

Vertical Integration and the Construction of NGA Networks

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1. Introduction

The purpose of this paper is to review arguments relevant to decisions about whether regulatory intervention is needed with respect to the integration or separation² of next generation access (NGAs) networks in Australia.

There are two contrasting arguments which are typically brought to bear on this question. One claims that where networks are inherently monopolistic, a structure of separation of control and ownership will eliminate any discrimination in favour of competitive activities affiliated with the network; while the other focuses on problems occurring in separated structures if firms at different levels in the value chain take separate profits ('double marginalisation') and if economies of scope are lost.

The task attempted in this paper is not to address the general theoretical considerations relating to the separation/integration decision, which point in different directions, but to examine the policy trade-offs in the specific context of NGA network development in Australia, including the Government's proposal to select private investors to deploy and operate a national broadband network (NBN). This inevitably involves the specifics of the problem: the scope for competition in NGAs in Australia, the extent to which existing measures in Australia have addressed non-price discrimination, the scale, priority specific risks of the Australian project, and so on.

In undertaking this task, I recognise that the evidence base for evaluating the effects of integration on NGA build-out is inevitably limited, because such investment is in its early stages. Accordingly this paper draws on empirical studies of the outcomes which different structures may generate or have generated in other economic sectors; reviews the experience of and plans for separation in the

¹ This paper has been commissioned by Telstra. The views expressed in this paper are those of the author alone.

² The debate over separation can be muddled by confusion over the differing degrees of separation. In the attachment, I have set out a taxonomy of the separation concepts used in this paper.

telecommunications sector; and concludes with a consideration of the special features of the NBN investment, which primarily are its very large scale, its importance for the economy as a whole and its demand-side uncertainties.

I recognise that the aggregation of these arguments cannot provide the sort of conclusions which could be provided by a full *ex post* econometric analysis (which even if it were possible, would face challenges and limitations of its own). Yet this is the conundrum policy makers currently face with NGA investment. Just as investors have to decide whether to build NGA infrastructure in advance of certainty about future demand and returns, so too policy makers must choose between competing views about the impact of regulation before the impacts can be fully assessed. In the past, policy makers could at least take some comfort that the basic network infrastructure was already in place and, if they were sufficiently vigilant, policy could be adjusted according to experience without too grave an impact on end users' welfare. However, regulatory decisions which necessarily have to be taken now about future NGA regulation can have a direct and immediate impact on whether and when the NGA infrastructure is built.

Other reports which have been prepared for the debate in Australia have faced the same difficulty when making arguments that the benefits of NBN separation will outweigh the costs³. We are all attempting to predict what will happen in the future in the very uncertain and unknown environment of NGNs.

However, in my judgment, the disquieting aspects of the experience of functional separation in the UK, when combined with the theoretical and empirical evidence I discuss in this paper, point to a presumption in favour of permitting vertical integration in the present case. This conclusion is bolstered by the significant competitive opportunities provided by NGAs and the inherently equivalent, open

³ CEG, Structural Separation for a National Broadband Network, A report prepared for SingTel Optus, May 2008; Dr Chris Doyle, Structural separation and investment in the National Broadband Network environment, A report for SingTel Optus, June 2008. Dr Doyle argues that the operating costs under a vertically separated model could be "slightly higher" compared to a vertically integrated model and as a result it is predicted that "in the very short term" that the prices may be "slightly higher" but will be driven down over time by enhanced competition from separation, but evidence for this is not specified - reported comments of Dr Chris Doyle, *the Australian*, 19 June, 2006.

access architecture of those networks, which make a weaker case for separation remedies in the case of an NGA than for legacy networks.

I agree with the Government that the early and quick deployment of the NBN should bring substantial economic and social benefits to Australia. However, there are already significant risks associated with the aspiration to be a leader internationally in nationwide NGN deployment. These risks are enhanced significantly by attempts to build the network on the basis of some of the vertically separated models proposed for Australia, which go beyond what has been realised elsewhere.

1. *Vertical structure and efficiency*

Two recent surveys have analysed the general literature in the impact of vertical structure on efficiency. Both reveal stronger support for vertical integration than the authors anticipated.

In the more comprehensive literature review by Lafontaine and Slade (2007)⁴ which is based upon citation of nearly 200 sources, 80 or so of which are empirical, the authors review the impact of vertical integration in a range of sectors from services through manufacturing to transport and cable television distribution. It is one of the strengths of the survey that it can identify efficiency effects which pervade the economy.

The authors identify a variety of theoretical frameworks, originating from R. H. Coase's famous 1937 paper on the theory of the firm.⁵ These are: moral hazard arguments (which focus upon the impact of structure on the incentives for agents to perform well or badly); transactions costs arguments (which focus on the costs of making and enforcing contracts in a separated environment); property rights models (which emphasise how asset ownership can change investment incentives); and

⁴ F. Lafontaine and M. Slade, 'Vertical integration and firm boundaries: the evidence', *Journal of Economics Literature*, 45, 3, pp. 629-685, 2007.

⁵ R. Coase, 'The nature of the firm', *Economica* 4(16), p. 386-405, 1937.

market power-based theories of integration (under which the latter eliminates double marginalisation but may permit foreclosure or the raising of rivals' costs).

It is worth quoting at length their overall conclusion in relation to public policy towards integration, which constitutes an authoritative new review of empirical evidence on the effects of integration:

'...we did not have a particular conclusion in mind when we began to collect the evidence, and we have tried to be fair in presenting the empirical regularities. We are therefore somewhat surprised at what the weight of evidence is telling us. It says that, under most circumstances, profit-maximising vertical integration decisions are efficient, not just from the firms' but also from the consumers' point of view. Although there are isolated studies that contradict this claim, the vast majority support it. Moreover, even in industries which are highly concentrated so that horizontal considerations assume substantial importance, the net effect of vertical integration appears to be positive in many instances. We therefore conclude that, faced with a vertical arrangement, the burden of evidence should be placed on competition authorities to demonstrate that the arrangement is harmful before the practice is attacked.' (p.680)

Paul Joskow's review⁶ is less extensive, but it reaches similar conclusions:

'Overall I would argue that there is substantial support in the empirical literature for various efficiency motivations for vertical integration. There is minimal empirical support for anticompetitive foreclosure motivations. This suggests that there is little empirical support for the anti-trust law's traditional suspicion of and hostility towards vertical integration and related non-standard vertical contractual arrangements, except under extreme conditions where firms controlling bottleneck monopoly facilities have the incentive and ability to exercise an anti-competitive foreclosure strategy. (p.29)

⁶ P. Joskow, *Vertical Integration* (2006), available at econ-www.mit.edu/files/1191

This last sentence encapsulates Joskow's suggestion of a presumption (based on the expected efficiencies) in favour of a firm's choice of an integrated structure, rebuttable on the basis of foreseeable abuses of market power, which are not otherwise remediable than by structural intervention. This is a useful starting point for a discussion which must take on board two issues which I address in this paper: first, the bottleneck or, alternatively, the contestable nature of the infrastructure owned by the otherwise vertically integrated entity; and second, the existence of intermediate modes of separation and behavioural regulation generally which address the perceived risks of vertical integration and which lie between the polar cases of ownership separation and full integration which are considered in the surveys reported above. In the case of NGAs, this assessment has to be made in a very dynamic environment in which investors must be persuaded to make large risky bets in order to get the infrastructure installed in the first place.

2. *How special is the telecommunication sector?*

Separation in telecommunications is often justified on the basis that it is a regulatory remedy which is commonly applied across other infrastructure industries which exhibit network bottlenecks to which downstream competitors require access to compete, such as electricity, gas, water and rail. While vertical separation is not without its critics in those other industries, such as rail in the UK, there are special features of infrastructure in telecommunications which need to frame the debate about the need for and acceptability of the solution of separation.

First, the pay-off to separation clearly depends upon the scope for end-to-end competition and the pervasiveness of the bottlenecks referred to by Joskow in the previous section. It is important to bear in mind the two relationships between regulation and structure: while regulation properly responds to structure it also shapes it – in the sense that regulating an asset as a bottleneck will probably keep it one, even if it could be replicated.

In most other network sectors, technology is relatively stable and, aside from minor increments, unchanging over decades. As a consequence, bottlenecks can be readily identified and remain durable over long periods of time. Long lived or irreversible regulatory solutions such as separation can be put in place in the knowledge that the underlying bottleneck problem which justified their adoption will not go away.

Telecommunications networks, of course, are characterised by dynamic technological change: indeed, innovation is the principal source of end user benefit. Past experience shows that judgments about the location of bottlenecks within telecommunications networks and the existence of downstream market power will change, often in unanticipated ways, with successive technological developments.

Separation imposes a rigid, inflexible structure on a business which is not easily reversed. The UK model of functional separation, although only implemented thirty months ago, already seems at risk of being overtaken by technological change. The model is, in large part, premised on local loop unbundling being the primary access service and accordingly, the boundary line between Openreach and the rest of BT is, with some limited exceptions, drawn at the copper access network. However, when in due course the network migrates to an NGA, these assumptions will no longer hold true, and the organisational framework devised for the legacy network will ill fit the changed network architecture of an NGA. Further, as I discuss below, there is some evidence emerging from the UK that the functional separation framework may actually be slowing the migration to an NGA in the UK.

Concerns, of course, about bottleneck control of the customer connection have persisted, but as I discuss below, there is emerging evidence of the significant opportunities for competing NGAs. However, even if the bottleneck does remain in some geographic areas, even within those geographic areas the location of the bottleneck within the network architecture can shift with technological change.

For these reasons, separation remedies are not readily adaptable to dynamic change. As they can also require extensive re-engineering of networks and systems,

separation models are not easily modified (or for that matter, reversed). The significant costs involved in implementing the separation remedy could be compounded by future costs in readjusting the boundaries between separated units to cope with the changes in technology – or if changes in the separation model are not made, greater inefficiencies will be introduced into the operations of the separated units as they try to work across boundaries which are an ill fit with the changed network environment.

We already see some evidence of these problems from the UK. A recent Ofcom survey of wholesale customers of their experience of functional separation found that wholesale customers found the separation between Openreach and BT Wholesale impaired their own dealings with BT:

“The asymmetric split between BT Wholesale and Openreach is acknowledged by almost all to be an awkward one. Some of the product boundaries are unnatural (e.g. should WLR be in Openreach or BT Wholesale?). Consequently the relationship between Openreach and BT Wholesale can be hard work, and there is a perception amongst some CPs [competitive providers] that Wholesale has lost its identity and sense of purpose”⁷;

Second, the technological dynamism of the telecommunications sector also means that even the bottleneck parts of the network are characterised by periodic substantial re-investments. The NGA is the biggest example to date. The Australian Government’s objective is that the National Broadband Network (NBN) will have a population coverage of 98%. NBN assets in most rural locations (subject to important and continuing developments in wireless) are likely to continue to be seen as bottleneck infrastructure, like the current PSTN infrastructure they will replace.

The NBN is likely to remain a work in progress for many years after the Government’s planned commitment is complete. Substantial further investment will take place, as fibre is taken, area by area, closer to the premises. Whatever regulatory structure is adopted to address any bottleneck power must be capable of sustaining that long-term process of progressive investment.

⁷ December Evaluation Report, page 69.

Third, no convincing argument has been made that the presumption in favour of vertical efficiencies which arise from the studies I discuss above is any less relevant to telecommunications networks. In my view, the case is probably stronger.

Telecommunications networks exhibit strong relationships between the network and service layers: downstream services depend on there being sufficient capacity at the network level; decisions about whether to wire up a customer premises to the network follow from a retail sale to the customer; and downstream service features can depend on or be shaped by upstream network characteristics, such as contention ratios . While next generation networks will allow more scope for downstream service providers to innovate, reducing the interdependency of product development between upstream and downstream layers, other interdependencies will remain strong, such as the maximum network speed which will depend on the technical solution implemented at the network level (e.g. the faster VDSL2 vs the slower ADSL 2+) The decision about when at the network level to make the next step change in network speed will very much depend on the likely consumer response to the downstream retail products, including price, offered through the service channels.

What does this mean for the debate over separation in the telecommunications industry compared to other industries? Both proponents and opponents of separation in the telecommunications industry draw on the arguments made in the general economic literature about the appropriate boundaries of firms. I do not intend to rehearse the arguments and counter arguments in this paper, although the studies I discussed at the outset of this paper clearly suggest that the proponents of vertical integration have the better end of the empirical argument relating to efficiency.

In my judgment, the technology-driven characteristics of telecommunications networks I outline above suggest that the deciding factor in the telecommunications industry must be the impacts of integration vs separation on investment and innovation, particularly when considering how to conjure into existence a new fibre network or networks.

As I now turn to discuss, both theory and empirical evidence suggest substantial difficulties arise with investment co-ordination across separated entities in the telecommunications sector.

3. *Separation as a mandatory remedy in telecommunications*

This section considers the experience of the telecommunications sector with respect to separation, beginning with the motive for separation and then examines the initial experience of separation.

3.1 The objectives of separation

Assuming a durable bottleneck has been identified, it is important when designing a regulatory remedy to understand clearly the nature of the competitive problem which that bottleneck might cause. This is why the European regulatory framework requires national regulatory authorities to undertake a two stage process: identify whether a market has competition problems because an operator possess significant market power and then consider the remedies which are proportionate to the competition problems identified.

My knowledge of the Australian debate over separation remedies suggests that there is some misunderstanding of the problems for which separation can be a possible remedy. This may have encouraged a misplaced faith about the relevance and utility of the UK model of functional separation to Australia.

Regulation of a vertically integrated operator's network is likely to be applied in the form of mandatory access (at either cost-based or 'reasonable' prices) to some of the incumbent's assets, such as the local loop, wholesale broadband access, interconnection, and so on. Such 'pro-competitive' regulation at network level is seen as an increasingly viable alternative to 'consumer protection' regulation in the form, of retail price controls.

The success of this approach hinges upon the appropriateness of the terms and conditions of access to the assets in question. If the incumbent can offer better terms to itself than to its competitors in downstream markets, it can exclude them from or weaken them in those markets.

Such discrimination can take two forms: price and non-price. I am aware of arguments made in Australia, by the ACCC Chairman among others⁸, that stronger separation of Telstra would address the perceived shortcomings in the current accounting separation model: in other words, separation is seen as a sharper tool in achieving non-discriminatory pricing than accounting separation. However, in Europe, functional and operational separation are clearly understood as a remedy for non-price discrimination⁹. Regulators have available other tools with which to address issues such as price squeezes. This was very much the basis on which Ofcom proceeded in requiring functional separation of BT. The powers which the ACCC has in respect of price discrimination seem to be more extensive than those which Ofcom possesses and considered adequate – for example, there is no power in the UK comparable to the ACCC's competition notice regime.

Some have argued for complete ownership separation between the network and downstream units as the only way to achieve true economic arm's length dealing. This appears to be the position taken in the CEG paper commissioned by Optus¹⁰, Ownership separation, representing the most radical solution, would sacrifice all of the economic benefits of vertical integration, including the most important benefit for NGAs, investment co-ordination. I will return to this fundamental issue below, having first discussed non-price discrimination, at which separation is principally directed

⁸ Speech by Graham Samuel to ATUG, 10 March 2005.

⁹ Dr Doyle also seems to agree that non-price discrimination is the focus of separation remedies in the EU: see Doyle Report, at page 8.

¹⁰ see CEG Asia-Pacific, *Structural Separation of a National Broadband Network, a report for SingTel Optus*, May 2008. While using the term 'structural separation', CEG describes their model as involving "particular assets and activities of the vertically integrated operator are divested" and the authors refer to the break-up of AT&T: see page 16.

3.1.1 Non-Price Discrimination

As I have said, Ofcom's 2003-5 Strategy Review focussed on non-price discrimination by BT.¹¹ If non-price discrimination is the enemy, then a variety of weapons are available to deal with it. The first, behavioural, approach is simply to prohibit it. In the circumstance postulated (of an integrated firm subject to effective price control of its wholesale products and subject to competition in retail markets), a motive for non-price discrimination is likely to be present – to gain market power in the unregulated retail market.

Can the problem be dealt with by a simple regulatory prohibition, such as is imposed by the regulators worldwide, including the standard access obligations of Part XIC of the Trade Practices Act? This is likely to depend upon the ease with which transgressions can be exposed and punished, as well as on the culture of the company providing services to its competitors. It was a theme of the debate in the UK, asserted by Ofcom and acknowledged by BT, that the company had a record of persistent non-price discrimination relating to a range of access products: unbundled local loops, wholesale line rental, bitstream etc. Both sides agree that this had a chilling effect on competitors' willingness to invest, particularly in assets which they would combine with unbundled loops.

Other European regulators do not admit to such derelictions, and indeed their achievements in unbundling local loops were considerably better than the UK's. This suggests that while the historic monopolists in those countries may have had the motive, they lacked the means to discriminate, because behavioural regulation has thwarted their attempts to do so.

Recognition of this fact – that non-price discrimination can often be resolved by behavioural remedies – has encouraged the European Commission, in its proposals

¹¹ See Ofcom, *A notice under Section 155(1) of the Enterprise Act 2002*, 2005; M. Cave, L Correa and P Crocioni, 'Regulating for non-price discrimination: the case of UK fixed telecoms.' *Competition and Regulation in Network Industries*, 1(3) 2006, pp. 39-71.

to reform the regulatory framework from 2010¹², to introduce a form of separation (functional separation) as a 'last resort' remedy to be used subject to two conditions – proof that behavioural remedies have been tried and failed, and subject to the Commission's specific endorsement.

This approach reflects a recognition that the goal of regulation in this respect is the achievement of equivalence - supplying the same quality of core wholesale products irrespective of whether they are supplied within a firm or sold to a competitor. Separation is one means to that goal, but an intrusive one which would in a European context be considered disproportionate if a less intrusive one were available.

This naturally raises the question of the degree to which Telstra delivers equivalence in the supply of wholesale products. I note that a recent CEG paper on the separation issue says that "regulators have even more difficulty in addressing 'non-price' discrimination" and the paper refers to the standard academic papers which describe the consequences of such so-called 'sabotage'¹³. Dr Doyle has been quoted as saying that "[o]perational and functional separation is very much targeted - if designed properly - to address [non-price] problems. In my opinion, the Australian operational separation plan is lacking in precisely doing that."

Dr Doyle's report refers to the record keeping rules which the ACCC has issued in relation to accounting separation, but he does not refer to the record keeping rules which the ACCC has issued requiring Telstra to report on the comparable treatment of retail and wholesale channels on key non-price service parameters. The information collected by the ACCC on Telstra's relative performance on non-price issues in supplying retail and wholesale customers for over 4 years has been published quarterly by the ACCC in its imputation testing and non-price conditions

¹² European Commission, *Proposal for a Directive of the European Parliament and of the Council, 2007/0247 (COD)*, November 2007.

¹³ see CEG Asia-Pacific, *Structural Separation of a National Broadband Network, a report for SingTel Optus*, May 2008, at page 9.

report. The latest report¹⁴ compares the percentage of Telstra's wholesale and retail customers for which performance standards are met. According to the ACCC, the results show that basic access connection levels had slipped for wholesale customers in the last quarter of 2007, but other results 'are similar and do not indicate that Telstra has materially discriminated against its wholesale customers during the quarter' (p.5). This reflects a consistent pattern of findings of non-discrimination by the ACCC over the 4 year reporting period.

These conclusions relate to current generation technologies, not to NGAs. But they do point to current success in controlling non-price discrimination. The next section discusses special features of NGA. But a possible conclusion so far is that separation, beyond the existing regulatory measures, may not be necessary to achieve non-price equivalence in the Australian environment.

Put simply, the UK model of functional separation may be solving for a problem which already has been addressed in Australia through a combination of other forms of regulation and the incumbent's own non-price behaviour towards wholesale customers. If, on the other hand, the real issue of dispute between Telstra and its competitors is price discrimination, then for the reasons I have discussed above, operational or functional separation is unlikely to be the right tool to address it.

3.2 The consequences of separation as a remedy

I now suppose that separation has been identified as a policy option worth considering,¹⁵ and examine the counterbalancing considerations which need to be taken into account in deciding whether it is, to use the language of the EU regulatory framework, a 'proportionate' response.

¹⁴ *Imputation Testing and Non-price Terms and Conditions Report relating to the Accounting Separation of Telstra for the December Quarter 2007*, ACCC, April 2008.

¹⁵ Different forms of separation are discussed in the Annex.

Separation imposes co-ordination problems, relating to day-to-day operations and to investment.¹⁶ To some extent, the nature of the problems depends upon the form of the separation, although as I suggest below, regulators would take a false comfort in an assumption that the co-ordination problems are significantly different as between operational and full ownership separation.

Under ownership separation, there is no restriction on the forms of opportunistic behaviour which each side in the vertical relationship will employ. The classic example of such behaviour is the so-called 'hold-up' problem. Here a firm makes a sunk investment; for example a supplier builds capacity dedicated to or dependent on purchases of its outputs by one particular customer. Because of this prior commitment, the customer is then able to drive the price it pays for the product or service in the limit down to short-run average cost, and thus appropriate the returns from the sunk investment. In anticipation of this outcome, the firm may not invest in the first place. In the present context, and given the uneven retail market shares of telecommunications operators, the separated NGA would be unhealthily dependent for returns on its investment to sales efforts made by the largest retailer of services to end users.

Any such obstacles to investment, deriving from the hold-up problem or other considerations discussed later, would have particularly unfortunate consequences in telecommunications, where a major and continuing programme of investment is required to bring fibre closer to Australian premises and yield the benefit of innovative services.

In relation to the appropriation of surpluses in a separated structure, in a section discussing what incentives should be put in place to ensure the necessary investment and innovation to upgrade the local loop, the OECD paper on structural separation notes the following (OECD 2003, 24):

¹⁶ This section focuses on investment co-ordination as operational co-ordination has proved a problem in some market contexts, especially in railways in the UK, but it seems less problematic in telecommunications.

“There are concerns over whether there will be adequate investment in network infrastructure when providers are denied the revenues and consequent incentives that flow from vertical integration. This problem is acute in the telecommunications industry, where technological change is rapid and where investment demands are pressing. Problems of co-ordinating investment between the wholesale and retail operators would also impede investment and innovation. These problems could be considerable and could serve to delay the extension of fibre closer to the customer.¹⁷

Later the paper notes (p. 29) :

“A vertically integrated telecommunications company may achieve lower cost structures, for instance, by spreading billing costs across a wide range of services. Similarly, it can produce service packages (“bundling”) at a lower cost than a firm producing the same services on a stand-alone basis. Vertical integration enables the firm to co-ordinate production and investment decisions by minimising external transaction processes and their attendant costs and delays. Such a mode of operation is particularly necessary in an industry operating on the 'technological frontier', where internal processes and structures need to be highly responsive to change.

General issues of co-ordinating investments across a transaction boundary and the adequacy of the contracting alternatives in comparison with a vertical integration are considered below. But it is useful to discuss here whether there is a material difference in the investment decision-making regime between operational and structural separation.

Consider first the UK arrangements for Openreach. These are set out in the lengthy UK undertakings, which give Openreach considerable latitude, recognising that incentives are not enough: management requires some latitude to pursue its

¹⁷ OECD 2003, *The Benefits and Costs of Structural Separation in the Local Loop*, DSTI/ICCP/TISP(2002)13/FINAL, p 24. The paper also discusses the prospect that contracts could make up this deficiency.

objectives. But equally, it must not be too much or shareholder control mechanisms are endangered.

The BT Undertakings seek to deal with this issue by imposing the following condition¹⁸ :

“Any investment decisions required in consequence of the product road maps and volume forecast referred to in Section 5.13.1 shall be considered solely on their own merits, and shall not take into consideration the potential impact on other products offered by BT’s businesses downstream of AS [Access Service i.e. Openreach] other than in as much as they affect aggregate demand forecasts.”

This paragraph crystallises an acute problem. On one hand separation is intended to allow the separated unit to make independent decisions; on the other hand, it is felt that major strategic decisions should be taken at group level. Yet the Group’s incentives are by definition group-wide – and may thus threaten the purity of the behaviour generated by local incentives arrangements. While in principle the restrictions operate symmetrically in eliminating from consideration all impacts on other businesses, in practice they are likely to be more effective in preventing locally loss-making investments than in enforcing the implementation of locally profitable projects.

Under the UK arrangements, the Equality of Access Board (which ‘polices’ BT’s Undertakings):

“shall also be responsible for monitoring and reviewing the product roadmaps and volume forecasts – as well as the associated investment decisions as referred to in Section 5.13.2 [quoted above], as they relate to AS and SMP (significant market power) products.”

¹⁸ Ofcom, *A Notice under Section 155(1) of the Enterprise Act 2002*, 2005 para 5.13.2.

The issue has not yet been faced, in large part because BT has yet to develop plans for a next generation access network, which would represent a major strategic investment in access. But the dilemma is an acute one: either the functionally separated entity acts as if it were structurally separated, or it remits strategic decisions to a group level at which interrelationships between the component parts are taken into account.

However, there are early signs of problems in co-ordination on BT's existing network across the functional separation boundaries within BT. The Ofcom wholesale customer survey to which I referred above reported a view amongst wholesale customers that:

“communication across the group can be stilted – there is certainly nervousness, and no-one wants to be “fired” because they breached an Undertaking”¹⁹.

Wholesale customers also expressed concern that Openreach and BT Wholesale tended towards an overly cautious “one-size-fits-all” approach to wholesaling which was resulting in an “equivalently average/poor” services rather than “equivalently excellent” services.

There is also some indication that these problems of co-ordination and over-caution may be adversely impacting investment in NGNs. Openreach has acknowledged that it will not proceed without commitments from internal and external downstream service providers. The views of the head of Openreach are reported below²⁰:

“The economics simply do not work unless BT Retail and rivals such as Sky, Tiscali and TalkTalk agree to make use of the new technology and pay for it. In essence, “the decision about whether to put fibre in is not just a BT decision”, [the Openreach CEO says] “Our model says we do not take the whole value chain, we

¹⁹ December Evaluation Report, page 69.

²⁰ <http://news.zdnet.co.uk/communications/0,1000000085,39289708,00.htm>.

do make it available to everybody else and that means the financial case is even more demanding”

This accumulation of evidence suggests that co-ordination problems in separated structures are potentially severe. It also suggests that as far as investment co-ordination is concerned, the difference between operational and structural separation diminishes on inspection; it is likely that objections to the one form of separation will apply to the other. This similarity may even extend to the hold-up problem, as it would clearly be discriminatory for a separated unit to forswear opportunistic behaviour in relations with an affiliated organisation, but engage in the practice with others.

Thus, I conclude that we are justified in lumping together, for some purpose in this discussion, operational, functional and structural separation.

3.3 The problems of co-ordination

Separation models will sacrifice to some degree the benefits of vertical integration in dealing with vertical externalities. These include²¹:

- potentially lower prices because double marginalisation is avoided;
- better and more efficient innovation processes because network level decisions can be made with much better knowledge of retail products and retail demand conditions;
- the network operator’s investment incentives to support innovative retail service offerings are promoted because the network level shares in the margins accruing downstream;

²¹ A description of the efficiencies of vertical integration in a telecommunications context can be found in the report prepared by Henry Ergas and lodged by Telstra with its submission on the G9 SAU: H. Ergas, *Vertical Integration, Vertical Separation and Efficiency Consequences of the G9 SAU*, 6 August 2007.

- more responsiveness to rapid technological change because a vertically integrated operator does not have to engage in bargaining to the same degree between upstream and downstream businesses over issues such as capital contribution and risk sharing.

These are well recognised as benefits of vertical integration in any sector. In this section, I consider in more detail the particular risks of co-ordination across organisation boundaries and whether they can be adequately addressed in any separation model. The reason I focus on the co-ordination issues – as important as the other benefits of vertical integration are – is that, as consumer benefit in telecommunications generally and in relation to NGNs in particular derives mainly from innovation, the co-ordination effects of vertical integration vs separation models should assume a greater importance for policymakers.

First, a risk-sharing issue arises in separated models because it is the network business which accrues a large investment in sunk assets, whereas downstream firms typically have an option to neglect the new services made available by the new network, and to continue to sell the old services.

Thus a potential investor in new assets in a separated networks business may be concerned about whether downstream firms will have adequate incentives to sell the new services made available. In other words, the network investor bears all the risks, but depends entirely upon separated retailers for returns.

One way of dealing with this situation is to write risk-sharing contracts, which align the incentive of upstream and downstream parties. The most direct means would be co-investment, but this would compromise separation. An alternative would be a risk-sharing arrangement such as a 'take-or-pay' contract, which committed the downstream firms to buy new network services in advance. These contracts would be complex to write and would require regulatory cooperation as the price charged for the service would have to reflect the degree of risk transferred, thereby creating the (false) impression of price discrimination. A 'contracting optimist' would expect

such problems to be resolved. A 'contracting pessimist' would emphasise the difficulties. In the absence of clear evidence from the sector, it is difficult at present to discriminate between these two views.

The second key problem relates to information transfer. A structurally separated network business has no direct contact with end-users. A network business separated in less radical ways is often prevented from contacts with them by rules relating to Chinese Walls. As a result, much information about end user preferences is only available at one remove - from downstream firms which may have an interest in distorting it (for example, to hasten or delay further investment).

There are ways around this difficulty, such as market research, or relying on a trusted and disinterested third party to forecast demand – as is done in the energy industry, but these may be no substitute for direct contact with end-users. The result will be less confidence in forecasts of demand for new services and delayed investment.

There also is an issue about the decision-taking process. Major strategic investments, especially those that require the board to 'bet the company,' require a comprehensive overview of all the relevant factors. Yet separation as noted above, works against that approach. In particular, a separately managed access business, subject to non-discrimination rules and incentives, may adopt a cautious and reactive approach to proposals for new services, rather than a pro-active approach.

This charge has been raised against BT's Openreach. As I have discussed above, BT's failure to make any investment in fibre connections compared to other EU member states without separation regimes has been partially attributed to the more cautious, rule bound approach which separation has engendered. Although it is too early to draw definitive conclusions, the dilemma the UK faces is that, if the view is eventually reached in the UK that functional separation model is contributing to the delayed NGA roll-out, it will take considerable time and effort to reverse or modify the model given the depth of re-organisation which has been required within BT to

meet the undertakings. This is another possible cost of co-ordination which has to be taken into account.

4. *NGA investment and separation*

This section addresses the key issue of whether, in light of the above discussion, a special case can be made for separation of Next Generation Access Networks. I concur with the Government's view that Australia's future prosperity is bound to the growth of the digital economy. Any delay or design fault in building and regulating NGA networks will impose a heavy price in terms of lost productivity gains and lost consumer benefits. I will also address in this section the view that has been expressed in some of the other separation reports recently published in Australia that the risks of separation are reduced for the NGN.

4.1 Features of NGAs

NGAs appear to have some fundamental characteristics which go to the root of the problems to which separation is directed as a regulatory remedy.

First, it is often asserted, falsely in my view, that NGAs are a natural monopoly, and that the development of end-to-end competition in the delivery of electronic communications services which have been seen in the past twenty years will be reversed.

This view is sometimes based on a definition of NGAs which confines them to FTTx networks which are a development and extension of the copper access network or CAN. But this omits hybrid fibre co-axial (HFC) networks ('cable networks'), which when developed up to DOCSIS 3.0 standard, are capable of meeting the functionality of FTTC and some variants of FTTH networks. They also have the capacity to broadcast entertainment programmes, rather than rely on IPTV.

Moreover, observation of NGAs in Europe suggests that investment in them is promoted by competition. Thus the Netherlands loss of subscribers to cable

companies seems to have been one of the factors driving KPN's investments in an NGA network, and competition between France Telecom and Free in parts of France has triggered an investment race which has benefited end users. Accordingly the European Commission's forthcoming Recommendation on the regulation of NGAs is likely to focus to a considerable degree on means of promoting competition among them, via sharing passive assets such as ducts, for example, rather than treating the network as a whole as a bottleneck.

While Australia's NBN, at least in the initial years, may not face facilities-based competition across its whole footprint, it is important not to ignore existing and future facilities-based competition when imposing significant remedies such as separation. Australia has in its Optus HFC network the basis for an upgraded NGA passing a significant proportion of households and businesses. I have argued elsewhere that, with fewer regulatory advantages, Optus would have an incentive to treat more households within its footprint as serviceable and to upgrade its network.²²

Additionally, wireless networks place a competitive constraint on NGAs, from either inside or outside the market. Their capability is demonstrated by Telstra's Next G network, which its mobile competitors have indicated they will seek to match. Although wireless networks may have difficulties in fully replicating the characteristics of fibre-based NGAs, because they involve more asset sharing, they nonetheless offer certain end-users a valuable alternative.

A second key feature of NGA networks is that they can rely on a range of architectures. The key distinction is between FTTH and FTTP,²³ while the latter can rely upon point-to-point fibre or a (shared) G-PON connection. My concern is not about the different access points which the alternatives offer (an important issue for behavioural regulation) but with the durability of the FTTC version. Many regard it as a transitional step, the installation of which will be followed by a larger investment required to take fibre to the home.

²² M. Cave, *The application of the ladder of investment in Australia*, submission to ACCC, December 2007.

²³ HFC networks differ in capability too, depending upon how far fibre is built into the network and on the DOCSIS standard employed.

To summarise these points, NGA construction is likely to be a gradual and cumulative, rather than a one-off process. It is likely that different networks, using different technologies, will co-exist at least in some geographies. It is in the long term interests of end-users that this competition should not start from the presumption of monopoly.

Thirdly, there is reason to believe that many of the causes of or opportunities for discriminatory behaviour will be eliminated or substantially reduced in an NGA compared to legacy networks. Past non-price regulation can be seen as an attempt to impose non-discriminatory access on legacy networks and systems which were originally built on the assumption of a monopoly supplier. As so many systems were either manual or susceptible to human intervention, organisational measures related to incentives were eventually seen as necessary to achieve a change in the incumbent's behaviour. In some ways, separation was an 'organisational workaround' for legacy systems not fit for the purpose of an open access regime.

NGAs have a network architecture more suited to open access. The network can be accessed through open, externally defined standard interfaces. Most remaining manual processes will be automated and the number of systems involved substantially rationalised. In this environment, much of the work which separation remedies were intended to achieve within the legacy networks will be encoded into the NGA itself.

Finally, there is the question of scale. Replacing copper with fibre throughout the territory of Australia will be a process continuing for a decade or more and, as more and more fibre will progressively be deployed, going beyond the set of activities contemplated in the Government's request for proposals. Telstra estimates that the total investment required will be of the order of \$15 bn. It is also an investment which will have major and ramified effects throughout the whole economy and society. The scale of the project increases the risks of regulatory failure as well as of market failure. I note that where separation has been imposed to date, it applies to an existing network and to downstream wholesale and retail PSTN and broadband

businesses which can be judged as carrying limited risks. Nowhere has the attempt been made to simultaneously implement separation and build an entirely new network. Singapore proposes to apply a structural separation model to its FTTP roll-out, but as I discuss below, unlike in Australia the FTTP will not replace the PSTN which SingTel will continue to operate as a vertically integrated entity.

4.2 Some proposals for a separated NGA network.

Here I comment on two proposals for a separated NGA, before discussing in the next section how best to realise the Government’s requirements for its proposed National Broadband Network (NBN)

The Singapore approach

In December April 2007 and April 2008, the Singapore Government issued requests for proposals to build and operate its proposed next generation national broadband network (Next Gen NBN)²⁴. This will offer competitively priced ultra-high speed broadband (100 Mbp/s downstream, 50 Mbp/s upstream) to all homes, businesses, schools and other premises. The Government is prepared to invest up to \$5 bn in the project.

The structure of the NRN is as follows:

| | | |
|-----------------|------------------------|--|
| Layer 1 | Passive infrastructure | NetCo (responsible for the design build and operation of the Network’s passive infrastructure) |
| Layers 2 and 3 | Active infrastructure | OpCo (responsible for the design build and operation of the Network’s active infrastructure) |
| Retail Services | | Retail service providers – RSP (purchase connectivity from OpCo (a) and provide services to end-users) |

²⁴ IDA Press Release, 4 April 2008; IDA, *Slides from media briefing-Next Generation National Broadband Network for Singapore*, December 2007.

The key separation requirement related to links between the Next Gen NBN NetCo and (one or more) OpCos²⁵. The OpCo must: operate as a standalone basis; be located in separate premises; and make its own decisions on assets and commercial policies. Its directors must not have responsibility for an affiliated operator, nor can their remuneration be linked to an affiliated company's performance.

This is supplemented by a requirement for structural separation between NetCo, the passive network operator (expected to be a monopoly) and downstream operators. In this context, structural separation means 'no effective control'.

The effect of the proposal seems to be a jump to an ultra-high speed networks (100 Mbp/s scalable to 1Gbp/s), as contrasted with the Australian Government plan to provide a universal 12 Mbp/s service. There is accordingly less reason to worry about subsequent incremental investment in NGA networks than in other contexts.

Notwithstanding, it is reasonable to anticipate problems in the relationships between NetCo (the NRN) and OpCo. The planned date of award of the NetCo contract is the 3rd quarter of 2008, while for the OpCo contract it is the 1st quarter of 2009. This means that OpCo will have to take NetCo's design as given, with no scope for overall optimisation.

More speculatively, I also note that, as the incumbent's copper network is not being utilised, it will continue to operate on that network as a vertically integrated entity. In addition, there is also a ubiquitous cable operator which has already upgraded its network to 100Mbp/s. Consistently with the views I expressed above about NGA competition, this should make separation remedies unnecessary in Singapore. The presence of vertically integrated operators may act as a spur to ensure that NetCo and OpCo work together, although the risk remains that they will take different views of the significance of external threats. I also note that OpCo apparently will be

²⁵ It seems that in practice there will be only one OpCo.

permitted to supply end users, and that the form of separation required at this level is operational or functional and not structural separation. Therefore, the form of separation proposed in Singapore is less extensive than the three way structural split that Terria proposes in Australia between Telstra (as the sub-loop provider), the FTTN wholesale only operator and the downstream retail providers.

Finally, of course, the risks of deploying an NGN in Singapore, which has a geographic size and population smaller than Sydney, would seem to be much lower than those involved in deploying the NBN across 98% of the population in a country as large as Australia. Again, the retention of the SingTel PSTN operated by SingTel as a vertically integrated entity also provides a backstop for end users in the event that problems emerge in the NGNBN rollout under its strictly functionally-separated model.

Separation arrangements relating to FANOC's special access undertaking

In mid 2007, FANOC, a coalition of nine operators, submitted to the ACCC a special access undertaking (SAU) in relation to broadband access service; the ACCC issued its draft decision rejecting the application in December 2007.²⁶

The ownership structure of FANOC, in which diverse interests are represented, inevitably imposes a significant degree of separation, simply because the participants have no desire to pool their retail or other network activities. Hence, full integration is not an option. Nonetheless the participation of FANOC shareholders on both sides of the line does still create a motive for discrimination.

As the ACCC observes, the standard approach would be for the regulator to investigate and adjudicate complaints of discriminatory behaviour. However FANOC instead proposed creating a Broadband Access Service (BAS) Manager Body to represent the interests of all access seekers.²⁷ This body might however, be

²⁶ ACCC, *Assessment of FANOC's Special Access Undertaking in relation to Broadband Access Service, 2007.*

²⁷ *Ibid*, p. 110-111.

dominated by FANOC shareholders colluding in arrangements for self-preference. This then required more elaborate rules within the BAS Manager and between it and FANOC to limit this risk. This, in turn raised, the prospects of deadlock which required an escalation procedure for disputes to be resolved by the ACCC or a third party arbitrator. An approach based on conventional regulation would be less susceptible to these risks.

Investment incentives in the NGA seem problematic too. Multiplying the stakeholders involved in the investment decision – potentially the entire industry plus the regulator or an independent third party to resolve disputes – escalates the investment co-ordination problems I have discussed above. Access seekers may have diverse and inconsistent preferences, depending upon their commercial strategies and whether they are FANOC shareholders.²⁸ Pressures via the BAS Manager would be compromised by conflicts of interest among access seekers, and might be influenced by a desire to exclude later entrants. This complex structure potentially replete with conflicts is unlikely to achieve the FTTN network upgrades which will be necessary. The ACCC itself expresses some doubts about the ability of the structure to elicit efficient investment.²⁹

The co-ordination problems – difficult enough as they are in any separation model - are more complex here because the G9 model involves a significantly higher degree of separation than other models which have been implemented or considered overseas, including in Singapore. Structural separation is applied at two levels. First, Telstra, as the owner of the sub-loops, would supply them to FANOC. Second, FANOC, as the OpCo, is a wholesale only provider and is structurally separated from the downstream applications and services providers (which may be retailers, wholesalers or both,)

This proposal illustrates the problems inherent in trying to use contracts to solve co-ordination problems at the level required for large scale, continuing investment.

²⁸ *Ibid*, pp. 115-8.

²⁹ *Ibid*, pp 124-6.

Finally, I note that the fact that non-vertically integrated entities bid for the NBN is no answer to the risks and problems of vertical integration that I have outlined in this paper. The higher costs and inefficiencies in building the NGN through a non-vertically integrated entity may have been traded off through a more constrained technical or geographic solution. As I have also noted, telecommunications networks and NGAs in particular are characterised by a pattern of continuing re-investment: the RFP stresses the importance of a future technology pathway. Even if the participants in a non-vertically integrated solution are able to resolve to achieve the initial roll-out, there can be no guarantee that they will be able to agree amongst themselves or with access seekers to timely re-investment in up-grades to the network.

4.3 The arguments made against co-ordination risks of separation for the NBN

Three responses have been made on the investment co-ordination issues in other separation papers recently published in Australia.

First, it is argued that with the evolution towards an IP network and the greater emphasis on downstream service diversity that downstream managerial effort will become more important and therefore companies are likely to find that there are increasing benefits to be obtained by separating retail and upstream activities³⁰. That may well be so for some operators in some conditions, but a voluntary decision to separate is an entirely different proposition from a mandatory remedy.

This argument also seems to assume that the upstream network is more or less static and that downstream technology decisions are divorced from upstream technology decisions. While NGNs will allow more innovation in the downstream applications and services layers, the upstream network will continue to face technological change and opportunity. The Australian Government's RFP emphasises the importance of a technology pathway for the NBN. An FTTN solution is likely to be a stage on the way to an FTTP solution, at least in many areas.

³⁰ Doyle Report, page 6.

Therefore, given the extent of likely technology and demand change both upstream and downstream, it would be wrong to assume that investment co-ordination issues are any less acute in an NGN – if anything they seem to be to more pressing than in today's legacy networks.

It is also important to bear in mind that the continuing investment which will be required upstream is not limited just to the transmission layer. In order to achieve ever higher speeds, it is likely that significant investment will be required in the physical network. This may initially involve re-investment in the copper network, to be followed over time by the replacement of copper sub-loops with a FTTH deployment. Hence, the double layer problem of co-ordination in the G9 model: the retail providers must co-ordinate with FANOC, which may have to then co-ordinate with Telstra, to get the overall commitment required to continue to move the NBN along the upgrade pathway. I note that for this reason Dr Doyle seems to prefer a simpler two way split between Netco/RetailCo, but it is not altogether clear to me how this would work in the Australian environment with Telstra's ownership of the sub-loops (i.e. Telstra would either have to forfeit its loops or exit the retail business – both of which would give rise to a thicket of issues – not the least being compensation).

Second, it is argued that contracting approaches can achieve an acceptable level of co-ordination. In past papers, I have certainly recognised that contracting is an approach which could be used in today's environment, although I have also cautioned, as I do above, that there are doubts about the efficacy of this approach. However, we are dealing here with a spectrum of risks. The larger and less defined the risks, the greater the investment requirement and the larger the number of parties involved, the more unlikely it is that contracting solutions will be workable.

While contracting may well conceivably work to manage risks between a manufacturer and a downstream supplier to develop a new product using the existing manufacturing or research facilities of the manufacturer and the existing distribution channels of the downstream retailer, policy makers face an entirely different situation when dealing with the deployment of as yet unbuilt network of the

dimensions and significance of the NBN. The task of building within five years an entirely new national network to replace the PSTN, and then of upgrading it, involves challenges, risks and unpredictable contingencies which are of a different order of magnitude from the exercise of developing enhancements to existing networks or products, where the prospects of foreseeing likely contingencies are much better.

The conflicts, uncertainties and inefficiencies inherent in a contracting model addressing the deployment of a new large scale network are, in fact, well illustrated by the FANOC-BAS Manager structure proposed by the G9 in its Special Access Undertaking, which have been discussed above.

Third, while acknowledging the strength of the investment co-ordination arguments, Davis and Williams comment³¹:

[these arguments do not provide] a sufficient explanation of why it is that assets such as local loops or, indeed, other network assets should be considered relationship-specific. The assets clearly cannot readily be turned to other uses, but, in many cases, they could readily be supplied to other firms. That should significantly reduce the possibility of investment hold-up.

Firstly, the hold-up problem is just one of the investment co-ordination problems to which separation can lead. Secondly, that problem may be greater in an NGN environment than with legacy networks. In a legacy world, network owners face less risk in when making *ex ante* decisions about investment from the subsequent conduct of downstream retailers. This is because legacy technology limits the scope for downstream retail product differentiation – one provider's pre-selected long distance telephone services are much like another's – and so the threat of displacement and diversion would be credible. However, as others in the debate over separation have noted, the extent of downstream product differentiation is much

³¹ Warwick Davis and Philip Williams, Structural Separation in Australia, Economic and Policy Issues, Telecommunications Journal of Australia, vol. 58, no.1, at page 115.

higher on next generation networks.³² The hypothetically separated FTTN owner has much less scope to threaten a large retailer which is reluctant to commit to upgrades with diverting its capacity to another downstream provider which is willing to come on board. Therefore, larger retail providers in a NGN world are likely to have a hold-up threat *ex post* that conditions the hypothetically separated FTTN owner's investment decision *ex ante* (i.e. knowing *ex ante* that it may be held up *ex post*, the owner is reluctant to invest).

Therefore, contrary to the above argument, if the network owner – whether Telstra or an operator leasing sub-loops from Telstra – is required to make irreversible decisions about further investment in capacity or capabilities of the network which depend on decisions by downstream users, the co-ordination problems I have described above arise.

5. Conclusion

I now summarise the chain of reasoning in this paper.

The policy context in relation to the NBN in Australia can be formulated as follows:

- there is good evidence from other sectors that integration enhances efficiency;
- this might be counter-balanced by adverse effects delivered by vertical leveraging of market power;
- clear evidence of such adverse effects must be available in order to overcome the presumption in favour of integration created by the efficiency benefits it appears to bestow; but
- there is scant evidence, based on the reports provided to the ACCC, that non-price discrimination, which has been the justification for functional separation in the UK, is a problem in Australia, or that it is a problem in Australia of the same scale as it was in the UK.

³² Competition Economists Group (CEG), *Structural Separation for a National Broadband Network: A report for SingTel Optus*, May 2008, p.12.

Turning to forms of separation and their consequences:

- imposing separation is a strong remedy, and quite distinct from voluntary separation;
- the opportunities for facilities-based competition and for technological change in telecommunications networks (even in areas where the prospects of facilities-based competition are considered low) make it difficult to identify enduring bottlenecks for the purposes of drawing boundaries in separation models in the telecommunications industry- more difficult than in other networked industries;
- separation creates challenges in the co-ordination of both operational and investment decisions. As telecommunications network elements – whether bottleneck or not – are characterised by the need for continuing re-investment, the effects of separation on investment co-ordination are more adverse than in other network industries characterised by more stable technology;
- these problems of co-ordination are of broadly the same nature and scale whether the separation is operational, functional or structural; on this basis, it would be wrong in my view to characterise functional or operational separation as fall- back options when structural separation is not adopted;
- while contracting can in principle achieve co-ordination, its effectiveness is open to question and highly case-specific.

Relating to NGAs:

- it is important to maximise the scope for effective competition among NGAs, and to avoid applying in competitive contexts regulatory measures such as separation which have no place in them;

- because of the scale and progressive nature of an NGA roll-out, and its likely subsequent development, the investment co-ordination problems entailed are very acute;
- the scale, complexity and level of risk associated with the NBN project make it highly unlikely that contractual arrangements between separated entities – whether in common ownership or not – could efficiently achieve the deployment and continuing upgrade of the network.
- unlike the legacy copper access network, NGAs can be designed to facilitate the attainment by behavioural means of equivalence between retailers affiliated with and competing with the network operator.

I therefore, conclude that a model incorporating integration and effective behavioural enforcement of equivalence is likely to be the best means of achieving the Government's objectives in relation to the NBN. On risk management grounds, this is preferable to experimenting with an untested separation method in the context of a project to deploy a large NGN to a highly ambitious timetable.

Annex: Separation Terminology

Table 1 contains a specification of separation options varying from accounting separation underneath a 'ladder' of options which extends to full ownership separation at the top.

Table 1. Separation Options

| |
|--|
| 6- Ownership or structural separation |
| 5- Legal separation (separate legal entities under the same ownership) |
| 4- Functional separation with localised incentives and/or separate governance arrangements |
| 3- Functional or operational separation |
| 2- Virtual separation |
| 1- Creation of a wholesale division |
| Accounting separation |

Accounting separation entails identification of the cost elements in supply of retail and wholesale products. Common network elements are separately identified. Some versions of accounting separation may require separate profit and loss statements and balance sheets for the separate entities.

This can be accompanied by the creation of a special wholesale (or otherwise named) unit, with a dedicated management (1 in Table 1). This will be responsible at a managerial level for the production and supply of the relevant products, but with no guarantee, at this degree of separation, of non-discrimination between affiliated and competitive access seekers.

Virtual separation (2) is the *modus operandi* of many telecommunications incumbents at present, given the obligations for non-discrimination imposed on them. The key issue here is the actual and perceived feasibility of achieving full

equivalence of treatment of affiliated and unaffiliated downstream or upstream organisations in such circumstances.

The next step up (3) involves functional or operational separation, which requires reworking of underlying business practices and not just changes at the transaction boundary, as with virtual separation. The aim is to segregate particular assets and other inputs within a separate unit, which then trades using non discriminating processes with both internal and external customers in way that can be verified transparently.

A higher level of functional separation (4) involves incentives for senior managers in the separated entity, and/or separate governance arrangements. A further escalation of measures in a similar vein would require the creation of a divisional board with non-executive directors independent of the group, or of a special scrutiny regime to enforce separation. This could take the further form of legal separation (5), a regime in which a separate board is created and separate statutory accounts are filed - all designed to emphasise and support the independence of the separated entity.

The final option (6) requires separate ownership of the separated assets. The cleanest situation arises where there is complete separation. This is the definition of separation in the studies reviewed by Lafontaine and Slade and by Joskow cited above. But there are other possibilities. One which is germane to the present situation in Australia as a result of the G9 proposal, is for there to be overlapping ownership on both sides of the separating wall. Thus, under the G9 proposal, some parties may be partial owners of the network activity and also participate on their own account of the downstream activity, and which others may only participate in downstream. This is a hybrid in which the adverse effects of integration may be concealed by the formal appearance of separation.