2016 12 20 PC TUSO Corrections - 02

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My Telecomms Expertise

My secondary formal education was The Kings School, Parramatta, where I obtained the Leaving Certificate in 1965.

My background in Australian Telecommunications started in 1966 as a (Telecomms) Technician in Training; a five-year hands-on Apprenticeship, consisting of first-year full time (8 am - 4.30 pm) class room / practical / theoretical training, then being based for the remaining 4 years (in my case) at the NSW Transmission Laboratory where I gained first-hand knowledge and experience on advanced electronic circuitry application / design, documentation, prototype design, small production technologies.

Inclusive with this 5-year Apprenticeship were 16 (6 week) field training sessions at several different NSW locations to work with Transmission / Long Line Maintenance, Radio Ops Centre, TV Ops Centre, Customer (Subs) Maintenance, City Install, Country Install, Radio (microwave) Lab, Digital Data Network, PABX Services, NASA comms, Regional / Main Telephony Switch structure & Maintenance, Transmission Network Design, Country Area Maintenance. Each 3 months there was also a two-week full-time mainly theoretical schooling "Unit Course" to augment the practical knowledge and expertise about all these telecomms technologies.

In 1971, I was one of the very few that passed the final Senior Technicians Exam, passing in both "Research", and in "Radio and Broadcasting". The pass mark was 80%, where I received 79% for my forte topic; "Transmission".

Concurrent with this 5-year TIT Apprenticeship, I also studied for 4 years at the North Sydney Technical College (now TAFE) and in 1972 passed the Electronics and Communications Certificate course, which significantly extended my theoretical knowledge about analogue electronics / radio / digital electronics / computer structures / programming code and program languages.

My main role until 1983 was in the PMG / Telecom Australia "NSW Transmission Laboratory" which created and produced a wide range of high-technology advanced telecommunications equipment that greatly extended the capabilities of existing telecomms equipment and/or introduced a range of new / far more economic switching / power and transmission capabilities of the then existing telecomms infrastructure. This environment also gave me a very wide practical and theoretical appreciation / knowledge of the overall Australian telecommunications network.

Concurrent with full-time research / development / manufacturing and supervising, I also attended the NSW Institute of Technology (now UTS) and completed a BE in Electrical Engineering in 1983, majoring in telecommunications electronics.

In 1984, I moved across to being a full time "Junior" Engineer in Telecom Australia and worked in several telecomms engineering areas for the first year to "widen my appreciation of the practical telecommunications engineering". During this year I made several radical changes to many long-held engineering practices and introduced a range of "efficiencies" that: cavitated network planning time from months to hours, resolved country network congestion, re-numbered Australian telephony, and designed the (previously technically impossible) Sydney - Melbourne Single Mode Optical Fibre (SMOF) high capacity transmission network (which became the biggest capacity network in Australia at that time).

As a Senior Engineer, I was heavily involved with the national carrier equipment maintenance program - to arrange orderly closure of several maintenance centres throughout Australia as the carrier / switching network equipment transferred from high maintenance analogue technology to zero maintenance digital technology.

In 1986 I was seconded to Network Investigations as the Voiceband transmission expert and headed many (Ministerial request) investigations to resolve the most intractable (mainly transmission) faults affecting customers in a timely manner.

In 1987/8 with the internal restructure to National Network Investigations my role became national and I requested the initiation of seven specialist working groups to tackle different aspects of (customer) Voiceband network transmission that was heavily impinging on Dial-Up / Fax / Bulletin Board / Telephony connectivity. These working groups successfully implemented many initiatives to resolve systemically incorrect Voiceband design and interfacing practices that had plagued the PMG / Telecom / Telstra since the introduction of pair cable (about 1945).

With the early 1990s realisation that the Inter-Exchange Network (IEN) was digital but the Customer Access Network (CAN) was still analogue, my focus moved to monitoring / analysing Digital Transmission and Common Channel Signalling using computer assisted analysis / identification of faulty network transmission / customer calling patterns, network fraud call pattern, identification / tracing criminal networks.

By the mid-1990s it was apparent to me that GSM1/2 mobile radio technology was a transmission disaster, Voiceband transmission was fixed, the senior executives did not know anything about Broadband, Emails and the Internet (although it was staring them in their faces), PDH was very inexpensively replaced by much wider bandwidth SDH / MPLS and IP; ADSLx and Cable Internet were on the near horizon; the Telstra Board did not entertain the notion of replacing pair copper with inexpensive FTTP for Consumers and the remotely control and reporting of all network equipment could be done by the Service Control Network (SCN) from Melbourne with very few staff.

Having joined Nortel Networks[1] (a then major multi-national telecomms equipment manufacturer) in late 1996, I was part of a small team installing a major SMOF digital transmission system through New Zealand from Wellington to Christchurch and back - in a big loop. From there I cemented a place in their Alternate Operators group in Australia and refined their bidding processes to minimise the stresses of near duplicated bids for virtually identical projects for different Service Providers - into a conformal non-duplicated, quick, painless and highly successful process.

As HFC was relatively new in Australia, I was headhunted within Nortel to manage the pilot project of Voiceband HFC in Ballarat - which proved highly successful, where the Optus Voiceband system was a known failure. The potential (USA based) clients thought they would run rough-shot over AUSTEL (now the ACMA) !

While creating many bids for alternate Service Providers I became acutely aware of how the global manufacturers used network demographic templates to quickly come up with a (transit / inter-exchange / and access) network structures that would in many cases suit the potential service provider. (**The NBN Cost Base Analysis is a classic case of the wrong (northern hemisphere) network template being used for an access network: and coming out with the wrong - Satellite - result, at**

[1] https://en.wikipedia.org/wiki/Nortel

enormous expense to Australia. Something that university academics can never learn but will incorrectly teach.)

Following the sudden downturn in the Asian economy in 1999 that adversely affected Nortel in that area, I amicably left Nortel. Shortly after, Nortel performed a "reverse takeover" of Bay Networks[2] (then a very similar business to Cisco Systems) with disastrous consequences, causing the multinational Nortel to be obliterated.

In 2000 while voluntary tutoring Seniors how to use computers / IT, this lead into being the Business Development Manager for the Australian Seniors Computer Clubs of Australia[3] (ASCCA). Having after two years, restructured this organisation to be national and with a best practices set of courses, and again I retired.

In 2005, in Silcar (now Thiess Services[4]) as Office Administrator (Occ. Health, Quality, Safety, Environment), I rationalised the monthly reporting from 4 weeks to 3 hours and created Visual Basic / Access training / qualifications database to proactively manage their workforce training and workplace accreditations.

In mid-2005 a contract came up in Silcar for Telstra to have its Cable Internet infrastructure totally rebuilt (a $2.5Bn national project) to potentially connect over 6 M premises. As the Supervising Engineer, I lead teams to design, deliver, install, commission and socialise all the equipment for the Sydney basin where we ran before time and under budget with no defects; and I updated my practical knowledge in these 124 Sydney-based exchange buildings. As this was complete in mid 2006 and other work was only much less interesting, I again decided to retire in early 2007.

In 2009 I was requested to consult to Market Clarity[5] about ADSL and other Broadband Access penetration throughout Australia. This was effectively another interesting two-year consultancy term where I again retired by choice in late 2011.

In the background I also volunteer (from 2007) at the Ku-ring-gai Neighbourhood Centre[6] where I am a JP, was on their Board for 9 years and managed the transform of their processes from paper notes and two isolated computers to an office network of over 12 computers and I wrote a comprehensive multi-user software package that transformed their operations so they advanced, where other Centres were closed.

More recently (2010 - 2012 and from 2015) I also volunteer at community radio station 2NSB[7] in Chatswood as their Director Engineering / Technical. This role is particularly challenging because of a physically close very high power commercial transmitter complex, and the internal / community process to rebuild / fit-out studios and now aged electronic equipment on a financial shoestring.

From 2002, using my professional, academic and hand-on experience, I have also written many Submissions to Federal Government Departments and attended some Inquiries as a Witness on a range of (primarily telecomms and transport) topics that

[2] https://en.wikipedia.org/wiki/Bay_Networks
[3] http://www.ascca.org.au/
[4] http://www.theaustralian.com.au/business/latest/thiess-buys-nbn-rollout-contractor-silcar/news-story/5e049e01b7144cda1d5162eb7aec0a53
[5] http://marketclarity.com.au/
[6] www.knc.org.au/
[7] http://northsideradio.com.au/

are my area of expertise. Copies of many of these Submissions are readily available on my Website[8].

Comment on Referenced Submissions

There is a systematic process of having (Government Department managed) Inquiries that commonly call for Submissions. Generally there are considerable number of Submissions and these usually fall into five categories:

1. The general public and how the conditions have negatively affected their local community and that their businesses have limited productivity.
2. Local Councils that relate how their communities business has been negatively affected.
3. Major businesses providing an overview of the situation - but categorically not their fault.
4. Academics / Lawyers / Journalists / Authors who have "limited" knowledge on the real subject - but have a public following
5. Engineers and Technical experts that have the experience, data, information and knowledge for answers on how to economically resolve most problems.

Because of the statistical volume in Category 1, this volume of extremely similar short statements is easily bundled into a simple chart and used as introductory material to justify the Inquiry.

In Category 2, because staff in Federal and Local Government departments are all Infrastructure Business (not Competitive Business) mindsets, these Submissions are referenced in passing because of the nepotistic infrastructure business relationship.

The Category 3 Submissions are used to substantiate that nothing is really wrong with the current process and if there were changes then this might impact on the profitability of major businesses / corporations (whose prime business is to maximise profits for shareholders) - at the expense of the general public and quite commonly why the Inquiry was initially instigated.

Category 4 is the prime source for Submission quotes to fill the Reports because these people are Academic Journalists and most staff in Federal Government Departments have Communications Degrees (or similar) and are also "Academic Journalists"; so these often very shallow quotes end up forming the difficult to refute basis of long and meaningless Reports that perpetuate the political problem.

The Submissions in Category 5 are usually discarded without any consideration by these departmental academic journalists who make up the vast majority of Report writing staff in these Government Departments. These people mentally "glaze over" when confronted with real data and real analysed data (information) because the information is direct and the analysed information (knowledge) that usually follows is usually contrary to the usually common pre-determined theme.

The sixth Category is a systematic problem then extends to a "House of Cards" situation where Federal Government Departments very commonly use each other's (systemically and factually incorrect) reports as the basis for their own reports that in turn perpetuates and extends the problem of Garbage in Garbage out (GIGO in IT

[8] http://www.moore.org.au/senh001.htm

language) and an extremely expensive bill to the Australian people and Australian business - because industry experienced Engineers are not employed and involved to correct this litany of systemic errors and provide direction to these Government Departments on getting practical and simple / economic legislation practices in place.

A classical simple case is the PC relying on technically incorrect ABS data for Broadband penetration (Figure 2.5) where "Other Broadband" is in fact "HFC", and "Non-Handset Mobile" is a very questionable. "Wireless" is a combination of Non-Handset Wireless / Satellite / Fixed Wireless. None is correct in the PC document.

Another classical simple case it the PC has relied on ACMA / ABS data "Trends in Voice Services" (Figure 2.1) (millions not thousands?) without including the number of ADSLx services that use Fixed Voice services (i.e. pair copper in the CAN) to facilitate ADSLx connectivity. The Draft Report has ignorantly misleading direction.

Box 6.3 is another classic from the ABS without consideration that a very high proportion of Villages (about 70% have no ADSLx - MyCommunications), so when the chart is normalised, the PC information is shown to be highly misleading - which leads to a totally incorrect assumption by the PC staff and management / execs...

It is rather disturbing that these Federal Departments (ACCC, PC, Dept Comms & Arts, ACMA, ABS etc.) repetitively refer to only to Journalists, Academics (and/or Lawyers) and themselves, that have very limited practical (telecomms) Engineering experience.

This blatant failure to use the Technical / Engineering oriented data, information and knowledge, available by practically experienced Engineers / Technical people as prime Submission references in these Reports is the main reason why so many of these Reports:

- **preferentially refer to parallel government department reports, industry inexperienced academics, journalists and sales staff,**
- **promulgate references that are vague and/or misleading,**
- **use data sets that ineptly miss telling the real situation,**
- **commonly draw misleading information from simple data,**
- **replace timeline history with incorrect overview paragraphs,**
- **are technically (and economically) incorrect in many aspects,**
- **have no strategy to solve the cause of the problems,**
- **ineptly misleading - drawing the wrong conclusions,**
- **fail to close out the problems raised in the inquiries,**
- **make what is rather simple into unnecessarily complex issues that are extremely expensive to manage and eliminate.**

This systemic failure is (I believe) costing Australia at least $10Bn per Investigation / Report in misguided and/or inappropriate legislation.

Draft Finding 2.1 (Page 19)

This draft finding has failed to affirm the simple and obvious fact that Broadband technology had replaced Voiceband technology by about 2010, and that the existing pair copper in the Customer Access Network is almost entirely used for providing fixed access Broadband connectivity by using ADSLx technology.

The top left chart (Figure 1, page 24) shows that mobile service connections have saturated from about 2008 and the associated top right chart shows that from about 2009 people are in preference (Narrowband) texting instead of using more expensive (Voiceband) over ("Broadband") personal mobile devices.

Considering that the enormously expensive NBN programme was created to install and commission the Broadband Customer Access Network (CAN) component of the telecommunications infrastructure that the competing telecommunications providers (i.e. Telstra) refused to provide; then with this factored in, the prices of telecommunications service provision is skyrocketing - not "falling".

Service Quality is best gauged by the (reduced) number of complaints to the TIO (Telecommunications Industry Ombudsman), and the (reduced) operating cost of the TIO. These imperative annualised figures over the past 30 years are missing from this PC Report.

The second gauge for Service Quality is the customer complaints mechanism. Having a very active totally independent Facebook BIRRR (Better Internet for Regional / Rural / Remote) Webpage flies very hard in the face of "improved Service Quality", and screams out that Broadband Satellite connectivity is an absolute failure.

The fact that complaints call centres are overseas based and have a waiting queue, instead of employing local Australians that know the area and without a waiting queue is complicit proof that telecomms customer complaints are way out of control.

Those in the PC that wrote this "reduced complaints" couldn't be using readily available factual evidence - probably journalistic "licence" instead.

The emerging technology of Wi-Fi (1992) has, since about 2010 facilitated Personal Mobile Devices to be connected by Local Area Network (LAN) and from the LAN through the Modem /Router (usually by ADSLx) over pair copper (used by telephones) to connect to Digital Services Line Access Multiplexers (DSLAMs) in local exchange sites where these DSLASMs back-connect through the Inter-Exchange Network (IEN) towards the main Internet infrastructure.

So, these telecomms services have converged into IP Broadband from about 2010.

From a telecomms engineering perspective, because of privatised financial greed and telecomms infrastructure competition: extremely poor engineering / installation / commissioning practices have prevailed - resulting in very sub-standard ADSLx services, virtually nil FTTP, and duplicated HFC infrastructure that in the long term is now costing Australia far more than it was ever worth to privatise.

The ACCC has a parallel investigation into sub-standard ADSLx service standards.

Draft Finding 3.1 (Page 19)

OK - basically several Government Departments have been "asleep at the wheel" while handing out well over $3.Bn to Telstra and none of these Government Departments have included any form of accountability.

This TUSO funding may as well have simply gone out the side door as Dividends to (mostly non-Australian) Telstra Shareholders, making the TLS share price substantially higher than it in reality should be (because in Australia the typical dividend price is 3.5% to 5.5% of the related share price).

This "blind" situation optimistically places the real TLS price at about $2.00.

Draft Finding 3.2 (Page 20)

According to the MyBroadband.Communications[9] website there were in the order of 7.665 M active phone lines in 2014/5, but according to the PC referenced data to the ABS the count is 8 M to about 5.9 M in 10 years (2015/6) or about -200,000 per year.

Considering that there were 7.665 M active phone line services in 2014/5, this makes about 7.465 M in 2015/6 and about 7.265 M in 2016/7 or a disparity of about 23% (which is huge, and this is very simple maths). [*Why is ABS data being used?*]

Analysing the MyBroadband data shows that about 95% of this pair copper CAN technology now has ADSLx (Broadband) fixed access technology connected.

Further fairly simple analysis (below) shows that Telstra has deliberately not installed ADSLx infrastructure in the Rural / Regional / Remote areas (even though a very high proportion of consumers would connect at 24 Mb/s because they are in Small Towns / Villages where the line lengths do not exceed about 1000 m).

Demographic	Count	Total Lines	Lines with ADSLx	Percent with ADSLx
Villages	2,545	228,514	62,966	**27.6**
Small Towns	1,136	591,768	511,889	86.5
Large Towns	415	685,521	653,617	95.3
Small Cities	390	1,651,311	1,618,370	98.0
Mid Cities	146	1,232,599	1,221,580	99.1
Large Centres	396	3,275,395	3,200,951	97.7
Totals	**5,028**	**7,665,108**	**7,269,373**	**94.8**

Because of the general technology drift from fixed line access telephony to mobile device telephony, and the general availability of mobile devices, and the excess of multi-duplicated Radio Base Stations (RBSs) in the metropolitan areas, the number of Telstra Payphones has dramatically decreased - in metropolitan areas (only?).

[*The PC statements seem to be a very broad brush in comparison to analysing the MyBroadband data, which seems to paint a very different demographic picture.*

This situation is very concerning because it strongly indicates to me that what has been written (and signed off) by those in the Productivity Commission sounds good

[9] https://www.mybroadband.communications.gov.au/upload/documents/BQP_DATA_v4.xlsx

but is factually incorrect and therefore very misleading as to what is the real situation, and it follows that the decisions made are therefore based on incorrect assumptions and findings.]

Because Telstra Payphones are generally located central to regional / rural and remote communities and the technology of Wi-Fi connectivity has since about 2014 advanced to be included on the Payphone sites (and most likely using the same pair copper as used by the Payphone service) - these Payphone sites are now being doubly used as "micro-cell" Wi-Fi connectivity points for Mobile devices, potentially making these Payphone locations profitable and not (loss making) "cost centres".

The vast majority of small 2,545 (Village) country exchanges (SCAX's) do not have ADSLx infrastructure to provide inexpensive Broadband connectivity over existing pair copper CAN infrastructure to over 226,000 inland premises.

Since 1982, the operational (overhead and equipment) costs of telephony-based telecommunications in inland Australia has plummeted, and basically since about 1993, I believe that very little new telephony equipment has been installed in the inland SCAX huts. The (apart from a very low percentage of DSLAM equipment in, and Wi-Fi equipment in Payphone sites attached to) the larger SCAX huts .

Draft Finding 3.3 (Page 20)

The Telecomms USO actually has formal its beginnings in 1980 with the Davidson Inquiry followed with the Davidson Report in 1982 calling for the USO to facilitate the sale of Telecom Australia (Commission) into the private sector.

The Federal Government was totally responsible for setting out the contractual obligations of the USO. The Federal Government has, without any structural form of contractual responsibility, effectively thrown away several $Bn to Telecom Australia / Telstra since 1982 to facilitate the sale of Telstra as a private equity business focussed on providing maximum shareholder value at the expense of the inexpensive, reliable, progressive, and ubiquitous telecommunications products and services to build Australian prosperity.

Following the move to sell off Telstra, over 14 Select Senate Inquiries and Regional Independent Telecommunications Inquiries have reported that the services are totally unsatisfactory (particularly outside the metropolitan areas where privatised telecomms businesses severely avoid infrastructure investment, and inside metropolitan areas where multi-duplication of equipment is highly uneconomic and rampant) and these associated Reports have not taken the simple initiative to stop the sale of Telstra and demand an immediate micro-economic reform to restructure the Australian telecommunications infrastructure to be a low cost minimum duplicated non-competitive infrastructure business (as a Commission) that can economically support several telecomms (only) retail service facilitators. These competing telecomms (only) retailers can be the on the ASX telecomms sector.

Draft Recommendation 3.1 (Page 20)

NO - USO and all associated hangers on to be immediately scuttled, no if's, no butts, no compensation.

Draft Finding 4.2 (Page 20)

OK - but (unfortunately) very loosely worded

Draft Recommendation 4.1 (Page 21)

OK but the timeframe is far too slow, with people in the Government Departments that know, this survey could easily be finalised by April 2017.

"In direct consultation with Federal, State and Territory Governments, the PC will finalise its USO associated survey by April 2017".

Draft Finding 5.1 (Page 21)

Half OK - but extremely loosely worded and full of totally unnecessary "verbiage".

The USO is now based around reliable Broadband connectivity, which can be very economically and inexpensively provided by eliminating infrastructure competition (particularly in areas of low population density), because the primary focus of "infrastructure business" (i.e. sub-Government commissions / bodies) is to provide reliable / optimised infrastructure-based services.

or

The USO is now based around reliable Broadband connectivity, which is inhibited from being provisioned in low population density areas, because commercial (privatised / competitive) business interests primary focus is to maximise profits - and provide minimum services.

Note: Broadband connectivity now includes Voiceband connectivity as a Broadband subset.

Draft Recommendation 5.1 (Page 21)

WRONG

Telephony (Voiceband) Universal Services Obligation was instigated to facilitate the sale of telecommunications infrastructure into the private sector. This privatisation push proved to be a extremely expensive economic mistake that has gradually become far more wasteful as Voiceband as morphed into Broadband.

The Australian Government needs to (immediately) eliminate all Telecommunications associated Universal Services Obligations (TUSOs), physically separate all private telecommunications businesses operating in Australia into Retail Reselling and Wholesale Infrastructure, then merge and nationalise the combined Wholesale Infrastructure into one sub-Government Commission (including the NBN) to operate as an "Infrastructure Business" to provide the ubiquitous delivery of Broadband connectivity throughout Australia through competing retail resellers.

Draft Finding 6.1 (Page 21)

WRONG and a wash of gibberish words meaning nothing substantial.

Fixed access ADSLx Broadband services are connected to about 95% premises in Australia (about 7.3 M lines); in larger urban cities this is in the order of 98% (plus HFC DOCSIS (about 1 M services) and a highly duplicated 4G coverage). Inland areas that have TUSO, the fixed access Broadband ADSLx penetration is only about 28%, no HFC and minimum 4G, causing immense productivity losses for people and businesses in these areas.

Because of privatisation, the lower ROI telecomms infrastructure has been let run into the ground and many inland areas have total Broadband isolation. Satellite Broadband has proven to be a massively expensive (Broadband) technology mistake that has not been arrested and is extremely non-productive for Australia.

The referenced Submission[10] (NBN May 2010) provides a simple overview on how to roll out very inexpensive inland infrastructure necessary for advancing Australia through to at least 2050. Unfortunately this Submission was not used and Australia is really paying the massive price for employing Communications Graduates and Academics where they should have employed experienced telecomms Electrical Engineers in their Government Departments.

The referenced PowerPoint-Show[11] shows clearly show how Broadband can be very inexpensively rolled out to the remaining inland in a matter of about 9 months. This inexpensive rollout will stop the rampant roll out of Satellite Technology and put Australia on the path to very inexpensive FTTP to build the Australian economy. This PowerPointShow[12] shows how Broadband can be very inexpensively rolled out in inland Australia and take the pressure off the NBN (and Telstra).

Draft Finding 6.2 (Page 22)

Potentially incorrect and very misleading - and very self

Only because of recent technology advances, the Broadband connectivity provided by the more recent NBN and competing service providers is (generally) superior in increased reliability, reduced latency, and increased bi-directional data speeds compared to ADSLx in a competitive environment.

Satellite connectivity for Broadband (and Voiceband) rural / remote / inland telecommunications connectivity **has proven by the NBN to be extremely expensive and an inappropriate technology for** inland **Australia**.

[10] http://www.moore.org.au/senh/2010/NBN%20Business%20Case%202.pdf
[11] http://www.moore.org.au/comms/03/201601inlandADSLbb.ppsx
[12] http://www.moore.org.au/comms/03/201601inlandADSLinSCAX.ppsx

INFORMATION REQUEST 6.1 (Page 22)

Participants are invited to provide evidence on the adequacy of NBN's satellite voice services in relation to defining an acceptable baseline for a universal service. Information on practical and cost effective alternatives to NBN's satellite voice services in areas that currently have no mobile coverage, and their relative merits and costs is also sought.

Response IR 6.1

Broadband Specifications are Plateauing

In much the same way that Voiceband (telephony) specifications plateaued out in the 1980's from about 100 years of gradual and continuous technology development; after about 80 years gradual and continuous technology development, Broadband connectivity specifications have also almost plateaued out.

The base specifications for Consumer Broadband connectivity in the Customer Access Network (i.e. between the Customer Premises and the Local Exchange Edge Router connection to the Inter-Exchange Network / Backhaul Network / Core Network) has fundamentally three parameters that need to be met to be acceptable.

1. The downstream data rate exceeds 20 Mb/s.
2. The transmission latency is less than 3 msec.
3. The Upstream data rate be not less than 1/5th the Downstream data rate.

The third parameter is still in development as Consumer Broadband technology is changing from a "broadcast" topology to an "interactive" topology, and when fully plateaued, the nominal upstream speed will be the same as the downstream speed. This is why:

Consider the usual (basically "Broadcast") Web-searching: type in a title, click on enter, virtually immediately see the list. Click on a topic and virtually immediately see the screen filled with a downloaded website. At the other (CAN) end of this Internet call (the Website host) the upload speed is quite often very fast - typically 100 Mbps (0.1 Gbps) or 1.0 Gbps or faster, and/or strategically located multiple Web-host site feeds that are geographically near the users (significantly reducing the latency to the end-user).

Consider several people playing an interactive computer game. The upload speed from one interactive user limits the download speed of the other users - because no matter how fast their "Internet connection" is, the weakest link is the limiting speed, which is the upload speed of the end-user at the other end(s).

Consider interactive High Definition Video (with multiple cameras / screens at each end) between a farm Homestead and a city office. The upstream speed from each location is the limiting downstream speed of the other end. This type of Broadband connectivity and use will be considered standard by about 2025 - in much the same way that Telegraphy was replaced by the Telephone in the late 1970s and the introduction of the Fax machine sealed the fate of Telegraphy by 1990.

With a range of very inexpensive digital / data compression techniques now at our fingertips (e.g. MPEG-2, H-265, Netflix 4K Ultra HD etc.) video data can be compressed well over 10 times so the effective data rate for a 20 Mb/s stream would be at least 200 Mb/s, or two 100 Mb/s concurrent HDTV screens.

Consider we have two HDTV cameras each streaming nominally 10 Mb/s, then include multi-channel voice (0.1 Mb/s compressed) and a base upstream (and downstream) rate of 20 Mb/s becomes apparent and practical.

So - pushing for a minimum of 25 Mb/s and typically 100 Mb/s downstream (when **ADSL can very inexpensively provide reliable 24 Mb/s downstream** in the short term (i.e. until 2020); which exceeds 20 Mb/s, is a very expensive folly.

The Basic Consumer Broadband Specification

Learning from the above notes it is rather apparent that the "plateaued" **Consumer Broadband Specification** through the (local) CAN will be fundamentally:

1. The data rate is 50 Mb/s.
2. The transmission latency is less than 3 msec.
3. The Upstream data rate equals the Downstream data rate.

Downstream and Upstream data rate is the same and is nominally 50 Mb/s with a latency (transmission delay) in the Customer Access Network (CAN) of typically less than 5 msec.

Put in terms of SMOF cable distance, the group velocity of light in free space is 300,000,000 m/s (or 300 km/msec) and in SMOF cable is the group velocity is about 0.67 that of free space, so the velocity of light in SMOF cable is about 200,000,000 m/s (200 km/msec).

So for a maximum latency of 3 ms the (radio) CAN (using revitalised DRCS / HCRC technology) the maximum transmission distance (with a latency of 3 msec) will be about 900 km, and for SMOF the maximum CAN distance is about 600 km.

Why (Broadband) Satellite is a Failure

Satellite has a distance factor of about 35,786 km above the earth's surface which makes the return path about 71,572 km and that works out at about 238 m sec, not taking into account the distance from the Satellite Earth Station to the Local Exchange, and the time delays in the Satellite to store and forward the (often congested) data - that can easily take another 200 msec.

While Satellite connectivity looks (at first instance) to be relatively inexpensive, the pre-existing telecommunications infrastructure is extensive and has the capability of considerable Broadband - and is extremely underutilised.

Broadband Satellite connectivity relies on a bi-directional link between the (remote) Homestead premises, the Geostationary Satellite and the Earth Station. The Geostationary satellite is about 35,786 km above earth's sea level and has to be monitored and controlled to ensure that the position of the satellite is stationary with respect to the rotating earth (which rotates every 12 hours).

The fatally expensive problem is that Satellites have a rather short life and a very high maintenance bill. The life is in the order of five to 8 years before they run out of fuel and drift out of orbit (and are lost) and the very expensive maintenance bill is continuous monitoring 24/7 from a control station together with the replacement of the satellite (at full launch cost, or the refuelling of the satellite (also including full

launch costs) and continuous supervision maintenance. So - by about 10 years the SMOF cable strategy is a far less expensive, far lower maintenance, far more reliable and far larger bandwidth strategy than Satellites.

The latency problem is that a Satellite may have in the order of 90,000 to 400,000 Homestead transceiver dishes all vying sequentially for the same bandwidth. Even if a Satellite can transceive several (say 10) messages concurrently, this is still in the order of 90,000 / 10 = 9,000 concurrent services that need to be signalled before and after each "datagram" of data is passed. This process can also take another 200 msec.

So the transfer time for Satellite based CAN infrastructure is, at the best about 200 msec and typically up to about 1000 msec.

For Voice on Internet Protocol (VoIP) as commonly used for terrestrial communications it is imperative to have the VoIP traffic runs as a priority so the datagrams are not delayed and that the datagrams are received in direct sequence.

If this criteria is not met then the audio reception of VoIP is hardly intelligible.

Historically, the GSM1 and GSM 2 mobile phone technology had a very similar problem where the voice encoding used a Linear Predictive Excited Voice encoding algorithm that had an unacceptable amount of Quantisation Distortion that resulted in the received voice being brassy or metallic - basically very hard to be intelligible.

VoIP works very well providing the transmission path is stable and highly reliable. Satellite transmission connections can't provide this degree of connectivity, so VoIP over (Broadband) Satellite is to be very much avoided.

Note: the perceived physical difference in data rates is logarithmic in nature and highly confused with (link) latency. Latency is the delay in time between when a signal is sent and when it is received.

The problem is not obvious until interactive speech happens and inevitably there are algorithms that "compact the speech" and introduce more latency, then what was perceived as "sidetone" becomes "echo" - but worse still if there are reflections in the audio path (which are common), the delay in the talkers voice comes back a clean delayed speech - causing the talking person the stutter.

Digital transmission uses a "clocking" sequence that synchronises the sub-data bits before they are transmitted, and at the receiving end the sub-data bits are re-constructed with a (synchronised) clocking sequence. When, or as data "packets" (or datagrams) are transmitted, these datagrams (much like a postal mailing envelope) include an address and are sealed with a "checksum". With Internet Routing, some of these data packets are delayed so that a temporary clear path is used. With local switching / routing the typically round-trip delay for data "packets" is in the order of 2 msec.

Geostationary satellites are about 35,768 km above the earth's surface, so the return path is about 72,572 km and at the speed of light (for radio transmission between earth and the geostationary satellite and back to earth again) is about 239 msec. Add a very optimistic 50 msec for the switch and the absolute minimum Latency is about 290 msec.

By limiting the Latency time to about 100 msec this works on the biggest files (100 MBytes). The smaller the file size (e.g. Voice on Internet (VoIP)) the more prevalent the latency and 10 msec latency would be more optimistic - considering that VoIP itself has an internal delay to transfer between analogue (voice / sound) and digital packets.

Proof that Inland Broadband Satellite is a Failure

The very high usage rate of the Facebook BIRRR (Better Internet for Regional, Rural and Remote) Website is far more than sufficient evidence that Broadband connectivity by Satellite is an extremely expensive failure:

- The last Broadband connectivity technology resort because Satellite is typically unreliable with persistent fadeouts, has unacceptably high latency, and suffers from excessive congestion (and is really expensive).
- Being proactively used as a very early option by the NBN to provide Broadband connectivity where Telstra already has very under-utilised (Broadband capable) Inter-Exchange Network infrastructure in Regional, Rural, and Remote areas.
- By far the most uneconomical Broadband infrastructure being implemented because ongoing overhead costs are not being factored in (else satellite technology would be dropped for all but the most extreme situations).
- Definitely not suitable as a baseline for a Universal Service as there are far less expensive non-urban technology options that have not been considered that are far more reliable and without continued maintenance overheads anything like that necessary for providing Broadband by Satellite.

There is a fundamental flaw in the concept of Satellite as an apparently inexpensive option for providing Broadband connectivity in inland (regional / rural / remote) Australia. (Satellite is by far the most expensive and worst performing Broadband customer access network option, and in my opinion should be phased out ASAP.

Would You Want Your Business Connected By Satellite?

Imagine Melbourne CBD entirely connected by (Broadband) Sky Muster Satellite...

Would this Sky Muster standard of Broadband Satellite connectivity meet the connectivity standards required by most medium sized businesses?

Do the city slickers realise that each farm / station in the "outback" and most farms in and around Villages, Towns and Country Cities have financial turnovers exceeding $2 M pa?

Most of these farms / stations are in-effect, Small to Medium sized Businesses...

The people in the Facebook BIRRR did an internal survey to find out first-hand who uses the Internet and what the Internet is used for.

I have taken the liberty of putting some of these BIRRR results into this response to show how much the major city-based telecommunications based business, i.e. the Sales and Marketing people there (and the PC people) are so badly out of touch with their fellow inland Australians. All indications because of the extremely low inland investment in Broadband telecomms infrastructure is that the farming industry is a

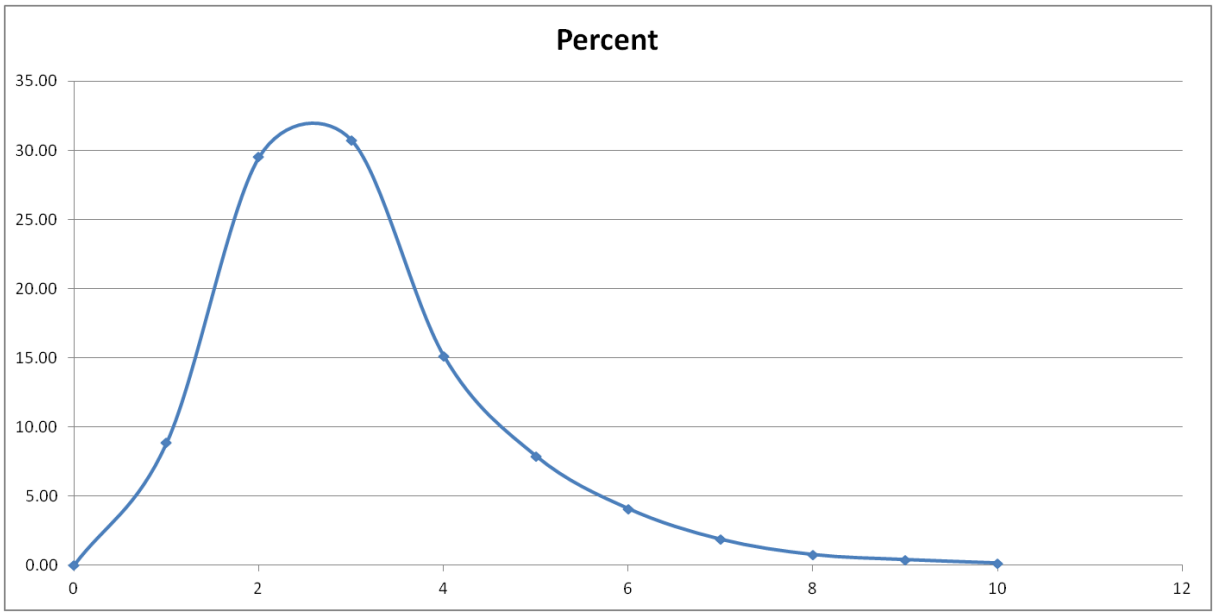
really low ROI for telecomms because of the apparent low usage of inland telecommunications facilities.

The problem is like a Catherine Wheel in reverse. Because the farmers used their phones until 8.30 pm and then stopped the incorrect assumption was they don't use their phones. So - they don't need to use Internet. So we will not invest in good (expensive) Broadband in the Country, because we will not make a killing in profits.

Wrong - Wrong - Wrong - Wrong.

Broadband is a very different telecommunications product than Voiceband (Telephone / Fax) and Narrowband (Telegram / Telex).

Broadband encapsulates Mobile Phone connectivity, Fixed Access Phone connectivity, Internet Website / Movies connectivity, and - **Video Conferencing**...



This first chart is a "corrected" number of **people per Homestead that are connected to Sky Muster and use the Internet**. (The original figures had a spread of age "buckets" that had to be averaged out - the sum count is identical).

Note the chart peaks at about 2.5 which is above the ABS national average of nominal 2.3 people per residence (not necessarily connecting to the Internet).

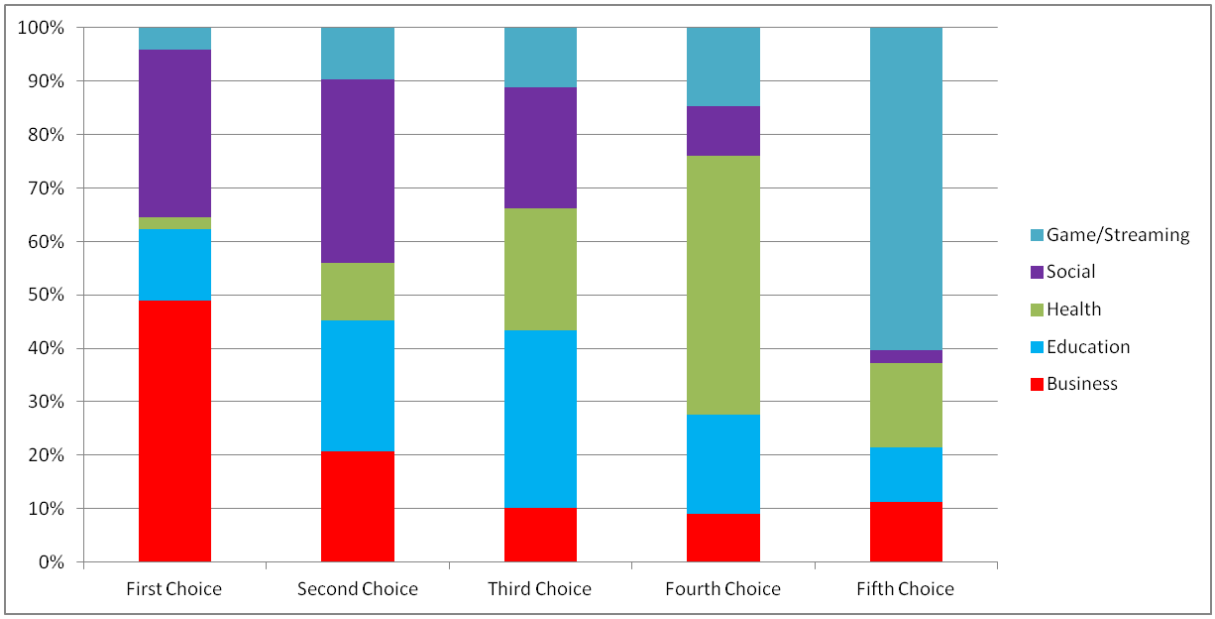
Note that the chart skews out to 10, so the average is actually 5.59 people per Homestead connected to the Internet, which is far greater than most urban homes.

The second chart is "interesting" because....

The Questionnaire asked "What is prime use for the Internet, then your second Choice, then your third Choice etc."?

Well - the first choice for almost 50% of the respondents is BUSINESS with their second option being SOCIAL connection (preventing mental and physical isolation and minimising the Social Services costs involved with picking up the pieces of suicides).

The second grouping was the SOCIAL connection (preventing mental and physical isolation and minimising the Social Services costs involved with picking up the pieces of suicides), and included significantly increased HEALTH, and a significantly increased EDUCATION requirement.



The third grouping was highly consistent in all categories but increased EDUCATION (which is all about growing our next generation to utilise the Broadband in their everyday activities) and build new business.

The fourth grouping had maximum HEALTH as the priority - and that should be screaming out that immense savings can be made by putting in proper Broadband in the inland so that video conferencing becomes the norm for medical issues.

The fifth grouping had STREAMING / GAMING as the priority. This is primarily (after hours) entertainment and Education (and Business) - so this technology should not be a surprise at all. Note that most Radio and TV stations now Stream their shows and that shows can be Podcast at a chosen time by the end user.

++++++++++++++++

The next column chart shows the BIRRR response to how well the service and install / maintenance procedure went:

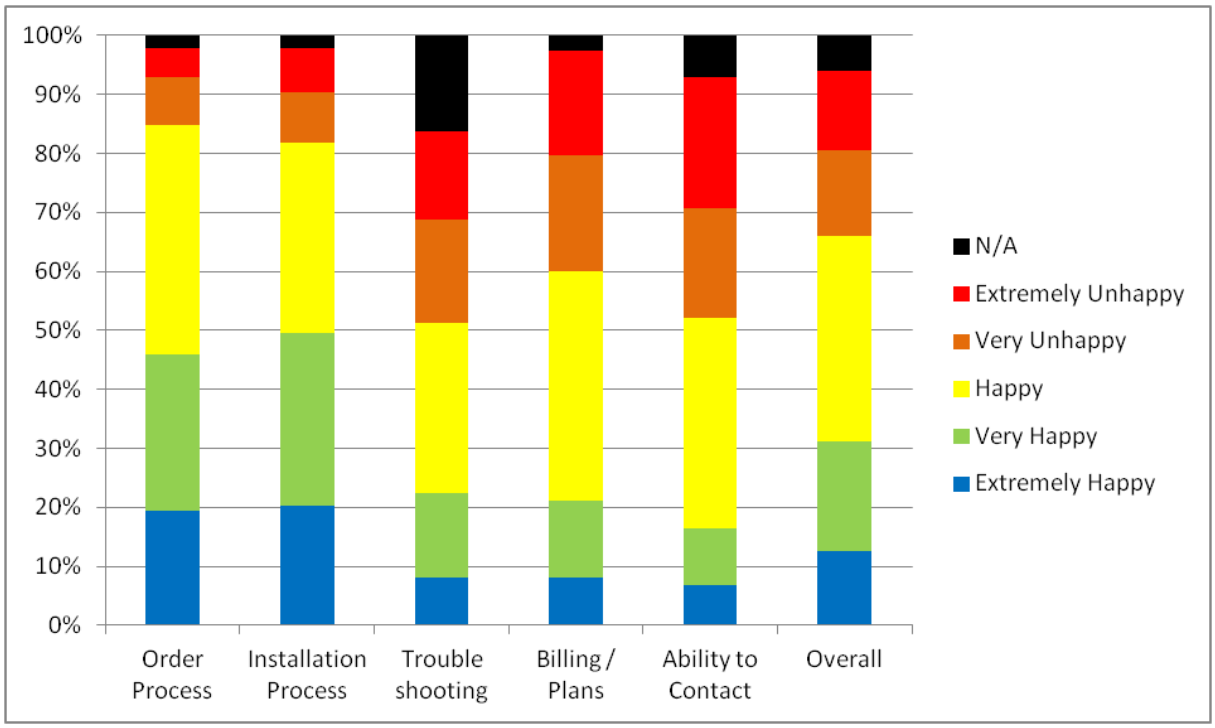
Considering that this is their first and probably last chance to get Internet connectivity (even thought the metropolitan areas have a multi-duplicated choice of Cable (HFC), ADSLx, FTTP, Radio Base Stations); any good result is an extremely happy one!

So you would expect that the "Extremely Happy" column value should be in the order of 80% as an absolute minimum.

Concurrently you should expect the "Extremely Unhappy" column value to be in the order of 2% or less

From my experience as the National Service Quality Manager in Telstra (circa 1994 - 1997), I would be absolutely livid with these figures and it is painfully obvious that the

process is botched from start to finish - and clearly many of the people who are involved with installation are of the same breed of incompetence that was involved with the Federal Government initiated Pink Batts fiasco.



The NBN - Telstra fiasco

The fundamental flaw of the Telstra / NBN fiasco is that only part of the overall Australian non-metropolitan telecommunications network is being considered by the NBN - that of connecting from the premises to a local exchange (or in the case of Satellites - to an Earth Station). Economically the other fundamental flaw is to have Telstra and the NBN in competition with each other - this is financially very wasteful of equipment / resources and manpower and extremely unproductive lunacy!

The missing part of the connection is the mainstream highways that interconnect the local exchanges (and earth stations). These mainstream highways have been totally omitted by those that designed the NBN (most probably because these people were academics - not practical and experienced telecomms network engineers).

How to Inexpensively Provide Inland Broadband

Do not hesitate to openly discuss with me as an Engineering Expert on Australian Telecommunications Technologies and I will describe / discuss in how to provide a very cost effective strategy that will set up mainstream Australian telecommunications Internet transport for the 50 years and concurrently provide inexpensive, highly reliable, low congestion, high speed Broadband connectivity to the vast majority of Inland Australia - and eliminate the requirement for Satellite technology, and the massive overhead costs of Satellite technology.

Draft Recommendation 7.1 (Page 22)

WRONG

The Australian Government must immediately introduce legislation to physically separate Telstra and the other major Telecommunications Service Providers in Australia and position their Retail Reselling component on the ASX.

The Wholesale infrastructure (including the NBN Co) is to be nationalised and brought into one sub-Government Commission (so that works hand-over procedures are totally eliminated to be far more productive than it is and the whole telecomms infrastructure operates as a highly efficient ubiquitous body - to be far more productive than it is).

Draft Recommendation 7.2 (Page 23)

WRONG

The National Telecomms Commission will (naturally) have as one of its operational mindsets (Key Performance Indicators) to proactively provide conformal Broadband service throughout Australia that continually exceeds consumer requirements, as purchased through the range of competitive Retail Service Resellers.

> *Competitive Businesses*[13] *operate in a diametrically differently manner than Infrastructure Businesses. Infrastructure Businesses proactively monitor and improve their service standards without any requirement for external monitoring and reporting (and continuously invoke process improvement) to improve their service standards / capabilities.*
>
> *Competitive Business naturally minimise their service / delivery standards to provide maximised shareholder profit (and invoke process compliance to a minimum standard) - hence competitive businesses need (very expensive) external monitoring (so they comply).*
>
> *The NBN Co. was innocently, ignorantly and totally incorrectly set up as a competitive business (instead of an infrastructure business), to make money instead of growing Australia; in head on-collision / competition with Telstra. This structural arrangement is the worst possible (most expensive and least performing) economic scenario for Australia.*

Draft Finding 6.3 (Page 23)

WRONG

By restructuring the entire telecommunications infrastructure as sub-Government Commission (naturally operating as an Infrastructure Business), one of the prime internal goals will be to provide specialised facilities for those with disabilities / homeless and/or emergency facilities - so that service issues as commonly caused by competitive business mindsets are anticipated and proactively resolved in the most cost effective manner.

[13] http://www.moore.org.au/busn/02/CompetitionInfrastructure.ppsx

Draft Finding 6.4 (Page 23)

WRONG

Reform to the Government support / pension will allocate some of the non-cash allowance to be used to cover telecommunications costs.

Draft Finding 6.5 (Page 24)

ALMOST RIGHT

Competition in retail (with a national Wholesale telecomms infrastructure commission) will keep the prices low and consistent - such that Government intervention for the less fortunate to be covered in the pension card resulting in virtually nil Government intervention.

Draft Finding 4.1 (Page 24)

WRONG

Voiceband telecommunications connectivity and a very wide range of similar social support facilities / safeguards are now (will be, before 2020) fully encased by ubiquitous Broadband telecommunications connectivity.

The Product Commission has this tilted / distorted belief that everybody is running away from their pair copper phone service - but the Dept Comms data clearly shows that a very high percentage of pair copper phone lines are being used for ADSLx connectivity to Broadband and that those that have left their pair copper lines (basically with ADSLx) - these have been replaced with FTTx - which if not FTTP is their same pair copper lines with a remote node (off SMOF) providing Broadband connectivity.

The problem with staff in the Productivity Commission (and ACMA, ACCC etc.) is that they are all using referenced second / third hand data references and drawing their own conclusions without going to the source reference and getting un-tampered evidence.

For a better understanding of what I am raising (about Total Quality Management and data gathering): See John McConnell - "Safer Than A Known Way" Chapter 7 (page 98 rule 4).

Draft Recommendation 9.3 (Page 24)

WRONG

The Australian Government should proceed with its intended review of the entire telecommunications industry in Australia with very serious consideration to optimise the entire telecommunications infrastructure into one sub-Government Commission and competitive reselling of wholesale services as bundled retail products through existing (Australian) private competitive resellers.

> *Because the infrastructure will be then run and operated as an infrastructure business (not a competitive business) there are several natural efficiencies that naturally fall into place:*

- *All current and future Safeguards are / will be anticipated and proactively / internally managed*
- *Telstra (and Optus etc.) will efficiently focus on being major telecommunications service Retail Resellers and not be involved with providing (extremely costly, inappropriate, multi-duplicated, expensive) competing infrastructure.*
- *Accessibility and affordability will be proactively catered for and served by the one National Telecommunications Commission (NTC).*
- *The ACCC role with the NTC will be virtually eliminated as the ACCC is then related to only competing telecomms specific competitive retail services resellers.*
- *The ACMA role will be virtually eliminated because the NTC will proactively monitor and act on wholesale Service Quality and proactively invoke appropriate engineering based network Design, Planning and Construction to anticipate and provide Australia's telecommunications in a timely and inexpensive manner.*
- *The TIO role will be drawn back to resolving occasional competitive / commercial issues because the NTC will be as one national efficient body with a minimum of internal process delays.*
- *Structural network multi-duplication will be eliminated creating massive cost savings that when invoked will save the Federal Government many $10 Bn and provide ubiquitous and consistent / reliable Broadband delivery.*
- *Service Quality standards (including installation proactive maintenance and fault repair) is a natural a prime responsibility of the NTC (and the NBN is totally absorbed into the NTC).*

Draft Recommendation 7.4 (Page 25)

CLOSE BUT EXPENSIVE

> *The Radio Black Spot Programme was caused by the fundamental economics flaw where Competitive Business mindsets priority installed Radio Base Stations (RBSs) to connect customers' Mobile Personal Devices in areas where the Return on Investment (ROI) is maximised (i.e. in the cities - causing unnecessary multi-duplicated services, which is extremely wasteful of expensive resources), and deliberately not installing RBSs in Radio Serving Areas where the ROI is far less than optimal.*
>
> *To complicate matters, because the telecomms network is "competitive" it is also very ineffective and more than double expensive to roll out - primarily because the best that a natural competitor in a simple competition can have is half the physical network (or the economic Law of the Second Best (imperfect competition) prevails - proving that competitive infrastructures is far more expensive than infrastructures that set up as a "natural monopoly" where duplication is zero and the national coverage is based on consumer need - not private sector profit).*

Immediately cease funding the Mobile Black Spots programme.

While focussing the prioritisation on community input and not from nominations from Members of Parliament (i.e. pork barrelling) there is an underlying national telecommunications network engineering input that very seriously needs to be very carefully considered above all this.

Radio Base Stations (RBSs) require being economically and practically back-connected into the mainstream national telecommunications Inter-Exchange Network (IEN) infrastructure - so it is not simply positioning a radio tower/ antenna and associated RBS to "fix the problem".

Much of the inland is virtually without available SMOF cable transmission infrastructure to economically back-connect Radio Base Station facilities (and FTTP / Payphones / Wi-Fi and a range of other telecommunications access network technologies).

Having multiple competing telecommunications providers in very low population density areas makes zero economic sense (unless you are the (non-Australian) equipment manufacturers - then you are laughing all the way to the bank).

*It therefore makes very rational economic sense for the Australian Government to **not have** multiple "competing" telecomms infrastructure providers (i.e. NBN / Telstra / Optus / Vodafone / TPG / Vocus etc.) because this "competing forum" provides the least geographic coverage with the most expensive equipment structures and the worst possible economic outcome for Australia.*

Draft Recommendation 7.5 (Page 25)

WRONG

From my extensive direct professional experience in the sales of telecommunications equipment / services I know that competitive tendering for low volume equipment such as this is an absolute waste of money. I can provide many examples.

So: Competitive Tendering process to allocate Funding (for a small / alternative market) is a fundamentally flawed concept.

Economic (i.e. cost-effective and timely) provision of such equipment can only be done through a set of coordinated large national purchases that involves the full national (Australian) infrastructure - else the multi-national (global) equipment providers simply play off the competing smaller telcos / and/or these much smaller side orders.

As stated before, Broadband now encases Voiceband, so providing a Voice (telephony) service is not only totally outdated but now irrelevant because the technology of Voice over Internet Protocol (VoIP) is already nationally utilised to transport telephony in VoIP as a subset of Broadband connectivity through the major Inter-Exchange Network (IEN) that spans Australia.

Mobile Phone infrastructure in urban environments is highly inefficient (expensive) because of competitive multi-duplication of expensive equipment. In non-urban environments mobile phone infrastructure is also extremely inefficient (expensive)

because this equipment is installed along urban guidelines. If Radio Base Stations for mobile personal devices were installed to suit Regional / Rural / Remote guidelines then there would be nil requirement for a Radio Black Spot programme.

By far the most economic strategy for the Australian Government is the immediate establishment of the National Telecommunications Commission (NTC) to operate as an Infrastructure Business (specifically not a Competitive Business), take in the NBN and sell off / transfer the competitive business components of the NBN, then take in the infrastructure components of Telstra, Optus, TPG, Vodafone, Vocus etc., to form one homogenous telecommunications infrastructure without internal infrastructure "borders" (and eliminate "hand-overs").

The new NTC can then take in the ongoing funding (from both the Federal Government and from competing Retail Resellers) and provide very economic, well planned and appropriate telecommunications infrastructure all throughout Australia - with a practical short, medium and long-term plan - requiring a minimum of involvement by Governments, the ACCC, the PC, the TIO and the ACMA.

This simple strategy puts Australian business and Australians first - not last.

Information Request 7.1 (Page 25)

Participants are invited to comment on the advantages and disadvantages of providing Indigenous communities in regional and remote areas with an Indigenous telecommunications program that addresses their particular needs, or whether their needs could be met through service-specific (that is, community-wide) programs.

Response IR 7.1

Remove Discrimination at the Source

Broadband connectivity is an essential service that should be equally available to all Australians (irrespective of their race, heritage or location). **In this text (at least), being indigenous or not, specific needs or not, living in communities in regional, remote, rural, urban etc. are totally irrelevant - because pandering to one part of the community is discriminating against the rest of the community.**

Because of the blinkered introduction of "competition" some years after 1982 (when the Davidson Report deliberately killed the then very efficient "infrastructure business" focus of the then Australian Telecommunications Commission); the focus of telecommunications changed from being an essential service where that service was essentially equally available to all "Australians", to being a selective service where that service was physically targeted to locations and facilities that provided the highest (internally accounted) ROI for the competitive business shareholders.

So - in effect - the Davidson Inquiry (1980 - 1982) by promoting telecommunications industry-wide competition; also deliberately (and very ignorantly) introduced racial, cultural, and geographic discrimination.

So - the "elephant in the room" is indiscriminate COMPETITION.

Re-position telecommunications product / service COMPETITION to being strictly Retail Reselling and everything else naturally heals itself.

Internal And External Accounting

Internal Accounting is the standard Profit and Loss (P&L) account keeping as done by private businesses. This is simple accounting that looks at the businesses income and expenditure over a specified period. The difference of these two is the Gross Profit and from that value, some of these funds are put aside to pay for (Government) Tax and future contingences, leaving the Nett Profit. The Nett Profit goes to the Shareholders - usually in the form of Dividends for their share in the private ownership of the business.

External Accounting is the financial cost / benefit to the country (managed by the Federal Government) as a result of a business and/or community / environment.

Again the standard P&L accounting procedures apply, but **the focus is exclusively outside the business**.

External Accounting is rather difficult to apply because all private businesses have an external impact on the rest of the common-wealth, and all private business conceal their external costs - or blatantly disregard their responsibilities wherever possible.

Privatised Telecomms Infrastructure

In the case of the Australian telecommunication infrastructure being "privatised" it was very clear that the infrastructure privatisation process would heavily discriminate against those living / working outside the major urban areas and give these non-major urban areas literally nil Service Quality.

The conceived Political / Economic / Government bribery arrangement to facilitate the theft of the Australian taxpayer funded telecommunications infrastructure from the Government(s) into the Private Sector was the introduction of a (Telecommunications) Universal Services Obligation (USO) that the Federal Government would fund - and provide to Telecom Australia / Telstra because it had virtually all the telecommunications infrastructure outside the major metropolitan (State Capital Cities and their Suburbs) areas.

My understanding of the thinking (for the Davidson committee at that time) was that:

- Financial Services (i.e. the ASX) will have a Telecommunications Sector for diversified investment (away from mining).
- A Telecomms Sector in the ASX will generate greater financial (tax) return, which will in turn increase Government Revenue,
- Telecommunications in Regional / Rural / Remote areas is a really "cost centre" scenario (void of big business) and running at a big loss,
- We definitely do not want the Regional / Rural / Remote areas to be on the books as it really impinges selling this infrastructure to the private sector,
- The Federal Government can fund a Universal Services Obligation (USO) from the extra tax generated and transfer this to cover / hide the Regional / Rural / Remote operational costs from public sector investment,
- The Federal Government can hide this USO cost in their mainstream Revenue budget,
- Splitting up Telstra will create "competition" and this extra competition will drive down end user costs.

- Less expensive end-user telecommunications costs will increase private sector profitability,
- The overhead maintenance of telecommunications infrastructure is very high (because this technology is analogue / mechanical),
- Long distance transmission is particularly expensive because (analogue) repeater equipment is required at regular (short) distances, and requires maintenance,
- New technologies will be innovated to reduce the overhead costs,
- The level of complaints is relatively low and can be managed, and with the USO in place the level will remain manageable.

In living and professionally working in the Australian telecommunications industry from 1966 through to 2010 it is very clear to me that the Davidson Report got it wrong on virtually every aspect. What is really embarrassing is that several Federal Departments are still after all these years still totally lost in the political fog - in the seriously mistaken belief that competition is the absolute panacea when in fact competition is the prime cause of the extremely expensive problems.

In going through the above points:

- The Financial Services Sector can have a Telecomms Sector - but it needs to be exclusively Retail Reselling where these retail resellers pay for the Wholesale common-wealth infrastructure,
- A Retail Reselling Telecomms Sector (**not infrastructure**) in the ASX will generate greater financial (tax) return, which will in turn increase Government Revenue,
- Telecommunications in Regional / Rural / Remote areas is restrained from being profitable because appropriate telecomms infrastructure is void in these areas,
- Keeping the Private Sector out of telecommunications Infrastructure fixes this Regional / Rural / Remote divide and favours the private sector,
- The Federal sub-Government Commission will keep the private sector out of discrimination where telecomms services are provided, maximising private sector profitability beyond metropolitan areas,
- The Private Sector funds the telecomms infrastructure with minimum government intervention as this is all handled by the Australian Broadband Telecomms Commission,
- Merging all the Australian telecomms infrastructure will create an "Economy of Scale" that will really drive down Wholesale costs.
- Less expensive Wholesale telecommunications costs will increase private sector profitability and drive down end-user costs,
- Purely because of significant advances in Silicon-based technologies the overhead maintenance of telecommunications infrastructure is virtually zero,
- Long distance transmission is particularly in expensive because SMOF can traverse well over 80 km in single hops and has virtually zero maintenance and has a massive bandwidth,

- New applications will be innovated to produce a far greater range of commercially competitive products,
- The level of complaints is extremely high (because of infrastructure competition) and when this infrastructure is consolidated the complaints will plummet to virtually zero.

There, that was not all that hard - was it!

Correctly Position Competition

Because of the introduction of industry-wide telecommunications competition in Australia from 1982 this service delivery model radically changed from being totally non-discriminatory to being internally-accounted maximised Return On Investment (ROI) focussed.

Competition has its place in Retail Reselling of discriminatory products and services; and that is what western economics was originally based around. Competition is "efficient" in retail reselling - that is - in the economic meaning of the word "efficient", being that retail reselling potentially employs a large percentage of the population.

Because of the Davidson Report and totally inappropriate COMPETITION, a wide range of geographically and needs diverse Australian communities were deliberately isolated because the internally accounted ROI did not compare with "low hanging fruit" of geographically suited affluent consumers where a maximum ROI was easy pickings.

The answer to quickly and efficiently arresting these immensely expensive disparity problem is really simple and straightforward - and I have spelt it out for several years to several Government bodies - all of which "glaze over" the moment any description involves basic telecommunications engineering strategy.

The problem is that the PC and other Federal Government Bodies (ACCC, ACMA, Select Senate Inquiries, Regional Independent Telecomm Inquiries, etc.,) listen only and reference only Professional Academics / Lawyers (who generally have virtually zero practical experience and knowledge about the Australian telecommunications network and how it is really constructed / connected) and specifically do not reference telecomms Industry Professional Engineers that have decades of practical and professional telecommunications industry knowledge and wisdom - and have the right answers at their fingertips to get Australia out of this telecommunications industry quagmire.

Use My Broadband Data

Australia is a large country with most of the population in urban settlements and most of the urban settlements are in the east and south coastal areas.

The MyBroadband.Communications (a Federal Government managed website - freely available to staff in the Productivity Commission) has a wealth of data in it relating to current and recently available telecommunications services throughout Australia. The data is included in a reasonably comprehensive Excel workbook[14], and it does require a basic understanding of the overall telecommunications service connectivity infrastructure to make meaningful analysis of this data.

[14] https://www.mybroadband.communications.gov.au/upload/documents/BQP_DATA_v4.xlsx

To complicate matters, much of this data has been "dummed down" making it easy to skim over and get an artificial perspective, but somewhat difficult to make a useful / meaningful analysis at a secondary or tertiary level, imperative for setting practical and functional Federal legislation that is productive.

A Quick Broadband Overview

Cable Internet (i.e. using HFC technology for access network connectivity with customer premises) is only available in (most of) the metropolitan areas of Sydney, Melbourne, Gold Coast / Brisbane, Adelaide, Hobart and Perth. So, HFC (Cable Internet) has no bearing on inland / remote Australian communities.

ADSLx is a far less expensive Broadband technology to promulgate than HFC Cable Internet, and ADSLx is generally available throughout Australia - except in small towns and village communities, where, if this ADSLx technology was installed in these inland / remote Australian communities, then the massive financial problem of the "inability to provide reasonable cost Broadband connectivity" would be very inexpensively annihilated.

In my earlier addendum submission to the PC "2016 12 PC Corrections (Part 1), I included a brief Appendix that did a quick and simple analysis of some of the features of the ADSLx penetration in Australia. The first table in that appendix broke down the demographic localities by telephone exchange customer line count (and showed that the total number of telephone lines was in the order of 7.66 M at that time).

Most of the metropolitan / urban lines have ADSLx connected as their Broadband connectivity (and the fixed access phone is used casually as the first available phone). But, the Mobile phone has the Address Book included so the Mobile Phone has become the telephone of choice because of its added in-house facilities. People are not "abandoning" their fixed access phone connections - they just don't use the fixed access phone if a mobile phone is handy.

People in premises with ADSLx connectivity do however use the ADSLx connection for their Mobile phones through the Wi-Fi LAN connection into the ADSLx modem.

Very few of the inland Villages have any ADSLx facilities. Most of the Village premises are within 750 m of the local exchange and would be capable of very inexpensive 24 Mb/s Broadband. Why has this not happened?

With the gradual advancement and introduction of GSM3 (G3) circa 2004, and GSM4 (4G) circa 2011 mobile phone technologies that are now effectively Narrowband (Texting), Voiceband (Telephony) and Broadband (Internet), and the general acceptance that Internet connectivity is a parallel to Telephony connectivity (and that telephony being Voiceband is now a subset of Broadband); Voiceband is now effectively obsolete and encased by Broadband.

Facilities in Regional and Remote Areas

The Draft PC Report shows that Internet usage is exponentially increasing with time, but does not draw the very logical (engineering) determination that Australia needs to be "Broadband connected" far more than it is now, and connected in virtually every Village, Town and City.

The massive missing component in this "Broadband Connection" is not what the NBN is (supposed to be) doing.

The massive missing component is the (missing) inland Inter-Exchange / Backhaul / Core Network so that major cities can connect without congestion and that every major city has multiple alternate geographic paths to connect.

Every minor city needs exactly the same multiple alternate geographic paths to connect. most Towns - same situation and Villages (and Homesteads) can be connected on the way through.

This telecomms infrastructure has not been thought through. **We need this Now.**

This telecomms infrastructure is inexpensive and has a massive (Federal Government) ROI.

So why is it missing? Private Sector COMPETITION

I have the answers - because I have decades of practical Australian telecomms experience - so let's talk....

Draft Finding 8.1 (Page 25)

NOT RIGHT

Because the Australian Telecommunications Commission (ATC) was privatised (circa 1990 - 2004); internally it functionally changed from being Australia's homogenous telecommunications infrastructure provider (and retail outlet), to being a telecomms competitive retail heavyweight focussed on maximising shareholder profit at the expense of maintaining and long-term planning and operating of the Australian homogenous telecomms network.

One of the direct consequences for this monumental economic mistake in privatising what was one of the world's most (engineering / infrastructure) efficient telecomms infrastructures before that time, was that the business focus changed to sharply focussing maximum ROI infrastructure at great expense to Australian productivity; particularly outside the major capital cities (read: Regional / Rural / Remote).

Further - because of enforced telecommunications infrastructure competition in Australia, this economic blunder then crippled the purchasing power of competing telecomms providers because they no longer had an "Economy of Scale" to get the lowest commercial prices and best delivery, engineering support etc. for telecomms infrastructure they purchased. So the competing telecomms providers paid substantially higher than the mainstream telecomms provider, delivered later and with much less support - and they have to cut corners to be profitable (which means the end users / customers have minimum support and the service is minimised.

Further - because Global Manufacturing is primarily a Northern Hemisphere business that sees Australia as a minnow, multi-duplicated competing telecomms businesses in Australia pay the highest prices and the network is neglected outside metropolitan cities (and their interconnecting arteries) to maximise profits for their shareholders - and the majority of (Telstra / Optus) shareholders are not in Australia.

Further - the Federal Government is already paying a massive premium to fund the NBN because of the massive economic blunder caused by privatising and splitting up what was a very efficient telecomms infrastructure in Australia. The PC needs to comprehend that the USO is dwarfed by the massively expensive NBN costs and the

PC needs to understand that the USO, NBN etc. would never be there if Telstra / Optus etc. were all physically separated and the infrastructure pooled to make a common and highly efficient homogenous telecomms infrastructure.

Further - the NBN is (extremely foolishly) set up to be a "competitive business" when in fact it is an "infrastructure business", and worse - instead of working hand-in-hand with Telstra (as the largest telecomms provider in Australia (by a country mile)), the NBN is (extremely foolishly) set up in direct commercial opposition as the most inefficient business arrangement possible - wasting immense funding on advertising instead of installing the necessary infrastructure.

Further - because the people that structured the NBN and the Cost Benefit Analysis apparently had a very "limited" knowledge of the Australian telecommunications Inter-Exchange Network infrastructure, we have what is effectively a national financial fiasco that makes the cost of the USO almost insignificant compared to the ongoing cost of the NBN and a range of other "Government payouts" caused by uncontrolled private sector greed.

Further - the inland telecomms infrastructure is really in a disastrous state where there is a very thin SMOF Inter-Exchange Network (IEN) "tiered-Star" structure that is Capital City centric. This inland IEN infrastructure in its present state is incapable of carrying Broadband because it is fully utilised for low capacity Voiceband on 2 Mbps (0.002 Gbps) PDH links (in most cases). Most of these SMOF cables are capable of 10 Gbps or more - but there is no alternate (mesh) paths to carry the expected Internet traffic through the inland in the new decade.

The only exceptions to the nominal 0.002 Gbps PDH links are some major high capacity links connecting radially from these State Capital Cities to Regional Large Cities (usually on the pathway between major capital cities).

The answer for this is very straightforward and economically sound. Once done then the USO is literally eliminated and the NBN is absorbed. Please discuss with me.

Draft Finding 8.2 (Page 26)

WRONG

With the model I am proposing, the Retail Reselling businesses will fund the Australian Broadband Telecoms Commission (ABTC) from the wholesale "rental" costs, and the Federal Government will chip in to assist covering costs that will in turn minimise other costs in other areas (Medical, Social Services etc.)

Draft Finding 8.3 (Page 26)

OK

Draft Recommendation 8.1 (Page 26)

WRONG

This is covered elsewhere in this submission. By far the most economical model is for the (new) ABTC to use their internal expertise and roll out whatever infrastructure they want - without the interference of "commercial tenders" that usually come from northern hemisphere-based global manufacturers that do not have the telecomms

Broadband equipment to match the inland of Australia. I can provide examples on request.

Draft Recommendation 8.2 (Page 26)

RIGHT

And do this through the new ABTC

Draft Finding 9.1 (Page 27)

OK

Draft Recommendation 9.1 (Page 27)

OK

Draft Recommendation 9.2 (Page 27)

OK

Information Request 9.1 (Page 28)

Address the "Elephant in the Room"

None of the above options will have any practical or economically useful effect because the "elephant in the room" problem has still not been addressed.

The "elephant in the room" problem is simply because business focus of private sector businesses is to maximise shareholder profit (at the expense of the community and all competing businesses), whereas the business focus of a sub-Government Commission is to maximise conformal and ubiquitous service availability at a minimum end user cost (so that the community and private sector can maximally benefit from the service provided).

When and after Telecom Australia was transferred from a sub-Government Commission to a Corporation (circa 1988?) and then later sold off as a private sector business (1993, 1997, and finally 2004) the business focus was also deliberately changed from providing a ubiquitous and conformal telecomms network infrastructure to providing a non-conformal telecomms network infrastructure that resulted in maximised shareholder profit mainly at expense to the inland.

None of the now more than 15 Select Senate Inquiries and Regional Independent Telecoms Inquiries and the like (ACCC, PC, ACMA etc.) have come anywhere near mentioning this "elephant in the room" issue, but this issue is the very obvious and major/main problem. This is like a children's pantomime but real.

Here is the Elephant - Fix it

Fundamentally, the Davidson Inquiry / Report (1980 - 1982) got it totally wrong on how to provide a Telecomms (investment) portfolio sector on the Australian Stock Exchange (ASX). The then pressure applied by the USA made it very difficult to do otherwise - but the political climate has substantially changed in about 35 years since

then - opening the way to quickly and inexpensively correct the dire Australian (financial and productivity / economic) situation.

The Inquiry followed the USA (greed) model of privatising the entire sub-Government infrastructure, splitting up the highly effective "Economy of Scale" national infrastructure into much smaller less-effective thin vertically integrated sub-national infrastructures, and have these smaller (infrastructure-based) businesses compete against themselves (with far larger relative overheads) and apparently provide a "cheaper" end-user product range. Australia's population is far too small for this extravagantly expensive model to work economically.

The massive endemic failures of this inherently corrupt USA business (greed) model was identified and exposed by Professor Sharon Beder[15] (Wollongong University) several years ago - but no sub-Government Commission (ACCC / PC / ACMA / TIO Treasury etc.) has had the "balls" to stand up and expose these massive economic fraud / failures - instead bleating out that "(increased) competition will fix everything", and the endemic problem continues to cripple Australia's productivity and GDP.

War is extreme competition and everybody knows the cost of war is extreme. When Competition is increased, the overhead costs rapidly escalate and the end user ultimately pays for the significantly increased competition costs with substantially increased retail costs.

Perfect Economic Competition has its place in discretionary products and services that are provided on an equitable basis from many retail resellers! Any variation of this is (Adam Smith) definition for Perfect Competition is really enclosed in the "Theory of the Second Best" (Lancaster, Lipsey 1956) that basically states that "Perfect Competition is impossible in practice and so the second best option is market cooperation (i.e. Retail Cartels) to maximise profits. In other words, cartels naturally set up between "competing" retailers to maximise their profits at the expense o the end users.

Put another way that I prefer: "Competition is always Second-Best to Co-operation"!

If you want excellent results then seek for a common goal (Edwards Deming - TQM[16]) through co-operation and seriously avoid workplace competition. The Federal Government (departments) very stupidly set up the NBN Co and Telstra are in head-on collision competition - which has proven to provide the worst possible outcome for Australian (Gross Domestic) productivity.

Competition has very high (advertising / marketing / promotional / management / legal / staff) overheads that are covered by high retail profit margins - and this is why Competition has its place in Discretionary products and services.

This mindset is also why Competition has a short term focus - ideally suited to the retail market (fashion industry) - and ideally suited to most telecommunications retail products and services (if the wholesale products are ubiquitously distributed).

[15] https://www.amazon.com/Power-Play-Control-World%C2%92s-Electricity/dp/156584808X
[16] http://info.ibs-us.com/blog/bid/47941/Quality-101-W-Edwards-Deming-14-Points-Explained

Telecommunications connectivity in Australia; which was (Narrowband - Telegraphy / Telex / TRESS) and (Voiceband - Telephony / Fax / Internet) from about 2000 has morphed into Broadband (Telephony / Texting / Internet / Video Conferencing).

In Australia Telecommunications Wholesale infrastructure is an Essential Service, not a Discretionary Service.

So - having competing telecommunications infrastructure businesses is inherently a very low productivity, high cost outcome; and this very poor economic situation has been festering in Australia since 1982.

The initial infestation was the Telecommunications USO placed as a discreet bandage over a financial seeping wound and the greed-based infection has spread with an astoundingly speed to really cripple the Australian economy.

Instead of cleaning out the massive infection by physically separating Telstra / Optus etc. and grouping all the telecommunications infrastructure under one large sub-Government commission to properly / economically manage the ubiquitous national infrastructure as a national wholesale resource to be re-bundled for competitive (private sector) reselling - successive Federal Governments have added substantially more telecomms-related economic infections in well over 10 very ill-conceived short-term **telecomms initiatives** topped with the **horrendously expensive NBN fiasco**.

The simple solution to remove the "elephant in the room" is to instead re-position the entire telecommunications infrastructure as a single sub-Government Commission and have several (ASX associated) private sector businesses "wholesale rent" the telecomms products / services and repackage / bundle the wholesale products as commercial retail products / services to Government / Business / Consumers.

Box 1.2 Reviews Relevant to this Inquiry (Page 34)

There is Nothing Relevant in these Reports

When I read though the list of Reviews (apparently) relevant to this Report, I was absolutely appalled that the references were so thin on engineering content, and so far off the target.

The whole subject about the USO is entirely based around the cost of telecomms engineering, the developments in telecomms engineering and the promulgation of telecomms engineering since (and well before) 1982, when the Davidson Inquiry (1980) initiated the concept of the USO.

Why? Because the engineering costs of operating telecommunications in Regional / Rural and Remote areas was comparatively expensive and did not offer the high profitability that could be capitalised on, in the metropolitan (Sydney, Melbourne, Brisbane / Gold Coast, Adelaide, Perth, Hobart cities and their suburbs) areas.

Hence the reason for the USO to deliberately conceal the Regional / Rural and Remote "cost centres" and deceptively appear to make the profits of the Australian telecommunications infrastructure palatable to the private sector so they would invest in, and expect a large Return On Investment (ROI) - at the opportunity cost of expense of new telecomms infrastructure not being rolled out - particularly in Regional / Rural and Remote areas of Australia.

Being a long-term Professional / Consulting Electrical Engineer with my speciality in Australian telecommunications technologies and the overall telecomms network; I have attended (and been a Witness at) several Select Senate and Regional Telecomms Inquiries and several other Inquiries, and been very far from being impressed at the level of detail that was lost in translation.

A classic example is the "broad brush of nothing" said in the Australian Infrastructure Plan about Telecommunications:

> ***The Australian Infrastructure Plan (Page 46)***
> *The delivery of the NBN is a transformational opportunity to enable all Australians to benefit from an increasingly digitised world. Governments should ensure that the full benefits of high-speed broadband are realised, and that it provides long-term connectivity dividends.*
>
> *Any failure to address these challenges will have adverse consequences for all Australians. But if we get it right, infrastructure that connects our cities and regions can substantially boost the capacity of our economy and the prosperity of our communities.*
>
> ***What the Audit Found***
> ■ *The quality of telecommunications service across Australia is mixed, with generally good services in cities and with lower quality services in rural and some outer urban suburbs. The NBN is expected to materially improve service levels and the ability of households in rural and remote regions to connect to their wider social networks.*

If children in primary school could use big words they would have said something far more substantial from their limited knowledge...

Telecommunications is a major infrastructure component that (should) run parallel to every Rail and Road corridor, and be a large national high capacity SMOF cable-based mesh to carry the expectations of low congestion Internet used beyond the next 50 years.

Irrelevant Reviews / Reports in a "State of Chaos"

Skimming through the list of apparently relevant reviews, it struck me that the most recent report was 2016 and the earliest report was 2014, but the original relevant report (the Davidson Report - 1982), is obviously missing from the list of apparently relevant list.

In one frame of mind it looks as though if a report is available on line (and it is recent), then it is relevant, otherwise it is too hard to pull out of the archives and physically read. Most likely those archives were scrapped as irrelevant. The original reference is by far the most relevant. Why is it missing from the references?

In terms of Total Quality Management referring to the latest reference without referring to the original reference creates a state of chaos[17] (pp98-99) where the target is hit but successive shots move further away from the bulls eye.

[17] https://books.google.com.au/books/about/Safer_Than_a_Known_Way.html?id=HBVVPAAACAAJ&redir_esc=y

*Consider you are sawing wooden Noggings to put horizontally in a building wall at 1200 / 1300 mm to support the wooden studs from warping under stress. The studs are spaced at 600 mm and the cross section is 50 mm * 75 mm, so every horizontal Nogging will be 550.0 mm long.*

The standard practice is to use a rule and measure the 550.0 mm length, then pencil mark it with a square and the use a hand-saw to cut on the outer edge of the pencil line so that the length is nominally 550 mm.

For standard Total Quality Management (TQM) control you personally put the Nogging in a reference stud (550.0 mm) spacing to ensure that the length of the Nogging is correct. Absolutely no need for external "Quality Inspection".

(The ISO9002x "Quality Assurance" is anything but and is really "Conformance Management", which is significantly different than TQM.)

With TQM in chaos mode the original piece of wood is measured and marked to be 550.0 mm, squared up and cut. The next Nogging to be measured takes its length measure from the previously cut Nogging and is cut, and the first Nogging is sent off while the next Nogging to be cut is measured from the just cut Nogging.

At the end of the day say 400 Noggins are cut and the Nogging length is now 590 mm not 550 mm, but that does not matter because somebody else has started the next day using the last available Nogging and at the end of five days the length of the Noggin is 750 mm. Nothing fits!

The original reference is long gone and no Noggings that have been cut from about mid-morning on the first day is useful (relevant) because the reference kept moving (in chaos mode).

What happens here is that the error was 0.1 mm and continually adding, so that by 10 Noggins the additive error is 1 mm, by 100 Noggings the additive error is now 10 mm and by 400 noggings at the end of the day the additive error is now 40 mm making the Noggings 590 mm, not 550 mm.

The Builder in this chaos mode would ignorantly space the Studs slightly further apart to use the (slightly) larger Noggings, and then blame the Drawing for being incorrect when the Walls and Windows do not fit.

This TQM chaos situation is exactly the same scenario as these useless recent Government Department references being brought up as being relevant - they are 35 years of moved false and further misleading reports.

Imperative Engineering Information is Deliberately Omitted

The transfer of information from the Witnesses in most of these "Inquiries" is really next to nothing, and it really would not surprise me at all that the Reports are written up as Drafts well before the Inquiry is properly scheduled, and then some favourable comments dropped in to make these useless Reports look professional (but not have any "balls" in these reports to actually cause action that puts Australians first).

As a Witness in the Select Senate Inquiry on the NBN July 2009, I was (intentional rhetorically) asked by Senator Ian McDonald (Qld) how could Broadband could be connected to Birdsville (in the remote South West of Queensland).

Because I have worked in PMG/Telstra for over 30 years and have extensive professional telecommunications national network knowledge - my immediate reply to him was that there is a long-haul (high capacity) radio link that connects from Emerald to Birdsville (about 1200 km long) with digital repeater towers (antennae dishes) about every 50 km. I suggested that this long haul radio system is most probably running in (Voiceband) network congestion, consequently making Broadband connectivity in the whole inland South of Queensland virtually impossible.

I further suggested that by extending the 125 km Single Mode Optical Fibre (SMOF) link that runs from Longreach SSW to Stonehenge on to Windorah / Galway Downs Homestead (where the long-haul Radio System passes through) - a distance of about 150 km passing through Jundah.

The cost would be about $4.5 M including Internet/Router transmission equipment). This then provides the opportunity to split the high Capacity Radio System into two shorter long-haul runs - each about 600 km long.

The centre portion of the now previous long-haul link would now back-connect via Longreach through the SMOF cable system. The Eastern link radio link can be further divided in length by two (300 km + 300 km); dropping the traffic density to about 25% of its current situation and facilitating the rollout of inexpensive Broadband connectivity east of Galway Downs for about 600 km.

The Western link from Galway Downs has a much lower population density than the eastern Radio sector, so the traffic density will be nominally 25% traffic density and 75% of the 2 Mbps PDH channels will be freed up allowing 64 Mb/s for Broadband connectivity towards Birdsville.

So the long-haul radio link network congestion is eliminated and there is now considerable spare capacity for Internet transport.

From here it is a simple matter of installing a Digital Line Service Multiplexer (DSLAM) in the local Small Country Automatic Exchange (SCAX) hut at Birdsville and virtually every premises in the town would have ADSL2+ Broadband connectivity at nominally 24 Mb/s.

I estimated that the total cost would be under $5 M and the externally accounted ROI would be paid for in a few months.

Even though I produced a more accurate addendum, absolutely nil of this simple strategy got into the ensuing Select Senate NBN Report[18].

I have several other similar examples where rather simple telecommunications Technical / Engineering information was provided to several Inquiries - but nothing of

[18] http://moore.org.au/senh/2010/NBN%20Business%20Case%202.pdf

an Engineering nature that has the potential to resolve the political problems gets through to these (and other similar) Reports.

It is as though the public servants involved with these Reports have nil Engineers amongst them and the staff simply "glaze over" when it comes to putting in the meaningful engineering information that would close out the problem and make the Reports / Review work taking note of.

Figure 2.5 (Page 45)

Figure 2.5 is fundamentally incorrect because HFC (as Cable TV) was introduced in 1993/4 and Cable Internet over HFC was introduced in 1999 (not 2011) and I have had Cable TV and Cable Internet in our home premises since 1999. *Further I was the Supervising Engineer contracted to Telstra via Silcar in 2005/6 who managed the Sydney and suburbs portion of the $2.5 Bn national metropolitan rebuild of the Telstra HFC (Cable Internet) infrastructure. So I do know what I am talking about.*

The "Other Broadband" as shown prior to 2011 is consistent with the count for Cable Internet (over HFC), as it had about 1 M premises connected in 2005 and very little has changed since about 2002, because Cable Internet (over HFC) was "not advertised" (as it clearly outperformed ADSLx - which was being pushed / advertised for all it was worth). **I would strongly suggest that the "Other Broadband" is in fact "HFC Cable Internet"**.

This chart only goes back to 2006, and Broadband had its beginnings in about 1990, so there is virtually 15 years of missed charting that provides the lead-in as to how and when various Broadband technologies came into play and have promulgated.

Fibre to the Business (FTTB) started about 1990 with 2 Mbps (0.002 Gbps) PDH as ISDN being transported by fibre and then being upgraded to sub-variants of 140 Mb/s bi-directional as mainstream in-house computers came on-line and Websites required hosting.

DSL had its beginnings since 1996 and was introduced in Australia in 1998 and had an inverse exponential growth peaking at about 7.3 M according to the My.Broadband physical results, which I know from first-hand practical / professional / technical / engineering experience to be very close to being extremely accurate.

Dial-Up Internet had its beginnings at about 1980, using the then new "World" Large Scale Integrated (LSI) silicon chip that performed the majority of (dial-up) modem functions but required peripheral electronic circuitry to make it "connect properly" with the pair-copper portion of the telephony-based Customer Access Network.

Because many of the then Dial-Up modem manufacturers in Australia were having major problems interfacing the LSI chip with "Australian" pair copper (and my then previous technical expertise was Voiceband transmission and electronic circuit design). I tutored most of the Australian modem Manufacturers' Engineers on how to properly design their Dial-Up Modem electronic circuitry to work optimally in the Voiceband environment, with a resounding success for manufacturers.

Page 45: (last paragraph) In premises, Most Australians use the Wi-Fi capability of the LAN in their ADSLx / Cable etc. Modem / Routers for multiple (often concurrent) device connectivity in a common premises through to the Internet .

Box 1.1 History of the TUSO in Australia (Page 75)

Very Many Missing Highly Relevant Paragraphs:

There are a huge amount of missing and highly relevant missing paragraphs from the brief History that are critical to correctly frame both the privatisation saga and the ensuing TUSO fiasco.

Without these paragraphs included it is rather easy to see how this Productivity Commission (PC) Committee have a very distorted historical view of what has actually transpired in the Australian telecommunications infrastructure.

Consequently this PC Committee has drawn a series of grossly incorrect findings, that have in turn come up with a series of totally incorrect and extremely expensive conclusions / recommendations.

The original paragraphs are in smaller font and the essential missing paragraphs are in a larger 12 point font.

Early TUSO and Government [Natural] Monopoly

This brief excerpt[19] is a tidy timeline of early telecommunications in Australia

1880 Only two years after the first exchange in the world is built, Australia's first telephone exchanges open in Melbourne and Brisbane, followed by Sydney in 1881.

1883 Exchanges open in Adelaide and Hobart, the Perth exchange opened in 1887.

1893 The first public telephone is opened at Sydney GPO.

1898 The Overland Telegraph Line, also known as the Magic Chain, is made from a single strand of iron wire. A second copper wire is added to the telegraphic connection with Europe and it remained a vital link for decades.

1900 30,000 telephone services are operating in Australia.

1901 The newly formed Commonwealth Government took over all phone, telegraph and postal services.

Arguably the first example of universal telecommunications service provision in Australia was established by the Postmaster-General's Department in 1901 (Corner 2012) where much of Australia's fixed-line infrastructure was progressively rolled out.

The Australian Government operated the Post Master General's Department (PMG) as a "**natural** monopoly[20]" (*which is diametrically different in concept and mindset to a "competitive monopoly" - but western economics "deliberately" skips over the topic*). As a Natural monopoly, the PMG was established and grew to be a major Australian employer with a prime focus to provide equitable telephony service to all households and at a consistent price (wherever possible).

Australia's Telecomm Research Centre

The unappreciated spinoff of having the PMG as a "natural monopoly" was that the PMG also became the Australian centre for telecommunications technical and

[19] http://www.vintagephones.com.au/ccp0-display/history-of-the-telephone-in-australia.html
[20] http://www.moore.org.au/busn/02/CompetitionInfrastructure.ppsx

engineering excellence. The PMG Research Labs, later renamed the Telecom (Australia) Research Laboratories (TRL) was centred in Melbourne and provided world-leading telecommunications-based research and development (R&D). This R&D was the foundation for many long-standing Australian manufacturing businesses over many decades to design, manufacture and sell / export excellent telecommunications-based equipment.

This R&D extended into innovatively and proactively building many Australian private manufacturing businesses to provide telecomms equipment (poles, wires, insulators, a range of telephone cables, concrete pits, underground cable conduits, exchange batteries, equipment racks, Manual (Sylvester) cord Switchboards, Step-by Step telephony switches, Crossbar telephony switches Long Line terminal and repeater equipment (and all the components in all this equipment) to cross connect and provide telephony / telegraphy services over 7,000,000 Subscribers.

Proactive Telecommunications in Australia

Even though Australia had a population of about 10,000,000, (1960) the then PMG / Telecom Australia employed well over 90,000 people (purely for telecomms alone) and the associated Australian private companies would have employed well in excess of another 20,000 to design and manufacture the associated telecomms equipment in Australia. Although "isolated" in the southern hemisphere, Australia with its PMG developed and created a very efficient (although intrinsically high maintenance) telecomms network.

> *All telecomms infrastructures (before the solid-state silicon era, (circa 1980) were inherently high maintenance because the "external plant" (poles / wires / insulators in particular) was affected by weather / trees / steam train smoke; and the "internal plant" (telephony switches / cords / thermionic valves / transmission equipment) was susceptible to dust / physical wear / metal fatigue.*

From about 1940, open wire (poles and crossarms) technology was crowding city footpaths and streets so virtually the entire national telecomms Inter-Exchange Network (IEN) / Trunk Network / Transit Network and associated Customer Access Network (CAN) were totally re-engineered and re-constructed with virtually nil fanfare to be rebuilt and trenched into underground conduits / cables by 1965.

Developing New Crossbar Technologies for Australia

In 1960 the then new technology of (Ericsson) Crossbar switching was nationally introduced to replace Step by Step (SxS) auto dialling and Manual (Sylvester) Switchboards. Crossbar technology dramatically changed the face of Voiceband telephony as this was rolled out. By 1975, enabling Australians to have Subscriber Trunk Dialling (STD) and International Direct Dialling (IDD) by 1976.

> *The Swedish-based Ericsson Crossbar (4-wire) ARM switching technology was not compatible with loaded cable (2-wire) SxS / Switchboard technologies in metropolitan Australia, but Crossbar provided considerable "alternate routing" which is critical in minimising network congestion with subscriber dialling. Also the overhead maintenance of Crossbar was considerably lower than for SxS and Sylvester (manual) Switchboards.*

Engineers in TRL effectively "re-engineered" the transmission path of Ericsson's Crossbar to work with 2-wire (loaded cable) transmission and introduced this Ericsson "ARF" exchange technology in the metropolitan areas, and made a variation of this for smaller cities in country areas. A third Crossbar variation was the PMG invention of the "ARK" Small Country Automatic Exchange (SCAX) that was a small remote subset of an ARF Crossbar exchange and thousands of these were installed in regional / rural / remote country areas replacing Sylvester Switchboards.

Why the PMG was Made a Commission then Privatised

Because Chile was being intensively gouged by the very well-connected (USA) International Telephone and Telegraph Corporation (ITT) that controlled about 80% of Chile's telecomms network infrastructure; the then Chilean Government moved to nationalise[21] its telecomms infrastructure. In 1972, the USA Regan administration harshly retaliated by deliberately bankrupting Chile, because the telecomms business in Chile was virtually controlled by the USA's private enterprise bloc.

Under the guise of the "USA-controlled" WTO and IMF; the USA Government then sent out as thinly veiled edict to all "western economy" countries to "privatise your (telecomms) infrastructures or suffer a similar fate as Chile"! In the mid-1970s there was a multi-country race of privatising telecomms infrastructures.

In 1975, the Australian Government split up the then massive Post Master General's Department into several Commissions including the Telecom Australia Commission (ATC). This was a major positive step as it freed up Federal Parliament from making debating and carrying hundreds of Acts to cover what would be normal (telecomms) executive business decisions and freed up Telecom Australia to make (what were essentially executive level "Infrastructure Business") decisions without having to wait months for Federal Parliament to finalise these Bills.

However, it was not until the enactment of the *Telecommunications Act 1975* that the TUSO (the 'Community Service Obligation') was formally introduced. This legislation required Telecom Australia to provide telecommunications services that best met 'the social, industrial and commercial needs of the Australian people' and were 'available throughout Australia for all people who reasonably require[d] those services' (s. 6). Telecom Australia operated as a vertically-integrated government **[natural]** monopoly, and the Australian Government was able to provide relatively straightforward regulatory oversight of the TUSO (Gregory 2015).

NOTE: *This **natural monopoly** put customers first - not (diametrically) last, as is standard practice with a **competitive monopoly**. Hence the oversighting of a natural monopoly was/is virtually unnecessary; **whereas with a competitive monopoly the oversighting is extensive, expensive, and has to be very heavily policed (to keep the greed of the competing businesses in check, limit rorting, limit gouging, and minimise geographic pricing / service differentials)**.*

21 https://books.google.com.au/books?id=bJukECfJvi8C&pg=PA228&lpg=PA228&dq=telecommunications+Chile+government+overthrow&source=bl&ots=Kqmm7V0Z9s&sig=oBgQOwTqcVpQoKgfTpM2rkvbU64&hl=en&sa=X&ved=0ahUKEwir6PjI243RAhVCpJQKHQYWBH4Q6AEITzAJ#v=onepage&q=telecommunications%20Chile%20government%20overthrow&f=false

The Dawn of Integrated Silicon Chips

By the mid 1960s, Silicon-based solid-state analogue technologies were rapidly replacing earlier thermionic valve and germanium transistor technologies. The dawn of the (silicon-based) digital era from about 1970 brought with it very low maintenance digital (solid state) switching (and digital transmission) technologies.

> *With small-scale integration (SSI) digital silicon technology significantly advancing in the 1970s, the PMG were actively looking to advance from relay-matrix switching technology to much lower overhead SSI silicon based computer controlled technology.*
>
> *In 1975 the PMG purchased 10C (reed relay switches, silicon computer processor) exchange equipment from the then Standard Telephone and Cables (STC). These electronic exchanges sat parallel to the main AXE trunk switches and provided an extended range of switching facilities, were very fast and had considerably lower maintenance overheads.*

By 1978, Telecom Australia was a very highly-efficient vertically-integrated "**natural monopoly**" - operating purely as an Infrastructure Business (providing the best possible telecomm services to all customers - irrespective of geographic location, and at a highly consistent minimum retail cost).

NOTE: *"Vertically Integrated" here means that sales, marketing, advertising, retail product range, wholesale product range, wholesale network infrastructure, and to a degree equipment manufacturing - were all under the one business (Board). There is a fundamental economic problem where there are the two diametric mindsets Commercial (Retail / Advertising / Marketing / Sales / Profit) is naturally "Competitive Business" focussed while Infrastructure (Network Structure / Maintenance / Equipment / Research / Buildings / Power / Air Conditioning) is naturally "Infrastructure Business" focussed and these two foci are diametrically opposite.*

In 1979 Telecom Australia moved to introduce the very new technologies of Digital Switching and Digital Transmission into what were previously very labour intensive (high manual overhead) Analogue Transmission and Mechanical / Manual Switching technologies that were the main bulk of their telecomms Inter-Exchange Network / Transit Network infrastructures.

> *In 1980, Telecom Australia opened a contract for Ericsson to manufacture / provide digital AXE exchanges, and a secondary contract to provide 2 Mb/s digital regenerators to operate on existing loaded cable.*
>
> *Neither of these radically different and new futuristic digital technologies comfortably fitted into the existing overwhelming analogue / mechanical telecommunications infrastructure, so for several years these digital silicon-based technologies were "integrated" over the pre-existing very labour-intensive telecommunications infrastructure.*

Private Sector Greed and the Davidson Inquiry

Seeing the rivers of gold that were flowing through Telecom Australia, (i.e. the Australian Telecommunications Commission (ATC)) to purchase these new digital technologies, the international (basically USA) private sector moved quickly in 1979 to intercede and "justify" the privatisation of the then ATC so that substantial funds

could be diverted into the private sector (themselves) instead of funding maximum telecomms Service Quality for Australians.

In 1980, the Australian Government seceded to (USA driven) private sector pressure and opened the Davidson Inquiry to "look at ways to improve productivity" in Australian telecommunications industry and to "put a telecomms sector in the ASX".

This 1982 Davidson Report determined that ATC needed to be broken up and have "infrastructure competition to make it efficient" (which is an economic oxymoron).

The irony of this whole saga was that a main part of the reasoning was to make the then Telecom Australia "efficient" was that in about 1975 -1979 it was hailed as one of the best constructed and operated telecomms network in the developed world!

NOTE: *In economists language, "efficiency" relates to the percentage of people employed - so a more efficient business means that it employs a higher percentage of the population. When competition is introduced, it also employs advertising, marketing, sales from multiple outlets that in turn makes the business "more efficient" in economists language. This tremendous overhead also makes the products and services considerably more expensive and is one of the prime reasons why "competition" strictly applies to "discretionary" services / items, and strictly not applies to "essential services" - of which "telecommunications" is an essential service.*

The now (2016) shattered and in-fighting telecomm networks in Australia are now recognised as being one of the worst performing networks in the developed world...

Part of this 1975 Telecommunications Act was the introduction of the Universal Services Obligation (TUSO), which very intuitively predicted that the Telecom Australia was to be later privatised and when this was to happen the prime focus would naturally move away from putting customers (and Australia) first (as it was then) to putting (multi-national) profits first (as it would be when privatised) and grade customer service standards on potential return on investment (ROI) - which meant that rural / regional / remote customers would be put last in due course.

The Davidson Inquiry initially raised the notion of the (Telecomms) USO to deceptively make the non-metropolitan (regional / rural / remote) areas to appear to be not operating as a "cost centre" but at worst "breakeven" or very deceitfully "look profitable" to politically facilitate the telecommunications infrastructure selling off process, and have the Federal Government (quietly) fund the loss areas.

The intent was that this USO funding process would greatly assist in the theft of the Australian people's Telecomm Australia Commission so it could then be transferred to a Corporation and then sold off as a private equity business.

One of the sections in the Davidson Report was the deliberate introduction of the Telecomms Universal Services Obligation (TUSO) to ensure that when the fractionated and privatised ATC would still be (financially) able to service customers in rural / regional / remote Australia (by dedicated Federal Government funding) - but still run as a "profit first - service last" competitive business organisation.

Circa 1981, almost all telecommunications products and services (except for telegraphy, radio and TV programme distribution, remote alarms, and "wideband"

data) were all Voiceband based - so the word "telephone" inferred "telecommunications" to the general public, and in the Davidson Report (1982)

In legal hands, this Davidson Report was (later) deliberately taken by "letter of law" - not "letter of spirit" to be "telephone" to minimise the amount of ageing infrastructure to be managed, to minimise the amount of Broadband services to be provides to maximise the amount of Federal Government payout, and keep the Telecomms USO coming (and growing).

Another part of the three-volume Davidson Report included a substantial devotion to the "tyranny of distance" where it was openly recognised that substantial operating costs of distance transmission (of the Inter-exchange Network (IEN) component of the non-metropolitan (i.e. inland) telecommunications infrastructure) was a major stumbling block to the fundamental plot to strip the Commission out of Federal Government hands and "move" all this common-wealth into the private sector.

The Davidson Committee (Report) saw the USO as the "vehicle" to facilitate the highly deceitful transfer process and camouflage the very expensive long-haul transmission technologies' equipment / overhead costs by deliberately hiding (secreting) these as ongoing Federal Government expenses.

> *In 1980 - 1982, most of the inter-City / inter-State IEN transmission was by point-to-point wideband, analogue, Frequency Division Multiplex (FDM) Radio Systems; with massive antennae dishes on towers spaced about 30 km, or by wideband, analogue FDM on Coaxial Cable with repeater huts spaced every 8 km.*
>
> *In the country, the City - Town IEN transmission used Quad Copper Cable with wideband, analogue FDM repeaters on every 4 km, and most of the Village to either Town or City transmission used Pair Copper Loaded[22] Cable up to about 30 km*
>
> *To keep this (transmission) infrastructure operational, it required a considerably high number of highly-trained technical staff (and test equipment), and most major locations required 24/7 shifts.*
>
> *Concurrently, most of the then inter-suburban (metropolitan) transmission component of the IEN had very extensive Loaded Pair-Copper "Junction" Cable mesh networks to join between the local and transit switches and had considerable alternate routing; minimising network congestion.*
>
> *Fortunately the lengths of metropolitan Loaded Cable was comparatively (to the inland) short, and the traffic volume quite high; so the vast majority of the metropolitan expert technical support was in ongoing mechanical switch maintenance in the Inter-Exchange Network.*

Introduction of Digital Transmission and Digital Switching

In 1980 Digital (Voiceband) Switches were new technology - but the inter-exchange transmission network was strictly analogue and these two technologies required massive (expensive) analogue / digital interfacing to make through connections.

[22] Voiceband discrete "Loading" is the inclusion of 88 mH coils spaced at 1830 m in each cable pair to flatten / equalise and shape the analogue Voiceband channel and minimise attenuation.

> *The first technology breakthrough (circa 1979) came with the development of a Plesiochronous Digital Hierarchy (PDH) 2 Mb/s regenerator, about the size of a matchbox. This 2 Mb/s regenerator could replace a Loading Coil in a Junction pair cable pair and connect 30 (digital Voiceband) channels where previously one (analogue Voiceband) channel in the pre-existing Metropolitan Junction network.*

So, the introduction of digital switching (particularly in metropolitan areas) together with 2 Mb/s digital transmission regenerators (over several years of installation) radically simplified the previous metropolitan Junction Network into a low maintenance / low overhead and highly profitable high-capacity mesh transmission network infrastructure.

After 1982, when the Davidson Report was (in haste) put in place; the inland (non-metropolitan) "tyranny of distance" was still a major "cost centre" problem - more than fully justifying the USO funding. **(And I believe the USO funding started in 1983 costing about $190,000,000 pa. to the Federal Government.)**

In the area of telecommunications research (when before being privatised the PMG / Telecom Australia had a world-leading facility: Telecom Research Laboratory), the rather new technology of Optical Fibre was beginning to show promise for efficient transmission (of light) over short distances - but there were major technical problems in terminating the fibre, and in lowering the length-dependent attenuation so that this technology could be made practical.

The Economic Revolution of Single Mode Optical Fibre

By 1984, the implemented Davidson Report was looking to be a highly questionable disastrous failure but in April 1984, the very rapid advanced development of Single Mode Optical Fibre (SMOF) technology (primarily in the 1300 nm spectrum[23] at Telecom Australia's Research laboratories) literally overnight killed off the immense "tyranny of distance" costs that haunted the Davidson Report from being financially / economically viable.

> *In April 1984 there were major breakthroughs where it was discovered that a slightly bevelled end of the fibre minimised back reflections and that Silica had a very low attenuation spectrum area that could be used with Gallium-Arsenide lasers to transmit over distances exceeding 8 km (and the bandwidth was immense compared to analogue Voiceband-based FDM technologies); also that Single-Mode transmission was far lower attenuation per unit length than Multi-Mode transmission.*
>
> *Within six weeks (I know - I was in the middle of it) the reliable spanning distance leapt past 8 km in quantum steps to finally exceeding 60 km (twice the distance for point-to-point radio hops, eight times the distance for coaxial cable repeaters, 15 times the distance for FDM over Quad Copper repeaters, 33 times the distance for Loading Coils or 2 Mb/s regenerators on Pair copper).*

This digital transmission breakthrough was revolutionary and had absolutely nil to do with "competition" and everything to do with "technology".

[23] http://www.olson-technology.com/mr_fiber/fiber-history.htm

Overnight, (1984) Telecom Australia radically changed its (Inter-Exchange Network) transmission policy - particularly for inland network structures to be based on SMOF technology. By 1993 Telstra had ploughed in many 10,000 km of Single Mode Optical Fibre cables to almost all country Cities, Towns and Villages to replace a wide range of very expensive overhead analogue transmission technologies with a few virtually zero maintenance overhead Voiceband digital transmission technologies.

I believe that Telecom Australia funnelled the large bulk of the then USO from 1984 to 1993 (about $1,710 M) into plus the sale of the aged and very substantial metropolitan pair copper Junction cable network into totally rebuilding the main and inland Inter-Exchange Network transmission infrastructure to be almost 100% SMOF-based.

This work was all done very economically by Telecom Australia's "Network Design & Construction" (NDC) with a minimum of external contractors and a maximum of in-house professionalism and expertise. At nominally $25k/km (circa 1986 - much of this cost is diesel fuel) this works out at about 68,000 km of SMOF cable trenched in at about 1.2 m deep throughout Australia.

In 1986, Telecomm Australia's major interstate high capacity transmission link, the Melbourne-Sydney SMOF cable system, cost $45 M and totally replaced the then very expensive and ageing (analogue) coaxial cable transmission system and several geographically parallel high capacity point-to-point radio systems. By 1993, virtually all analogue Cable Systems and most long-haul Radio Systems in Australia were economically replaced by many thousands of km of SMOF (digital) technology.

Then the SMOF cable rollout plan stopped in 1993 as fast as it started!

The Scramble to strip Telecoms related assets

Following the Davidson Report (1982), there was a scramble to strip Telecoms related assets from the Federal Government to justify establishing a (competitive) telecommunications sector on the Australian Stock Exchange (ASX). This scramble really went nowhere because Telecom Australia had a natural monopoly (with its very extensive and very efficient by "economy of scale" nationwide wholesale infrastructure) and a competitive monopoly (with its very extensive though at that time naive commercial / competitive monopoly.

Optus was floated in 1988 in direct opposition to Telstra and started with a Nortel DMS switch to divert mobile business away from Telstra. After an intensive world-wide search for contractors, Telstra's NC&D came in with a quote virtually half that of all other network construction businesses. (This was definite proof that external contractors are far more expensive (uneconomic) than internal infrastructure expertise.) Telstra's ND&C built Optus' first major exchange complexes.

Even with very inexpensive and fault free construction, Optus remained non-profitable and the Federal Government stepped in at 1991 to virtually give Optus the Aussat Satellite system, and stripped Telstra of its ABC TV distribution, so as to build up Optus to be a maximum infrastructure competition to Telstra in the (totally flawed and not thought through) belief that competition actually reduces end user costs.

Australia's Pay TV / HFC Competitive Fiasco

In 1992, word was out that Pay TV (on Hybrid Fibre Coax (HFC)) was the next big market product. Refer to the Appendix **HFC Infrastructure Stupidity**

In 1993, Telstra's privatisation hit home and this meant cutting all overhead costs and tightly focussing on what (retail) areas made the biggest profits - and bolstering those areas at the expense of "cost centres". Pay TV was new and needed the money (lots of it) as did mobile phone Radio Base Stations (RBSs) and Telstra very quickly dropped upgrading the non-metropolitan (country) areas like a very hot stone (but still kept receiving the Telecomms USO).

The technology of SMOF was the extremely inexpensive very wideband transmission medium that perfectly fitted into digital switch technologies and made the inter-urban Australian telecommunications infrastructure economical - even against the massive inefficiencies introduced by infrastructure competition (duplication) and privatisation.

Digital Switching (using solid-state silicon technology) and then Digital Transmission (using SMOF silica technology) together had virtually zero maintenance overheads and were pivotal in providing the very low overhead wide bandwidth telecommunications Inter-Exchange Network (IEN) infrastructure that is now taken for granted and virtually invisible to the general Australian public. (***So much taken for granted that those formulating the NBN, totally omitted this major and imperative IEN infrastructure in their fundamentally flawed network plan.***)

Meanwhile in the Regional / Rural and Remote areas . . .

Telecomms network switching in the country areas tagged along beside main urban based network switching: In the mid-1950s there were about 250 Rural Automatic Exchange (RAX) huts installed in (then) Villages that provided automatic (step-by-step mechanical) subscriber dialling facilities. The main bulk of rural/remote subscribers/customers in Villages and Towns were connected through manually operated Sylvester Switchboards and a proportion of farm Homesteads had "Party Lines" where one customer line connected to more than one farm Homestead.

With the introduction of Crossbar (mechanical switching) from Sweden in 1960, this (ARM) technology could automatically "alternate route" traffic to minimise network congestion - but it was primarily 4-wire (transmission path) working which did not sit well with the existing 2-wire loaded cable network of the major capital cities.

Very quickly, the PMG / Research Labs totally re-engineered the 4-wire transmission path of the Crossbar technology to operate very economically with 2-wire transmission and this (ARF / ARE) technology was then rapidly rolled out across all major centres by 1970 and half-solved the (automatic) telecommunications connection problem!

The sticking point was about 3,000 Villages and Small Towns that had Sylvester Switchboards in the back of their Post Offices, or RAX huts nearby the Post Offices, or "nothing"! These localities needed to have small country automatic exchanges: something the Northern Hemisphere technologists had never considered because their demographics are entirely different to inland Australia.

In the mid 1960s, the PMG/Research Labs came up with a sub-ARF Crossbar technology that was effectively a rural / remote demographic subscribers switch

(ARK) that was parented into the Local (or Minor Switching Centre) ARF switch and be connected by Loaded Cable or a small Analogue FDM transmission system.

These ARK switches were installed in a container-like "Small Country Automatic Exchange (SCAX) huts and could connect up to about 500 subscriber / customer lines; but typically about 90 to 140 lines per hut.

By the mid 1970's. SCAX huts / ARK technology was very widely rolled out to virtually every Town, Village and rural Locality and it was this ARF / ARK Crossbar technology that literally removed manual Switchboard technology from Telecom Australia. The "tyranny of distance" was the lingering, unreliable, high maintenance transmission problem.

With the Metropolitan Junction pair copper cable (and USO) funded wide rollout of highly economical SMOF technology from 1984 through to 1993, virtually all the inland Inter-Exchange Network (IEN) transmission was now connected with SMOF cable. At the SCAX huts, Crossbar technology ARK switches were initially back-connected with Loop (signalling) Multiplexers providing 30 Voiceband channels per pair of SMOF strands running at nominally 2 Mbps (0.002 Gbps).

RRR - Almost Zero Maintenance and Still No Profit

This 30 channel "grading" facilitated very low network congestion connectivity (where before, congestion was a major customer complaint) in country areas. The comparatively high overhead costs[24] of Analogue Transmission were gone as the digital SMOF has virtually zero overhead maintenance costs and massive (unused) bandwidths.

In the late 1980s, recent advances in customer line interfacing technology using medium scale integrated (MSI) silicon chips eliminated mechanical switching and made the Line Interface purely electronic, very inexpensive and very reliable.

Customer (Electronic) Line Interface equipment replaced mechanical switching in a grand scale, and very cost-effective Remote Integrated Multiplexers (RIMs) were widespread rolled out in non-metropolitan areas (using the same SCAX huts as before - replacing the now aged Step-by-Step and Crossbar ARK equipment), making regional / rural and remote (Voiceband) telecommunications very low maintenance - and that meant highly susceptible to being profitable - which put the ever-flowing but unaccounted and massive TUSO Government funding in great peril if it was found out that these areas were not running at a massive loss.

In the early 1990s, Telstra made a major contract with Alcatel to provide the System 12 telephone exchange technology. This technology had 24? lines per Line Interface card and a direct interface that produced data streams. This technology was particularly "mass production" friendly and thousands of cards could be inexpensively manufactured daily.

The System 12 exchange technology moved into quickly replace the now ageing Crossbar technology and by the early 2000s the entire telephony network was electronic, solid-state and based on Voice on Internet Protocol (VoIP) with virtually zero maintenance nationally.

[24] http://www.moore.org.au/senh/2002/Aust_Telecomms_Network_01.pdf

The Advent / Domination of Mobile Telecommunications

The technology of Mobile Phones was always a sticky political problem, because this technology has evolved to bridge over Voiceband (as a Telephone), then included Narrowband (as Texting) and later included Broadband (as Internet connectivity).

As a commercial product line, Mobile Phones now provide a very wide range of combined facilities that can be (and are) marketed at a premium price.

Initial targeted marketing in the mid 1980s was aimed at the high disposable income people to use mobile phones as a prestige item - which turned out to be a dismal failure - because the early phones (bricks) were too large / clumsy to be a prestigious. These mobile phones proved in default to be a necessary tool for (mobile urban) trades people (certainly not the intended target market)!

In the early 1990s, with advanced Large Scale Integration (LSI) technology and Lithium batteries put into mobile phones, the physical size of mobile phones significantly decreased to about the size of phone handsets. The underlying problem was that the digital technologies used in GSM1 / GSM2 mobile phones had a "too narrow" radio (and digital) bandwidth resulting in very poor Voiceband quality. But - "Texting" was available as a very inexpensive option to making a fully priced (mobile) phone call, and "Texting" was virtually free to produce because it used CCS7.

In hindsight, the new technology of "Texting" as a new commercial retail product most probably saved the mobile phone infrastructure from total financial collapse!

The new GSM3 (G3) mobile phone technology had a substantially wider radio spectrum bandwidth with an associated significantly larger digital bandwidth enabling the Voiceband to be reasonably good quality, and have "Texting" too.

From here, the telecomms retail advertising / marketing / sales people targeted the majority of high disposable income as a prestige / fashion item, and mobile phone technology really took off.

From about 1995 until about 2009, Mobile Phone ownership rocketed where virtually adult in every major urban area has a (personal) mobile phone. Most larger businesses provided their staff with a (works) mobile phone. This is why there are more mobile phone (numbers) than the Australian population.

With the advent of touch-screen technology by about 2010 (and the advent of GSM4 (4G)) technology with a significantly wider radio spectrum and a much wider digital bandwidth capability; the now saturated mobile phone market re-invented (more accurately re-financed) itself with the majority of mobile phones being replaced by 3G / 4G touch-screen cable mobile phones that have Voiceband, Texting and Internet capabilities (and in colour too).

The added bonus "thrown in" with these new generation 3G/4G touch-screen mobile phones was the capability of Wi-Fi connectivity. Most premises-based ADSLx Modems / Routers from about 2005 already had Wi-Fi as part of their Local Area Network (LAN) capability, so that Printers and Laptops could connect without wires.

The hidden bonus was/is that a 3G/4G Mobile Phone with Wi-Fi can also connect to the Internet (and the phone network[25]) via the in-premises ADSLx (or Cable Internet, or FTTP Internet) Broadband Switch/Router (and connect phone calls) at a very reduced rate - and not have to use the expensive rates applicable to Mobile phones.

And the Regional, Rural and Remote have (almost) no ADSL

Considering pair copper to premises in major urban areas; the vast majority of these (>98%) have ADSLx Broadband connected. In the inland, the vast majority of premises have pair copper phone services **but less than 28% of the associated premises have ADSLx facilities in their Local Exchanges**.

This <28% compared to >98% figure for ADSLx connectivity is a massive discrepancy that is entirely caused by deregulation / privatisation of now very inexpensive essential telecommunications services based on (apparently isolated) geographic locations and associated potentially very low ROI from these geographic areas in comparison to the much higher density urban areas.

Deregulation and privatisation

The Government deregulated the telecommunications sector in the 1990s to develop an internationally competitive, low cost and innovative industry (Ross 2004). Telecom Australia was RENAMED ~~gradually replaced by~~ Telstra in 1992, and the Government began to licence competing carriers in the fixed and mobile services markets. During this period, the Government determined that Telstra would provide its services to all Australians at standardised prices and would be responsible for fulfilling the TUSO (DoCA 2007).

Telstra underwent partial privatisation in 1997 and became fully privatised in 2006. Since opening to full competition, the number of telecommunications services and platforms has greatly diversified. Twenty-one licensed carriers operated in Australia by the late 1990s, and 248 carrier licences are active today (ACMA 2016i).

[**NOTE:** *Virtually all these "competitive" carrier licences[26] are tiny transmission extensions off the main telecomms infrastructure to provide connectivity that otherwise should have been provided by the main carrier (possibly using the TUSO). These carrier licences are not "in competition" but in augmentation with the major infrastructure, so the previous paragraph referring to 248 carrier licences is extremely misleading. The chart on page 83 confirms there is really only one major telecomms infrastructure provider and the competitive infrastructure policy is really costing the Australians big time - proving that telecomms privatisation was a massive policy flop.*]

Since digital telecommunications technologies have very significantly evolved from the 1980s, a very wide range of digitally-based consumer and commercial product lines / platforms are now available, making telecommunications retail reselling a far more lucrative proposition than the highly inefficient and very expensive infrastructure competition business model.

Funding and bidding for the TUSO

As **competition** developed, the monopoly model of internal cross-subsidisation of TUSO services became more complex. **Competition** lowered prices, particularly in metropolitan markets. Price controls were also imposed on Telstra to prevent leveraging of market power in rural markets (DoCA 2007). Telstra was compensated for providing non-commercial services under the TUSO — funded by a combination of an internal industry cross-subsidy (the Universal Service Levy) and a direct payment from the Australian Government.

[25] Because the Inter-Exchange Network from about 2005 is now essentially "IP structured" and uses VoIP for Voiceband connectivity virtually everywhere (including in Broadband connections).

[26] http://acma.gov.au/~/media/Numbering%20and%20Projects/Information/Spreadsheet/Register%20of%20Licensed%20Carriers.xlsx

[**NOTE:** *In the above paragraph* ***there is fundamental mistake*** *where the word "**competition**" is incorrectly credited for what is really advancing "**technology**". (Refer to "TQM Chaos" above in this submission - showing how irrelevant the named references in the Draft Report really are, and how incorrect the Draft Report really is.)*

Competition has not lowered prices but substantially increased prices far in excess of the savings made from the economies of new silicon-based technologies (and the ensuing significant technology developments in digital transmission, data routing) that have combined to very significantly lower the operating costs and massively increase operating bandwidths at virtually nil expense. These new technologies had/have literally nothing to do with competition and everything to do with better engineering-based operational practices, that have subsequently made dramatic economic efficiencies - in the face of far more economical advancing technologies.]

In 1999, the Government established the 'Australian Universal Service Obligation Fund' to encourage competition in universal service provision. They identified two underserved 'net cost' regional areas to act as pilot projects, but failed to attract any of Telstra's competitors to provide this service (ACMA 2000). To become more technology relevant, the TUSO definition was expanded to include data and services to enable better access for people with disability. However, the digital data service obligation was later removed from the TUSO's scope.

> *From my professional experience in Telecom Australia / Telstra, once the Davidson Report (1982) came in, the mindset of business in Telecom Australia significantly moved from providing ubiquitous service standards to providing services based on potential Return on Investment (ROI). This "competitive business" mindset was totally overridden by immense technology advances to telecomms infrastructure at very little cost.*
>
> *As stated before in this addendum, the business efficiencies gained by implementing silicon-based technologies (particularly in the 1980s) was a real game-changer that radically reduced maintenance overhead costs and made what were major "cost centres" into potentially lucrative infrastructures, because the high overhead maintenance costs and associated operational costs were all but totally eliminated.*
>
> *When Telecom Australia internally restructured its management from State Boundaries to National Business Units in 1989, the USO funding became highly visible and was (as far as I know) re-directed into "cost centres" to ensure that this funding would not be in jeopardy of being lost.*

TUSO funding has varied significantly over time, reflecting the different modelling approaches to calculate its costs (Fletcher 2015). The use of detailed cost models in estimating the cost of the TUSO was largely discontinued, and (prior to 2012) the Minister for Communications, based on advice from the Australian Communications and Media Authority (ACMA), set the annual level of TUSO funding (Coutts 2015). In 2012, the USO levy and the National Relay Service levy were combined to create the 'Telecommunications Industry Levy' (TIL). The agreement set the annual level of TUSO funding (and the Government's contribution) to a fixed amount, significantly higher than the average received in years prior (Fletcher 2015).

Economical Restructuring (this also needs including)

In the 1980s, many western sub-government telecommunications infrastructures were privatised for capital sector profit. This new wave of "competition" rode on the back of several very substantial silicon-based technology developments that more

than covered the immense social and government costs of supporting fundamentally uneconomic competiting (multi-duplicated) telecomms infrastructures.

By the early 2000s many leading countries were retreating from the then massive uneconomic costs of multi-duplicated infrastructures in competition. These countries have now restructured their competing telecommunications businesses into one national infrastructure with multiple competitive telecommunications retail resellers.

This far more economy-of-scale non-duplicated telecommunications infrastructure arrangement has no requirement for any service obligation and/or associated social services funding, and has a healthy telecomms retail reselling component on their respective stock markets.

It is high time that Australia followed suit - dropped the USO and all associated fringe payout bribes[27] and physically separated Telstra so that it can get on with being the prime Retail Reseller of bundled telecomms services.

D Affordability and the NBN (page 317)

The introductory paragraphs in this section consider "Internal Accounting" - i.e. the cost of the essential service of (Broadband) telecommunications connectivity. This is typically less than half of the overall economic equation and the majority accounting in the (essential service of telecommunications) equation relate directly with "External Accounting".

In this case, External Accounting includes the (monetary) value of the increased standard of living facilitated by provisioning the essential service of (Broadband) telecommunications connectivity.

Data Sources for the "External Accounting" (monetary) values are rather straightforward to gather because these values relate to the costs of other Federal Government (Departments) providing support that is not generally provided to readily provided to the remaining general public that already has Broadband telecommunications infrastructure "at their doorstep".

Data sources should therefore also include the differential costs of:

- Social Services,
- Medical (including mental health / depression),
- Drug addiction (alcohol and pharmaceutical products are inclusive with illegal drugs),
- Educational facilities, productivity
- Farming / Grazing / Mining productivity.

With these data sources included the (differential) "Internal Accounting" resultant of "Internal Accounting" costs pale into insignificance.

Counting Service Providers not Providing Competition

On page 317 according to www.whistleblower.com there is a number of broadband packages offered by some 36 "Service Providers".

[27] http://www.moore.org.au/senh/2010/NBN%20Business%20Case%202.pdf

APPENDIX

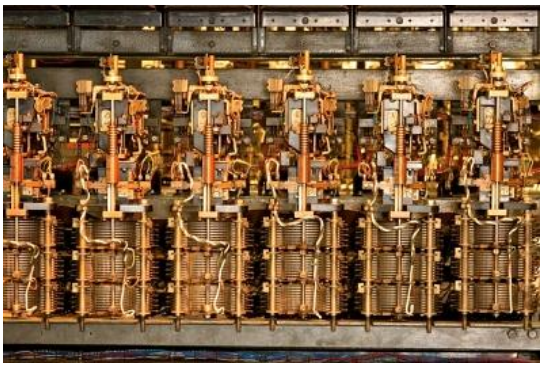
Step-by-Step (SxS) Basics

The basics of Step-by-Step (SxS) technology is that the "Bi-motional Selector Switch" had a vertical (stepped) motion controlled by the person dialling the required number (by "pulse dialling"), and then a rotary (stepped) motion controlled by the availability of "Trunks" or "Junctions" to the next switch.

Mechanically, this process of "stepping" was electromagnetically controlled.

The vertical stepping was by a vertical ratchet with a stepped movement of about 6 mm and there was nothing "gentle" about it!

The rotary stepping was about 5 degrees so that in about a nominal 160 degree arc this provided about 10 separate optional paths out of the switch (these figures are open to correction - depending on the brand / model / use etc.). The path required three wires "a", "b" and "Private".



The above left is a picture[28] of part of a bank of bi-motional switches. Note the three banks of contacts in the lower portion of the picture and the extensive mechanical / magnet structure in the upper portion to manipulate the switch contacts.

The above right picture shows the extensive wiring (down and into the left of) the back of the switch contact area, and the relays to manage the switch actions.

So, in simple terms, the person dials in a number and the switch responded by stepping up (vertically) according to the number dialled (for example 7). After a brief pause, the rotary control took over and stepped the switch blades around in a circular stepped sequence, looking for a "Private" connection that was not active.

SxS Maintenance

These switches were very high maintenance, requiring "oiling and dagging" on a regular weekly basis - so this was a full time job in virtually every automatic exchange location.

The stepping motion was physically stressing on the spring tensions and on the ratchet mechanism and on the bearings themselves. This usually required monthly checking and re-tensioning of the stepping mechanisms - and careful replacement of broken and/or work components on a regular (monthly or more often) basis.

[28] http://m.inmagine.com/image-ptg01384840-Strowger-switch-(aka-Step-by-Step-or-SxS)%20historic-telephone-switching-system.html

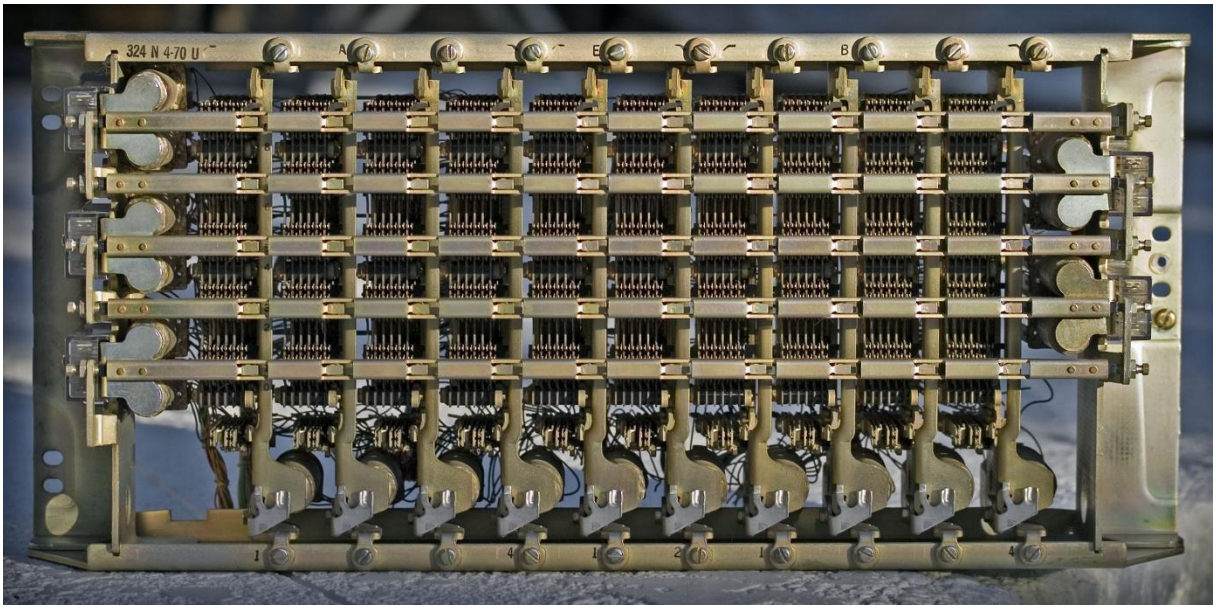
Copper is a soft and ductile metal by when vibrated (for a few years) becomes crystalline and brittle. So not only did the leads connecting the rotating switch wipers become fragile and break, but the switches were in rows and horizontally connected by banks (many multiple rows) of common wires. These wires commonly broke near their soldering terminals and fixing one often resulted in a few more breaking off.

The "low maintenance" time of thee switches was really only 10 to 15 years, but because of the costs of the depression and World War II, most of these SxS switches were used for over 40 years.

Crossbar Basics

The Crossbar switch[29] was elegantly revolutionary in that it had very little mechanical movement compared to a Step-by-Step switch.

Basically, one of several horizontal bars was slightly rotated about 10 degrees (very low movement and comparatively little inertia) by pairs of electromagnets. These bars have small steel "pins" along them that when deflected (by the rotation of the horizontal bar(s)) got in the way of vertical relay movements - so when a selected vertical relay armature is activated, the only set(s) of relay contacts to be connected were associated with that of the slightly rotated horizontal bar(s) set of contacts.



In comparison to Step-by-Step, Crossbar telephone switching technology was very low maintenance and very compact.

The heart of Crossbar technology were large matrices of relays that formed simple "registers" (far more simple than an electronic hand calculator). The registers / markers were "common equipment", so was switched in to facilitate switching a call connection and then switched out to be available for another call connection.

Crossbar technology is as close as you would get to an electro-mechanical (micro) computer controlled telephony switching (using hundreds of relays for logic control).

[29] http://eti2506.elimu.net/Cross-bar/Crossbar.html

With advances in medium scale integration (MSI) in the mid-1970s the register function was "re-engineered" by Telecom Australia engineering specialists to replace the electromechanical relays with solid-state electronics, very significantly increasing the operational reliability and virtually eliminating ongoing maintenance for all but the physical crossbar switch itself.

The metropolitan tandem and country minor switching centre (MSC) crossbar ARF exchanges (at the "district" level of inter-exchange network switching) with the highly reliable electronic register were renamed as crossbar ARE exchanges.

Analogue Transmission Basics

With analogue telephony, the continuously varying acoustic speech intensity is converted into a direct equivalent electrical power intensity which is then transmitted through a pair of wires (and switches) to the distant end where the continuously varying electrical power is converted to an equivalent acoustic energy that the listener at the distant end can hear the speech.

With analogue telephony, the Voiceband is nominally limited between 200 Hz and 3400 Hz with the "Channel" bandwidth 4000 Hz (4 kHz) increments.

Digital Transmission Basics

With digital telephony, the continuously varying acoustic speech intensity is converted into a direct equivalent electrical power intensity that is then regularly sampled and approximated (with quantisation errors) into digital values that are transmitted to the distant end where the regular digital samples are re-constituted (with more quantisation errors) to an approximate continuously varying electrical power that is converted to an equivalent acoustic energy that the listener at the distant end can hear the speech.

Digital data is usually transmitted serially (one after another) as serial binary bits that are usually structured as 8 bit blocks forming a Byte or larger structures commonly called data "Word(s)". There are 256 different Bytes that are (usually) used to transfer Digital data as printable characters or as control elements.

With higher level digital transmission, the data Bytes are often put together as fixed length digital Words, and in reception checked (and corrected) for errors and deconstituted back as Bytes or Words as they were as when transmitted.

As Digital data is received, it needs to be accurately synchronised so that the receiver can "clock" and sample the incoming digital stream to accurately reconstitute the transmitted bits into error-free Digital data.

With digital telephony, the Voiceband is nominally limited between 200 Hz and 3400 Hz with the "Channel" bandwidth nominally 64 kbps and clocked at 8 kHz. To minimise bits, noise and quantisation errors, the sampling is logarithmic, not linear.

With Voice on Internet Protocol (VoIP), considerable bandwidth savings (say 75%) are made because voice-related data is sent only when a person speaks.

Electronic Switching Basics

With electronic (digital) switching, the data is nominally sent in "packets" or "datagrams" as a stream.

Generally data packets are "hard wired" connected or directly switched through a (silicon logic gate) digital "multiplexer" or microprocessor by external control very much like that used in a mechanical crossbar switch. These data packets are generally without headers and footers of any addressing significance (or without any headers and footers at all). Data packets have virtually nil data overhead and can be transferred very quickly - but the connections are usually hard-wired or pre-programmed so the addressing versatility is very limited.

Datagrams are the next generation of data transfer and these usually have a defined block length plus each "datagram" has a header and as footer - much like a postal envelope. The Header contains the intended address and some detail about the size of the datagram. The Footer is like the sticky envelope seal and contains the end notification and usually a contents checking value (or series of value).

When a datagram enters a switch, the switch is usually "firm-wired" to one or more specific exit ports - usually under external control. So the datagram enters the switch, the header is read and understood as the datagram is saved; the switch then forwards the complete datagram through to the required port(s).

When a datagram enters a router, the router listens to the header and interprets the address and internally switches that specific datagram to a specific port or number of ports (on the fly), but a router usually encapsulates the existing datagram and sends it through and/or strips of an encapsulation and either re-encapsulates it or sends the new datagram out - with a new header and footer to go to a new address.

There is a large family of data transfer rule sets (protocols) that facilitate the transfer of data (as a datagram / packet). Internet Protocol (IP) is one of a "small family" of rules (called a "suite") that facilitates the transfer of datagrams / packets between differently addressed networks - hence the term Inter-Network Protocol.

The Subscribers Metering Solution

The automatic (dialling directed) switching technologies of SxS and Crossbar brought with them the technology of electromechanical metering, where customers calls were registered / counted. These meters had a front about the size of a postage stamp and far less labour intensive than millions of paper slips to be manually accounted.

The only way to transfer the data from electromechanical meters was also by hand; by (mass) photographing the meters and then transcribing the numbers, then calculating the increase in count and then transcribing that to a cost and putting that on each customer's bill. This process was also very labour intensive; but it was far more efficient than millions of paper slips!

In the mid 1970s, with recent advances in large scale integration (LSI) of solid-state electronics, the meter registering process was gradually replaced by "pseudo-electronic" metering, where the metering wires were cross-connected (wired) to a specially "reengineered" micro-processor interface that registered and counted the pulses (and the time / date) and saved all this data locally, then under remote control (through the new and developing Service Control Network (SCN) transferred this

data to a central processing facility for further computer-based accounting and processing to the customers.

This technology advancement in (electronic) metering techniques had absolutely nothing to do with competition and everything to do with better methods and practices (i.e. standard infrastructure business operations). The manual methods were very labour intensive, was highly prone to human error, and consequently was the bane of existence for management; because a very high proportion of customer complaints were about (traditionally very expensive) phone call costs.

Electronic metering made massive productivity improvements and in business efficiency where the number of people involved in the metering and billing process was significantly decreased. Not only was the accuracy many orders of magnitude better, but systemic problems of "stuck meters" and incorrectly allocated meters were identified and corrected (which also cause of a string of "complaints" for a few of those that had never been charged for phone calls for many years).

The introduction of (Ericsson AXE) Digital telephony Switching in 1980 already included electronic metering - so these combined metering technologies were to a very large degree common, very efficient, highly accurate and facilitated a range of retail products not previously available with electro-mechanical metering.

The "Integrated" Inter-Exchange Network

Circa 1980, the introduction of digital transmission over pair copper using 2 Mb/s regenerators in the Inter-Exchange Network (IEN) infrastructure was a short-lived success. This transmission technology was limited by unexpected high maintenance and in 1985 a fatal flaw in the redesign of the regenerator's 2nd generation integrated circuits caused this technology to be too unreliable and had to come out.

With digital switches now in all larger urban areas, Telecom Australia was in a bizarre situation with about 400 metropolitan exchanges mesh connected with "digital" pair copper and the sudden realisation that SMOF cable was low cost wide bandwidth and an ideal replacement for "digital" pair cable technology. The cost of SMOF cable was very largely offset by the sale of many thousands of km of now redundant pair copper cable from metropolitan conduits and the conduits meant no trenching costs; so this very pleasant situation saved Telecom Australia many billions of labour costs.

Now the country (non-metropolitan) situation... By 1985 many Regional cities had their (mechanically switched, analogue 4-wire transmission) ARM exchanges replaced by (digital switched, digital 4-wire transmission) AXE exchanges with SMOF (digital 4-wire) transmission connections from the State Capital City switches.

The rest was an unfortunate "dog's breakfast" where the (mechanical switched, analogue 4-wire transmission) Minor Switching Centres (MSCs) in minor country cities connected by (analogue 4-wire) Frequency Division Multiplex (FDM) transmission systems and the (mechanically switched, analogue 2-wire transmission) ARF / ARK exchanges connected under that - largely connected by smaller (analogue 4 wire transmission) FDM systems or (analogue 2-wire transmission) Loaded Cable!

This Inter-Exchange Network (IEN) structure was a minefield for extremely poor Voiceband performance that had a "ripple-down" effect and some of the tens of

thousands of standard 2-wire / 4 - wire (hybrid) interfaces had systemic impedance mismatches causing occasional howling and excessive echo like never before).

With the realisation (1986) that digital Plesiochronous Digital Hierarchy (PDH) transmission over SMOF cable was extremely reliable, it was a no-brainer to replace the loaded cable being used as the ageing transmission medium to out-posted rural / remote ARK switches. But this is costly and there would be several thousands of km of SMOF cable to be ploughed in.

Similarly, Minor Switching Centres (MSCs) were connected by smaller analogue FDM transmission systems from the major city 4-wire transmission AXE switches. These FDM systems also had a rather high maintenance overhead. The major systemic problem here was that the 2-wire / 4 wire hybrids were incorrectly matched. Nationally correcting this problem significantly reduced howling and echoes - but it was clear that there would have be several thousands of km of SMOF cable to be ploughed in country areas to convert the transmission to PDH from FDM.

With the first (and very big) MEL-SYD (PDH) digital transmission link in place and commissioned by late 1996, it was full steam ahead to plough in many thousands of km of SMOF cable in country (regional / rural and remote) areas on a concurrent and continuous basis for seven years through until mid-1993 (when everything dramatically stopped).

Circa 1987 onwards, in SCAX huts, ARK switches were now back-connected with (2 Mb/s PDH) Loop Mux (2-wire analogue Voiceband) transmission equipment that was directly connected to (new) SMOF cable running at (only) 2 Mb/s to the (soon to be phased out) parent analogue ARF or new parent digital AXE exchange.

Because of the 30 available Voiceband channels per two strands of SMOF to the parent switch site, facilitating extended alarms was easy and in many cases, the switch grading in the rural ARK exchanges could be radically simplified (1987 onwards) to make these remote exchange sites very low maintenance.

The next generation of rural exchange equipment, a RIM, (circa 1988) literally replaced many ARK switches overnight. A Remote Integrated Multiplexer (RIM) is a solid-state based Line Interface Card (LIC) - identical to that used in mainstream local electronic (digital) exchanges - directly back-connected to a SMOF transmission terminal - all in the one rack of equipment; complete with remote monitoring, supervision and control.

This RIM technology proved to be extremely versatile (and very inexpensive / low maintenance/ remote control) and was also used in many towns, suburbs and metropolitan areas to very inexpensively augment the existing local exchange line count as the number of active phone lines extended towards 10 M in Australia.

By 1993 the Integrated Digital Network (dogs breakfast) was all over, and the vast majority inter-exchange network (IEN) was entirely digital. While all this (virtually zero maintenance digital transmission digital switching replacement of mechanical switching / analogue transmission was going on, there were two other major technological revolutions quietly happening in the background (Common Channel Signalling and Remote /Centralised network management).

Common Channel Signalling

With mechanical switching, the standard privacy control was by a third wire (called the "private") that when earthed, tells the rest of the switch hierarchy that the pair of wires associated are being used so that should not be connected as this will cause switch crosstalk between unintended telephony parties.

With analogue transmission there are a variety of methods to convey the "I'm busy" message to other channels, but basically this is one of several channel associated signals (CAS) that accompany a transmission path.

Most of the modern frequency division multiplex (FDM) transmission systems (based on 4 kHz channel frequency steps and with a channel bandwidth of 200 Hz to 3.4 kHz) include an "out of (frequency) band" tone at 3.825 kHz that was used to convey the "I'm busy" and several other time-coded messages to hold the call up and sequentially drop out the call after the caller has hung up.

With the advent of Plesiochronous Digital Hierarchy (PDH) transmission systems based on a 2.048 Mb/s clock, there are 32 channels where one channel is used for timing synchronisation and another channel is used for "CAS" signalling so the remaining 30 channels can be used for synchronous 64 kb/s data transfer (which is commonly used for Voiceband telephony, or direct Integrated Digital Services Network (ISDN). So each of the 30 channels has its own CAS signal channel.

This PDH structure works extremely well with most PABXs and other Voiceband equipment like Loop Muxes (that have 30 Voiceband channels), Channel Muxes (that have 30, 4-wire Voiceband channels each with their own signalling), and most first generation Digital Exchanges - because these switches work in pseudo Voiceband technology based on 64 kb/s .

The next generation digital exchanges moved all the signalling to one common (2 Mb/s) channel and leave the remainder of the many 2 Mb/s streams for speech paths. This concept takes a little re-thinking to get the picture. The 2 Mb/s stream has 32 channels of which one is reserved for timing synchronisation, so the remainder 31 channels are available for Voiceband / Data transmission or for Common Channel (No7) Signalling (CCS7) .

With CCS7 structure there is no requirement for a 31st channel for CAS so the 2 Mb/s streams associated with CCS7 have 31 channels of 64 kb/s (not 30 channels).

One 2 Mb/s CCS7 stream between two switches can easily handle the data for say 400 switched Voiceband channels (and a whole lot more) - and this is really where the story starts. Because the digital telecomms (telephony-based) switches can "talk" with each other they can pass on switch connection (occupation) statistics, that can be used by associated switches to re-direct traffic away from a congested switch.

Taking this further, the Telephone User Part (TUP) network common channel switching data can tell of pre-allocated switch paths, call holdup time, the A and B (etc. numbers if calling is transferred via a 13xx or 008 etc. arrangement, metering data) and a whole lot more on the fly.

The CCS7 also carries network management data and can also carry information about mobile phones (e.g. changing radio base stations, their signal strengths etc.),

network capacity (e.g. available transmission systems, health of transmission (bit error counts), blocked circuits, etc.)

By monitoring the CCS7 data and displaying / analysing this to get CCS7 information and transferring this to a common location - a wealth of "network management" can be very efficiently done with an absolute minimum of specially trained staff.

Major labour intensive processes (like metering and billing) that previously took many thousands of people can be very efficiently transferred through the CCS7 signalling directly into dedicated computers with extremely low process errors and very inexpensively (and very quickly) provide comprehensive billing details to customers.

Because CCS7 is almost instantaneous this live (network) CCS7 data could be monitored and correlated with relatively simple software routines to provide a wealth of information (when analysed) that previously was totally impossible.

Forensic call tracing, primarily used to identify faulty electromechanical switches usually took an hour or so to back track (especially if the fault was in another exchange building several kilometres away). With CCS7 TUP monitoring and analysis, this data was available as bulk data on the hour for hundreds of thousands of calls - easily over 30,000,000 call traces per day (for a rather limited part of Australia's telecomms network)!

Using special software from Netmap[30], this (complete) call data could be very easily and quickly thrown up on a screen and calling patterns identified en-masse. If a particular number is of interest, calling patterns to and from that number could be very quickly called up (and historically traced too) and identify groups of people - and when and where they are - names, addresses, family, business, gang, etc.

All these competitive advantages came through from a long list of continuous gradual advances in digital telecommunications technologies and associated disciplines that when put together over a few decades totally repositioned the nature of telecommunications from a massive overhead small product range essential service to an essential service that now had very little labour overhead but a focus of essential services provided in a wide range of (somewhat) discretionary products.

Centralised Network Management

In the early 1960s when the Small Country Automatic Exchange (SCAX) huts using (Ericsson-based) ARK Crossbar electromechanical technology was being developed in Australia, the realisation became apparent that if alarms could be transmitted (extended) to a more central location where technical staff were present, then the overall Quality of Service could be maintained without having permanently out-posted technical staff at or near these rural exchanges.

The solution came in the form of using a "spare" Voiceband channel that was reserved for two alarm circuits. So, having a small number of Voiceband channels from the SCAX hut (ARK exchange equipment) to the Local Exchange or Minor Switching Centre (District ARF / ARE Exchange site) provided the facility of "extended alarms" from these remote SCAX huts without requiring permanently out-posted staff in these locations. Also, the overall count of specialist trained technical staff count was reduced, significantly reducing the overhead costs.

[30] http://netmap.com.au/crime-investigators/

This technical strategy was very successful because these SCAX huts often could operate alarm free for upwards of a month (or two) without the need for maintenance staff to be called out. So proactive maintenance could be implemented, further minimising the need for urgent call-outs and minimising major outages.

In the background world of telecommunications network maintenance from about 1970 there was an internal push to extend alarms from a wide range of exchange equipment to centralised locations (e.g. to a single floor in a major multi-story building, and/or to a control location for a major transmission system).

The reasoning was simple in that all the big exchanges required 24/7 operational staff and this was very expensive. By physically extending the alarms to a centralised location in a major exchange building then the other floors did not require operational staff 24/7 and a small core of operational staff could operate each major exchange building. The minor exchange buildings could be left with normal daytime staff because in the overall scheme major overnight faults were very rare, and extremely rare in minor exchange sites.

By 1980 in Telecom Australia, this internal research and development work was matured in this area, and a range of microprocessor-based alarm monitoring and extending facilities were in place for most switching and transmission equipment.

Virtually all the new PDH transmission equipment and the new AXE (and Nortel DMS) switches included internal remote alarm and monitoring facilities and all this had to be pulled together with pre-existing local and extended alarm (and control) systems.

Te introduction of the new Common Channel Signalling (CCS7) technology came about in 1983 which radically increased the scope of extended alarms to extended network switching, extended transmission performance and extended alarm data.

These combined networks became known as the Service Control Network (SCN) by about 1985 - but it has a way to be developed to be truly national.

As new technologies came on board these transmission / switching / routing, power / batteries, air conditioning, entry alarms etc. technologies all had digital interfacing that facilitated being connected to and through the SCN to facilitate a very efficient total telecommunication infrastructure.

The grossly inefficient part of this telecommunications infrastructure was caused by competition where duplicate (competing) networks were set up in geographically (near) identical locations to perform virtually the same function.

In these cases the "economy of scale" massive efficiencies are heavily crippled by totally unnecessary multi-duplicate infrastructures that serve no purpose other than the strip Australian wealth.

The ACCC and associated Government Departments that prophesise "increased (infrastructure) competition" have an awful lot of explaining to do - because competing infrastructures do nothing to build Australia and everything to damage / cripple Australia's economy at the expense of other countries that globally manufacture and sell telecomms equipment at Australia's expense.

Following the national Telecom Australia executive management restructure in 1989, the entire Inter-Exchange Network (IEN) finally came in under one Business Unit and the network control centres were gradually transferred to a much smaller set of larger "Operations Centres".

The big breakthrough started in about 1990 with the use of Internet Protocol connectivity through the totally isolated SCN. This meant that instead of simply alarms being sent into the Operations Centres (by IP), control could be sent out to reset and re-configure equipment from the Operations Centres.

This added functionality also significantly lowered the amount of highly trained maintenance staff required because not only was the digital equipment virtually zero maintenance, but the amount of early digital switching / transmission / air conditioning / battery / power was now being retro-fitted with digital (IP) control interfaces that could be remotely connected and remotely control virtually all telecomms associated equipment.

In 1995, the next technology breakthrough was the national restructuring of the control centres to one "Global Operations Centre" to manage the entire national (Telstra) Inter-Exchange Network (IEN). This was a natural technology progression that made the "economy of scale" network infrastructure management both extremely efficient, highly effective and also significantly increased network reliability.

Competition and Efficiency

The dropping of telecomms prices had absolutely nil to do with competition and everything to do with gradually advancing (silicon-based) technologies that came together making what were extremely expensive telecommunication overheads to become virtually zero.

Competition when "increased" is economically very "efficient" (in economic terms "efficient" means "full employment/use (of human resources)[31]" - and specifically does not mean "less costly to the end user"). In general terms "efficient" means minimum wastage of energy. In engineering / physics "efficiency" is calculated as the ratio **power out / power in.**

In this Draft Report, the word competition is very ineptly interchanged with technology, and consequently most academic journalists get it totally wrong by prophesising competition as the savings when it was really a radical change in technology that has absolutely nil to do with competition and everything about "building a better mousetrap".

Technology and Productivity

Service Quality is a direct relation to intrinsic equipment reliability where the MTTF (Mean Time to Fail) has changed from a few weeks / months with valve / mechanical technology pre 1970 to over 3000 years with solid state digital technologies.

In Australia, since the introduction of digital switching and digital transmission (circa 1980) plus the later rapid introduction and promulgation of Single Mode Optical Fibre (SMOF) technology (1985 - 1993), telecommunications maintenance zeroed resulting

[31] www.investopedia.com/terms/e/**economic_efficiency**.asp

in very profitable Voiceband services. The (1994) introduction of Synchronous Digital Hierarchy (SDH) very significantly increased the available bandwidths replacing the existing PDH infrastructure making telecommunications again far more profitable.

Creation of the Internet Protocol (IP) in the late 1970s from digital packet switching technologies took several years to develop into a mainstream long-haul wholesale transmission product that (circa 2000) replaced dedicated Voiceband with Voice on Internet Protocol (VoIP), dramatically decreasing Inter-Exchange Network (IEN) route occupancy. IP technology also facilitated a new wide range of "digital" products, and introduced the concept of ubiquitous Broadband connectivity through the IEN with virtually zero maintenance Routing Switches utilising IP over SDH for very inexpensive (and very wide band) long-haul digital connectivity.

Broadband connectivity in most Customer Premises is now primarily via ADSLx over pair copper as part of the Customer Access Network (CAN) into the IEN infrastructure. Personal Mobile Devices are now Broadband compatible and connect via SMOF back-connected Dario Base Stations into the IEN infrastructure.

Australia's HFC Stupidity

In 1992, word was out that Pay TV on Hybrid Fibre Coax (HFC) was the next big market product. Optus and Telstra started virtually simultaneously rolling out HFC infrastructure in fierce competition, 7 days per week for about 18 months. Each covering each others' new territory and special (internationally manufactured i.e. not manufactured in Australia) equipment being rush purchased / flown in / delivered / installed / commissioned.

> *For those that have never been involved with Project Management; if the project time is decreased by 10% (or competition is increased by 10%) the costs rise by (at least) 20%. These costs include physical overtime for a very wide range of professionals and field staff, and the purchasing / hiring of extra equipment at far greater than "economy of scale" prices that would normally be negotiated and contracted to be well below nominal list price.*
>
> *The next 10% increase in "competition" costs considerably more as far more people will be required to work longer overtime, and process errors creep into the overall project causing massive cost blowouts.*

In round figures, Telstra spent about $2.5 Bn and Optus spent about $2.2 Bn. There was an 85% overlap (duplication) in geographic network coverage. Only about 80% of the total metropolitan (Sydney, Melbourne, Brisbane / Gold Coast, Adelaide, Perth, Hobart) streets were installed with HFC infrastructure.

Breaking this down: In total, about $4.7 Bn was spent in this fierce infrastructure competition. There was an 85% duplication of infrastructure, so if this was to be 100% then the cost would have been $4.7 / 0.85 = $5.529 Bn. If this was to be 100% metropolitan coverage then the total cost would have been $5.529 / 0.80 = $6.912 Bn or a further $2.21 Bn; or about $3.456 Bn for Telstra and for Optus.

In other words, if one infrastructure business (Optus or Telstra) had rolled out this HFC infrastructure under fierce competition climate for a 100% metropolitan coverage with nil geographic duplication, this would have cost only $3.456 Bn or about 74% of the total price, saving about 26% or about $1.2 44 Bn; but it gets worse - much worse as this saga of failed competition unfolds.

Because this HFC infrastructure was rolled out in fierce competition, there was plenty of overtime costs and plenty of HFC equipment purchased at extortionate rates (not at "economy of scale" purchase prices in massive bulk orders), so these costs can be fairly simply broken back to a properly run infrastructure rollout:

Split the fierce competition single HFC infrastructure cost 50:50 for labour and materials. We get $1.728 Bn; now cut the labour costs by 50% = 864 M, and the materials costs by 60% = $691 M and the total cost for the 100% HFC coverage of all the metropolitan demographic would have been $1.555 Bn.

So without fierce competition and one infrastructure business rolling out the infrastructure, the HFC infrastructure would have cost about 22% of the extrapolated ($6.912 Bn) price for the 100% metropolitan areas coverage. Considering an 80% un-duplicated metropolitan areas coverage, then the (un-duplicated) project cost would have been about $1.244 Bn, instead of the nominal $4.7 Bn, or about 26% of the fierce competition costs.

But it gets much worse! Because the HFC was rushed out in fierce competition (the competition that the ACCC keeps on bragging about without any realistic proof to show the utter foolishness of their mindless mantra), the HFC infrastructure was installed with a minimum of connectivity (yes it could "pass" premises but cannot connect to a high proportion of these potential customer premises because the line length is too long for the minimum amplifiers installed).

> *The "dips" in the coax are vacant locations for Line Amplifiers to go in and cover for the excessive attenuation. This HFC infrastructure is a dud - all thanks to the ACCC and its "competition fixes everything" mantra!*

As it turned out, there was only one Pay TV content supplier - so my educated guess is that the person involved at the top of this organisation most probably whispered in both Telstra and Optus CEO ears within a day or so of each other and watched the HFC Pay TV network be built under fierce competition.

In 1999 the technology of Cable Internet became available and the Internet Broadband Modems were geographically centrally located in every State Capital City to co-inside with the Pay TV infrastructure. My recollection is that this technology had the capability of about 33 Mb/s downstream and about 0.25 Mb/s upstream. In comparison with the new technology of ADSL, which was limited to about 6 Mb/s this Cable Internet connectivity was "light years ahead".

The big problem was that ADSL technology could reach every premises (if the Digital Service Line Access Multiplexer (DSLAM) was installed in the local exchange building so the telephony-engineered pair copper could be used). With HFC, because of the fierce competition resulting in rather low percentage of premises being able to be attached without significant re-engineering of the HFC infrastructure, and the rather low take-up of Pay TV (generally in Australia); Cable Internet was not openly advertised (but about 1 M premises have Cable Internet).

In 2004/5, there was a temporary political move to physically separate Telstra into commercial retail and infrastructure / wholesale. I understand there was a Telstra Board decision was to re-structure the Cable Internet infrastructure to be able to (if suddenly required) connect far more premises with (Broadband) Cable Internet

(because the current equipment structure was in serious physical racking congestion).

In 2005/6 a Telstra national project costing about $2.5 Bn totally rebuilt the Cable Internet infrastructure (Broadband Routers and associated Service Control and Edge Routers, about 12,000 km of SMOF cable strands, power supplies etc.) into 400 metropolitan local exchange buildings all back-connecting into with SMOF pairs of main Internet Router / Switches in two parent sites per Capital city.

This Broadband infrastructure could handle up to about 7 M premises (if the HFC infrastructure was properly engineered and not rushed out in fierce competition), but has not been substantially changed since then - apart from replacing some Broadband Routers with newer versions - to simplify the then proposed fleshing out of the thin Broadband Router infrastructure.

In 2016 the NBN co (stupidly) purchased the HFC infrastructure from Optus for about $800 M, if I recall correctly. In my opinion Optus should have paid the NBN $800 M to take it this infrastructure off their hands. I was extremely un-surprised to hear that the NBN has decided that refurbishing the Optus HFC infrastructure is a "cost centre" and they are dropping that option for metropolitan areas.

We are all waiting with "baited breath" to find out which infrastructure will be the next to have its costs blown out of all proportion because of totally unnecessary and unwarranted (infrastructure) "competition" - no thanks to the ACCC and other Federal Government Departments that reference the ACCC to promote "competition" without understanding that competition has its place in retail reselling and nowhere else.

Conclusion

From my professional and historical knowledge of telecommunication in Australia there is so much incorrect with this Draft Report that I would have to write an entire report to correct the thousands of obvious errors and insinuations that are frankly very misleading and draw totally incorrect conclusions. I have had to stop here...

If you have the time I will make my time available to work through this Draft Report with you all and correct it for Australia and for future Australia.

Malcolm Moore JP BE(Elect.)
15-Jan-2017