have to pass through the Inter-Exchange (Backhaul) Network and the Customer Access Network (CAN) at each end.

Most people are innocently unaware that there is an immense Inter-Exchange Network (IEN) primarily of SMOF cables, upwards of 5000 exchange sites and a huge amount of switching and transmission, power and air conditioning equipment in the IEN; and on the exchange end of the CAN to effect an end-to-end connection.

Initial Effects of the Davidson Report

The Davidson Report[47] came out in 1982 and it really struggled to come up with excuses to privatise the then Telecom Australia. Fundamentally the report showed that Telecom Australia was still analogue and mechanical, and that long distance transmission was a major impediment to profitability as seen on the commercial front.

The report did however show that Telecom Australia (now divorced from the Post Offices that were it's front counter when working as the PMG a few years before) really had little if any public interface, apart from the Telecom Tech's van and the leading 20 or so pages in the front of the White / Yellow Pages books.

One of the arguments put forward to have Telecom Australia privatised was that it was apparently a "Monopoly". I found this argument particularly fascinating (or fundamentally flawed), as the non-metropolitan end-user prices were deliberately cross-subsidised to enable those in high cost areas (regional / rural / remote) to have telephony infrastructure. Otherwise these locations would never be provided telephony services, nor would most customers be able to afford the service costs.

In desperation, the Davidson Report specified that cross-subsidisation was to stop (and the Government made that law), forcing the regional, rural and remote areas of Telecom Australia's telecommunications infrastructure to run as a loss and therefore minimise the services they otherwise supported before.

In this same report, the notion of a Universal Services Obligation (USO) was introduced, where the Government would pay Telstra (or which-ever competitive business was operating the regional, rural and remote area's telecommunications infrastructure) a sum to cover the operating cost "to make the network operations look more competitive"! I would call that cross-subsidisation, but with Government intervention, which is grossly inefficient compared to the previous internal operations!

[47] A copy of the Davidson Report is at
http://www.moore.org.au/senh/1982/1982_Davidson.htm

Telecom Australia may well have been the only telecommunications provider, but the end-user prices were in line with the costs of running the organisation, the products were maximised wherever possible and the customer service was personalised.

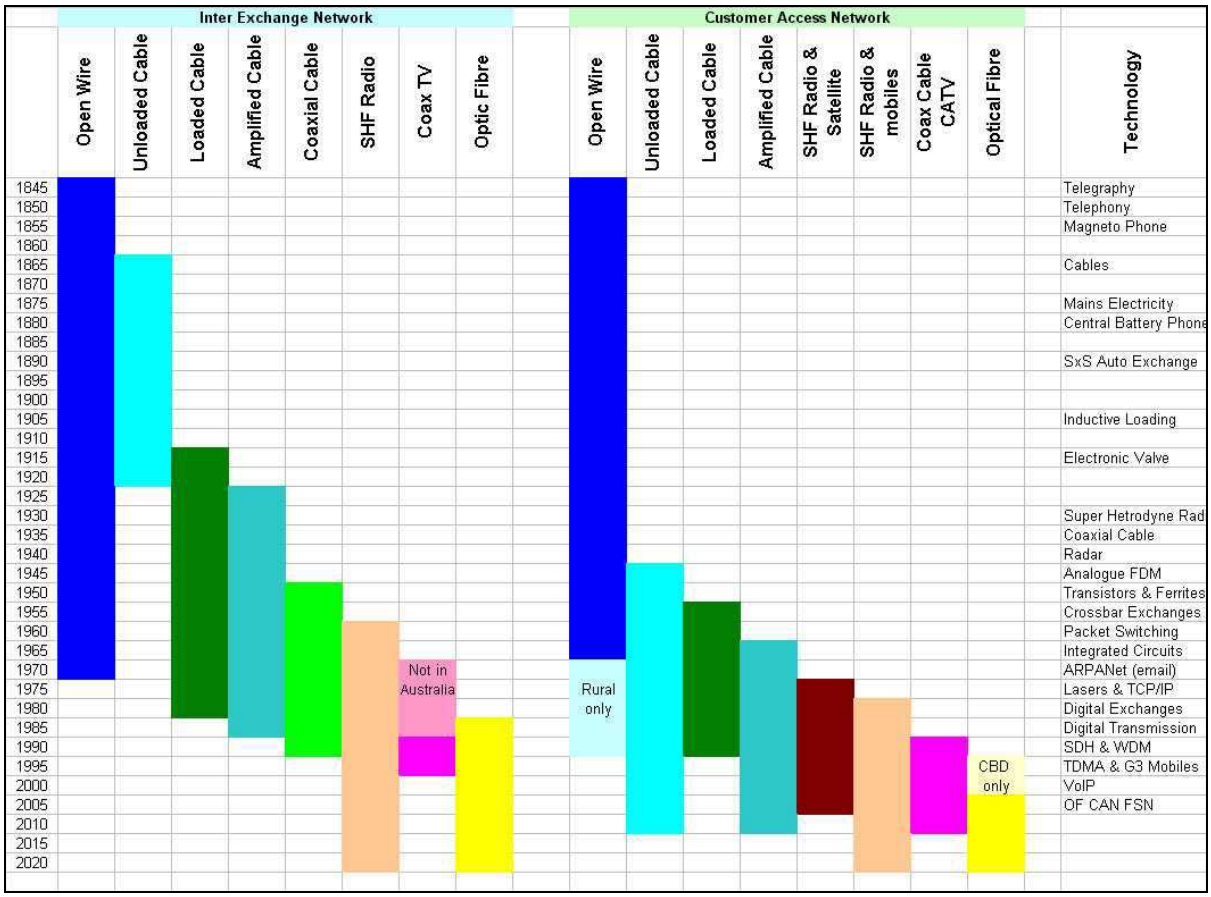
So, tying the term “Monopoly” to Telecom Australia (Country) was a very long bow to draw, because the term “Monopoly” refers to a Competitive Regime situation where the competing busineses are actively closed out of being competitive by the Monopoly competitive business.

In essence, Telecom Australia was operating as an Infrastructure Business, where the services are maximised and the end user prices are minimised. As such the term “Monopoly” has no place here because the nearest equivalent (infrastructure business) term would be an “Economy of Scale” where efficiencies are greatly increased because purchasing powers make infrastructure much less expensive for the infrastructure provider and in turn, for the end user.

Those pushing for a privatised Telecom Australia as per a competitive business were ignorantly wanting the services to be minimised and the end-user prices to be maximised so that not ignorantly the profits would be maximised and their share price investments would then be maximised.

The Ageing Customer Access Network Infrastructure

Over several decades, the transmission mediums in the Inter-Exchange Network (IEN / Backhaul Network) have substantially advanced and become broadband digital, meanwhile the transmission mediums in the Customer Access Network (CAN) have remained substantially analogue in Australia and almost all the physical CAN is still twisted pair copper wire to most premises.



The trend of infrastructure transfer from IEN to CAN is well documented[48] and it stands to reason that as open wire and pair copper transmission technologies were phased out of the IEN / Backhaul in the 1960 and 1970s respectively, then open (aerial) wire and the pair copper cable should have been phased out of use in the Customer Access Network (CAN) by 1980 and 1990 for Open Wire and Pair Copper cables respectively.

As far as I am aware, Open Wire CAN technology was phased out before 1980 in rural and remote locations, and replaced with point-to-point radio (to the premises), or with active (powered) pair gain systems to considerably extend the in-specification length of the pair cable.

In the early 1990s, in line with the push to privatise Telstra and make it look more profitable, the number of lines field staff was drastically cut and some put on contract. The unexpected externality was that long-term expertise lost and the Quality standard of lines maintenance had fallen considerably, because faults were being repaired on a “time standard”, not to a “Quality standard”.

Up until the early 1990s, the Telecom / Telstra Research Laboratories (TRL) in Melbourne were world leaders in optical fibre technology. With the push for globalisation and global manufacture and the extreme pressure to privatise Telstra, TRL were sequentially closed down and this technology advantage was totally lost.

From about 1990 there was a concerted push from Telecom Australia Headquarters for a Full Services (customer access) Network, and Fibre to the Premises (FTTP) was a very strong contender even then. As I understood it FTTP was vetoed in favour of increased dividends for shareholders.

In the meantime the existing pair copper network remained in place and as Asymmetric (directional data speeds) Digital Services Line (ADSL) technology became mature in the mid-late 1990s. ADSL was competitively rolled out for consumers, while the Corporate and Government customer were connected with FTTP CAN because of their much higher bandwidth requirements and also their much higher ROI’s than for consumers.

The Metropolitan HFC Competitive Rollout

With the heavy competitive pressure from Optus, the default Hybrid Fibre Coax (HFC) broadband network was rolled out in the mid 1990s in great haste and this competitive infrastructure, making this extremely expensive for Australia.

With a Competitive Business mindset:

Telstra’s HFC rollout cost in the order of	$2.5 Bn
Optus’ HFC rollout cost in the order of	$2.2 Bn
Total Competitive Rollout cost	**$4.7 Bn**
Geographic Duplication =	85%
Service Duplication =	100%
Full Geographic Duplication cost =	**$5.53 Bn**

[48] http://www.moore.org.au/comms/04/20030323%20The%20Customer%20Access%20Network.pdf

With an Infrastructure Business Mindset

		Base	Full Build
Total Competitive Rollout cost		**$4.700 Bn**	**$5.530 Bn**
Competitive Price (one Provider)		**$2.500 Bn**	**$2.941 Bn**
Overtime Eliminated	-20%	**$0.500 Bn**	**$0.588 Bn**
Urgent Delivery eliminated	-17%	**$0.425 Bn**	**$0.500 Bn**
Base **Infrastructure Business** Price		**$1.575 Bn**	**$1.853 Bn**
Waste caused by Competitive Business		**$3.125 Bn**	**$3.677 Bn**
Cost Ratio Competitive / Infrastructure		**2.98**	**2.98**
Waste as percentage of Infrastructure Price		**198 %**	**198 %**

Clearly, the **Competitive Business strategy is extremely uneconomic**, costing an immediate **$5,530,000,000 instead of $1,853,000,000** or almost **THREE times** too much, **using 198% more revenue.** This rollout could have been done far more economically (as per the Theory of the Second Best[49]) for **about 33% of the total cost** and provided wholesale infrastructure to be competitively retailed.

Restructuring HFC and Broadband Internet

In 2005, Telstra recognised that it had a massive Broadband Internet infrastructure problem involving ADSL on pair copper, DOCSYS 2.0[50] Internet over HFC, very congested main Internet Switches and a serious lack of Broadband connectivity with the local (metropolitan) exchange sites.

The crux of the problem was that in every State Capital City, one exchange site had been nominated as the HFC Internet Node Router / Switch site, the SMOF Backhaul connectivity for ADSL was very thin, and the Cable Broadband Internet infrastructure was centralised at metropolitan Headends. Similarly, the IEN / Backhaul SMOF connectivity for Radio CAN (for mobile devices) was thin and congested.

In other words, the ADSL, Radio and Cable Internet infrastructure was not forward planned beyond a couple of years and now this structure was physically congested such that expansion was not practicable, particularly if the proposed NBN were not to go ahead and Telstra was to roll out Cable Internet everywhere in the metro areas.

In 2006, Telstra made a $2.5 Bn Broadband rollout of Cable Internet equipment in the metro areas, by totally restructuring the existing Cable Internet Broadband Router locations to the hundreds of local exchanges and make provision for considerable expansion of the metropolitan Backhaul SMOF mesh infrastructures and associated main router switch pairs; if the proposed NBN were to be stopped.

In Sydney, where I was the contracted Construction Supervisor, there were more than 120 local exchanges provisioned for five racks of Broadband Cable routers and pairs of Edge Routers. Also these Edge Routers were geographically diverse-connected with pairs of SMOF transmission to main switch /routers in two separate

[49] http://www.moore.org.au/senh/2009/NBN2%20Sub045b%20Moore.pdf

[50] http://en.wikipedia.org/wiki/DOCSIS

main exchange sites in every capital city, totalling about 6000 km (in round figures) of SMOF fibre in Sydney alone.

Nationally this infrastructure was capable of connecting 6 Million metropolitan premises with HFC (Cable Internet), in other words, literally all metropolitan premises if and only if the premises that were passed were actually connected with Cable for TV / Internet. As far as I was aware the Broadband infrastructure for this programme was later fully fleshed out for complete Broadband Internet coverage in Melbourne.

Need to Remove the HFC CAN Infrastructure

Cisco have announced[51] that the Broadband Routers that they have sold to provide Broadband Internet over HFC will be coming out of their maintenance support phase in about 2018. This means that having Broadband Internet on HFC after 2017 is a liability and that this technology needs to be phased out and replaced by FTTP well before 2020.

In a similar mindset, the coax cable used for HFC distribution is nearing its high maintenance end of life period, and it too needs to be phased out by 2020 at the latest, if not before.

These two scenarios put real pressure on removing all the HFC technology and totally re-directing this onto the FTTP as a matter of urgency.

What was not generally realised was that Cable TV originated in the USA shortly after WW2 and components were scarce. As a direct consequence most components used in the Cable TV wiring are barely commercial quality, where they should be at least industrial quality, and this is why CATV is not reliable.

Examples include: The coax cable centre conductor is copper plated iron (skin effect where the waves travel on the surface), but the copper is not smooth with an electroplating of nickel under the electroplated copper. The connectors are from metals that are widely spaced on the electrochemical table, so these metals corrode each other – particularly if wet or moist.

Because most of the premises were “passed”, the bare minimum of amplifying and splitting equipment was installed; so in most cases the signal levels are too low for connection the “battle-axe” / lane premises without the inclusion of extra amplifiers and splitters. The “dips” in the overhead cable near the power poles are the places for amplifiers to be included as the premises take-up is increased. This is yet another reason why “competitive infrastructure” economics is really seriously flawed.

Why the Pair Copper CAN Needs to be Removed

In 1988 a special set of National Working Groups were set up in Telstra to address several areas of concern, relating to poor end-to-end transmission performance that was heavily impacting on customer satisfaction. **I was heavily involved in six of the seven National Working Groups.**

Most of the main causes of the systematic problems heavily impacting on customers were related to incorrect switch interface technologies; unused, irrelevant and vitally missing CAN specifications; and extremely poor line field maintenance techniques.

[51] Cable Broadband Equipment does not last forever and some will go out of production before too long http://www.cisco.com/en/US/products/hw/cable/ps2217/prod_eol_notices_list.html

All these problems were easily associated with externalities of any competitive business model being forced into what is really an infrastructure business model.

For example if a footpath cable pit was opened and many of the joints were found to be corroded; the repair person on a time standard (competitive business) mindset would fix the pair that was reported faulty, inform the supervisor the fault is fixed and leave as fast as possible.

The person on a Quality standard (infrastructure business) mindset would initially call the supervisor to report the bigger problem, stay and fix every joint and ensure the whole joint is properly sealed against moisture before moving to the next fault.

One of the more obvious findings of those Working Groups was that in general the physical state of the pair copper cables used in the CAN was very poor, and that most of these cables had either past their practical use-by or it was due very soon and this was in early 1990. This is now 2014, some 24 years later.

These findings were no real surprise because most of the larger cables have been in service since well before 1960 and the pair copper wire in these cables are paper insulated. The problem is that the paper is breaking down with age. No cables in the CAN were dry gas pressurised to minimise moisture content.

The problem with using ADSL on ageing paper-insulated pair copper is that the paper insulation is aged and somewhat moist, which dramatically increases the inter-wire capacitance per unit length, and consequently this extra capacitance makes the line “look longer” and usually results in significantly increased Far End Cross Talk (FEXT), particularly in the high frequency end of the ADSL spectrum.

The increased FEXT has the effect of increasing the noise floor (particularly for premises modems), which in turn really limits the allowable bandwidth that DSL technologies can use, and that in turn cripples the download speed to well below what would be expected.

With the newer polyethylene insulated cables, the jointing and sealing practices were generally well below acceptable standards, leading to faults re-occurring in a few years or sooner when these joints were opened. In general most field staff used incorrectly sized jointing clips and/or made triple joints, and/or crossed pair joints in total ignorance of the consequences as the engineering training was minimal.

The Working Groups also found that the workmanship of the lines field staff was far lower than acceptable, and most of this was caused by a serious lack of appropriate training coupled with a competitive business mindset of “quickly fix it and move on” mentality in management, field staff and of contractors.

Further, because these joints were manhandled far more than necessary, the copper becomes brittle with bending, severely shortening the mean time to failure (MTTF) of these services. With the newer gel-filled cables (to prevent moisture in capillary between the insulated wires), it was later found that the gel actually etched the copper wire, causing other maintenance issues that also crippled MTTF figures.

Investing Superannuation into Infrastructure

For some decades in Australia, the size of the superannuation wallet has been continually growing. The problem for financial management investors is where to deposit these funds so that they give a maximum return on their investment (without doing any real work).

- Private / competitive businesses look to get greater than 20% pa on a compound basis and much more if possible.
- Government / Infrastructure busineses look to get about 5% to 7% pa on a compound basis
- Superannuation funds look to provide about 15% to 20% pa growth on a compound basis for their clients.

It therefore stands to reason that if superannuation funds are invested in to infrastructure businesses, then

- These infrastructure businesses do not provide nearly the amount of return on investment (ROI) that the superannuation investors are wanting.
- Because of the size of these investments, these Funds Managers would see it as their right to be in the Boards of these infrastructure businesses.
- These Funds Managers will then be pushing the infrastructure busineses to "be more efficient" and maximise their ROI, when for all infrastructure businesses, maximising ROI is not a prime business focus.
- In pushing these infrastructure busineses to increase their ROI's well over 7% pa, this strategy undermines the prime efficiencies of infrastructure business to maximise their service standards.
- Part of the strategies "to make the infrastructure businesses more efficient" include:
  - removing planned maintenance with reactive (nil) maintenance,
  - contracting out / outsourcing core business functions,
  - removing low ROI products and services,
  - focussing on high ROI products and services,
  - charging for previously free products and services,
  - hiring consultants instead of using internal expertise knowledge and wisdom,
- Ultimately the infrastructure business becomes highly profitable for a few years, so the executive / directors then fleece the finances with outrageous wages, salaries etc as "compensation" for ruining what was never theirs.
- After some years, the Infrastructure Business starts to falter as the privatised infrastructure starts to run into disrepair and the service standards gradually decline, and services / products become rather expensive.
- Public unrest about the poor performance of particular Infrastructure Businesses forces the Government of the day to make inquests to address the public unrest.
- High level inquiries (and/or Select Senate / Productivity Commission etc) are usually set up to look over the situation and make a series of (usually flawed) recommendations based on Competitive Business mindset / economics.

- Some of the Competitive Business recommendations are carried out and/or Government funds are injected to somewhat counter what has been stolen by misappropriation in through every expensive salaries, consultancy and contracting and continuing to not use the Infrastructure Business model and mindset.
- The infrastructure business looks better for a year or two before it again gets the ire of the general public. The cycle of inquiries repeats.
- Meanwhile the Superannuation Investment lobby has moved onto another Government Infrastructure Business in which they "see value" in privatising and start compromising the political figures of the day to change the laws to suit themselves for yet another raid.

Clearly, Superannuation investments must never be rolled into any infrastructure (business).

Superannuation investments must always be rolled only into competitive busineses.

It was extremely disappointing to see the main Editorial of "The Australian" Page 11, Thursday 9th January 2014 titled "**Privatisation can be popular if done right**".

Whoever wrote this article and also whoever allowed / promoted this article to be published as the Editorial are all seriously lacking any knowledge / education / expertise about the role of infrastructure business and how it compliments competitive business to make a country's economy really healthy.

By privatising what are essentially infrastructure busineses, this effectively puts in Boards that have a Competitive Business mindset, (to maximise profits for shareholders and run with at least a 20% pa ROI) which is exactly the diametrically wrong mindset for what is required to oversee and steer these Infrastructure Businesses.

This situation then throws two rather powerful national commissions (the Productivity Commission and the Australian Competition and Consumer Commission) into the firing line because both these Commissions are incorrectly pushing for increased competition to increase productivity and profitability in infrastructure businesses.

While it is true that increased competition can increase profitability in a competitive business scenario (providing the initial amount of competition is very small). As competition is increased, the cost of competition grows exponentially and the stakes very quickly move to be very high. Why is this not taught in schools and universities?

We have all witnessed the terror tactics, drive-by shootings and murders between various bikie gangs as they compete for metropolitan territory, because in the illegal drug trade, the ROI pa is rather high once the territory is claimed.

More legitimate professional competitive businesses conduct in a similar manner with people being hired and fired, Political and Board seats won and lost, marriages made and destroyed – mostly through finely veiled greed and corruption, particularly obvious in executive / political pay and perks.

Creating the New Broadband Era

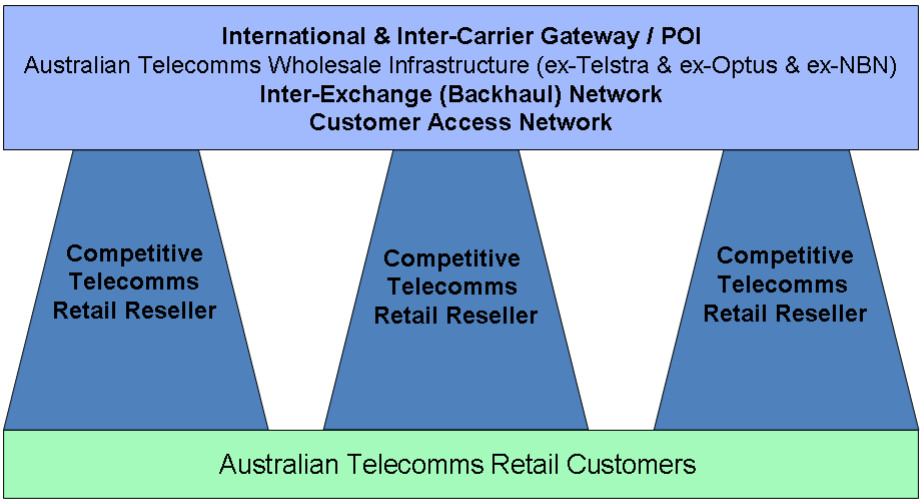
From about 2005, Australian telecommunications plunged slowly into a crisis of gigantic proportions. All the signs were there but there was no quick and inexpensive fix, and the Federal Government had tried a range of more than 20 "competitive business" mindset (quick and inexpensive) fixes and unsurprisingly, these all failed.

From my decades of experience in the PMG / Telecom Australia / Telstra / Nortel and Silcar in a very wide range of roles and technologies, it was extremely clear to me that a massive CAN rebuild was necessary, and to support that rebuild, the IEN / Backhaul Network in the country also needed to be re-built and re-structured.

In a nutshell, the existing pair copper CAN is not at all suitable for Broadband transmission, and needs to come out. Running Fibre to active Nodes (FTTN) and then using Radio at these nodes as a Broadband Radio CAN involves a considerable amount of Optical Fibre cabling, particularly in large urban areas. The option of rolling out optical Fibre to the Premises (FTTP) is a very future-proof, congestion free, secure and an economic strategy.

Although the IEN / Backhaul Network has gone through a massive transformation since 1980, the throughput capability becomes extremely limited with distance away from the major capital cities. The non-metropolitan IEN / Backhaul Network needs to be augmented from the inland to the coast to join up with the existing IEN / Backhaul.

In the time between 2000 and 2008 there were more than 12 Senate Inquiries to comprehend and resolve the problem of poor telecommunications infrastructure throughout Australia. This situation is yet another externality of privatising (moving to the competitive business mindset what is really an infrastructure business mindset).



Fundamentally, these political inquiries scratched the surface of what experienced Professional Telecommunications Engineers do in their work every day! With this Professional Engineering stripped out through the ongoing effects of Privatisation, and the focus of Forward Network Planning almost totally removed and repositioned into a much shorter timeframe of sales and marketing (with a serious lack of long term engineering expertise), it was extremely obvious to me as to why there is so much national anguish in the country areas.

Looking through these reports with a "helicopter view" they all have the same set of problems that are caused by privatising what is essentially an infrastructure business that has very powerful commercial / competitive business mindset. This is a prime reason why Australian telecomms is in such a mess.

For me, the solution[52] for the problem was crystal clear: One nationally operated sub-government business / commission with an infrastructure business mindset should be the sole national network provider and several private commercial businesses with competitive business mindsets should be the retail retailers of the wholesale products provided by the sole national network provider.

The above picture[53] is an "inverted" re-draw of a similar depiction that was included in my presentations to a Senate Inquiry circa 2004 - 2009. Since the NBN Mk 2 has made a transitory change to this basic infrastructure, but my overall strategic solution remains extremely similar to have one nationally operating telecomms infrastructure business providing wholesale delivery and a number of privately operated sales and marketing retail delivery businesses all in competition with each other.

Sequential Federal Governments of the day cannot see how to roll out infrastructure without it being in private hands, or at least partially privatised; and even after more than 10 failed "**initiatives**" they still didn't "**get it**"[54] that **infrastructures should never be privatised**! ***Reselling wholesale as retail is the only area to be privatised.***

So much cost for Australians learning only part of Economics![55]

[52] This short document "**Maximising Telstra's Value**" was written in 2005
http://www.moore.org.au/comms/07/20050716%20Maximising%20Telstras%20Value.pdf

[53] This was the presentation slides provided to the **Select Committee on the NBN 2009**, as usual almost all of what I informed to that Committee was lost well before it even reached the Report stage.
http://www.moore.org.au/senh/2009/NBN2%20Pres045%20Moore.pdf

[54] http://www.tree-of-souls.com/debate/1806-why_industry_should_nationalised.html

[55] Professor Sharon Beder, Wollongong University has written several highly referenced books on the core downsides of the incorrect application of competitive business economics, caused by privatisation and greed.

Check out "**PowerPlay - the world fight for the control of electricity**" Scribe Publications, 2003 ISBN 0 908011 97 0. This book's content has a striking similarity to that of privatised telecommunications – particularly in Australia.
http://www.herinst.org/sbeder/Books/power.html