

Submission to the Panel conducting a Cost-Benefit Analysis and Review of Regulatory Arrangements for the National Broadband Network

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1 Introduction

1.1 Thank you for accepting this paper as a submission to the Panel conducting a Cost-Benefit Analysis and Review of Regulatory Arrangements for the National Broadband Network

1.2 This paper summarises the issues that lead to the formation of the NBN, identifies the core problems and attempts to answer the questions posed in the Regulatory Issues Framing Paper¹.

1.3 As a general principle, this paper will assume properly function market mechanisms are the preferable method of resource allocation, and their application should be maximised. i.e. an “ideal market” will deliver optimal resource allocation.

1.4 Externalities

1.4.1 Generally speaking, the purpose of a cost-benefit analysis of government interventions is to quantify and assess the external benefits and compare that with the direct and indirect costs. I find it curious the issues paper appears to ask no questions that would aid in the NBN Panel of Experts² (the Panel) in quantifying these external benefits.

1.4.2 Despite the lack of direct questions re externalities, I have no doubt the panel will inundated with submissions a myriad of external benefits for structuring the NBN and it's regulation in a particular way.

1.4.3 I argue this is the largest single structural problem with NBNC0: that as an irrational monopolist, and exactly how irrationally it behaves is determined by political and bureaucratic processes, this cost benefit analysis process among them.

1 http://www.communications.gov.au/__data/assets/pdf_file/0011/211016/Regulatory_Issues_Framing_Paper.pdf

2 http://www.communications.gov.au/broadband/national_broadband_network/cost-benefit_analysis_and_review_of_regulation

- 1.5 This paper will make no attempt to try and quantify any external benefits, other than to note here there almost certainly are some, and these are almost certainly non-trivial.
- 1.6 Instead, this paper will focus on models intended to provide (as much as practical) effective market mechanisms for future resource allocation, and costing these against politician's guesses at what optimal resource allocation might be.

2 **Defining the Problem**

2.1 **Telecommunications as a Natural Monopoly**

2.1.1 Traditionally Telecommunications is regarded as a natural monopoly industry

2.1.2 Telecommunications is also regarded as an essential service

2.1.3 For these two reasons, every jurisdiction on earth makes some form of intervention in their telecommunications industry.

2.2 **Telecommunications in Australia: a textbook economic monopoly**

2.2.1 Australia's approach to dealing with this was originally nationalisation.

2.2.2 In the 1990s partial deregulation and privatisation was attempted to driver efficiencies in the industry.

2.2.3 During the 2000s ACCC regulation attempted to create more competitive market conditions in some sectors of the industry.

2.2.4 There is a widespread perception that Telstra has acted as a “rational monopoly” and, however efficiently, has both over priced and under serviced the market³.

2.2.5 The NBN intervention was to create a new government owned alternate monopoly that could be directed to act irrationally, being more in the national rather than the intervener's interests.

2.3 **Lack of affordable services**

2.3.1 There is a widespread perception that broadband services in Australia are both inadequate, overpriced and insufficiently widely available.

2.3.2 Working assumption #1⁴ is a political expression of the lack of broadband services available.

2.3.3 OECD Comparisons support this assertion⁵, with Australia in the bottom half of all OECD countries in almost all broadband categorisations.

2.3.4 Australia is however a leader in wireless broadband usage, in part at least to unavailability of adequate fixed line services.

3 See Appendix A

4 “Broadband services providing defined minimum upload and download data rates should be generally available to all end-users, along with such other broadband products as market participants (including NBN Co, in the case of wholesale products) choose to provide. The Government has expressed a policy objective of ensuring universal access to minimum download data rates of 25 Mbps (assuming the NBN Co fixed wireless and satellite programs are delivered as promised). The NBN Co Strategic Review has proposed an approach that would provide 50 Mbps to around 90 per cent of the fixed line footprint by the end of 2019;” P5 Regulatory_Issues_Framing_Paper.pdf

5 <http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm>

2.4 What Creates the Monopoly?

2.4.1 The “Last Mile”

2.4.1.1 The “last mile” usually refers to the physical connection (OSI Model⁶ Layer 1) between the end user's premises and the nearest aggregation point, typically a telephone exchange.

2.4.1.2 Monopoly at Layer 0 (Conduits)

2.4.1.2.1 In Australia, most layer 0 infrastructure is owned and exclusively used by Telstra.

2.4.1.2.2 Layer 0 is also a logical natural monopoly⁷, as typically the highest component cost is trench digging, typically \$50/m with piping ~\$4/m⁸.

2.4.1.3 Monopolies at Layer 0: Land Access

2.4.1.3.1 By definition, most land corridors connecting customers and markets are owned and controlled by various layers of government.

2.4.1.3.2 These are both monopolistic and (arguably) irrational suppliers of basic layer 0 resources.

2.4.1.3.3 The right to install such infrastructure and use it exclusively was granted to Telstra's government owned predecessors by federal government statute.

2.4.1.3.4 Significant regulatory barriers exist to the development of alternate/competitive layer 0 infrastructure at both local government and state government levels.

2.4.1.4 Monopoly at Layer 1: Cable

2.4.1.4.1 Layer 1 is also a monopoly in most of Australia, though ACCC unbundling regulations have required Telstra to wholesale layer 1 services (over PSTN telephone cable) at regulated rates for some broadband services⁹.

2.4.1.5 Fibre Optic Cable

2.4.1.5.1 Fibre Optic Cable intrinsically creates natural monopoly conditions in a manner unlike copper, as the incremental cost of adding fibres to a single cable is substantially lower than the cost of deploying new cables.

2.4.1.6 Economies of scale at Layer 2

6 http://en.wikipedia.org/wiki/OSI_model

7 http://en.wikipedia.org/wiki/Natural_monopoly#Formal_definition_of_a_natural_monopoly

8 ToDo: References supporting these prices

9 <http://www.accc.gov.au/system/files/ACCC%20position%20paper%20on%20possible%20ULLS%20variation%20-%20Dec%202007.pdf>

- 2.4.1.6.1 The nature and pricing of back-haul at layer 1 gives substantial economies of scale for RSPs.
- 2.4.1.6.2 In the absence of a competitive aggregation service, **the most significant component of an RSPs' cost base is *scale*** within a given aggregation area.
- 2.4.1.6.3 Regardless of the RSPs' efficiency otherwise, this sets a high minimum viable market share.
- 2.4.1.6.4 This limits the number of genuine viable providers at Layer 2, which in turn constrains the market for services at the higher layers.
- 2.4.1.6.5 This creates a logical natural monopoly/oligopoly, and we have already seen this form in the NBN RSP market
- 2.4.2 **Back-haul**
 - 2.4.2.1 Back-haul: the transit of data from the initial aggregation point to an Internet Exchange Point (IXP) is a partially contended market in Australia.
 - 2.4.2.2 Chronic underinvestment in “Last Mile” infrastructure has seen a corresponding suppression in demand and thus underinvestment in back-haul capabilities.
 - 2.4.2.3 Back-haul is intrinsically cheap to supply (where investment appropriately matches demand).
 - 2.4.2.3.1 Back-haul has been delivered by fibre optic cable for decades
 - 2.4.2.3.2 Capacity of a fibre optic cable (at design stage) increase with the square of the cost of the cable. As the cable itself typically represents only 20% of the cost of a Layer 1 deployment, so cable capacity can be doubled with less than a 7% increase in total cost.
 - 2.4.2.3.3 The prime business considerations of any layer 1 provider are
 - 2.4.2.3.3.1 Risk of overbuild/predatory irrational behaviour by competitors
 - 2.4.2.3.3.2 Ability to create scarcity and levy an economic rent.
 - 2.4.2.3.4 Theoretically, the ultimate determinant of the cost of delivering back-haul (ignoring economic rent) is the ratio of population served to cable length.
 - 2.4.2.3.5 For urban centres, this per user cost asymptotically approaches zero where resources are correctly allocated.
 - 2.4.2.3.6 In Australian regional areas the required population density is only about 10 end users per cable km¹⁰ for back-haul to be a substantial portion of the total cost of

10 See Appendix D

service provision. This equates to more than 97% of the entire Australian population.

- 2.4.2.4 **NBN Layer 2 architecture over-uses backhaul** by not appropriately facilitating peering services
- 2.4.2.5 If I wish to send data to my next door neighbour via NBN, it takes the following path:
 - 2.4.2.5.1 Along the local fibre network via my AVC (Access Virtual Circuit) to the OLT¹¹ (Exchange),
 - 2.4.2.5.2 Along the NBN CVC (Connected Virtual Circuit) back-haul to the POI (Point of Interface)
 - 2.4.2.5.3 Via my RSP's 3rd party back-haul provider to my RSP's router
 - 2.4.2.5.4 Routed across more backhaul to my neighbour's RSP's router
 - 2.4.2.5.5 Back along my neighbour's RSP's 3rd party back-haul (probably the same pipe as my RSP's) to the POI
 - 2.4.2.5.6 Returns down the NBN CVC from the POI to my OLT
 - 2.4.2.5.7 Back along the same local fibre path to my next door neighbour's property.

¹¹ OLT: Optical Line Terminator: The device at the Telco's end of a fibre optic cable, usually in the local telephone exchange

3 **How best to ensure end-users have ready access to affordable and fast broadband and affordable and reliable voice services?**

3.1 ***Functioning free markets***

3.1.1 If optimally resource deployment is assumed to be that of an ideal free market, then clearly the simplest way of achieving this is to have resources allocated by functioning free markets.

3.1.2 Functioning free markets are best achieved by identifying the impediments to them, and addressing these directly.

3.1.3 The current NBN concept is the antithesis of this approach. NBN attempts to encapsulate all the monopolistic elements in one government body. NBNCo is then directed to operate irrationally to achieve a politically defined outcome which may, or may not, allocate resource closer to an ideal market than a monopolistic one.

3.1.4 **Give Consumers *Real and Informed Choice***

3.1.4.1 Ideally end users, based on appropriate price signals, determine the type of service they require.

3.1.4.2 Consumer's decisions should ultimately direct resource allocation

3.1.4.3 NBN's RSP competition is little more than a joke in this regard.

3.1.4.3.1 **NBN's wholesale pricing structure bares little resemblance to it's underlying costs**

3.1.4.3.2 While there is a bewildering array of retail NBN products available from an extensive range of brands, the fact is most of the brands are owned by a few providers.

3.1.4.3.2.1 The only real differences between the products are:

3.1.4.3.2.1.1 Back-haul contention ratios.

3.1.4.3.2.1.2 The degree of throttling NBN applies to the connection to achieve differential pricing.

3.1.4.3.2.2 The net effect of this "competition" at the RSP end is to obscure the RSP's margins and/or the deficiencies of their product.

3.1.4.3.2.3 The effect at the NBN level is to allow NBNCo to use it's monopoly position to maximise revenue while completely divorcing any relationship between their customer's demand and NBN's resource allocation..

- 3.2 **Identify the barriers to a free market, and address these specifically**
- 3.2.1 Rather than socialise most of the elements of the supply chain, identify the specific barriers to a free functioning market and address those directly.
- 3.2.2 Confine interventions to where they are actually needed.
- 3.2.3 Where possible, expose resource allocation to market forces and competition.
- 3.2.4 In my view the primary barriers to competitive service delivery are:
 - 3.2.4.1 End user have no control over the layer 1 and layer 0 infrastructure on their property
 - 3.2.4.2 Layer 0 of the “last mile” is a physical monopoly
 - 3.2.4.3 Layer 1 of the last mile is a natural monopoly
 - 3.2.4.4 Fibre Optic Cable has natural monopoly properties
 - 3.2.4.5 Lack of accessible and competitive markets at the nearest aggregation points
 - 3.2.4.6 Lack of appropriate scale agnostic layer 2 aggregation providers to provide sufficient competition at layers 3 and above
 - 3.2.4.7 The “need” for layer 2 providers to control layers 1 and 0.
- 3.3 **Ideal Scenario: Devolved decisions on communal access to functioning markets:**
- 3.3.1 In my view, the ideal scenario involves local government providing the essential communal infrastructure to physically connect the end user's to their nearest markets, typically the local telephone exchange.
- 3.3.2 See Appendix F for a first person detailed description.
- 3.3.3 The barriers to consumers accessing open markets are largely physical, generally encapsulated with a local government jurisdiction, and for the most part require physical communal solutions.
- 3.3.4 In my view, a fair analogy are local streets. In the same way they allow people to access physical markets, local communal cabling allows residents to access data markets. Decisions on resourcing local streets are preferably devolved to local democratic institutions, with federal government involvement – if any – limited to setting technical standards to ensure interoperability.
- 3.3.5 Clearly there are constitutional problems with this approach in Australia, as the Federal Government cannot mandate local governments do anything. Never

the less structures facilitating devolved local decisions that create access to functioning markets arguably represents world's best practice, and to the extent possible should facilitate this approach.

3.4 **An abundance of (Open Access) Dark Fiber.**

3.4.1 In other words, any market intervention occur primarily at Layer 1

3.4.2 The natural monopoly is primarily a Layer 1 phenomenon.

3.4.2.1 It's repercussions are generally experienced by purchasers of Layer 3 and above services.

3.4.3 The marginal cost of adding more supply at Layer 1 is very low.

3.4.3.1 This creates the natural monopoly in the first place.

3.4.4 The “dead weight” cost of any over-allocation of Layer 1 resources is low and contained.

3.4.5 The costs of delivering layer 1 services are largely tangible and widely well understood.

3.4.5.1 By contrast, layer 2 back-haul is extraordinarily difficult to price “fairly”.

3.4.6 Interventions based on price regulation can thus be well and fairly targeted.

3.4.7 This concept is at the heart of the CLEC¹² intervention in the United States, the legacy of which is back-haul is rarely a significant portion of the cost of delivering retail data services anywhere in the USA.

12 http://en.wikipedia.org/wiki/Competitive_local_exchange_carrier

- 4 **“What broader structural model or models for the industry should the panel consider? Why? Should the panel be considering significantly different industry scenarios to those outlined? If so, what are those scenarios and why should they be considered?”**
- 4.1 **FTTdp (Fibre to the Distribution Point)**
- 4.1.1 This is a technical model that sits between the technical architectures brought to the 2013 federal election by the major parties (FTTP and FTTN).
- 4.1.2 The purpose of this technical model is **not to “pick a winner”**, but the minimum intervention required to open a significant portion (by value) of the NBN supply chain to market based resource allocation.
- 4.1.2.1 FTTdb can have multiple meanings, but in this case:
- 4.1.2.1.1 The Distribution Points are on average 50m from the end user's premises and not more than 100m
- 4.1.2.1.2 The **end-user gets to determine the choice of technology** and installer (if any) for the final 100m of their deployment.
- 4.1.2.1.2.1 Installation would be competed by the end-user's choice of local licensed electrician, not dictated by NBNCo.
- 4.1.2.1.2.2 In HFC areas Distribution Points could use HPNA technology (otherwise known as Ethernet over Coax).
- 4.1.2.1.2.2.1.1 HPNA achieves the primary economic benefit of NBN over HFC: reuse of legacy coax-lead in conduits.
- 4.1.2.1.2.2.1.2 Customers could – at their own expense – upgrade their legacy cable to Ethernet (100-1000mpbps over multiple high grade copper twisted pairs), or full fibre optical.
- 4.1.2.2 **The last 50m represents approximately 50% of NBN's build capex**
- 4.1.2.2.1 In part this is because other parts of the network are communally shared, but the cable drops and ONT¹³s vest with a single user
- 4.1.2.2.2 It requires internal access to user's premise.
- 4.1.2.2.3 Legacy Lead in Conduits (LICs) have proved to have substantial deficiencies and required the most additional civil works to install.
- 4.1.2.2.4 Provision of these installations has been organised by multiple layers of sub-contractors

13 ONT: Optical Network Termination – the customer's end of a fibre optic cable

- 4.1.2.3 **The end-user gets to select the level of capitalisation** on their premise for their needs.
- 4.1.2.3.1 Provides a market mechanism for allocating much of NBN's build resources
- 4.1.2.3.2 Drives efficiencies by creating a competitive market for installation of the cable drop and civil works on customer's premises.
- 4.1.3 **Why FTTdp?**
- 4.1.3.1 **It exposes at least 50% of the NBN access supply chain to competitive pressure.**
- 4.1.3.2 **Market demand side forces determines resource allocation**
- 4.1.3.3 This architecture guarantees **everyone has access to adequate and affordable services** even if their needs are beyond the 25/2016 50/2019 political national estimate. **End users get to determine for themselves what is "adequate"**.
- 4.1.3.4 **The absolute maximum "dead weight" cost of this architecture compared with the proposed HFC and FTTN is extremely low. (See calculation in Appendix B)**
- 4.1.3.5 **In HFC areas offers the same economic benefits as HFC** (reuse of existing Coax lead-ins) without the adverse impacts.
- 4.2 **Functional Separation of NBN at Layer 1**
- 4.2.1 **NBN to be a market maker at Layer 2, rather than a monopolistic supplier.**
- 4.2.2 **NBN would be obliged to deliver it's wholesale service over any appropriate layer 1 network**, or viable combination of networks.
- 4.2.2.1 Potentially restricted to the *first* available network.
- 4.2.2.2 Rates to fixed and published by NBNSCo, regulated by the ACCC.
- 4.2.3 **Any Layer 1 network owner should be obliged to allow NBNSCo to offer it's wholesale service over it's network.**
- 4.2.4 The various elements of the layer 1 services could be unbundled and provided concurrently by numerous (perhaps competitive, perhaps not) suppliers¹⁴.
- 4.2.5 NBNSCo ceases to be the primary provider of layer 1 services, but more of a clearing house linking NBNSCo's RSPs, unbundled services and unbundled service providers.

14 See Appendix C for as more detailed example proposal

- 4.2.5.1 E.G. A local council might chose to build it's own fibre distribution network in an otherwise unprofitable/non-commercial area. NBN would lease the network from the local council at the scheduled rates, the difference made from ratepayers.
- 4.2.5.2 A state government could instruct it's power utility to do something similar on a state wide basis or regional basis.
- 4.2.5.3 For profit companies could also construct/complete networks where profitable to do so.
- 4.2.5.4 A neighbourhood association could build a local fibre distribution cable just for their street, and members of the association could be duly compensated for it's use by their members and other non-member users in that street.
- 4.2.5.5 Cabling within MDUs would be predominantly provided by the Body Corporate, and be compensated accordingly.

4.2.6 **Caveats:**

- 4.2.6.1 Mechansims need to be in place to prevent undue private sector cherry picking, such as ACCC rate regulation, or a Super Profits Tax on Layer 1 services provided to NBNC0 which might also attract private investment to more marginal deployment opportunities in a revenue neutral way.
- 4.2.6.2 Providers at all layers and sections of the supply chain should bear the connection risk equally, and **not** exclusively by NBNC0.
- 4.2.6.2.1 NBN's lease of layer 1 rates need to be on a per connected user basis.
- 4.2.6.2.2 NBNC0 would thus be statutorily profitable.
- 4.2.6.3 Never the less, nothing should preclude a 3rd party offering competitive Layer 2 market making services within the confines of NBNC0's regulation.

4.3 **Why Functional Separation at Layer 1?**

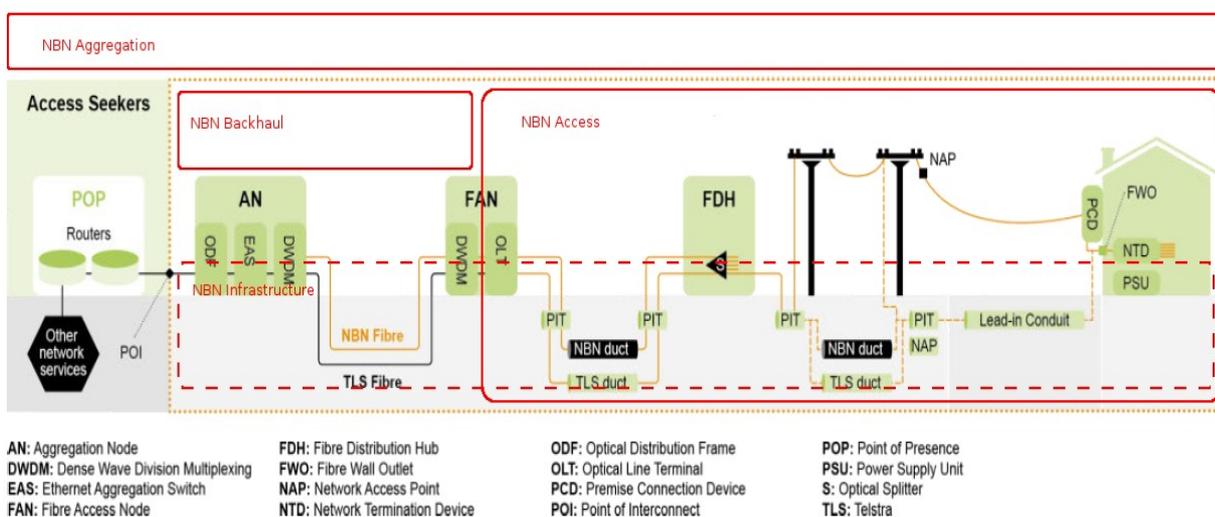
- 4.3.1 **Enables true facilities competition at Layer 1.**
- 4.3.2 **A rational market gets to decide where fibre is or is not deployed.**
- 4.3.3 Provides mechanisms for **non federal government agencies to contribute to the build cost** in otherwise non-commercial deployments and **properly price their contribution.**
- 4.3.4 Provides a mechanism for **private investment and for profit organisations to contribute private capital** to some of the build where it is commercially viable.
- 4.3.5 Unlike Layer 2 services, where bit-rate as an expression of pricing declines with

Moore's Law, dark fibre pricing should remain relatively stable with time. Interventions expressed in terms of dark fibre availability/pricing are far more reliable and time stable method of intervention.

4.4 **Break up of NBNS into distinct organisations to address specificity identified “market failings”.**

4.4.1 At very least, “Last Mile” access and back-haul price variability should be recognised as separate problems and addressed directly by separate dedicated institutions. Arguably NBNS's infrastructure ownership and market making/wholesale service obligations are incompatible, or at least give rise to very different market valuations of these respective businesses.

4.4.2 **Suggested Break-up of NBNS:**



4.4.2.1 **NBN Access:** specifically to address “Last Mile” access issues and connect users to telecommunications markets

4.4.2.1.1 NBN Access would provide POIs at every OLT/FAN (Approximately 500), as well as the existing 121 POIs.

4.4.2.2 **NBN Back-haul:**

4.4.2.2.1 to address the disparity's in back-haul pricing across Australia, and provide “equity”, or at least affordability for distant rural and regional communities.

4.4.2.2.2 Set a nationwide ceiling price for back-haul, ideally one that declines over time with Moore's Law.

4.4.2.2.3 Provide a mechanism for direct subsidisation of specific back-haul routes

- 4.4.2.2.4 Provide a mechanism for NBNCo to dispose of unwanted/unneeded back-haul it may have already acquired.
- 4.4.2.2.5 NBN Back-haul should be exposed to competition, necessary to drive competitive investment in new back-haul capacity in line with market demand.
- 4.4.2.2.6 NBN is essentially a back-haul would be a provider of last resort.
 - 4.4.2.2.6.1 In practice it would only be used in cases where it was not undercut by competitors on more profitable routes.
 - 4.4.2.2.6.2 As such it would invariably be a loss making institution.
 - 4.4.2.2.6.3 In the vast majority of cases where NBN Back-haul is required (ie the current market price exceeds the NBN Back-haul designated ceiling price, presumably due to transit fibre scarcity), it could commission sufficient new Layer 1 capacity to deliver it's services profitably.
 - 4.4.2.2.6.4 As a loss making institution, a political decision on how to fund this shortfall to achieve the desired policy outcomes would be required.
 - 4.4.2.2.6.5 The level of subsidy NBN Back-haul receives would be well known, and the cost to the public (or whoever) of meeting this policy objective is not obfuscated as with the current NBN project.
 - 4.4.2.2.6.6 Where NBN back-haul is required to deliver service, it could – if economically viable to do so (and it would be in most cases) – commission the construction of sufficient new dark fibre supply to bring the back-haul market price below NBN's ceiling price.
 - 4.4.2.2.7 NBN Back-haul's job is to deliver affordable/appropriately priced back-haul where the real world market has (thus far) failed to do so. Also, it's role is to foster procurement of the appropriate level of investment where it is currently lacking.
 - 4.4.2.2.8 The mere existence of NBN Back-Haul may be sufficient to drive greater supply in the back-haul market.
- 4.4.2.3 **NBN Infrastructure**
 - 4.4.2.3.1 A body to house NBNCo's existing Layer 1 (and other) hard assets.
 - 4.4.2.3.2 The assets involved would be long lived with a know stable rate of return.
 - 4.4.2.3.3 NBN Infrastructure Assets would hence be particular attractive investments and would likely attract favourable valuations in equity markets.
 - 4.4.2.3.4 NBN Infrastructure could thus raise private equity by:

- 4.4.2.3.4.1 Issuing equity directly (it statutorily allowed/enabled)
- 4.4.2.3.4.2 Engaging in sale and lease back arrangements of it's hard assets.
- 4.4.2.3.5 NBN Infrastructure is also a potential vehicle for NBNCo to use it's existing committed construction contractors to develop Layer 1 infrastructure to be leased to NBN Access or NBN Back-haul, or perhaps an equivalent competitor.
- 4.4.2.3.6 Provides a mechanism for delivering requisite new infrastructure to NBN Back-haul
- 4.4.2.4 **NBN Aggregation**
- 4.4.2.4.1 The purpose of this body is to address the specific issue of RSPs requiring large scale in each of their connectivity service areas, or points of presence.
- 4.4.2.4.2 It's importance would be greatly increased if NBN Access and NBN Back-haul see the number of POIs increase from 120 to over 500.
- 4.4.2.4.3 NBN Aggregation would provide a virtual connection between the customer's premise and no more than 14 POIs with a single flat per-user fee for backhaul.
- 4.4.2.4.3.1 ISPs could purchase different classes of user based on anticipated data usage and desired contention rates.
- 4.4.2.4.3.2 This is *almost* a layer 3 service
- 4.4.2.4.4 It was presumed as part of NBN's design that an unregulated market would deliver small RSPs the aggregation services they need to be viable in small volumes. This hasn't happened.
- 4.4.2.4.5 The only organisations capable of viably offering such services are themselves large competing RSPs.
- 4.4.2.4.6 Ideally NBN Aggregation would be a not for profit organisation, with the back-haul capped flat fee but ultimately determined by the number of aggregations.
- 4.4.2.4.7 The effect of this body would/should be to to put small scale RSPs on a similar competitive footing with larger ones, ensuring adequate genuine competition in the sector.
- 4.4.3 **Why break up NBNCo?**
- 4.4.3.1 **Interventions can be contained and better targeted** to addressing the specifically identified issues.
- 4.4.3.2 **The effectiveness of each specific intervention can be better understood,** and adjusted where necessary.

- 4.4.3.3 **Cross subsidies** – to the extent they exist – **are more transparent.**
- 4.4.3.4 It enables **more of NBN's operations to be *fairly* opened up to competition.**
- 4.4.3.5 **Enables the freeing up of public capital** currently tied up in long life assets.
- 4.4.3.6 **NBN's broken up components can send appropriate price signals** to wholesalers and users **that properly reflect their cost of operation.**
- 4.5 **Unbundling of NBNCo's Services**
- 4.5.1 At it's simplest, this means separation of local access and back-haul
- 4.5.2 Further unbundling of NBN services should also be done for the various supply chain elements. These should include:
 - 4.5.2.1 An ONT lease fee
 - 4.5.2.2 The premises' drop cable
 - 4.5.2.3 The local Fibre Network
 - 4.5.2.3.1 Users share the cable, but not the fibres.
 - 4.5.2.4 The Distribution Fibre Network
 - 4.5.2.4.1 The cable that links the splitter box with the OLT/Exchange
 - 4.5.2.4.2 Users share the cable and share fibres.
 - 4.5.2.5 Distribution Fibre Conduits
 - 4.5.2.5.1 The probability is a need for PtP fibre architectures (where each home has a dedicated fibre all the way to the exchange) will emerge at some stage in the future.
 - 4.5.2.5.2 Open and reasonably priced access to the Distribution Fibre conduits too allow this extra capitalisation is need for the market to correctly determine the appropriate time for this investment.
 - 4.5.2.5.3 Without open access at this point, artificial scarcity of distribution fibres has the potential to create another point of rent seeking.
- 4.5.3 Any, all or none of these elements might be provided by NBN Co.
- 4.5.4 Whoever does provide them gets paid an appropriate proportion of the wholesale fee NBN passes on tho the RSP.

- 4.5.5 Price signals are sent directly to end users about the type and nature of connection they choose.
- 4.5.5.1 E.G. An FTTb implementation in a medium sized Multi Dwelling Unit (MDU) complex residents may elect to purchase an RSP's offering over NBN via their Body Corporate's Ethernet cable to the communal ONT in the basement.
 - 4.5.5.1.1 The end-user's would receive a rebate on the standard access charge from NBNSCo for not having a dedicated ONT, instead billed only for the percentage of the communal unit in the basement.
 - 4.5.5.1.2 The body corporate would receive the drop cable component of the user's access fee.
 - 4.5.5.1.3 Were the user to supply their own cable, these users would receive the drop cable fee rebated from their connection fee.
- 4.5.5.2 For this architecture to work it is critical the pricing structure be predominantly per user based, so that all members of the supply chain share the connection risk equitably.
- 4.5.6 **Why Unbundle NBNSCo Services?**
 - 4.5.6.1 **Sends more direct price signals to end-users, retailers and other providers.**
 - 4.5.6.2 **Enables genuine facilities competition across the whole NBN supply chain**
 - 4.5.6.3 **Increases facilities competition** by allowing **small players to participate** in specific sections on the supply chain (namely work within the end-user's property), rather than the whole thing.
 - 4.5.6.4 **Exposes more of NBNSCo's activities to genuine competition.**

5 **Should the panel consider and adopt working assumptions other than the ones outlined?**

5.1 **The assumption:** *“broadband services providing defined minimum upload and download data rates should be generally available to all end-users, along with such other broadband products as market participants (including NBN Co, in the case of wholesale products) choose to provide. The Government has expressed a policy objective of ensuring universal access to minimum download data rates of 25 Mbps (assuming the NBN Co fixed wireless and satellite programs are delivered as promised). The NBN Co Strategic Review has proposed an approach that would provide 50 Mbps to around 90 per cent of the fixed line footprint by the end of 2019;”* **needs to be interpreted very loosely.**

5.1.1 Specifying a specific data rate is really only relevant to certain architectures, notably those where the “last mile” is the limiting factor.

5.1.2 Demand, and indeed supply, of data telecommunications has largely increased in line with Moore's Law¹⁵, doubling roughly every 18 months.

5.1.3 As consumer computers and electronic devices become more capable, they generate more, and more voluminous, content requiring increasingly more bandwidth to share.

5.1.4 This political target (25 by 2016, 50 by 2019) is a doubling every 3 years, and while it sounds impressive to people who don't understand logarithmic scales, it is almost certainly an underestimate of likely demand.

5.1.5 This target is most definitely **not** a market determination of demand.

5.1.6 As such, it should be taken for what it is, a qualitative assessment of user demand rather than a serious attempt to quantify it.

5.1.7 Hence, I ***strongly recommend*** the panel come to its own determination of what constitutes demand for broadband, and what minimum service standards are appropriate.

15 http://en.wikipedia.org/wiki/Moore%27s_law

6 **Should NBN Co continue to be subject to wholesale-only (structural separation) and open access requirements? If so, to what extent and under what circumstances, if any, should those obligations apply to other market participants?**

6.1 Absolutely yes.

6.2 Structural separation and open access requirements (currently applicable to new networks only) should apply to **all** comparable networks: new and legacy equally.

6.3 The current structural separation requirements for new networks are at Layer 2, the layer NBN provides services at. However this is **not** the layer the natural monopolies exist, and the effectiveness of these provisions at this point in the supply chain is – in my view – questionable.

6.4 Further, perhaps alternate, regulation at (actually within) layer 1 is required to ensure an appropriate abundance of dark fibre and thus adequate competition in the layers above.

7 **Where providers other than NBN Co supply fixed network services, should there be provisions that ensure consumers secure particular outcomes, for instance by comparison to those generally available from NBN Co?**

7.1 This question, and the following three questions, suggest the panel is considering a model where multiple providers deliver a roughly similar service to their own captive section of the fixed line footprint.

7.1.1 The implication that multiple providers with their captive markets somehow represents infrastructure competition is absurd. It's akin to designating certain suburbs as belonging to either Coles or Woolworths, forcing all residents to shop at the nominated supermarket and claiming this is competition.

7.1.2 Quite frankly, I'm disturbed these questions were even asked.

7.1.3 **I strongly urge the panel to abandon any further consideration of such models on competition grounds.**

8 **Where an infrastructure provider other than NBN Co delivers outcomes comparable to those delivered by the NBN, what obligations or restrictions should apply on NBN Co? For example, should NBN Co be preventing from overbuilding that network?**

8.1 Alternate infrastructure providers should be required to either:

8.2 Offer NBN Co services directly over their network at wholesale rates that ensure those NBN operations are profitable for NBN Co. ... **OR** ...

8.3 The third part should be required to provide an *identical* service to NBNCo at the same or lower prices to all of NBNCo's RSP customers.

8.4 Further, NBNCo should be *obliged* to use a 3rd party network rather than overbuild where such a network exists first and NBNCo can operate over it profitably.

8.5 The effect of these rules would be:

8.5.1 Actual NBN services (or better) are available to all users in the 3rd party network's footprint on the same (or better) basis as on the regular NBN.

8.5.2 No 3rd party network provider can be both viable and less efficient than NBN Co. I.E. a 3rd party network provider cannot make itself more viable than the NBN by creating scarcity, only by being more efficient).

8.5.3 Such an inefficient provider would effectively be required to divest itself of its telco assets to allow either NBNCo or some other more efficient provider to deliver service.

8.5.4 3rd party network providers who are *more* efficient than NBN Co could profit directly from their increased efficiency, but only to the extent they are more efficient.

9 **To what extent should the provision of non-commercial services by NBN Co be funded through cross-subsidies, and if so, what safeguards, if any, should apply to those cross-subsidies?**

9.1 In short, as little as possible.

9.2 NBNCo's wholesale pricing structure bears little resemblance to its actual cost of operations.

9.2.1 NBN Co's Access Virtual Circuit pricing is entirely about exploiting its monopoly position to achieving differential pricing by throttling users' burst/maximum speed.

9.2.2 NBNCo's Back-haul pricing, while structured like typical genuine back-haul provider, bears no relation to the actual back-haul requirements of NBNCo, if any.

9.2.3 The level of subsidy drawn from these activities is completely opaque.

9.3 It's completely unclear how much given users are cross subsidising others, nor the extent to which cross subsidies are funding non-commercial services or simply NBN inefficiency.

9.4 Were NBN an actual fully functioning free market, it's unlikely *any* non-commercial services would exist that needed to attract a cross subsidy.

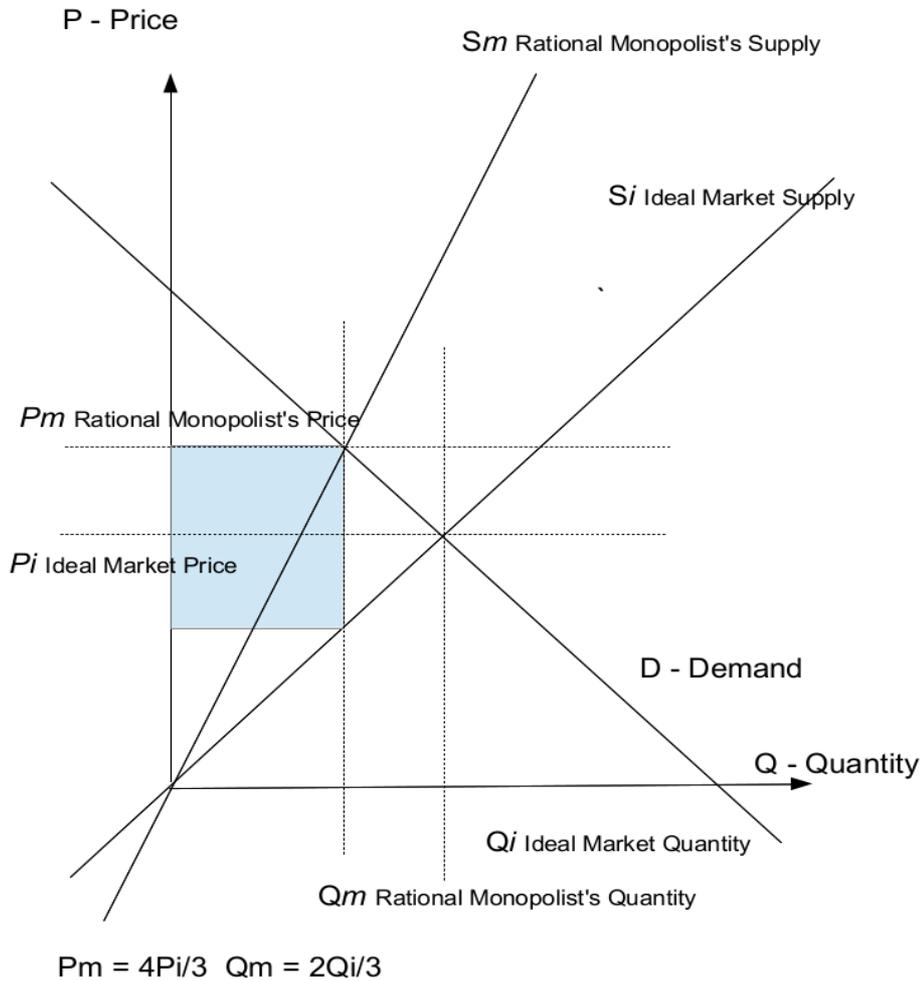
- 9.5 Where NBN engages in cross subsidisation, by definition it cannot compete fairly in those markets.
- 9.6 Cross subsidisation is a substantial barrier to exposing NBN to competition.
- 9.7 The desire to cross subsidise has led to an expansion of the NBN monopoly beyond the natural monopoly issue it is supposed to address.
- 10 **Were it not feasible or sustainable in a competitive market for NBN Co to earn sufficient revenue to enable it to cross-subsidise uneconomic customers, how should services to those customers be provided and funded?**
- 10.1 The answer to this question is highly dependant on **why** the service is uneconomic.
- 10.1.1 If it's because the premises are located on a 10000ha freehold land holding then it should be incumbent on the landholder to provide that infrastructure, not NBNCo or the taxpayer.
- 10.1.2 In regional communities where prior government policies have resulted in disproportionate under investment in infrastructure, there is clearly a strong case for any subsidy to be drawn from general revenue.
- 10.1.3 In distant small/micro communities where service provision is a marginal proposition, appropriate mechanisms to ensure that community equitably bear (at least some) of the cost of otherwise uneconomic infrastructure.
- 10.1.4 For ultra-low density urban developments, appropriate mechanisms should exist to allow users to equitably share the additional cost of access where it's beyond any regulated minimum.
- 10.1.5 If it's because the service in question is uneconomic because the provider is not delivering it's service efficiently, the equity owner of the provider should bear that cost, and hopefully take appropriate remedial action.
- 10.2 There is little, if any, economic argument to support the notion that efficient fixed line users specifically should bear the cost re-mediate telecommunications infrastructure. The idea that a few rural and regional Australian users will produce economies of scale benefits to the Internet is patently absurd.
- 10.3 Similarly, there is no rational at all for the amount of subsidy an efficient user should pay be a function of their usage volume.
- 10.4 Ultimately, who subsidises who and how much is a political decision. But political institutions can only make these decisions rationally if the nature and purpose of these subsidies is understood. **The purpose and level of subsidies need to be as simple and transparent as possible.**

- 10.5 If NBNCo is to be the vehicle for sourcing subsidy funds, it's preferable this be a flat rate per user charge, and it's equally preferable that equivalent providers should also have to collect this charge.
- 11 **Should responsibility for the economic regulation of telecommunications remain with the ACCC?**
- 11.1 If *any* industry warrants strong competition regulation in line with core principles by an arms length regulator it's telecommunication.
- 11.1.1 The natural monopoly nature of telecommunications has repeatedly results all forms of anticompetitive and rent seeking behaviour by providers.
- 11.1.2 Jurisdictions where competition regulation is also performed by the industry regulator are characterised by relatively less competition. Industry providers are able to effectively argue for "special case" exemptions from general principles.
- 11.1.3 TODO: Site examples from Canada vs USA?
- 11.1.4 The ACCC remains the most appropriate available body for economic regulation of Australia's telecommunications industry.

12 **Recommendations Summary:**

- 12.1 Where practical, create genuine market mechanisms to direct future resource allocation.
- 12.2 The preferred technical model for NBNC_o be FTTdp, with an emphasis on the customer, **not** NBN or other Telcos, determining the nature of the last 50ms of the connection.
- 12.3 NBN be broken up into components that directly address the specific natural monopoly elements in the telecommunications industry, and remove opaque cross subsidisation. These should include:
 - 12.3.1 Access of consumers to data markers.
 - 12.3.2 Artificial scarcity in back-haul markets.
 - 12.3.3 Better scale agnosticism to facilitate smaller and thus more competition above Layer 2.
- 12.4 Unbundling of NBN Services to:
 - 12.4.1 Expose NBNC_o to more direct competition.
 - 12.4.2 Provide mechanisms for an equitable sharing of the connection risk across all members of the supply chain.
- 12.5 Functional Separation of the industry at Layer 1.
- 12.6 Recommend efficient policies to foster a greater abundance of “dark fiber” that don't necessarily need the direct involvement of NBNC_o.

Appendix A: What is the “dead weight” cost of a monopoly? A simple market analysis of monopolistic behaviour:



- 13.1 Using the simplest assumptions (linear supply and demand functions, price elasticity =1) with the result $P_m = 1.33 \times P_i$.
- 13.2 Curiously enough, this 4:3 price ratio exists between NBN fibre plans and comparable plans offered by Telstra in their South Brisbane FTTP deployment.¹⁶
- 13.3 A similar phenomenon is observed in some Australian DSL markets where the ACCC had mandated/enabled facilities competition and 3rd parties have been able to install DSLAMs and lease Telstra's copper loop.
- 13.4 The “dead weight” cost is $Q_m \times P_m / 2$.
- 13.4.1 In the Australian Fixed Line market of 10mil households and using Telstra's ARPU¹⁷ (~\$600pa) puts the **national dead weight cost at up to¹⁸ \$3bil pa.**

¹⁶ http://www.internode.on.net/residential/fibre_to_the_home/south_brisbane/

http://www.internode.on.net/residential/fibre_to_the_home/nbn_plans/

¹⁷ <http://www.telstra.com.au/abouttelstra/download/document/Telstra-Annual-Report-2013.pdf> Page 13

¹⁸ “Up to” because this is only to the extent Telstra can act as a rational monopoly, and that is only in some segments and some layers of of the Australian Telecommunications Industry

Appendix B: FTTP/FTTdp/FTTN “Last Mile” Access Price Comparison:

FTTP/FTTN/FTTdb Cost Comparisons:

This table summarises the monthly component costs of connecting the “Last Mile”

Finance Rate: 7.00%

Common to all models (more or less)	Capital Costs	Users	Capex/User	Lifespan	Annualised	Monthly
Distribution Fibre: 8km @\$60/m	480000	2500	192	25	21	1.76
OLT Port	1000	20	50	7	11	0.89
					32	2.65

FTTP Specific:	Capital Cost	Users	Capex/User	Lifespan	Annualised	
Local Access Fibre (1km @\$200/m)	20000	50	400	25	44	3.67
Installed Local Drop Cable	750	1	750	25	83	6.88
ONT	600	1	600	7	128	10.64
Splitter Box	5000	200	25	25	1	0.08
			1775		287	23.91

FTTN Specific:	Capital Cost	Users	Capex/User	Lifespan	Annualised	
Node Cabinet	10000	200	50	10	9	0.71
Node DSLAMs	500	1	500	5	100	8.33
			550		140	11.69

FTTPdp Specific:	Capital Cost	Users	Capex/User	Lifespan	Annualised	
Local Access Fibre (1km @\$200/m)	20000	50	400	25	44	3.67
Splitter Box	5000	200	25	25	1	0.08
Distribution Points	1000	4	250	25	28	2.29
Shared ONTs	1000	4	250	7	53	4.43
			925		157	13.12

14.1 Notes:

- 14.1.1 Telstra “Line Rental”, or whatever the cost of using legacy cable has been excluded from these calculations. FTTN and FTTdp potentially use progressively more legacy Telstra cable, with the potential for dead weight costs associated with doing this left uncoded.
- 14.1.2 With long life assets accounting treatment is a substantial part of the outcome. Assets are costed here at 7% annually plus simple linear depreciation.
- 14.1.3 For large Multi Dwelling Units (MDUs) FTTN and and FTTdp are essentially the same, and have the same costs.
- 14.1.4 Actual local access fibre costs can vary greatly depending on the availability of suitable, and suitably priced, conduits.
- 14.1.5 In cases of aerial deployment, installation of an FTTP drop cable at the time of the local fibre installation is typically \$300 cheaper than if done later (no need for a second visit by the cherry picker)
- 14.1.6 For the purposes of this exercise, FTTN and HFC are regarded as the same.

The underlying technologies are different, but the fibre to legacy cable ratios are much the same.

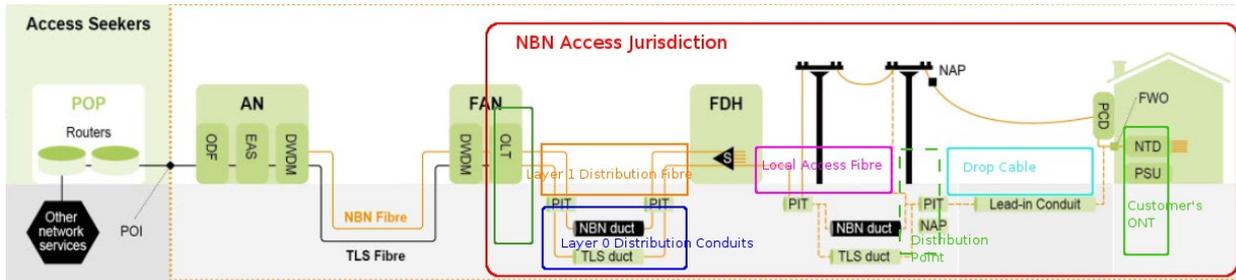
14.2 **Comments:**

14.2.1 **The maximum possible “dead weight” cost of FTTdp over FTTN** is \$17 per non MDU property per year, or **~\$130mil pa** across 8 million premises.

14.2.2 The Annualised cost of FTTP access is remarkably close to Telstra's wholesale “line rental” fee for a PSTN loop between the customer and the exchange.

14.2.3 A more aggressive amortisation treatment of long lived assets would favour FTTdp and FTTP architectures. E.G. Capitalising using the current long term bond shows FTTdp cheaper than FTTN.

Appendix C: Details of NBN Access Proposal



15.1 **NBN Access' primary role is to address the “last mile” natural monopoly.**

15.2 **NBN Access addresses this issue by being a market maker/collections agency/clearing house at Layer 2, rather than an exclusive supplier.**

15.3 **Elements of the supply chain are to be unbundled into the following elements:**

OLT Ports

Distribution Fibre Layer 1

Distribution Fibre Layer 0

Local Access Fibre

Drop Cable

ONT

15.4 There be a standard access fee payable by RSPs (Access Seekers) on a per user connected basis.

15.5 Providers, where they are not NBNCo, are paid their appropriate share of the common access fee.

15.6 RSPs would be obliged to report the breakdown to their end-users, and pass through any variances between the regular scheduled fee and the actual fee charged by NBN Access based on the user's circumstance.

- 15.7 NBN Access would not throttle users, unless requested to do so by an RSP for their demand management purposes.
- 15.7.1 All users would (over the fibre portion of their connection) receive a burst rate capacity of 2500Mbps down and 1250Mbps up, and a minimum contention free capacity of 125/62.5.
- 15.7.1.1 This assumes a maximum of 1:20 user split at the splitter box, though this could be changed to as much as 1:32 with NBN's architecture. Were this to happen this should be appropriately recognised in the users' billing.
- 15.8 Unbundling of Layer 0 distribution fibre is to facilitate investment in new distribution cable should a Point to Point¹⁹ (PtP)
- 15.9 All participants in the supply chain to share the connection risk. Hence, **NBN Access is statutorily profitable.**
- 15.10 For existing NBN installation, NBN Access (or perhaps other differentiated elements of NBN) provide all of the services.
- 15.11 Where NBN is offered over a third party network, all of the elements are provided by that network. NBN Access delivers that provider a market of competing RSP customers.
- 15.12 For most MDUs, the Body Corporate is the likely supplier of drop cable, and for large MDUs the Body Corporate would likely provide the Local Access Fibre (or it's equivalent).
- 15.13 Unbundled rates to be reviewed and ultimately fixed by the ACCC.

19 PtP: Where each user has a dedicated fibre from their property/ONT all the way to the exchange

15.14 **Possible Unbundling Pricing (Per User Per Month):**

15.14.1	OLT Port	\$1
	Distribution Fibre	\$2
	Local Fibre	\$4
	Drop Cable	\$7
	ONT Fee	\$10
	Total:	\$24

15.14.2 RSP Wholesalers charged **\$25pm** for this “standard” FTTP connection.

15.14.3 \$25 per month has long been established in the Australian market as the amount most people will bear for *any* form of fixed line connection. The fact that an FTTP NBN could (in theory) be deployed for about this amount is what makes that concept viable, if not optimal.

16 **Appendix D: Ideal Back-haul Layer 1 cost calculations**

16.1 Over the life of the fibre, Moore's Law suggests the cost of layer 2 bit-rate will decline at roughly the same rate as end-user demand will increase.

16.2 Fibre counts within a cable can be increased more or less arbitrarily to suit the number of users

16.3 Hence, the cost per user of providing adequate back-haul capacity is:

$$\text{Unique Cable Length} / \text{Number of Cable Users}$$

Low Volume/Population Density Cable Costs per user

	Capex	Lifespan	Annualised	Monthly	
Cable @ \$10000/km	10000	50	900		75

Users per KM Monthly Cost Per User:

10	7.50
20	3.75
50	1.50
75	1.00

16.4 **Notes:**

16.4.1 Cable cost @\$10/m assumes it is either aerial deployed or "lightly" trenched

16.4.2 Back-haul cabling costs only become significant at densities above 75/cable km, and prohibitive above 10/cable KM.

17 **Appendix E: My Personal Preferred Scenario**

- 17.1 Using the type of cable I have selected and purchased, the first part my connection will be through **my** conduit on my property to a nearby distribution point.
- 17.2 At the distribution point my cable will connect to either a reverse powered communal ONT (network hub), or if I have chosen an optical cable from home directly patched into my dedicated fibre on the communal local distribution cable (the cable which “passes” properties) built to federal government specified standards.
- 17.3 The communal cable runs through local government owned and maintained conduits, or aerially along power poles in accordance with the democratic decision of my neighbours.
- 17.4 At the local splitter box, my fibre is patched into the splitter connecting me to the fibre for the layer 2 network of **my** choice.
- 17.5 This fibre runs through a cable, perhaps one shared by many layer 2 providers, or one of the third party cables, through conduits owned and controlled by my local government.
- 17.6 At the nearest aggregation point (the exchange) my traffic is then routed via any number of layer 3 paths over any of the multiple cost effective back-haul options chosen by my chosen RSP.
- 17.7 Peering Traffic, traffic to devices within my fibre service area, are routed directly to that device, and not sent back and forth across any back-haul link, regardless of the respective choice of RSPs
- 17.8 When I receive my monthly bill, I get a nice rebate from the layer 2 provider for my self provisioning of the drop cable, as well as a rebate (or perhaps surcharge) for my neighbourhood's choice of aerial or underground local access fibre deployment.
- 17.9 **Notes:**
- 17.9.1 This is broadly in line with arguably world's best practice: achieving near the highest standard of broadband availability, at the lowest cost, and with the least government intervention^{20 21 22}.

20 In the USA: www.gao.gov/assets/670/660734.pdf

21 From Canada: <http://www.qnetbc.net/about/qnet/default.htm>

22 Stockholm: <http://www.stokab.se/In-english/>

18 **Appendix F: Author's Personal Background**

18.1 I have been an IT professional for 15 years specialising in networking and software financial services

18.2 I also have a background in accounting and tax accounting.

18.3 Most recently I have been the full time primary carer for my small children who have just started school this year, giving me time to make submissions such as this.