

6 Ensuring ubiquitous backhaul availability

SUMMARY

- Unavailability of competitively priced backhaul is a bottleneck to providing affordable, high-speed broadband services in many parts of Australia today. In addition to building its fibre access network, NBN Co should therefore also provide sufficient transit backhaul capacity to alleviate this bottleneck. This should be achieved through two targeted investments.
 - First, the NBN should include approximately 70,000 km of transit backhaul on routes that are currently monopolies. This backhaul should connect NBN Co's fibre exchanges to points located deeper in the network where multiple backhaul service providers are available, to ensure service providers can always link to NBN Co's network via competitive backhaul connections. This portion of the transit backhaul build would include the 6,000 km of links being constructed under Government's Regional Backbone Blackspots Program.
 - Second, NBN Co should provide approximately 3,500 km of additional transit backhaul to connect to wireless tower locations, where required by the provider(s) of the future fixed-wireless network.
 - NBN Co should be prepared to build its own backhaul network, but should also be open to securing long-term indefeasible rights of use (with concrete options to renew) from existing dark fibre assets on these routes.
 - NBN Co transit backhaul services should be specified and priced separately from access services and available to other network operators on an open-access, equivalent basis. Where transit is offered, to ensure a level playing field, all service providers should be required to use this service to connect to the NBN access network, and not permitted to connect below the POI.
 - Transit backhaul should be priced affordably, for example as a small percentage of the total price of the access service for a given premises, given a defined contention ratio.
 - The shared transit backhaul network is most appropriately run as a public asset over the long term due to the risks of anti-competitive behaviour in a privatised model. Regulation of backhaul assets will be difficult given high projected levels of traffic growth, and corresponding needs for investment in active equipment.
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Australia's geographically dispersed population means that backhaul routes form natural monopolies due to the long distances (and hence high costs) relative to the sizes of the available revenue pools in remote areas.

In order to achieve Government's objective of providing superfast broadband to all Australians at affordable prices, NBN Co will therefore need to intervene selectively to provide competitive backhaul and remove existing bottlenecks.

This chapter proposes the role NBN Co should play in providing transit backhaul services as part of the NBN. Three subsections follow:

- 6.1 Creating a transit backhaul network to enable the NBN access service
- 6.2 Creating a future-proof transit backhaul solution
- 6.3 Managing the transit backhaul network to meet evolving market needs

6.1 Creating a transit backhaul network to enable the NBN access service

NBN Co's mandate is to enable affordable and competitive availability of broadband services to all Australians. This firstly requires service providers to have competitive access to its fibre access network anywhere it is deployed. Second, it requires that NBN Co set wholesale prices—including all necessary network links—that encourage affordability of retail services.

Today, backhaul capacity is expensive in many regional areas, preventing delivery of competitive retail services. Current high prices are driven by both structural and industry factors. NBN Co should make lasting interventions to ensure affordable capacity for NBN services, constructing the necessary transit backhaul to connect all fibre serving areas and fixed-wireless access points to NBN Co points of interconnect.

Unlike other assets such as the fibre access network, this shared backhaul network is most appropriately run as a public asset over the long term due to the risks of anti-competitive behaviour in a privatised model. Regulation of backhaul assets will be difficult given high projected levels of traffic growth, and corresponding needs for investment in active equipment upgrades.

This section discusses the need for, and appropriate scope of, the NBN's backhaul services:

- 6.1.1 Addressing affordability of NBN retail services with backhaul
- 6.1.2 Intervening in backhaul where required
- 6.1.3 Deploying a 60–70,000 km fibre transit network
- 6.1.4 Anticipating backhaul to support fixed-wireless.

6.1.1 ADDRESSING AFFORDABILITY OF NBN RETAIL SERVICES WITH BACKHAUL

Access to affordable backhaul capacity is an essential part of delivering retail broadband services. To reach their customers, access seekers such as retail service providers (RSPs) and application service providers (ASPs) need to establish connections to NBN Co's fibre exchanges from their points of presence (POPs). This generally involves leasing backhaul capacity, of which there are three main types (Exhibit 6–1).

Exhibit 6–1. Introduction to backhaul

What is backhaul?

Backhaul is a generic term for the transmission links that connect service providers' core networks with points of service delivery, for example:

- Copper network exchanges and mobile towers today
- Fibre exchanges in a future NBN

For the purposes of this report we define three types of backhaul:

- **International.** Transmission between Australia and the rest of the world via submarine optical fibre cables. Six high capacity cables exist for Australia.^a These are generally considered competitive, particularly with the recent addition of the PPC-1 cable. The stated Southern Cross list price for 5 Gbps of restored Australia-US capacity is currently around \$US0.28 per GB downloaded, 86 percent lower than December 2003^b
- **Intercapital.** Long distance transmission between Sydney, Melbourne, Brisbane, Perth, Canberra and Adelaide. Intercapital routes are all competitive
- **Community.** Links between local exchanges, regional aggregation points, towns and cities and the rest of the network. 5,000+ community backhaul routes exist, primarily provided by Telstra. Only a small number of routes in densely populated areas are competitive today. Community backhaul can be separated into two subcategories:
 - Intercity connects regional aggregation points to intercapital backhaul
 - Intracity / regional connects local exchanges to regional aggregation points

In this chapter, the term 'transit backhaul' refers to an NBN Co-provided link between fibre exchanges and points of interconnect (POIs) in the fibre network. This can be any type of backhaul, but is likely to be community backhaul.

a. Industry interview 2009

b. Corner, S 2008, 'Australian Researchers' 10 Gbps links to US guaranteed to 2020', *iWire*, 8 February 2010, viewed 10 February 2010, <<http://www.itwire.com/telecommunications-news/networks/36632-australian-researchers-10gps-links-to-us-guaranteed-to-2020?start=1>>

Source: Implementation Study

Backhaul drives significant costs in today's service provider business model due to a lack of competition in parts of the network. Intercapital routes, some intercity community backhaul routes and some intracity community backhaul routes in the CBD areas are considered competitive.¹⁵⁸ However, on many regional routes, costs of backhaul are particularly high due to a number of inter-related factors:

- **Monopoly and duopoly pricing.** Many routes are served by only one or two providers, increasing the ability to extract monopoly rents;
- **Vertical integration.** Telstra is the only national backhaul provider, and also operates in the fixed and mobile retail access markets. This vertical integration provides incentives to set higher prices on backhaul to reduce competition from other retailers;

¹⁵⁸ ACCC 2008, *Telstra's domestic transmission capacity service exemption applications*, Canberra

- **High build costs.** Long distances in regional Australia drive high costs, requiring higher prices to generate a return on investment. This discourages the deployment of new fibre links;
- **Case-by-case, cost-based regulation.** Uncompetitive backhaul links are declared services under the *Trade Practices Act 1974* and subject to the negotiate-arbitrate access regime. However, the ACCC has not set an arbitrated price because all disputes have been withdrawn prior to ruling.

These factors result in high costs for service providers—in some cases 20 percent of operating costs are for backhaul.¹⁵⁹

These high costs make backhaul a bottleneck today in many areas. Absence of competitive backhaul prevents service providers from competing in regional areas, and is a constraint on the regional DSL market.¹⁶⁰ For around 2 million premises, served by exchanges large enough to justify retail competition, Telstra is the only DSL provider, as other ISPs have not secured backhaul on affordable terms.¹⁶¹ Unless resolved, this limited competition is expected to continue in a future fibre access world, with many retailers unable to offer affordable services to fibre customers due to a lack of competitively priced backhaul up to NBN Co’s fibre aggregation points. NBN Co therefore needs to play an active role in backhaul to fulfil its mandate.

6.1.2 INTERVENING IN BACKHAUL WHERE REQUIRED

There is reason to believe that today’s backhaul bottlenecks will persist without direct intervention by NBN Co. An operator’s willingness to build capacity on a given backhaul link is determined by the size of the revenue pool served, the share of that revenue pool the operator expects to capture and the capital costs involved. Many community backhaul links in Australia are long and serve locations with small, isolated revenue pools (Exhibit 6–2). These links will not support progressive (link-by-link) competitive entry. Exhibit 6–3 shows this effect for intracity backhaul routes of less than 50 km.

¹⁵⁹ Stakeholder interviews

¹⁶⁰ Stakeholder interviews

¹⁶¹ ACCC 2009, *Fixed LRIC model documentation*, report prepared by Analysys, Cambridge, UK; ADSL2exchanges.com 2009, *ADSL2exchanges.com.au*, viewed 1 December 2009 <<http://www.adsl2exchanges.com.au>>; NBN Implementation Study analysis

Exhibit 6–2. Backhaul market dynamics

Backhaul market dynamics

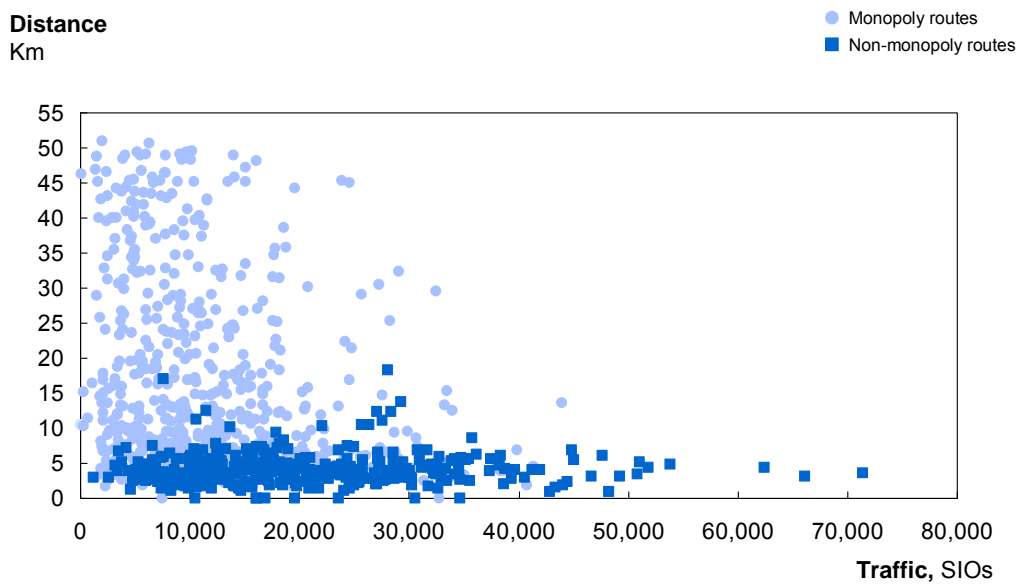
Many community backhaul routes in regional Australia are natural monopolies as they are characterised by high sunk capital costs due to the long distances involved, unlimited upgrade capacity at relatively low cost and small market sizes.

- **High sunk capital costs.** Backhaul exhibits a classic infrastructure cash flow profile—very high upfront capital expense and low recurring cash costs. The long distances involved in regional Australia make these costs relatively high per head of population. Because of these high barriers to entry, backhaul competition can be limited by market size resulting in many community backhaul links being monopolies
- **Upgrades with relatively small additional expenditure.** Once the physical link is built, transmission equipment can be upgraded at a relatively low cost. With upgrades, a single fibre is able to transmit terabits per second
- **Small market sizes separated by large distances.** Approximately 20 percent of premises are in areas categorised by the ACCC under its ULL pricing regime as regional or remote. With a smaller population density, the high capex costs are shared among fewer users. For example, the capital expense of building backhaul to Alice Springs has been estimated at \$4,000 per premises. This cost equates to approximately \$30 per premises per month assuming 100 percent market share. These links are either monopolies or have no fibre backhaul.

Source: Implementation Study

Highlight. Market forces have resulted in little competition on community backhaul routes of more than 10 km in length.

Exhibit 6–3. Competitiveness of intracity community backhaul routes less than 50 km



SOURCE: ACCC LRIC model; ADSL2+ website; Implementation Study

One option for resolving the bottleneck caused by monopoly links is regulation. However, there are multiple difficulties with applying a regulatory solution in practice:

- **Average unit cost varies from link to link, as it depends on distance and total traffic.** The primary component of backhaul cost is the passive cabling, which is determined by the distance of the link. The fully allocated unit cost of capacity on a link will depend therefore primarily on the distance, and the total traffic on the link.
- **Fair regulation at LRIC can be difficult to implement.** As the unit cost for capacity varies, effective LRIC regulation requires the regulator to maintain a cost model for each backhaul route and keep track of the capacity on each route. Effective price regulation of backhaul routes could therefore be administratively onerous and problematic to implement. Fair LRIC regulation is something that would be desirable in the long term, but could be problematic in the short term.
- **It is difficult to choose the right service to regulate.** There are two products that can be regulated, bitstream or dark fibre, but doing so would be difficult for both. A bitstream product would be difficult to regulate because it would need to be based on traffic volume, which is expected to rise rapidly in coming years. Dark fibre would be hard to regulate because at a given price, an access seeker can obtain almost unlimited bandwidth through active equipment upgrades, thereby capturing much of the traffic on a route. Access rights would therefore need to be limited.
- **A one-size-fits-all solution is inefficient.** A simple solution would be to ignore total capacity on the route and set prices for a bitstream service on the basis of distance. New Zealand's telecommunications regulator chose this solution. However, it risks over-pricing regional backhaul links with limited capacity, because the revenue pool is limited and might not cover costs. Furthermore, the same price would be inefficient on very high capacity routes where the unit cost is low, resulting in inflated returns at the price set by the regulator.
- **There is a risk of market gaming.** Another issue is anti-competitive conduct. The access provider can refuse to increase capacity, by not adding or upgrading active electronics, by claiming spare dark fibre is needed for its own use or no space is available for co-location in the nodes.

As a result of these factors, the conclusion of the Implementation Study is that a purely regulatory approach is not a robust solution to ensuring access to backhaul at competitive pricing, and direct provisioning of backhaul capacity by NBN Co should be a core element of the solution.

6.1.3 DEPLOYING A 60–70,000 KM FIBRE TRANSIT NETWORK

The ‘transit backhaul network’ within the fibre footprint should link all fibre exchanges to points at which at least two independent backhaul fibre connections to the national backbone are available. Geospatial modelling by the Implementation Study suggests this network will need to cover a total distance of about 70,000 km. NBN Co should only procure backhaul capacity on non-monopoly routes where this is necessary to create redundant loops for network resiliency or for system management, in which case dark fibre or capacity should be leased at market rates from existing asset owners.

Providing a transit backhaul network as described is a ‘minimum’ intervention. Duopoly links will remain, with a risk that pricing on those links may not always be affordable, despite competitive pressures on those duopoly providers with NBN aggregating traffic to POIs. Currently, the business case for regional backhaul deployment is difficult. A new backhaul route in a regional area only provides connectivity to local premises at the end of that route, and redundancy may still be required, necessitating the use of third-party links—further undermining the business case for investment. In future, by enabling greater retail competition, the NBN will make the backhaul revenue pool more contestable for a new entrant, potentially increasing the likelihood of entry. Chapter 9 discusses the risk this poses to competitive outcomes for the NBN, and the need to maintain a watching brief on the backhaul market.

6.1.4 ANTICIPATING BACKHAUL TO SUPPORT FIXED-WIRELESS

As we discuss in Chapter 5, in addition to providing transit backhaul links within the fibre footprint, NBN Co should extend fibre backhaul to existing towers and new tower sites needed by the fixed-wireless network operator to provide coverage between the 94th and 97th percentiles of premises. These routes should be operated on an open-access basis and priced using the same mechanism as the transit backhaul network (See Chapter 5).

6.2 Creating a future-proof transit backhaul solution

NBN Co aims to create an enduring platform for long-term industry benefit. In the case of backhaul, this is particularly important because the cost of passive fibre links is high but the incremental cost of capacity through active electronics upgrades is low. Relying on a third party to provide capacity on a commercial basis where limited competition exists is risky for the long-term interests of the industry. In this section, the Implementation Study addresses how NBN Co should ensure backhaul bottlenecks are resolved. Two subsections follow:

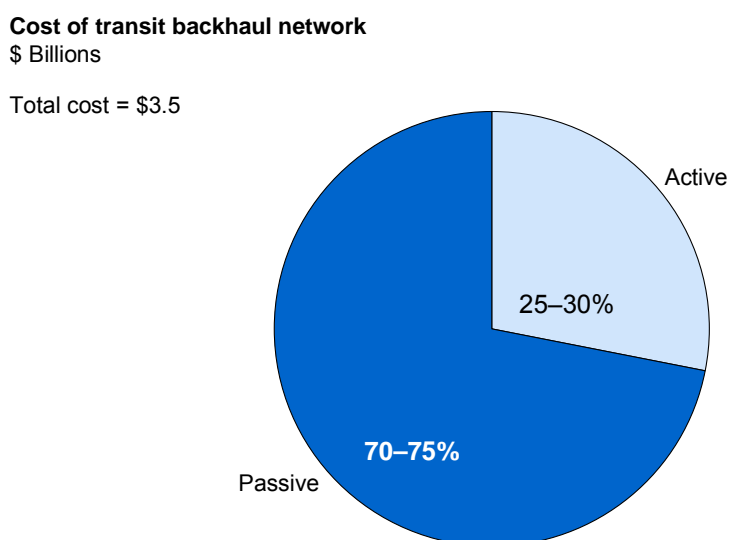
- 6.2.1 Deploying a new backhaul network
- 6.2.2 Securing rights more efficiently where possible.

6.2.1 DEPLOYING A NEW BACKHAUL NETWORK

NBN Co should be prepared to build its own backhaul network. However, it should be open to secure long-term rights where they can be procured on an affordable basis from existing service providers. Ownership or rights of use over dark-fibre provides the greatest degree of control over pricing and quality of service, and enables fixed instead of variable costs for NBN Co.

While the logic of an infrastructure-sharing agreement is compelling for NBN Co and for Telstra, it is not assumed in our expenditure modelling. We have modelled an overbuild of approximately 70,000 km of backhaul for an estimated cost of approximately \$3.5 billion (Exhibit 6–4).

Exhibit 6–4. Build cost for transit backhaul network of 70,000 km



SOURCE: Implementation Study

Exhibit 6–5. Approach to estimating backhaul construction costs

Approach to estimating backhaul construction costs**Estimating distance covered**

- The assumed inter-exchange network ring in the ACCC LRIC model was used as a starting point for exchanges and geospatial modelling was employed to connect exchange sites in a ring structure with geographical diversity. Links assessed as competitive were then removed to calculate overall distances required to be built
- Where the transit network overlaps with the access network, trench and duct sharing is assumed, reducing cost per metre for those cable runs
- As NBN Co will only provide backhaul in areas with monopoly backhaul today, all non-monopoly backhaul is disregarded in the model. The number of exchanges without multiple DSL providers was used as a proxy for the number of exchanges with monopoly connections today, since competitive backhaul is assumed to coincide with DSL entry by providers other than the incumbent

Unit costs

- Unit costs for the passive and active cost drivers were estimated based on input from technical advisors and vendors
- For passive costs, the per metre cost of deploying fibre is estimated separately for areas with and without overlap with the access network
- Separate estimates of active costs per node were made for aggregation and local nodes, based on input from technical advisors and vendors.

Source: Implementation Study

The approach taken to estimating backhaul construction costs is described in Exhibit 6–5.

Recommendation 48. That NBN Co be required to construct a transit backhaul network to connect all fibre exchanges to the nearest practical point where backhaul services are available from Government (e.g., Regional Backbone Blackspots Program) or multiple providers, not including NBN Co; for fibre exchanges that are already located at a point with multiple backhaul providers or Government backhaul services, NBN Co not to construct transit backhaul links.

6.2.2 SECURING RIGHTS MORE EFFICIENTLY WHERE POSSIBLE

Although the construction of all necessary backhaul links is viable and would provide complete assurance of availability, it would be expensive and economically inefficient since most of the required infrastructure already exists. NBN Co should therefore seek commercial arrangements providing guaranteed access to existing dark fibre, where this is economically preferable to constructing a new network.

Recommendation 49. That NBN Co be directed to construct the transit backhaul network including passive fibre elements and active electronics, except where NBN Co is able to secure long-term indefeasible rights of use (with options to renew) to other parties' fibre assets at the physical layer ('dark fibre') more economically.

6.3 Managing the transit backhaul network to meet evolving market needs

NBN Co will need to manage its backhaul assets to meet the needs of an evolving industry. This will require creating a level national playing field and making backhaul available at an affordable price, while also ensuring policy objectives are supported. We discuss these requirements in the following subsections.

- 6.3.1 Creating a national level playing field
- 6.3.2 Providing backhaul at an affordable price
- 6.3.3 Recognising challenges in privatising backhaul
- 6.3.4 Providing open access to NBN transit links.

6.3.1 CREATING A NATIONAL LEVEL PLAYING FIELD

To create a national level playing field, NBN Co will need to carefully choose POI locations and design an appropriate transit backhaul product.

Choosing POI locations

NBN Co transit backhaul in the fibre footprint will provide connectivity from fibre exchanges to the nearest point at which multiple backhaul providers are available. Exhibit 6–6 shows three different options that NBN Co may use to achieve this. The POIs for the NBN Co transit backhaul services in each case will be located at the boundary of today’s competitive backhaul. fibre exchanges served by multiple backhaul providers will become POIs.

Recommendation 50. That NBN Co be required to offer a single POI in relation to a given premises:

1. At a fibre exchange where there are multiple alternative backhaul providers; or
2. At a fibre exchange linked to the Regional Backbone Blackspots Program; or
3. At a point accessible from the fibre exchange over an NBN Co transit backhaul link.

It would be possible for the NBN Co to further aggregate traffic and offer POIs in capital cities. This would enable smaller providers with limited network footprints, such as ASPs, to connect easily to the NBN at an affordable price. However, this would involve stranding significant lengths of competitive backhaul that have been deployed through healthy market investment and would harm incentives for ongoing investment. It would

also be an inefficient use of funds for NBN Co to procure access to backhaul which is already available to service providers at competitive prices.

The competitive benefits of such centralised POIs would be limited. Under the proposed model, NBN Co's customers will have access to backhaul from multiple providers from their POP to the POI that serves their customers. The capital expense of POI connection will be small—significantly lower than today's DSLAM equipment located in exchanges which serve fewer customers than a typical POI. It is true that ASPs lacking network infrastructure will need to purchase IP connectivity from wholesale network service providers. At this time, NBN Co need not intervene to provide such services. The potential dynamics of this market are discussed in Chapter 9.

On a regular basis, the location of POIs should be reviewed to determine if they need to be taken higher or lower in the network. POIs would be taken higher if the presence of multiple backhaul operators did not translate into affordable pricing on selected routes. In other words, NBN Co would overbuild duopoly routes in this instance. POIs would be taken lower where multiple providers were prepared to invest in building backhaul links. In such a case, NBN Co could lease or divest its backhaul links.

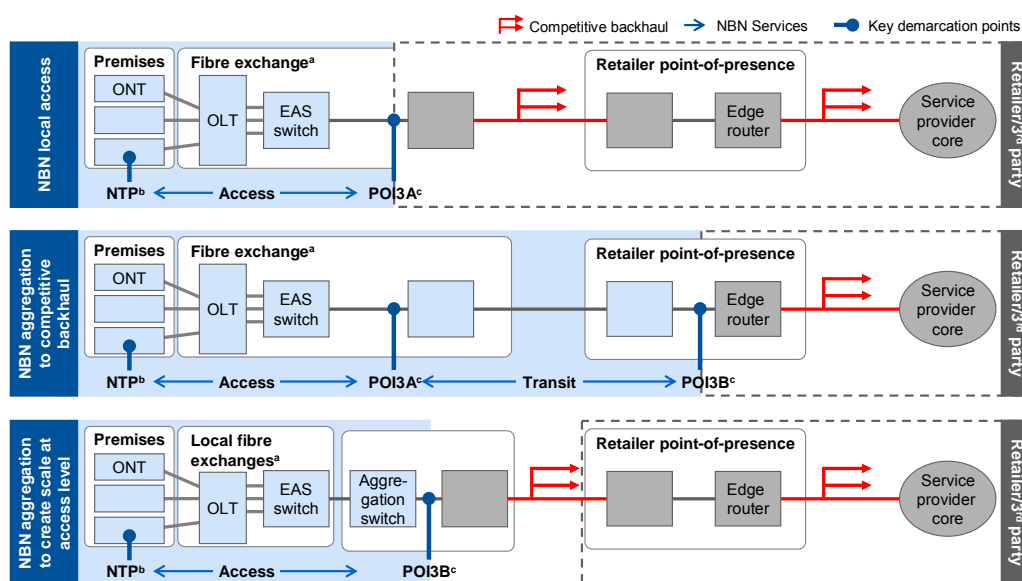
Recommendation 51. That the location of NBN Co's POIs be reviewed on a regular basis to permit new investment below the POIs and to ensure the objectives of affordability and a level playing field are met above the POIs.

Defining the characteristics of the transit backhaul service

The transit backhaul service should have the following features:

- **End-to-end.** The transit backhaul product offered by NBN Co should be an end-to-end product for connection from the POI to the fibre exchange including redundancy for backup. This would be instead of, for example, a point-to-point product on each route. An end-to-end product has two benefits. First, it will minimise the number of products a service provider is required to manage for connection from a POI to a fibre exchange. Second, it will simplify pricing. The product should have redundancy to provide backup in case of, for example, a cable cut. Exhibit 6–7 illustrates the difference between a route-by-route product and an end-to-end product. Note that pricing is purely for the purposes of illustration.
- **Modular.** The NBN access service and transit backhaul should be offered as separate services. This will allow access seekers to choose appropriate backhaul products for their required capacity. It will also allow uniformity of pricing on the access products across the country.

Exhibit 6–6. NBN interconnect options

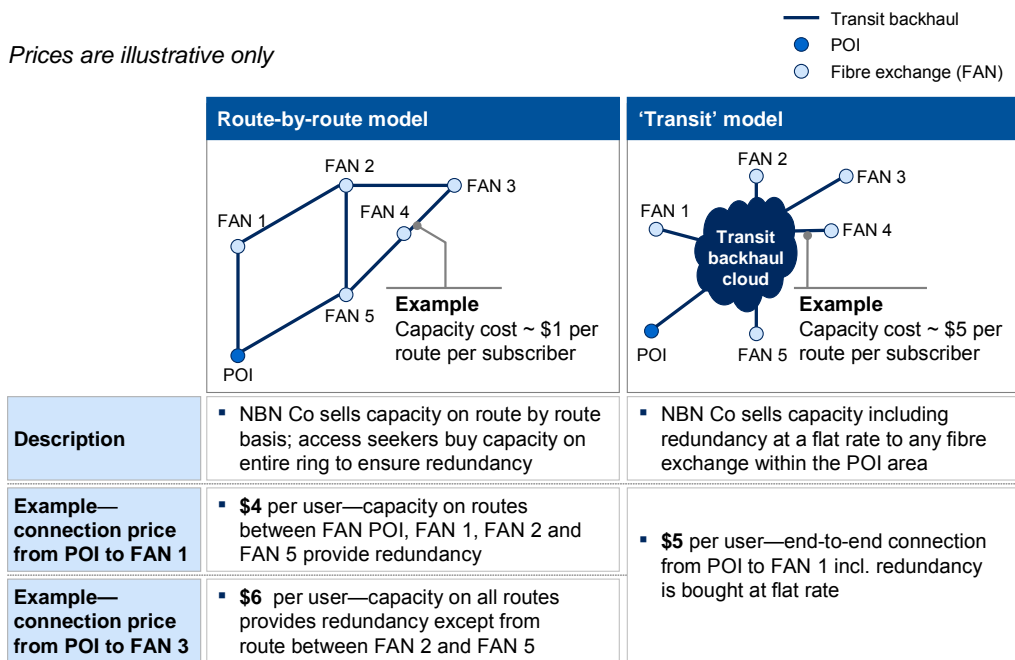


a. Fibre exchange or Fibre Access Node = Physical environment containing OLT, Ethernet switch, patch panels
 b. NPT—Network termination point = Port on ONT
 c. POI—Point of Interconnect to Access. Note: POI numbers refer to Communications Alliance reference architecture
 SOURCE: Adapted from Communications Alliance 2009, *High level architecture options for the NBN*

Where NBN Co offers a transit service, access seekers should not be permitted to connect directly to the fibre exchange. In other words, there is a single POI per premises served. This is despite the NBN transit and access services being offered separately. Direct access to a fibre exchange (i.e. bypass of the NBN Co transit service) would not provide a level competitive playing field. Telstra is the most likely provider to seek this access. Telstra has a nationwide backhaul network, which is a sunk cost and is needed to support wireless services. The cost to Telstra of using the backhaul network for NBN access products is therefore marginal. Therefore, Telstra will have a cost advantage, compared to other access seekers who do not have a nationwide backhaul network, equal to the cost of using NBN transit backhaul—which, depending on pricing, could be in the vicinity of 10 percent of the retail ARPU for typical entry-level services. The ACCC could still require NBN Co to offer access at the fibre exchange to access seekers who have sourced alternative backhaul—although a more likely approach would be to move the entire POI lower in the network.

Exhibit 6–7. Options for transit backhaul product

Prices are illustrative only



SOURCE: Implementation Study

Recommendation 52. That for defining NBN Co’s backhaul services:

1. NBN Co be required to offer backhaul services as single Ethernet links from the POI to the fibre exchange, with some level of protection (alternative secondary links in the case of outages on the primary link) available on all links;
2. The transit backhaul bitstream product to be specified as a separate product from the access bitstream product, allowing service providers to select their preferred combination of backhaul capacity and access services;
3. NBN Co not to offer or be required to offer connection below the POI to an NBN Co access network.

Denying Telstra access to the fibre exchange in monopoly areas will effectively strand Telstra backhaul for the purposes of the NBN, if an agreement with Telstra to share this infrastructure is not reached. However, in this case Telstra would still use its backhaul assets to support other services such as mobile. Presumably such an outcome would only arise as a last resort given the strong commercial logic for both Telstra and NBN Co of sharing infrastructure.

6.3.2 PROVIDING BACKHAUL AT AN AFFORDABLE PRICE

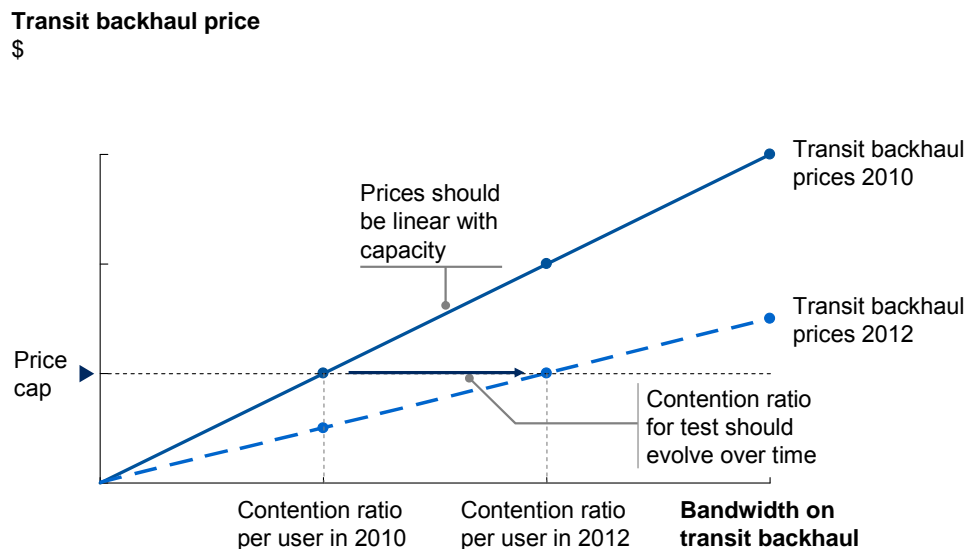
NBN transit backhaul products should meet a simple and measurable affordability test. In some areas, access seekers will only connect to the NBN Co access product through the

NBN Co transit backhaul services. This will provide NBN Co with an effective monopoly on backhaul for users of the NBN for around 20 percent of the country. Therefore, Government should require that NBN Co backhaul prices meet an affordability test set by Government. This is required because affordability of backhaul is important to achieving affordability of retail prices of NBN-enabled services, and ensuring take-up of services in areas without competitive backhaul.

Affordability of access prices should be evaluated on a per user basis as this would establish a transparent price that can be subject to comparison with retail ARPUs. Backhaul is typically sold as bandwidth that is shared by many end-users and a price per user depends on assumptions about an appropriate contention ratio. An affordability test for ‘a reasonable price level’ therefore has to be linked to a defined contention ratio—one that matches leading international standards and evolves with the market.

The transit backhaul product should be offered as a block of bandwidth end-to-end from the POI to the fibre exchange. Service providers can match the amount of bandwidth to the number of subscribers and the desired contention ratio. Link capacity should be priced in a linear fashion (Exhibit 6–8)—a 100 Gbps link should cost 10 times a 10 Gbps link. The linear scaling is important to avoid distorting the market and creating a disproportionate scale advantage for large providers. The linear pricing on bandwidth will also incentivise NBN Co to sell as much bandwidth as possible and upgrade active electronics to increase the revenue pool on transit backhaul.

Exhibit 6–8. Contention ratio for affordability test should be allowed to evolve



SOURCE: Implementation Study

Recommendation 53. That NBN Co be required to specify transit products to meet an affordability test; specifically:

1. That the price of transit backhaul services attributable to a single premises' access service be not more than a certain percentage of the retail price of a typical entry-level NBN wholesale broadband product;
2. That Government define the percentage, preferably not more than 10 percent; the transit backhaul service be defined from the POI to the fibre exchange, on a per-user basis, given a defined contention ratio;
3. That NBN Co be required to set a minimum contention ratio based on international benchmarks, and to review it annually based on ongoing monitoring of customer experience and observed network performance;
4. That the NBN Co transit backhaul prices scale linearly with bandwidth for contention ratios higher than the one used in the affordability test.

The price points in the affordability test should be determined by Government. This is a policy decision as the transit price drives the difference in price between regional and metro areas. It also requires a trade-off between consumer affordability and the commerciality of the NBN backhaul network. Our estimate is that a price less than 15 percent of wholesale ARPU—less than \$4.50 for a \$30 wholesale service—will be required to achieve affordability for all geographies. This would equate to approximately 10 percent of an expected entry-level retail broadband service. At this level, most retailers would be expected to absorb the difference and offer consistent pricing nationally. At 20 percent of the retail price, it would be difficult to have consistent retail prices and be profitable in regional areas—leading to less retail participation, lower end-user take-up and lower NBN Co revenue.

Service providers will need a minimum number of subscribers in a fibre exchange to receive the price determined by the affordability test. This is because backhaul is sold in blocks of bandwidth rather than on a per-subscriber basis. In the present DSL market, ISPs use 150–200 subscribers as a rule of thumb¹⁶² for when it is commercially viable to enter an exchange, when affordable backhaul is available. NBN Co should strive to make backhaul viable for ISPs with around 100 subscribers. Small fibre exchanges in the NBN will serve approximately 1,000 premises, so this would translate to a target take-up in small exchanges of around 10 percent.

Highlight. The minimum unit of transit backhaul connectivity should be economically viable for a small service provider. Given the current DSL market threshold for DSLAM deployment of around 150–200 subscribers, the NBN Co should strive to make backhaul viable for around 100 subscribers. Based on a potential 20 Mbps residential service at 30:1 contention, this principle would suggest NBN Co offer the option of a 100 Mbps link rather than starting at a higher link capacity (this is referring to bitstream speed, not physical interface).

Note that in any case, the retailer is still free to determine the contention ratio and to purchase from NBN Co any dedicated or QoS bandwidth for the delivery of premium services. This pricing policy is intended to ensure that best-efforts Internet-grade connectivity can be provided to end-users at an affordable price.

6.3.3 RECOGNISING CHALLENGES IN PRIVATISING BACKHAUL

While Government has expressed a commitment to privatise NBN Co, privatising the backhaul assets will be problematic. The NBN backhaul will have strong natural monopoly characteristics and is unlikely ever to face competition on most links in either the active or the passive part of the network. In Chapter 10, we recommend an independent review of competition prior to privatisation. This review should start with a presumption not to privatise backhaul, but the flexibility to define an acceptable privatisation approach.

We considered several options for privatisation (Exhibit 6–9), but each has challenging issues. The privatisation of the passive fibre, based on an agreed lease payment for exclusive use of that dark fibre, is plausible, but is essentially a form of capital management rather than true privatisation. However, operational management can be outsourced through competitive tenders to improve the operating efficiency of the assets.

Not expecting to privatise the backhaul assets has implications for how ownership of the backhaul links being constructed under the Regional Backbone Blackspots Program may transition. It has been contemplated that ownership of these links would transition to NBN Co at the relevant time in the life of the contract. However, it makes more sense for them to remain owned directly by Government until the full independent competition review is undertaken. This would not preclude NBN Co from taking over operational responsibility.

NBN Co should manage the backhaul assets during the roll-out of the network. This would provide efficiency gains from rolling out the access and backhaul network in parallel, such as combined planning of fibre routes, sharing of trenches, etc. Operation of the government-owned backhaul can eventually be outsourced through competitive tenders. With strict SLAs, this option could optimise operations while ensuring high service standards. However, gains from this option are likely to be small given the typically low ongoing operational costs of backhaul links.

Exhibit 6–9. Options for privatising backhaul

Privatised part of backhaul	Privatisation issues
Passive and active layers	<ul style="list-style-type: none"> ■ High backhaul prices likely if privatised due to strong integrated monopoly or duopoly ownership in a market that is difficult to regulate ■ Low quality of service in regional areas because competitive pressure to upgrade active equipment over time will be low. Upgrades are hard to force on a private entity.
Active layer alone	<ul style="list-style-type: none"> ■ High prices in remote areas due to limited competition as the revenue pool is too small to support multiple providers of active equipment. A large variation in prices for active layer services would run counter to Government's affordability policy. ■ Low quality of service in remote areas because competitive pressure to upgrade active equipment over time will be low. Upgrades are hard to force on a private entity.
Passive layer alone	<ul style="list-style-type: none"> ■ Possible, but risk of future increases in dark fibre costs for NBN Co ■ If objective is capital return to Government, backhaul assets could simply assume debt in line with very stable cash flows—no need for equity sale ■ No benefits for upgrade and no competition on active equipment as only passive part is privatised.

Source: Implementation Study

Exhibit 6–10. Economics of NBN backhaul

Economics of NBN backhaul
<p data-bbox="284 1218 1406 1312">Investment in backhaul assets within the fibre footprint is not expected to provide a commercial return and should be seen as a Government investment to provide future telecommunication services to regions at an affordable price.</p> <p data-bbox="284 1330 1374 1424">Revenue will roughly cover the operational cost on the backhaul assets and the depreciation and interest on the investment in the active equipment. It will not contribute significantly to interest or depreciation of investment in the passive infrastructure.</p> <p data-bbox="284 1442 1422 1671">Revenue. NBN Co's revenue from the transit backhaul network will be determined by the transit backhaul ARPU (assumed to be \$4 per month) and the number of premises with a fibre connection needing transit backhaul (assumed to be 20 percent). Revenue will slowly ramp up as the NBN is being rolled out and take-up of NBN-enabled services increases. The transit backhaul revenue from NBN services is estimated to be in the order of \$100 million after full roll out of the NBN. NBN Co will have additional upside from providing backhaul to competing access technologies. However, NBN Co will compete with Telstra for this revenue.</p> <p data-bbox="284 1688 1422 1883">Cost. Cost of providing backhaul arises from the operational cost and the cost of capital and depreciation associated with investment in active and passive infrastructure. Operational cost of the passive infrastructure is negligible. The depreciation of the investment depends on the lifetime of the assets. The lifetime of the active equipment is expected to be in the order of 8 years. Lifetime for fibre infrastructure is likely to be greater than 40 years, but for modelling purposes it is been assumed to be 40 years.</p>
Source: Implementation Study

The backhaul investment should be seen as a Government investment to provide future telecommunications services to regions at an affordable price. Exhibit 6–10 describes the economics of NBN backhaul if it were built. Revenue will roughly cover the operational cost of providing transit backhaul. However, it will not be enough to achieve a commercial rate of return due to the large investment in passive infrastructure.

6.3.4 PROVIDING OPEN ACCESS TO NBN TRANSIT LINKS

Once the backhaul network is in place, there is an opportunity to create value by enabling other access networks—for example, mobile providers, or WiMAX ISP operators—to access backhaul. This section proposes requirements for opening up NBN backhaul to provide backhaul services for all access technologies on an equivalent basis.

There is no commercial or technical reason why wireless and other access networks could not use the NBN backhaul as a transmission network. The NBN transit backhaul product should be a separate product from the access products (Subsection 6.1.3) and the product should be priced separately. An access seeker could therefore buy this service alone, if NBN Co permits. Denial of standalone transit backhaul services to providers of other access networks (e.g. mobile operators) would permit NBN Co to operate in a vertically-integrated way and protect its access network. Instead, backhaul is best managed as a standalone public utility. The bias for the backhaul assets to be structurally separated from NBN Co prior to privatisation and to remain in Government hands is consistent with this characterisation of backhaul as a public utility.

The impact of providing open access to the transit backhaul product on NBN Co's financial performance is expected to be limited over the long term. Mobile services are expected to be complementary to fixed broadband. As we discuss in Section 4.4. Telstra already has backhaul links everywhere in Australia, so NBN Co will face competition from DSL in the near term. Therefore, in the long-run, NBN Co should offer open access to the backhaul network to stimulate competition on all access technologies, not only on FTTP.

In the more immediate term, there are practical reasons why Government may choose to not make transit backhaul available to other network owners. This includes the operational complexity of forecasting unpredictable demand from alternative networks and the commercial imperative to drive early take-up of NBN services. Accordingly, some temporary relief for NBN Co to not be required to offer standalone transit backhaul could be appropriate. The effect of such temporary relief on wireless operators should be small given NBN Co is required to provide access services on a commercial basis—requiring transit services to be sold with access services below POIs. Clearly, such temporary relief would not be relevant to NBN Co's transit backhaul links to serve the 94th to 97th percentiles beyond the fibre footprint.

A final point to emphasise—the intention to allow transit backhaul products to be sold separately from access products should not be confused with an intention to allow connection to a fibre exchange below a transit link. In other words, for NBN Co’s access network, the location of POIs should be determined by whether multiple alternative backhaul providers exist and connection below a POI should not be permitted.

Recommendation 54. That NBN Co be required to provide transit backhaul services to alternative network operators, specifically:

1. That such transit backhaul services be offered on equivalent terms to those offered to customers of its own access network;
2. That NBN Co provide a point of interconnect for the transit backhaul service in the fibre exchange environment (but not the access service if not at a POI) and access seekers be responsible for all costs of reaching and entering the fibre exchange environment to meet this point of interconnect;
3. That the Minister consider granting temporary relief from this requirement, but not in relation to backhaul services necessary to enable the provision of wireless broadband services beyond the fibre footprint, once it is defined.