

Leased line product migrations

A REPORT PREPARED FOR VODAFONE

TOWERHOUSE LLP

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Executive Summary

- 1.1 In a competitive leased line market, suppliers would have strong incentives to minimise the cost and disruption to customers associated with product migrations, and would likely be forced to avoid passing these costs on to the customer. These incentives derive from the risk of losing customers: if a customer perceives the cost and disruption to be equivalent to switching supplier, then they are likely to see product migration as an opportunity to consider alternative suppliers.
- 1.2 BT has SMP in most wholesale leased line markets, and also some retail markets. Any incentive it has to ensure a smooth and efficient migration process is weakened by the lack of effective competition. It is therefore unsurprising that BT's migration processes are often poor, or even absent, in which case the customer must cancel their existing service and order the new product as if they were a new customer.¹
- 1.3 BT also maintains more products than we would expect to find in a competitive market, and this creates unnecessary product migrations. A case in point is the relatively minor difference between EAD and WES. Competitors to BT, and any supplier in a competitive market, would most likely present such a change as an internal technology upgrade – at the expense of, and coordinated by, the supplier.
- 1.4 There are many parallels between product migrations and switching supplier in leased line markets. In SMP markets in particular, an inefficient and costly migration process may prevent customers from using the service which best meets their needs. In recent years, Ofcom has undertaken a number of detailed investigations into barriers to switching in fixed telecoms markets. As a result, it has proposed changes to regulation to lower these barriers, and thereby reduce the impediments to a well-functioning market.
- 1.5 Intervention is also needed in relation to product migrations - to adjust BT's incentives and to help produce an outcome for consumers that mimics a competitive market. This is true in general, but is particularly important in relation to end of life product migrations which are forced on the customer.
- 1.6 Ofcom's current approach to product platform closure has emphasised the use of price signals to encourage customers to change services. We find that this will be ineffective for a significant minority of customers for whom the costs of adapting internal systems and processes to use a new product far outweigh the price of a leased line.² This is an example of behaviour we see in in other sectors with rapid advances in technology: customers with a significant investment in

¹ That is, to cease and re-provide.

² For example, if the customer operates a large and complex system which uses leased lines as an input and relies on the specific technical interface or performance characteristics of the current service. If the modern equivalent leased line does not replicate this interface or characteristics, the customer may need to rebuild its entire system to accommodate the new leased line service.

an old technology platform will rationally choose to continue using the old technology even after it is no longer supported.

Recommendations

- 1.7 The significant differences in the approach to product migrations taken by a supplier in a hypothetically competitive leased line market and by BT where it has SMP represent a market failure. The consequences for consumers include the following:
 - Customers are forced to undertake migrations more often than would be expected in a competitive market;
 - Those customer undertaking the migration face unnecessary disruption and costs due to the poor processes; and
 - Some customers will be put off by the costs and disruption, and will choose not to migrate even though BT is offering a product which better meets their needs.
- 1.8 To address these issues, Ofcom should make the following changes to leased line regulation:
 - 1.8.1 To require BT to supply an efficient managed migration service between any two leased line products irrespective of technology used by these products.³ This should include, in particular, the ability to migrate to the proposed dark fibre service. Although this may be difficult to apply retrospectively to legacy services, on a forward looking basis, the obligation would help align BT's incentives with those found in a competitive market, and encourage BT to adopt a simpler product portfolio.
 - 1.8.2 Develop charge controls with a presumption that the efficiently incurred costs of migration are to be included in the costs of the new service, rather than being passed on to existing customers. This would encourage BT to undertake minor product updates, such as the move from WES to EAD, as an internal technology upgrade.
 - 1.8.3 Allow positive incentives for BT to encourage the provision of help to customers who face significant costs adapting internal systems to the new product. For example, it may be appropriate to allow BT to retain the additional margin on the new platform created by increases in volume that result from migrating this set of customers.
- 1.9 In addition, it is clear that price-based signals will not be effective at encouraging the last remaining customers to leave a legacy product that has no direct substitutes. Therefore, Ofcom should no longer allow significant increases in price as a product approaches end of life.
- 1.10 Finally, we recommend that Ofcom investigate leased line product migrations as part of the ongoing BCMR. BT is planning to withdraw both WES/BES and very low bandwidth services over the next few years. This is likely to be followed by the removal of PPCs. The ongoing Business Connectivity Market Review presents the ideal opportunity for Ofcom to explore these issues further, to develop a set of policies that will address the market failure that exists in relation to

³ There may need to be exceptions to this rule, but the presumption should be that the rule applies in all circumstances.

product migration, and to be able to implement any necessary changes in regulation to ensure that customers are afforded sufficient protection through these planned and expected product withdrawals.

Introduction

- 2.1 This paper looks at the issues faced by customers needing to move from one BT leased line product to another. Leased lines are supplied using a variety of different technologies and products. These technologies and products create a range of leased line services with different characteristics catering for the wide variety of customer demands. In many cases, providers can deliver a very similar service using different technologies, or different products. As such, for any given customer demand for business connectivity, there will be a range of solutions to fulfil this need, each with different commercial and technical characteristics.
- 2.2 The process of changing products is usually referred to as migration. In general, wholesale competitors to BT try to protect their customers from the disruption and costs associated with product migrations. BT does not make the same effort, and this paper explores why that might be the case. Our approach is to consider supplier and customer incentives in a hypothetical well-functioning and competitive market⁴, and to compare this to markets where BT has SMP.
- 2.3 It is important that customers are able to use the service which best meets their needs – regardless of whether this service is provided by their current supplier or a competitor. High costs to either switch supplier or migrate products have a direct adverse impact on consumers by constraining choice, and therefore may also damage competition and investment. Ofcom noted the following in relation to supplier switching, but given the similarities, the same would apply to product migration:

“Well-functioning communications markets require effective switching processes. The ability to switch Communications Providers (‘CPs’) allows consumers to exercise choice, purchase the service or combination of services which best meet their needs, and switch away if they are dissatisfied with a provider. Conversely, ineffective processes constrain consumer choice, and hence can also be harmful to competition, investment and market entry.”

Document outline

- 2.4 In the following chapter we consider what would happen in a competitive leased line market. We find that suppliers would have a strong incentive to minimise the cost to their customers of migrating between products. This acts as our benchmark with which to assess actual conditions in UK leased lines markets.
- 2.5 In section 4, we consider BT’s incentives with regards to product migration. The incentives in a competitive market stem from the threat of losing customers. In SMP markets, these incentives are either entirely absent, or significantly weakened. Therefore, we consider BT’s preferences with regards to the costs associated with two different product platforms on the assumption

⁴ Perfect competition is not a helpful point of reference, since it assumes that there are no switching costs. Hence, we consider a market which is reasonably competitive, in which no operator has market power, and therefore customers have a choice of supplier.

that products display economies of scale. We find that once BT has a reasonable volume of customers on each platform, it is likely to be largely indifferent between which platform is used, and therefore will only have relatively weak incentives to encourage, or otherwise assist, its customers in migrating from one platform to another.

- 2.6 Section 5 then turns to customers, and considers how product migrations affect their incentives. Our main conclusion is that the last few customers remaining on a legacy technology platform are likely to be highly unresponsive to price signals. Therefore, it is not appropriate for Ofcom to allow prices to rise to encourage these customers to migrate to a modern equivalent service.
- 2.7 In section 6, we look in more detail at the issues faced by customers of BT's WES product in migrating to the new EAD service. Finally, the last chapter draws together the conclusions from the theoretical analysis, and makes a number of recommendations to Ofcom.

Product migrations in a competitive market

3.1 This section considers the supply of leased line products in an effectively competitive market. We are interested in the following questions:

- What incentives would exist in relation to product migrations?
- What approach would suppliers take to closing old products?
- What range of products would typically be offered by each supplier?

3.2 We start by setting out the assumptions implicit in our model of competition.

Model of competition

3.3 We assume a well-functioning and effectively competitive market, in which no supplier has SMP and consumers have an effective choice of supplier. In these circumstances, the varying demands of consumers will be met by a range of services, and prices can be expected to be close to cost.

3.4 However, to ensure our model of competition captures some of the key characteristics of leased lines, we assume that there are non-negligible switching costs (i.e. the costs associated with changing supplier). Switching costs in leased lines markets stem largely from compatibility and transaction costs associated with the process of changing supplier. This process could require:

- the installation of a new network connection, possibly requiring a new duct into the building and agreement from the relevant landowners;
- new equipment at the customer premises;
- testing to ensure the new service works as expected, including parallel running of old and new services to provide a fall back option; and
- an outage while the service is moved between the two networks.

3.5 Given the complexity of the systems and services involved, switching costs are an inherent feature of leased line markets. As Ofcom found in its review of the economic literature⁵, the theory suggests that switching costs create a degree of market power for suppliers over their existing customers. In turn, this encourages suppliers to compete more aggressively to win customers in the first place. The market power over existing customers creates the potential for profits from their repeat custom. This is consistent with the provisional findings of the Competition and Markets Authority in its investigation of energy markets.⁶ As such, firms tend to place a higher value on attracting and retaining customers relative to markets without switching costs.

⁵ See, for example, 5.7 *et seq*, “Strategic Review of Switching, A consultation on switching processes in the UK communication sector”, Ofcom, 10th September 2010.

⁶ For example, the CMA found that “[f]or all the dual customers of the Six Large Energy Firms, average potential gains from switching externally to any tariff offered were equivalent to 14% of the average bill” (paragraph 22, “Energy Market Investigation, Summary of provisional findings report”, 7 July 2015”).

Product migration incentives

- 3.6 In almost all circumstances, suppliers in a competitive market will have a strong incentive to avoid losing their existing customers. The presence of switching costs only adds to this incentive. Therefore, we would expect suppliers in a competitive leased line market to make great efforts to retain existing customers.
- 3.7 The disruption to the customer caused by migration between two products from the same supplier can be similar to that from switching supplier. In some circumstances, such as a move from a copper based leased line to a fibre based service, the process would be almost identical.
- 3.8 For a customer facing a product migration (whether through their own choice, or forced on them by the supplier), the costs and disruption associated with that process will tend dampen the lock-in effect of switching costs. The customer is being forced to incur costs similar to those associated with changing supplier, so it is rational to take the opportunity to consider alternative suppliers.
- 3.9 Therefore, we would expect **suppliers in a competitive market to make significant efforts to minimise the disruption and cost to customers from product migrations between their different offers.**⁷ This will be true in general as the supplier would want to be able to accommodate a customer whose requirements have changed without triggering an evaluation of competing services. These incentives to minimise costs and customer disruption would be particularly strong in relation to forced migrations, such as at the end of a product life, where the decision to change product is being made by the supplier.
- 3.10 In some cases, minimising disruption will be straightforward. For example, the supplier may wish to upgrade the customer premise equipment, but otherwise leave the customer's service the same. In these circumstances, we would expect the supplier to arrange for access to the customer premises at a time convenient for the customer, to inform them of a service outage, and to make the replacement. In fact, it is unlikely this would ever be treated as the introduction of a new product; or if this were the case, that the customer would receive an automatic upgrade. The customer would be notified and only aware of downtime.⁸
- 3.11 In cases where the new product entails a change in technical interface or service characteristics, the migration process will be more complex. The incentive to keep the customer happy and minimise costs and disruption remains, and therefore we would expect suppliers to provide a

⁷ This behaviour does not extend to switching between different suppliers. As discussed above, switching costs are an inherent feature of leased lines markets. In general, suppliers will not be incentivised to reduce these costs as this would make customers more likely switch to competing services.

⁸ This type of behaviour is now common when software is supplied as a subscription service. The software is continually upgraded, with the customer paying the same subscription. This is in contrast to the traditional model of software, in which a customer would purchase a licence which would give the customer access to the current version of the software and maintenance upgrades of that version. To access any new versions, the customer would need to buy a new licence.

considerable amount of support managing the migration process according to the needs of each customer.

- 3.12 This is likely to include an option to 'hot swap' services. In essence, a hot swap is a supplier managed process in which the old circuit is switched off and the new circuit is switched on almost at the same time to ensure that any loss of service is kept to an absolute minimum. In an ideal world, there would be spare network infrastructure to the customer site. This would allow the new service to be installed in parallel without first switching off the old, but without any material additional cost to the customer. Once it has been verified that the new service is working correctly, and is fully compatible with the customer's systems, the old service can then be switched off. Given the benefits of this model, and the relatively limited incremental cost of additional fibres in the drop wire to the customer premises, we would expect many suppliers to offer such a service in a competitive market.
- 3.13 The key to a smooth and efficient migration process is the management of the cease and new provide processes to link both activities. Therefore, should there be a delay to one or other of these processes, the two remain synchronised. In addition, the efficiency depends on knowledge of the access network - of knowing where spare capacity exists, and therefore being able to plan parallel running of the old and new services without requiring additional infrastructure to be built.

End of life products

- 3.14 End of life services represent a special case in which product migration is forced on the customer. We believe that same incentives to minimise customer disruption would apply under these circumstances. Suppliers in a competitive market would want to help their customers find an appropriate product, and help them migrate in a timely fashion. We would expect suppliers to try to coordinate customer migrations to fit to a particular timetable, and this would most likely require positive incentives for customers to move at a particular time in addition to very clear communications well in advance of the planned withdrawal.
- 3.15 We would also expect to see many suppliers offering emulation services to cater for customers for whom the costs of using a new service would be too great. Legacy technology emulation is found in many industries to cater for this type of scenario. For example, TDM emulation over Ethernet is now very effective.

Range of products

- 3.16 Given the incentive to maintain the existing customer base, and avoid the need to force customers through a product migration process, we would expect suppliers to offer a fairly limited range of products. Competition would ensure that only efficient services would remain in the market, and so it seems unlikely that a supplier would be able to maintain different products which offered essentially the same service. The duplication of costs would be inefficient, and there would be an increased risk of losing customers who were forced to migrate to accommodate a change in their needs.

- 3.17 Commercial and contractual terms can also be an important aspect of product migration barriers. In this regard, a technologically neutral leased line product would give the supplier the greatest degree of flexibility in meeting its customers' needs without automatically triggering a 'product migration'. Such a product would offer a certain amount of bandwidth between two sites with set performance characteristics. The interface to the customer's equipment would need to be specific to a technology, but otherwise the supplier would be free to choose the most appropriate technology to deliver the service.
- 3.18 Given the benefits of convenience for the customer and flexibility to the supplier from such an arrangement, we would expect to see at least some suppliers offering this type service in a competitive market.

BT's incentives regarding product migration

- 4.1 BT has SMP in almost all wholesale leased line markets in the UK, and therefore does not face a significant threat of losing customers to competitors. As a result, BT's incentives to minimise the costs and disruption caused by product migration are low relative to the suppliers in a competitive market discussed in the previous section.
- 4.2 Under competition, a supplier wanted to avoid product migration because it would be seen by customers as an opportunity check alternative offers from other suppliers in the market. BT's customers will view its product migrations in the same way, but the other offers in the market are likely to be based on BT Openreach wholesale inputs. Therefore, even if a retail customer does choose to switch supplier having been prompted to assess the market by a planned product migration, BT will most likely retain the business at the wholesale level.
- 4.3 The characteristic behaviour we found under competition was that suppliers would:
- try to minimise the chance that a customer has to face an explicit product migration scenario, for example, by having broadly defined products;
 - pay for the cost of migrations rather than passing these on to customers;
 - make extra efforts to ensure that product migration process was as smooth as possible; and
 - offer incentives to encourage customers to meet a predefined timetable in the event that a product was being withdrawn.
- 4.4 In contrast, we find that as a general rule, BT:
- has very narrowly defined products;
 - forces customers to pay the cost of migration;
 - does not always offer migration services, instead leaving the customer to manage their own cease and re-provide; and
 - even where migration is offered, it falls short of the equivalent services supplied by competitors in terms of minimising disruption for the final customer.
- 4.5 In this section we discuss BT's incentives with respect to the migration of customers between an old and a new leased line product. We assume that BT has SMP in relation to both products, and therefore the threat of losing customers is not a material factor in relation to its decisions about migration.
- 4.6 In these circumstances, BT's incentives are likely to be driven by the relative levels of profitability on the two platforms. In turn, this depends on the regulatory regime, and on charge controls in particular, given that most leased line prices are subject to some form of ex ante controls.
- 4.7 This analysis is most readily applicable to circumstances in which there is a good substitute for the legacy service. Customers using retail leased lines based on very old technology are often in the position of having no obvious modern equivalent. In these circumstances, BT's decision to

close the old platform is more likely to relate to engineering rules and strategy rather than the costs of one product platform relative to another.

- 4.8 In section 5 below, we discuss the incentives for a customer in these circumstances and find that some customers are likely to face very significant costs moving to a different service. As such, although we agree that BT should not be required to supply a legacy service indefinitely, these customers still need to be afforded some protection to ensure that they are given appropriate levels of support to help them migrate, and receive adequate service levels whilst still using the legacy service.

Costs and a typical leased line product life-cycle

- 4.9 Assuming that regulated prices are fixed exogenously⁹, then BT's margins will be determined by its costs. In annex 1 we develop a model of the incremental (historic) costs associated with a particular product. This model is based on a plausible assumption that product costs will display economies of scale.
- 4.10 The key determinant of unit costs in this model is volume. We now feed into the model a typical pattern of volume growth and decline during a product lifecycle in order to see how costs (and therefore margins) are likely to vary.
- 4.11 We assume that a typical lifecycle will include four distinct periods:
- Growth: an initial phase of rapid growth (usually after a slow start) as customers migrate from an older technology;
 - Plateau: a second phase of continued, but slowing organic growth, matching the changes in market-wide demand for business connectivity services;
 - Decline: a period of rapid decline as customers migrate to a new product. This will mirror the growth phase for the new product, and so start slowly as the new platform is tested by early adopters.
 - Persistence: a dwindling group of customers who face significant switching costs will remain on the platform.
- 4.12 We can now link these changes in volume to our cost model to understand how supplier costs are likely to vary through the product lifecycle. In Figure 1 below the growth phase is shown by the movement from point 1 to 2; plateau from point 2 to 3, and so on.

⁹ This is a reasonable assumption on the understanding that prices will be regulated according to a forward looking view of costs, such as LRIC.

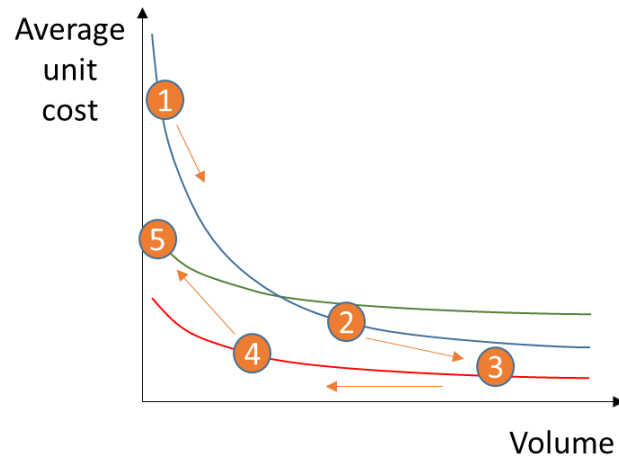


Figure 1 Costs during a typical product lifecycle

Product migration incentives

- 4.13 We consider a scenario in which BT has a relatively mature product supporting a large volume of customers. Therefore, its costs are likely to be towards the end of the plateau phase of growth, and so moving towards point 3 in Figure 1 above.
- 4.14 We assume BT now introduces a new product which can be used as a substitute for the old service. The new product has the potential to achieve lower unit costs in time, but the initial position is one in which unit costs are high due to low customer volumes. This equates to point 1.
- 4.15 One further assumption is that the price of both services is regulated on the basis of a forward looking view of costs, and therefore the price of the new service is no higher than that of the old service. This initial position is shown in Figure 2 below.

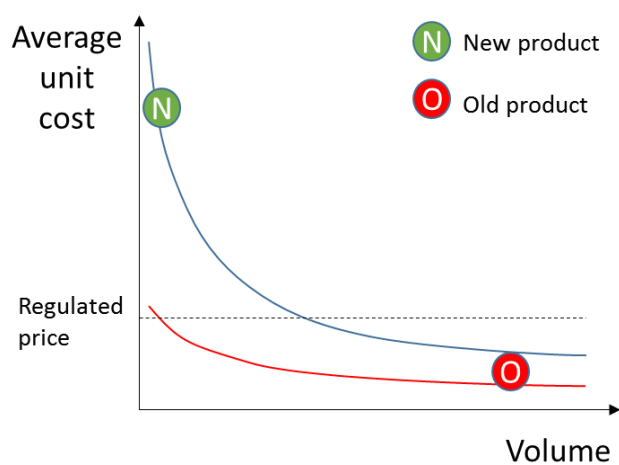


Figure 2 Unit costs following the introduction of a new service

- 4.16 From this starting position BT faces very strong incentives to increase volumes on the new product platform in order to move along the cost curve and reduce unit costs. These incentives are likely to far outweigh the one-off process costs associated with the migration of customers from one platform to another.
- 4.17 For the sake of simplicity, we can assume no new market-wide growth in volume, and so each new customer for the new product implies one less customer on the old product. At the margin, BT will significantly reduce its unit costs with every additional customer on the new product. In contrast, the loss of a customer on the old platform will make very little difference to its historic unit costs on that platform.¹⁰
- 4.18 The incentives created by these relative marginal changes in costs and profitability continue until the new product reaches a significant volume, and the average unit costs fall below the regulated price. At this point both products are making a positive margin (on an historic cost basis).

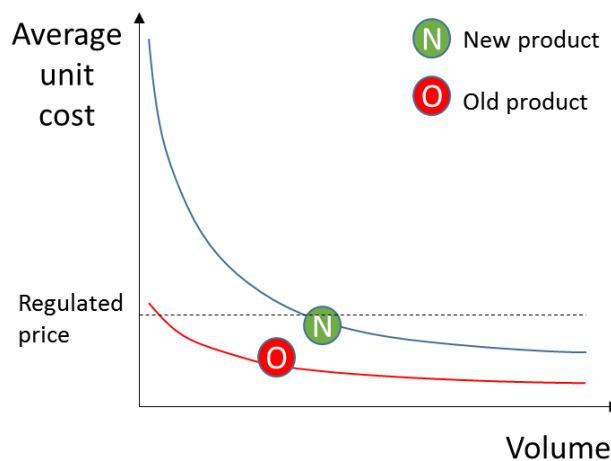


Figure 3 Unit costs when both services are profitable and BT does not have strong incentives to move customers onto the new platform

- 4.19 At this stage, BT's incentives to migrate customers to the new platform are less clear. The incremental gain in margin due to the reduction in unit costs on the new platform will be offset by both the switching costs and the reduction in margin from increasing costs on the old platform.¹¹ Therefore, over a reasonably large set of volumes, BT is likely to be largely

¹⁰ One could argue that BT should only care about the total level of profitability across all services. However, for a variety of reasons, including compliance with Competition Law and the incentives for individual product managers, it is reasonable to assume that BT will not want any individual service to operate at a loss.

¹¹ In theory at least, if we assume that the switching cost is included as an upfront cost of the new service, then BT would continue to migrate customers until the slope of the marginal reduction in the new product costs equalled the margin increase in old product costs, i.e. the point on the diagram when the slope on the two curves is the same.

indifferent between the two platforms. At the very least, its incentive to migrate customers to the new platform is much reduced relative to the initial period.

- 4.20 At least part of the migration to the new platform will be organic. That is, without any specific efforts to encourage migration, BT can expect customers to migrate. Eventually, costs are likely to start to rise significantly on the old platform, and begin to have a material impact on BT's profitability for this product. Therefore, we need to distinguish a final phase where BT will again want customers to leave the old platform. To be precise, however, the incentive will be to close the old platform. The additional volume from these last remaining customers will make little difference to the profitability of the new product. It is unlikely to be a major concern if these customers were to leave BT, or to use a completely different product.
- 4.21 An important caveat to our assessment of this last phase concerns price regulation. So far we have assumed the regulated price level is set exogenously. To the extent that regulation allows prices to increase, as Ofcom has suggested in relation to WES/BES platform closure, and is also proposing for very low bandwidth services, BT can continue making positive returns and the incentives to encourage the last remaining customers to migrate and to close the platform are diminished.

Conclusions

- 4.22 Our analysis indicates that BT is likely to go through three phases in a typical product lifecycle in which its incentives with regards to product migrations change:
- An initial phase where BT has strong incentives to encourage customers to migrate to the new platform;
 - A second phase where BT is largely indifferent about which platform is being used; and
 - A final phase where BT would like to close the old platform and therefore will encourage customers to stop using this service.
- 4.23 For the purposes of the present discussion we are not concerned with the precise boundary points between these three stages. These incentives contrast with those we discussed in relation to a hypothetically competitive market, in which we found that suppliers would **always** make great efforts to help customers move between product platforms.
- 4.24 To the extent that BT has greater influence over its internal downstream customers, we would expect BT to focus its attention in the initial phase on the migration of these customers. This dynamic could give rise to issues of discrimination in that a disproportionate number of external customers would then be left using legacy services in the second phase. The data presented in section 6 below relating to the migration of WES services to EAD tends to support this hypothesis.

Customer incentives

- 5.1 This section considers a customer's incentives to move between two leased line products. In this paper, we take a simple view: a customer will want to move to the new platform if the benefits outweigh the costs; and will otherwise want to continue using its existing product.
- 5.2 We can distinguish between two sets of costs associated with product migration:
- **Product adoption costs**
These are the costs of any adaptation required by the customer in order to use the new product. For example, this may include the adoption of new processes to manage the product, changes to interfaces of interconnected equipment, or new software or hardware to accommodate differences in the product's performance characteristics. These may include both one-off development or capital costs, and increases in ongoing costs (relative to those associated with the current product).
 - **Migration process costs**
These are the one-off costs associated with the process of changing products. This includes things like service outage, arranging access to customer premises, any arrangements (possibly including wayleaves) for additional physical network access, and management of the overall process.
- 5.3 Weighing against these costs are the benefits associated with the new product. Benefits may stem from characteristics of the new product, or new features that it enables. Equally, benefits can relate to the price of the product, and/or the commercial terms more generally. It is important to emphasise that all the benefits should be measured relative to the current product. As such, the relative benefit of migrating will increase if the price of the old service increases.
- 5.4 In the rest of this chapter, we consider these costs and benefits and their effect on customer incentives in relation to two scenarios:
- first, migration between near perfect substitutes; and
 - a case where, from the customer's perspective, there is no effective direct substitute for the legacy product.

Near perfect substitutes

- 5.5 Given the assumption of near perfect substitutes, product adoption costs are zero (or close to zero). Therefore, the incentives for the customer are dictated entirely by the balance between the migration process costs and new product benefits.
- 5.6 It seems likely that the near perfect substitutes will, in fact, be very similar. This rules out significant differences in product characteristics and cost (and therefore price). An exception to this rule would potentially be legacy services which are emulated using a more modern technology. This may offer the customer potential future benefits, and imply differences in cost.

- 5.7 However, we will assume that in most circumstances, very good substitute products will be very similar, and therefore the most important factor in determining the strength of the incentive for the customer to migrate is likely to be the migration process cost. The lower the costs, the stronger the customer incentive to migrate; and all else equal, the faster the migration.
- 5.8 The migration from WES to EAD fits this scenario well. Therefore, we can infer that customer incentives to move to EAD will be driven largely by the migration process costs. If customers faced less disruption and lower costs, we could reasonably expect the migration process to move faster.

Poor substitutes

- 5.9 The more interesting case to consider is where the customer cannot move to a close substitute, and is likely to face costs adopting the new product. Product adoption costs relate to the compatibility of the new product with the existing systems and processes used by the customer. Given the range of different systems in which leased lines are used, we would expect to see a wide distribution of adoption costs between customers.
- 5.10 At one end of this distribution there is likely to be a group of customers who face very significant costs adapting to use the new service. In some cases, for example utilities, the customer operates a large and complex system which can only accommodate a specific technical interface, and/or the very specific performance characteristics of their current leased line service. Unless the old service can be emulated accurately using a more modern technology, the product adoption costs relate to changing the entire complex system.
- 5.11 When the complex system itself uses legacy technology, it is likely that any major change will trigger a question about replacing the entire system with a modern equivalent. This could require a very large investment and create significant disruption to the customer's business. Under this scenario, leased lines are likely to represent only a small proportion of the overall system costs, and as such, the price of leased lines will not be a material consideration in the system replacement investment decision. In consequence, these customers will become highly insensitive to leased line prices.
- 5.12 There are two important conclusions from this analysis:
- 5.12.1 First, as a leased line product without very close substitutes reaches the end of its life, and assuming its modern equivalent has been available for some time, customers with the lowest adoption costs will already have migrated. The customers who continue to use the legacy product are those with the highest product adoption costs.
 - 5.12.2 Secondly, a significant minority of these remaining customers are likely to display very low price sensitivity. That is, increasing the relative price of the legacy service will not have a material effect on their incentive to migrate to the new product.
- 5.13 There are many examples from outside the telecoms sector of customers continuing to use old and obsolete technology. For example, it is estimated that more than 10% of desktop PCs still run Windows XP, despite the fact that it is Microsoft stopped supporting the product in April

2014.¹² To put this figure in context, that is still more than double the number of Apple Macs. The main reason for the reluctance to move to a more modern of operating system is the lack of compatibility of software applications and code developed in-house. The product adoption costs are the key driver for the customer's decision to migrate: the costs of redeveloping the software to work on a new operating system are far greater than either the licence costs for a new version of Windows, or the process costs for installing the new operating system.

- 5.14 In many cases, the solution is to emulate the key features of XP, or to continue running XP within a virtual machine, rather than try to redevelop the relevant software applications to make it compatible with the new operating system.¹³
- 5.15 Another reason why the customer may want to stick with the old technology is simply that it continues to be a better match for the needs of the customer than a modern equivalent.
- 5.16 In relation to PPC migration we can see this is often the case in relation to very low bandwidth leased lines. The customer may only need a tiny bandwidth, but requires the reliability and support associated with a leased line. The cheapest modern equivalent leased line from BT is a 100Mbps Ethernet service¹⁴. Even if the older services can be emulated faithfully over an Ethernet connection, these can cost significantly more than the legacy service.

Conclusions

- 5.17 There are three important conclusions to draw from this analysis:
- The older the legacy service, the more likely it is that the last remaining customers will face very high costs to adapt to allow the use of a modern service.
 - These customers are unlikely to respond to price signals to encourage the migration to a new service.
 - In circumstances where the new and old products are similar, and therefore product adoption costs are unlikely to be material, customer incentives to migrate will be driven by the relative ease of the migration process.

¹² Netmarketshare reports 14.6% for XP in May 2015 (<http://www.netmarketshare.com/operating-system-market-share.aspx>), although this is falling fast having been at around 19% in January (<http://www.windowscentral.com/new-os-market-share-data-shows-slight-gain-windows-81-and-also-windows-xp>).

¹³ See the following article for an example of how Avis used emulation to allow migration from XP to Windows 7. <http://www.computerweekly.com/feature/How-Avis-is-bridging-the-application-gap-between-IE6-XP-and-Windows-7>

¹⁴ Given that 10Mbps is currently priced higher than 100Mbps, and EFM solution do not offer the same quality of service as a fibre based product.

A case study: WES to EAD migration

- 6.1 This section considers a specific example of the issues faced by wholesale and retail customers relating to leased line migrations. Without a productised migration service, switching between BT wholesale access products requires the customer cancel the old service and arrange to have the new replacement provided by ordering a new circuit. This self-managed cease and re-provide causes avoidable disruption and additional cost for the customer.
- 6.2 BT offers a 'Transfer Migration' service for customer wishing to migrate from WES/WEES or BES to EAD. This service is essentially a cease and re-provide which is planned and managed by BT so that both processes happen on the same day. This has a number of benefits over a customer managed migration:
- There are no early termination charges for ceasing the old circuit.
 - Same day cease and re-provide is co-ordinated by BT rather than by the customer, and therefore ought to be more efficient, with fewer risks of failure.
 - Transfer migration usually represents a small saving over the standard connection charges incurred in a self-managed cease and re-provide. However, BT is currently offering discounts of up to 70% on some transfer scenarios where the customer chooses to upgrade the circuit bandwidth. Some examples of the differences in cost faced by the customer are shown in the table below.

Current product	Future product	Migration managed by	Connection charge
WES 10	EAD 10	BT	£ 1,950
WES 10	EAD 100	BT	£ 585
WES 10	EAD LA 10	Customer	£ 2,108

Figure 4 Examples of charges for WES to EAD migrations

- 6.3 BT has only offered as a specific service option the most common migration scenarios between WES, BES and EAD. Many options are missing. For example, transfer migration is only available on BES if upgrading the bandwidth. Aside from upgrading bandwidth, no other changes to modify the product are allowed. If the customer wishes to alter their existing service, this cannot be coordinated through a BT managed process, and so the customer will need to plan a self-managed cease and re-provide.
- 6.4 The inability to alter the product configuration is likely to have a disproportionate impact on external customers. BT's downstream businesses reach a large proportion of serving exchanges, and have done so for a long time. As a result, BT has already taken advantage of local access variants of WES and EAD. In contrast, competitor footprints of serving exchanges are expanding. The migration to EAD provides an ideal opportunity to rearrange circuits to take use local access variants to fit with the growing connectivity to serving exchanges. However, this is not possible using transfer migration.
- 6.5 In scenarios where transfer migration is available, customers can now order an additional set of migration features. The standard version, which costs £240, offers the following benefits:

- An environmental audit to identify potential issues with things like space and power at the customer site, capacity on the CPE, and so on. If the order cannot be progressed as a result of the findings, then some alternative suggestions will be proposed.
 - Guaranteed rollback and continuity of service.
 - CPE re-use.
 - Additional testing to ensure the new service works as planned.
- 6.6 The enhanced version of this optional transfer package then adds the possibility of out of hours support for the migration at an additional charge.
- 6.7 These are the kind of services that we would expect any supplier to offer as standard in a competitive market.¹⁵ For the migration to EAD, which is effectively an upgrade of the same technology, we would also expect this to be undertaken at the supplier's expense.

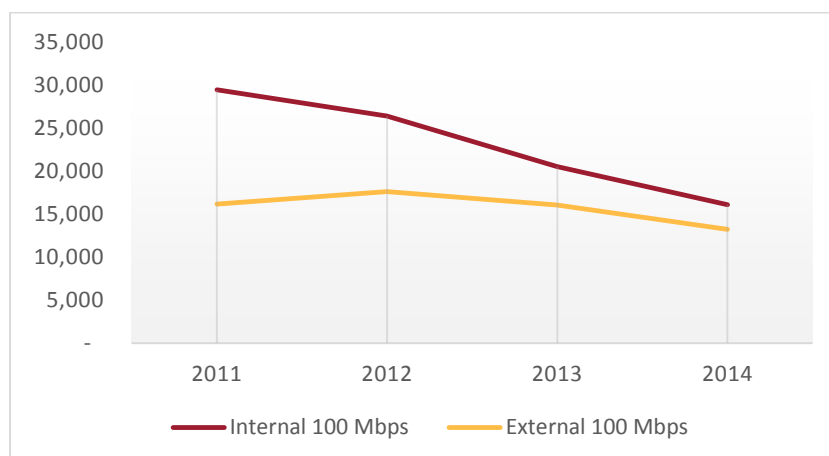
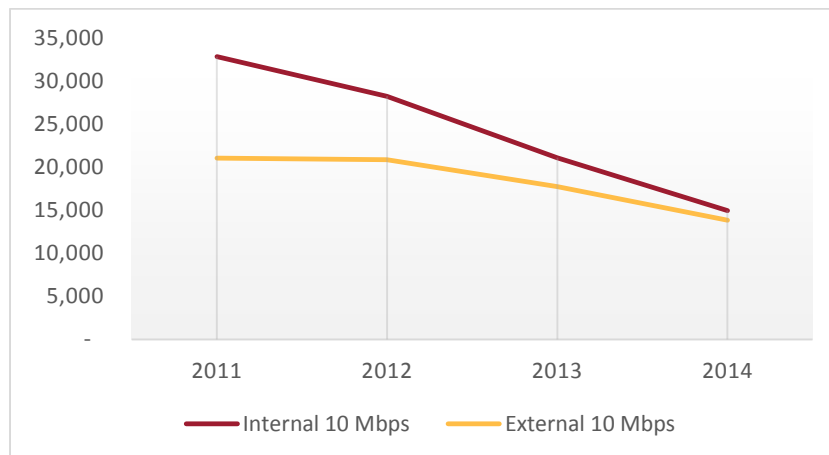
Vodafone WES migrations

- 6.8 Vodafone and its downstream customers face migration costs which limit their ability to move from WES to the more efficient EAD service. Vodafone has built out to more serving exchanges since it bought many of the WES circuits in its inventory. In theory, this should open the possibility of using cheaper Local Access variants of Ethernet services. This would involve an 'External Rearrange', whereby one end of the access circuit is moved from the remote exchange or point of handover to the serving exchange of the customer end.
- 6.9 Clearly, if the customer is to incur an outage in the process of migrating from WES to EAD, it would make sense to allow for an 'External Rearrange' at the same time. That is, to allow migration from WES to EAD LA. However, it is not possible to undertake any product modifications whilst using the transfer migration service. The only way Vodafone to benefit from a migration product, and the current discount, would be to migrate to an equivalent EAD service.
- 6.10 As such, Vodafone must either:
- Cease and re-provide, and forego all the potential benefits associated with BT co-ordinating the process to ensure service continuity.
 - Use transfer migration to move to the equivalent non-Local Access EAD service but maintain an inefficient network topology.
 - Use transfer migration to move to the equivalent non-Local Access EAD service, and subsequently order an External Rearrange, incurring extra costs and more service disruptions for the customer.
- 6.11 All three options are inefficient. We do not believe that this would happen in a competitive market, and Vodafone's experience of BT competitors suggests that this type of problem only occurs with BT.

¹⁵ Whilst noting that out of hours support is always likely to incur additional charges.

WES migration volumes

- 6.12 Despite the fact that BT plans to withdraw this service, and stopped supplying new connections 4 years ago, there remain a substantial number of customers using the service. As discussed in section 4 above, in these circumstances with a large number of customers on both the old and new platforms, BT does not face strong incentives to encourage the migration of customers to the new platform.
- 6.13 Initially, there are strong incentives to gain an efficient scale on the new platform. It is natural to suggest that BT has greater leverage over its internal customers, and therefore we would expect to see a more rapid decline in internal WES volumes and a commensurate increase in internal EAD volumes following introduction of the new service. Data from the Regulatory Financial Statements would appear to support this hypothesis. The trend is most clear in relation to the decline in WES volumes, as can be seen in the following 3 charts:



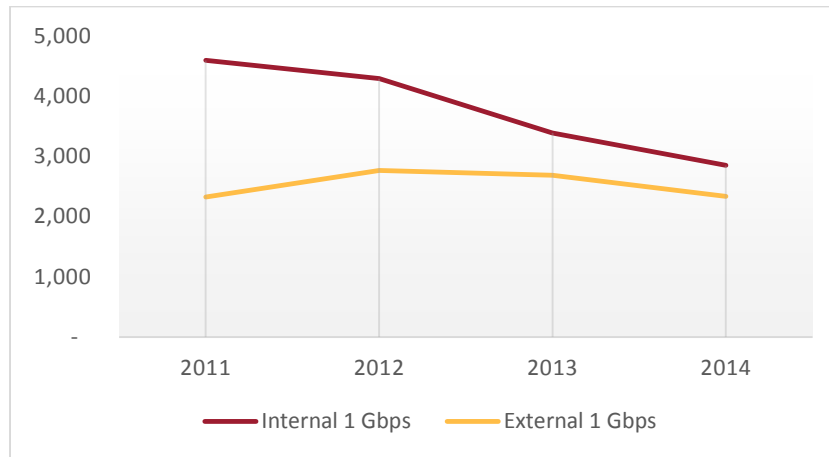


Figure 5 WES volumes (local ends) 2011 – 2014

- 6.14 At each bandwidth, but for 10 Mbps in particular, the decline in internal WES volumes has been far more rapid than for external volumes. Assuming these trends have continued, then it is likely that there are now fewer internal 10Mbps WES circuits than there are external, and similar numbers of 100Mbps circuits.

Conclusions and policy implications

- 7.1 In a competitive market, we would expect to see suppliers making great efforts to ensure that existing customers can migrate easily between different leased line products. The switching costs that are inherent in leased line markets imply a model of competition in which suppliers compete aggressively to gain and protect market share, since a degree of market power exists over retained customers.
- 7.2 In effect, a difficult product migration makes supplier switching costs appear relatively less onerous. Therefore, a customer facing product migration is more likely to use the opportunity to consider the services offered by competitors. As such, we would expect supplier behaviour in a competitive market to display the following characteristics:
- Paying for the cost of migrations rather than passing these on to customers;
 - Making extra effort to ensure that product migration processes are as smooth as possible;
 - Trying to minimise the chance that a customer has to face an explicit product migration scenario, for example, by having broadly defined products; and
 - Offering incentives to encourage customers to meet a predefined timetable in the event that a product was being withdrawn.
- 7.3 BT has SMP in many leased line markets, and does not face the threat of losing customers to its competitors as a result of poor, or non-existent, migration processes. More generally, BT's behaviour contrasts strongly with the efficient ideal of a supplier in a competitive market:
- BT has very narrowly defined products, often restricted to particular use cases, and this generates additional product migration events;
 - BT's customers are usually forced to pay the full costs of product migration, regardless of whether the choice to migrate is their own or results from a product withdrawal;
 - BT managed migration services are only available in a limited set of scenarios, with the customer being forced to manage their own cease and re-provide in all other cases; and
 - Even where migration is offered, it falls short of the equivalent services supplied by competitors to help minimise disruption for the final customer.
- 7.4 This behaviour constitutes a market failure with a detrimental effect on consumers. Customers who choose to migrate face inefficient costs and an unnecessarily disruptive process. Perhaps more importantly, some customers will choose not to migrate precisely because of these costs and disruptions, and will therefore continue using a product when there is a better alternative on the market. This is analogous to the damaging effect of switching costs, but without the offsetting benefit that switching costs can encourage a more aggressive form of competition.
- 7.5 Absent the risk of losing customers, BT's incentive to encourage migration between two products will be dictated by the relative margins on the two product platforms. Our analysis suggests that BT's incentives will go through three phases:

- Initially, BT will face strong incentives to increase volume on the new platform to bring down average unit costs to breakeven point. The easiest way to increase volume will likely be to migrate existing customers, and therefore BT would be expected to encourage and assist migration.
- Once margins between the two platforms are comparable, which is likely to happen when there is significant volume on both platforms, BT will be largely indifferent with regards to product migration.
- A final phase where BT would like to close the old platform and will therefore encourage customers to stop using this service (but not necessarily to migrate to another service).

- 7.6 This assessment suggests that BT's incentives will only be similar to those found under competition at the start of a new product's life. Once a new product reaches a minimum efficient scale, then BT is likely to be largely indifferent as to whether a customer uses the old or the new product, and will have little incentive to assist the customer in migrating between its products.
- 7.7 This analysis makes an important assumption that regulation sets a fixed price based on current rather than historic costs. However, Ofcom's current policy is to allow BT to increase prices at the end of a product's life. This will dampen BT's incentives in the final phase. This policy is based on an assumption that customers will respond to increased prices by leaving the platform. Our analysis of customer incentives suggests that the desire to migrate to a new platform will be dictated by the balance between potential benefits and product migration costs. Unless the benefits outweigh the costs, the customer will not want to migrate.
- 7.8 Some customers face such significant costs to move away from using legacy leased lines that they will rationally choose to continue using these old services based on obsolete technology. These locked-in customers will be largely unresponsive to the price of the legacy leased line services. As such, the policy of allowing price increases will not achieve its objective of encouraging customers to migrate, but will simply add to BT's margins and reduce its incentives to assist with the migration process.

Recommendations

- 7.9 There are significant differences in the approach to product migrations taken by a supplier in a hypothetically competitive leased line market and by BT where it has SMP. These differences in behaviour represent a market failure that Ofcom should address through changes in existing regulations such as leased line charge controls, and through additional SMP obligations.
- 7.10 BT maintains a very broad leased line product portfolio, and leaves a large number of customers without an option for a managed migration between these different products. Customers therefore have to cease and re-provide in order to take advantage of new, and potentially more efficient products. In a competitive market, we think it very unlikely that a supplier would ever force a customer to cease and re-provide. Switching to a competitor service might even be less disruptive in these circumstances.

7.11 The consequences for consumers are:

- Customers are forced to undertake migrations more often than would be expected in a competitive market;
- Those customer undertaking the migration face unnecessary disruption and costs due to the poor processes; and
- Some customers will be put off by the costs and disruption, and will choose not to migrate even though BT is offering a product which better meets their needs.

7.12 To address these issues, Ofcom should make the following changes to leased line regulation:

- 7.12.1 To require BT to supply an efficient managed migration service between any two leased line products irrespective of technology used by these products. This should include, in particular, the ability to migrate to the proposed dark fibre service. This obligation would help align BT's incentives with those found in a competitive market. For example, it would encourage BT to adopt a simpler product portfolio.
- 7.12.2 Develop charge controls with a presumption that the efficiently incurred costs of migration are to be included in the costs of the new service, rather than being passed on to existing customers. This would encourage BT to undertake minor product updates, such as the move from WES to EAD, as an internal technology upgrade.
- 7.12.3 Allow positive incentives for BT to encourage the provision of help to customers who face significant costs adapting internal systems to the new product. For example, it may be appropriate to allow BT to retain the additional margin on the new platform created by increases in volume that result from migrating this set of customers.

7.13 In addition, it is clear that price based signals will not be effective at encouraging the last remaining customers to leave a legacy product that has no direct substitutes. Therefore, Ofcom should no longer allow significant increases in price as a product approaches end of life.

Annex 1: A simple model of leased line product costs

- A1.1 This annex develops a simple model the incremental costs associated with a specific leased line product platform. All leased line product platforms tend to display economies of scale to some degree due to the fixed costs associated with setting up a new product, such as costs to create the IT systems to manage customer transactions and maintenance, and staff to develop and then manage the product. All these costs are specific to (i.e. incremental to) the product, but either wholly or largely independent of product volume.
- A1.2 In addition, all non-customer specific network equipment and associated facilities represent fixed costs. These costs may be driven by geographic availability of the service rather than circuit volume.
- A1.3 Variable costs¹⁶ include things like customer equipment (CPE), which vary with each additional unit of volume, through to customer facing staff such as sales and account teams, and network equipment maintenance, for which additional units are required only once certain volume thresholds are reached.
- A1.4 Given these assumptions, platform specific average unit costs can be expected to follow a downward sloping path with respect to circuit volume, as shown in the diagram below. The average unit cost includes both operating costs and capital costs through an appropriate depreciation charge.

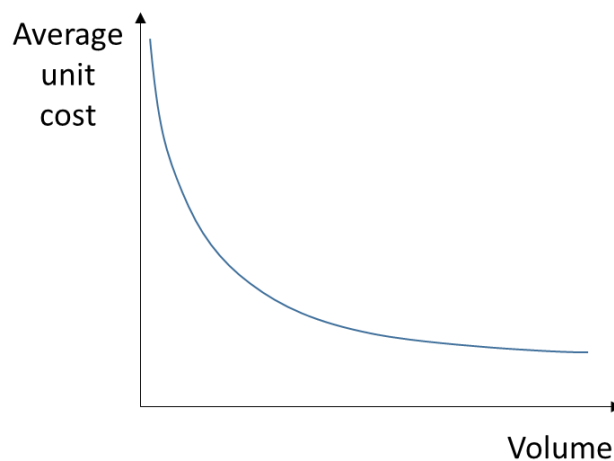


Figure 6 Platform specific average unit costs

- A1.5 These are the forward looking costs that one might expect to see at the time of the introduction of the service. On this basis, the costs presented above are equivalent to the long run average incremental costs for the relevant product at various (long run) product volumes.

¹⁶ In the case of leased lines, variable with respect to the number of customer circuit ends.

- A1.6 In the present exercise, we are interested in understanding the cost function of a supplier as a product or platform approaches the end of its useful economic life. LRIC is not a particularly useful concept when considering end-of-life services, since it assumes that services are revalued on a current cost basis. This requires assumptions about the relevant modern equivalent assets, which may be an interesting academic exercise, but is often of little practical use: the valuation ends up being dictated almost exclusively by exogenous factors that can only be determined as a matter of judgement.
- A1.7 A large proportion of the initial fixed costs are likely to have been fully written down by the time the product platform reaches the end of its life. On an historic cost basis, the depreciation charges for capital costs (and capitalised operating costs, such as product development) will either be very low, or will have disappeared altogether. The result is that the cost curve shifts downwards, and the slope of curve will tend to fall with time. Therefore, on an historic cost basis, the extent of economies of scale tends to fall. This is shown in Figure 7 below.

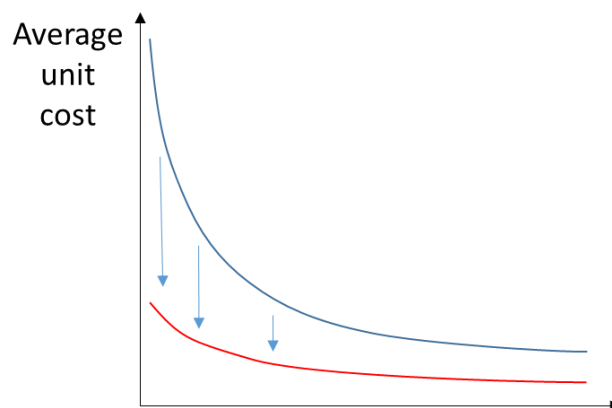


Figure 7 The change in the average unit historic cost function as assets are written down

- A1.8 Finally, as we approach the end of life for the product, it is likely that some of the costs of maintaining a platform will start to rise. In particular, vendor specific costs may rise dramatically once volumes fall to such a small level that it is no longer economic for the vendor to continue providing support.
- A1.9 These effects are perhaps best viewed as being exogenous to our model. They are driven by the technology in general rather than the specific implementation of a technology by one operator. For example, in its discussion of very low bandwidth services¹⁷, Ofcom notes the diminishing number of engineers with suitable experience of legacy technologies. When BT is the supplier in question, their volume may often represent a sufficiently large proportion (at least within the UK) of the total use of a technology, that it would be better to model the effects endogenously.

¹⁷ "Business Connectivity Market Review, Very low bandwidth leased lines", Ofcom, 15th May 2015.

A1.10 For our purposes, the difference is largely academic, but for the sake of completeness, we show the difference in effect of endogenous and exogenous input cost increases at end of life in the figures 7 and 8 below.

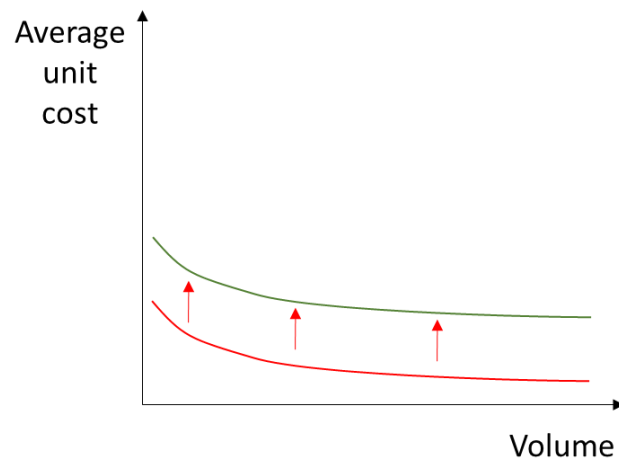


Figure 8 Exogenous end of life cost increases: economies of scale remain low.

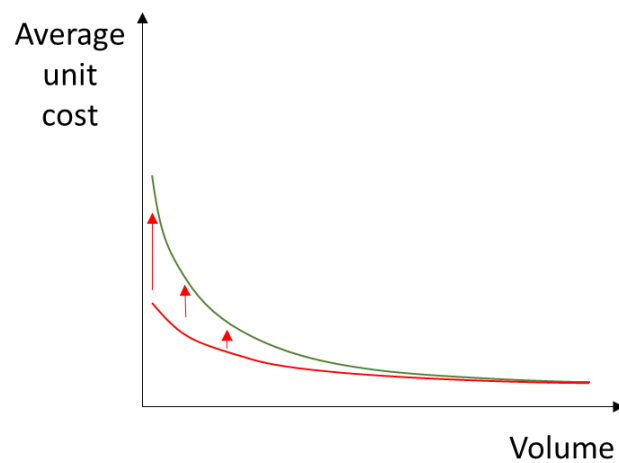


Figure 9 Endogenous end of life cost increases: economies of scale re-introduced