Leaving a legacy: enabling efficient network transition

A report for BT

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February 2015

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Executive Summary

This report considers market transition from legacy services to their new counterparts, specifically relating this to the business connectivity market. We assess transition from the perspective of efficiency, timing and incentives for innovation, investment and competition. We evaluate and propose a preferred approach focussing on wholesale services.

We conclude that Ofcom should apply price controls to only one or the other of legacy traditional interface (TI) and new alternative interface (AI) services to promote an efficient transition. The argument for this approach is analogous to that for anchor product regulation of broadband access. However, in this case we propose that new rather than the old services are price-controlled, given that regulation is already applied to new services and that it may be efficient to retire legacy services in the near term.

Pricing freedom for legacy services and over the legacy-new margin is desirable because, if both new and legacy prices are controlled, the following challenges and inefficiencies are likely:

- It is difficult to assess the appropriate rate of increase in prices for legacy services given falling but uncertain demand. Fixed regulated prices may therefore be inefficient due to errors in estimating future demand.
- Legacy services may be under-priced relative to new services given that their assets are more fully depreciated in accounting terms. This would discourage and delay efficient transition.
- The risk of legacy technology and service failure increases over time given the difficulty in obtaining necessary spares and expertise. This risk is not, and is unlikely to be, signalled to end users via regulated prices. This results in a moral hazard problem and overexposure of users, particularly critical national infrastructure users, to legacy input failures.
- Finally, if legacy services are under-priced, innovation, investment and the development of alternatives (including wireless alternatives for some users) will be discouraged.

The above considerations imply that regulated prices for legacy services are hard to set at efficient levels and are likely to be low compared to efficient levels. However, price controls on new services will, in addition to competition from alternative infrastructure and services, act as a constraint on excessive pricing of legacy services.

Efficient transition is also likely to require a balance of price and non-price incentives. For example, in relation to the rising risk of legacy service failure a service provider can be expected to inform customers of the risk, potentially signal limited 'best endeavours' support, reflect some of the risk by way of legacy service prices, assist customers with transition and ultimately set out a timetable for removal of legacy services. The service provider is in a better position than the regulator to manage price and non-price incentives for transition and to adapt the approach over time.

In conclusion, we propose removal of wholesale price controls for legacy TI services in order to promote efficient transition. In addition, we propose flexibility in relation to support for legacy services and the timing of their eventual removal. Additional flexibility could be coupled, if considered necessary, with a revenue safeguard cap for legacy services set equal to existing legacy revenues. This approach does not require information regarding risks, costs or anticipated volumes for legacy services, and would allow the constraint on unit prices to relax progressively as volumes fall.

1 Introduction and context

This paper considers how services should be regulated during transition from legacy to newer technologies and service. We focus on the regulation of wholesale services.

The paper is motivated by the transition in the business connectivity market from traditional interface (TI) services such as TDM to alternative interface (AI) Ethernet services (for simplicity we refer to these as legacy and new services). We note that elements of our analysis are general rather than specific.

We also note that we focus on regulation rather than the prior steps of market definition and assessment of significant market power. However, whilst Ofcom have concluded that legacy TI and new AI services are in different markets, it is accepted that a customer transition is underway from legacy to new services. Further, the development of applications that are more tolerant of jitter and latency and the development of 'carrier-class' Ethernet is increasing the scope for substitution. Our analysis therefore assumes a degree of substitutability and responsiveness to relative price shifts between legacy and new services.

The paper is structured as follows:

Section 2 discusses what would constitute efficient transition and provides an initial evaluation of regulation versus the market in achieving an efficient transition.

Section 3 considers lessons from previous transitions including regulated and market driven transitions.

Section 4 evaluates the options for regulation, in particular price regulation, during the transition from legacy to new services in the business connectivity market.

Section 5 sets possible safeguards in relation to the pricing of legacy services.

2 What would constitute efficient transition?

An efficient transition from legacy to new service provision will typically (but not always) involve a period of overlapping service provision. Efficiency can be thought of in terms of:

- The efficient time for each customer to transition given the costs, benefits and risks associated with legacy versus new services.
- Efficient levels of innovation and investment in alternative platforms and services to meet demand during transition.
- The efficient time to close the legacy platform, thereby eliminating dual running costs.

In order to motivate efficient transition a mix of price and non-price signals may be utilised, for example, combining rising unit prices for legacy services with an announced timetable for legacy service closure and, potentially, reduced support for the legacy service during transition.

2.1 Efficient switching and legacy platform risk

Efficient switching will be a function of the economic costs and benefits of alternatives, and the point at which switching is efficient will vary between customers (which is one reason a period of parallel running may be efficient).

The benefits of using legacy versus new services are best assessed by end users. However it is important they make an informed choice and understand if continuing to use legacy services involves risks in terms of security of supply, either via the price necessary to maintain service levels and/or through the provision of information regarding service levels and risks.

Legacy networks use older technology. As such they may be more prone to failure than newer services. It will harder to find replacement equipment and spare parts. It may also be increasingly difficult to find engineers with the appropriate expertise in legacy systems and networks.

As a consequence, the risk of failure and/or service discontinuity on the legacy network is likely to rise over time. For example, in relation to PPC sub-2Mbits products BT noted that: [1]

> *"…should a major incident, such as a fire at switching centre occur, which directly impacts PPC sub-2Mbits products; there is a strong possibility that [BT] will be unable to restore full service due to the limited availability of equipment."*

It is also important that the underlying costs of legacy service provision are signalled to users via the prices they pay. There is a risk with ageing systems that accounting costs fall in comparison with newer services as legacy assets become fully depreciated. Regulated prices which do not reflect the full economic costs of legacy services may discourage efficient transition to new services, potentially exposing customers to a rising – but hidden – risk of failure.

[1] https://www.btwholesale.com/shared/document/News_and_Insights/Briefings/PPCs/Sub_2Mb_Review_Briefing_Revision_Issue.pdf

2.2 Efficient investment and innovation

Innovation and investment is happening in relation to both the demand and supply sides of the market. Customers may need to invest in new Internet Protocol (IP) based services and, on the supply side, innovation and competition may prove particularly important during transition since there is an opportunity to capture customers who must in any case transition to a new service.

The consumerization of IT, the reorientation of product and service designs around the individual end user, also open up greater scope for substitution by alternative platforms for legacy services. IP services are designed to work well over the majority of consumer grade fixed and mobile broadband connections, and utilise compression and specialised codecs to reduce requirements in terms of speed, latency, packet loss etc. For example, Google Chromebox video collaboration is designed to ensure interaction with anyone on any device – and is therefore designed to work with IP networks and consumer broadband.[2]

In addition to regulated fixed line Ethernet services there is a growing range of innovation and alternative sources of supply which may meet the needs of different customers in the business market. Whilst these will not fulfil all needs of existing users of legacy services they will offer alternatives for many users. Possible alternatives to new Ethernet services are set out in Figure 2-1.

Figure 2-1: Investment and innovation is occurring in relation to alternative services

Fixed line alternatives:

- The growing capability of mass market broadband with fibre to the cabinet and fibre to the premise offers an alternative for some, but certainly not all, users. Mass market broadband may also prove adequate, despite the lower service level agreement, when complemented by 4G to provide redundancy.
- Virgin Media provides fibre products to enterprise customers including mobile operators[3], whilst Cityfibre signed a deal in November 2014 to provide dark fibre to EE and 3.[4]

Wireless alternatives to wired and fibre connections:

- Low bandwidth applications which currently rely on fixed connectivity may migrate to 3G and 4G wireless, for example, point of sale terminals and wireless ATMs.[5] In addition, wireless machine to machine (M2M) connectivity services are likely to play an expanding role and to utilise dedicated networks in addition to cellular and local area Wi-Fi and Bluetooth connectivity.[6], For example, Neul[7] and Arqiva (in partnership with SIGFOX)[8] are developing M2M networks.
- Wireless backhaul for mobile networks. Ericsson trials have demonstrated that high-frequency systems can outperform those using sub-6 GHz bands – even with no direct line of sight.[9] Ericsson modelling of heterogeneous networks has also found similar performance with fibre or wireless small cell backhaul.[10]
- Free space optical systems coupled with microwave links for backhaul, high capacity links and redundancy e.g. AOptix claim to offer a constant data rate of 2Gbps up to 10 kilometres with delivers carrier-grade availability in the harshest weather conditions.[11]

[2] Google. February 2014. http://googleblog.blogspot.co.uk/2014/02/chromebox-now-for-simpler-and-better.html

[3] http://www.virginmediabusiness.co.uk/News-and-events/News/News-archives/2011/MBNL/

[4] http://www.cityfibre.com/news/2014/11/12/cityfibre-signs-dark-fibre-deals-with-ee-and-three-to-enhance-mobile-networks

[5] http://www.verizonenterprise.com/resources/factsheets/fs_verizon-managed-wireless-atms_en_xg.pdf
http://www.cisco.com/c/en/us/products/routers/819-integrated-services-router-isr/index.html

[6] http://stakeholders.ofcom.org.uk/binaries/consultations/iot/statement/IoTStatement.pdf

[7] http://www.neul.com/neul/

Innovation and competition in relation to alternative and substitute services would be impeded by a policy approach which slowed transition. Further, existence of alternatives may also reduce the cost of erring on the side of an inefficiently fast transition.

2.3 Efficient closure

Over time, the per-user costs of providing legacy service will rise as volumes fall. Further, the risk of outages and service quality problems may increase. The market may also evolve in ways that make new more capable services comparatively more valuable to end users.

At some point continuing to maintain legacy services will no longer be efficient, and this point is likely to be reached well before all customers have transitioned to alternatives. Experience of commercial transitions, discussed in Section 3, provides examples of platform closure whilst customers remained on the platform; or commercial arrangements with laggards to extend service.

Finally, given the role that expectations play in investment decisions, it may be important to signal platform closure ahead of time.

2.4 The challenge of motivating efficient transition

Transition is a dynamic process dependent not only on levels of service and prices for legacy and new services, but also on expectations regarding future levels of service, prices and platform closure. To set the price and price differential at the efficient level to motivate transition requires information (regarding actual and expected volumes, the true costs of maintaining the legacy platform and the risks associated with the legacy platform is required). Uncertainty and information asymmetries will constraint the ability to set efficient prices.

Further, competing demands over when to transition can be anticipated. Those customers who do not wish to transition early may seek to have price increases capped as volumes fall and have closure extended. In particular, some customers may lobby for continuation of service on grounds that their service has particular social value and/or they operate critical national infrastructure.

In relation to possible arguments regarding wider benefits and social value we note that it is preferable to fund outputs rather than subsidise specific inputs.[12] If the service is regarded as critical national infrastructure there is a case for encouraging early rather than late transition given the increasing risk associated with dependence on legacy services,.

Critical infrastructure providers may have a false sense of security concerning the continued reliability of legacy inputs, given the growing difficulty of maintaining such services. Critical infrastructure providers may therefore delay transition, seeing transition as in itself risky in comparison to the status quo which may have served them well in the past.

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[8] http://www.arqiva.com/news/press-releases/we-are-building-a-uk-network-dedicated-to-the-internet-of-things/

[9] http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2013/er-nlos-microwave-backhaul.pdf

[10] http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2014/er-wireless-backhaul-hn.pdf

[11] http://www.aoptix.com/products/high-capacity-wireless-transport/

[12] Such arguments arose in relation to spectrum used for services including public service broadcasting. See Indepen and Aegis (October 2005), "Study into the potential application of Administered Incentive Pricing to spectrum used for Terrestrial TV & Radio Broadcasting." Section 2.2. http://www.indepen.uk.com/docs/broadcast_spectrum_pricing.pdf

However, should problems arise in relation to legacy service provision, there will be pressure to restore service quickly irrespective of the cost, which may be borne by all customers and/or the service provider. In other words there is an element of moral hazard attached to continued use of legacy services by critical infrastructure providers. Encouraging early transition, rather than delaying it, may therefore be efficient.

The following elements may therefore be required to motivate efficient transition:

- Prices which increase as volumes for legacy services decline, reflecting rising unit costs. Prices may also need to change to reflect unanticipated changes in the rate of transition and therefore of volumes.
- Clear and credible advance signalling of platform closure and potentially of a reduced commitment to supply in the interim, for example, signalling a best endeavours approach to maintaining and restoring service.
- Prices may also play a role in reflecting legacy platform risk to end users due to the moral hazard problem associated with a loss of service.

2.4.1 Can price regulation get transition right?

The requirements for efficient transition are particularly challenging to manage via regulation of price and non-price dimensions of transition. The reasons for this correspond to the challenges of motivating efficient transition, namely information asymmetry and potentially moral hazard.

With information asymmetries economic rent is a necessary counterpart of incentives and innovation.[13] Constraining the ability of the supplier of legacy services, customers and potentially alternative suppliers to bargain freely over transition may limit the potential for suppliers to capture rents, but at the expense of a less efficient transition. The approach to setting price controls, particularly to the extent that it draws on accounting estimates of costs including fully depreciated assets, may also constrain the ability of price signals to promote efficient transition.

In relation to moral hazard the regulator (and Government) may be perceived as susceptible to pressure to maintain legacy services at inefficiently low prices and for too long, with the risk of restoring service should problems arise transferred to other customers and/or the service provider. Pricing in an element of the risk of failure may be particularly challenging, if not impossible, for a regulator. Indeed Ofcom have in the past highlighted critical infrastructure, for example:[14]

> *"Recognising the critical nature of the utilities' telemetry applications, BT has also established a regular dialogue with the electricity utilities via the Energy Networks Association. The utilities have made arrangements to migrate their telemetry applications away from the analogue and sub 2Mbit/s digital services and are keeping BT informed of the progress of their migration programmes." Paragraph 10.24*

There is therefore a risk that tightly regulated transition will discourage and delay efficient transition, discourage innovation and competition and increase overall risk of service failure.

[13] Jean Tirole. 2014. "Market power and regulation". http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2014/advanced-economicsciences2014.pdf

[14] Ofcom. March 2013. "Business connectivity market review - final statement". http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/

Allowing a greater degree of freedom to service providers and customers to come to commercial arrangements regarding transition would in our view be more efficient.

2.4.2 How might the market manage transition?

Ofcom note a number of concerns regarding transition, for example Ofcom:[15]

> *"…we are concerned to ensure that CPs and end users will have certainty of continuing supply, appropriate notice of retirement dates of service, protection from potentially excessive pricing and protection from the risk that groups of customers will be subject to undue discrimination." Paragraph 1.48.*

We now consider how the market, given greater flexibility over pricing, timing and levels of support, might manage transition; and whether legitimate public policy concerns arise.

A service provider, even with a degree of market power, would arguably not wish to promote inefficient transition. Rather, it would be preferable to promote an efficient transition and capture a share of the surplus associated with transition. A service provider would also be motivated to mitigate moral hazard risk. In relation to pricing the service provider's options are set out in Figure 2-2.

Figure 2-2: Service provider pricing decisions

Charge a price above costs and above the user cost of migration	• The service users would migrate rapidly to alternative solutions, or leave the market. Some economic rent would foregone by the service provider.
Charge a price above costs but below the user cost of migration	• A price is set somehwere within the range, potentially with bargaining and/or some price differentiation.
Charge a price lower than costs	• The service provider stops supplying the service.

Note: Costs above refer to economic costs and may include an element of risk related to the legacy platform.

An overly high price would drive service users to either migrate to alternative solutions inefficiently early, or to discontinue their business. In either case, economic returns may be foregone by the service provider. The service provider is also unlikely to close the service while there is still sufficient willingness to pay in the market.

On the other hand, charging a price lower than the costs of providing the service would not make sense, as the service would be economically unviable. If the users of the service are not willing to pay to meet the costs of the service, then the shutdown of the service would be socially efficient. Similarly, if the minimum the provider would profitably charge (the breakeven price including normal return) is higher than the cost of transition then immediate transition is efficient.

[15] Ofcom. March 2013. "Business connectivity market review - final statement". http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/

We would therefore expect a service provider, even with some market power, to choose an intermediate price above the costs of providing the service, but below the price that would promote inefficient migration. Migration will nevertheless occur progressively as costs (and prices) rise and as the relative benefits of utilising the new service increase.

Price setting by the market is therefore more likely to facilitate efficient transition and migration away from legacy services. A service provider will have incentives to encourage efficient transition, and is better able to judge the risks of legacy service failure, though these may be hard to objectively justify and verity. The efficient approach to managing such risks is likely to involve a combination of price and non-price signals to customers to transition to new services.

3 Previous transitions

We examine several past transitions away from legacy products and services, with varying degrees of regulatory management. Regulation can include price controls and other non-price elements (for example, requiring transparency, requiring a given level of support, or setting a termination date).

Figure 3-1 illustrates the approach to price control for various transitions in telecoms services, considered further in this section. In addition we consider the transition away from Microsoft Windows XP.

Figure 3-1: Use of price controls in past and ongoing telecoms transitions

Old service \ New service	Price control	No price control
Price control	Business connectivity (TI to AI)	WBA in market A (IPStream to WBC) Fixed access (copper to fibre) Network charges (TDM to IP voice)
No price control	Analogue private circuits (Analogue to TI)	WBA in rest of market (IPStream to WBC) Mobile (2G to 3G/4G)

3.1 Transitions with price controls on one product

3.1.1 The copper-fibre transition

In the UK copper to fibre transition predominantly involves investment in hybrid fibre to the cabinet (FTTC) technology and parallel running of copper and fibre (rather than retirement of copper network assets which is, for example, a key issue in the US). In relation to this transition Ofcom (2010) adopted anchor product regulation whereby the legacy ADSL copper service is regulated whilst fibre services are not price controlled, stating that:[16]

> *"…we have decided not to regulate the prices of the product(s) that BT provides under its VULA obligation. We consider that this approach will give BT the flexibility to price its VULA services according to emerging information on the demand for, and supply costs of, NGA services. At the same time, the prices of these services will be constrained by the availability of current generation broadband services and by competition from services provided over cable TV network infrastructure." Paragraph 1.17.*

[16] Ofcom. October 2010. http://stakeholders.ofcom.org.uk/binaries/consultations/wla/statement/WLA_statement.pdf

The anchor product approach not only economises on information requirements for price regulation, but also sets up the conditions for efficient fibre investment and efficient copper retirement. As Peter Culham of Ofcom put it in a 2010 presentation:[17]

In relation to fibre investment

- *"Aim is to provide correct incentive to upgrade network to NGA"*
- *"Key is the incremental revenue vs incremental cost of upgrade"*
- *"Anchor pricing of CGA provides a good test of NGA investment"*

In relation to copper switch off ("*Whose Decision?*")

- *"With anchor pricing for legacy services, switch off does not damage consumers"*
- *"And firms will switch off only if that leads to cost reductions"*
- *"So regulators should focus on anchor products and leave switch off to the firm"*

The specific approach, namely anchor product regulation with a legacy product anchor price, is tailored to the copper to fibre transition. However, the approach to other transitions also needs to recognise information constraints and the requirement for efficient investment and network/service closure that motivated the approach to copper-fibre transition. Ofcom have noted various benefits of the anchor product approach including those summarised in Figure 3-2.

Figure 3-2: Benefits of anchor product approach

It allows efficient technology choice by both suppliers and downstream users:

> *"Where there is a set of services we propose to control, it is generally efficient to reflect differences in demand (especially the responsiveness of demand to prices) or costs in relative prices. BT is generally better placed than Ofcom to do this." Paragraph 7.74*[18]

> *"…controlling all the different products separately would reduce BT's ability to respond, for example, to unanticipated changes in relative costs or in the demand for services." Paragraph 7.76*[19]

It encourages innovation in alternative solutions:

> *"Anchor pricing has good incentive properties. It allows the dominant provider the flexibility to charge more to reflect any enhanced functionality of the new service. In turn, this creates the incentive for the investment required to advance service characteristics which are directly related to customers' willingness to pay for improvements in quality." Paragraph 7.112*

It minimises the information informational burden:

> *"If we were going to apply separate controls, we would have to decide an efficient allocation of common costs. This would require extensive analysis based on detailed information on the costs and demand for individual services. This is not likely to be a practical or desirable proposition." Paragraph 7.75*

[17] Peter Culham. November 2012. "Pricing Access Networks in the Transition to NGA - Promoting Efficient Investment". ECTA Conference.

[18] Ofcom. July 2013. "Review of the Wholesale Broadband Access Markets - Consultation" http://stakeholders.ofcom.org.uk/consultations/review-wba-markets/.

[19] Ofcom. July 2013. "Review of the Wholesale Broadband Access Markets - Consultation"

3.1.2 Wholesale broadband access (WBA)

BT provides a number of wholesale broadband access products (WBA). Using ADSL, BT offers DataStream (a legacy product) and IPstream (an IP service). BT also offers the Wholesale Broadband Connect (WBC) product using ADSL2+, and access to its NGA network via its WBC FTTC/FTTP products.

Figure 3-3: BT's wholesale broadband access products

DataStream	• A legacy service based on asynchronous transfer mode.
IPstream	• IP-based services based on ADSL technology, with a maximum downstream speed of 8Mbit/s
WBC (ADSL2+)	• IP-based service with a maximum downstream speed of 24Mbit/s
WBC FTTx	• Provides services over FTTC and FTTP, with headline speeds of 80Mbit/s and 330Mbit/s respectively

In 2011, Ofcom adopted an anchor pricing approach to regulate the WBA market in 'Market A' - areas in which there was not effective competition (11.7% of UK premises, mostly in remote and rural areas).[20] Ofcom's approach was to impose a charge control only on the IPstream Connect products. Ofcom reasoned that this control would constrain BT from excessive charging on the other products available in Market A. As Ofcom noted in 2014:

> *"Protecting all consumers within the market does not necessarily mean that all service variants or technologies need to be directly controlled." Paragraph 7.70*[21]

Ofcom has noted several advantages to the anchor pricing approach. Firstly, it ensured BT faced the correct incentives:

> *"Our approach to anchor pricing ensures that BT has an incentive to undertake investment required to improve service characteristics which are directly related to customers' willingness to pay for improvements in quality, and as a result it will not deter efficient investment in WBC or fibre in Market A." Paragraph 7.130*[22]

Secondly, anchor pricing is more likely to lead to efficient pricing:

> *"…controlling all the different products separately would reduce BT's ability to respond, for example, to unanticipated changes in relative costs or in the demand for services."*[23]

Thirdly, anchor pricing reduces the information requirements and the burden on the regulator:

[20] Ofcom. July 2011. "WBA Charge Control" http://stakeholders.ofcom.org.uk/binaries/consultations/823069/statement/statement.pdf

[21] Ofcom. June 2014. "Review of the Wholesale Broadband Access Markets - Statement"

[22] Ofcom. June 2014. "Review of the Wholesale Broadband Access Markets - Statement"

[23] WBA Consultation 7.76

"We use anchor pricing when there is uncertainty about what technology is most efficient for a SMP operator to use to deliver a service (or where there is significant uncertainty about the costing of that service)."[24]

"If we were going to apply separate controls, we would have to decide an efficient allocation of common costs. This would require extensive analysis based on detailed information on the costs and demand for individual services. This is not likely to be a practical or desirable proposition."[25]

3.1.3 Analogue fixed voice to IP fixed voice and mobile voice

The revised European Commission recommendation on relevant markets no longer includes fixed narrowband access and call origination in the list of relevant markets susceptible to *ex ante* regulation.[26]

Whilst the particular circumstances in the UK may differ from those assessed for Europe as a whole the EC recommendation shifts the presumption in favour of concluding that fixed voice should no longer be subject to regulation. As the EC noted:[27]

"….in view of the progressing fixed-to-mobile substitution, availability of wholesale access products (LLU and bitstream), transition towards all-IP networks and increasing penetration of VoIP/VoB technology, as well as progressing NGA roll-out, the establishment of a direct connection to end users' premises and, consequently, also the market for wholesale call origination, are no longer considered as being characterised by significant barriers to entry on a Union level from a forward-looking perspective."

In other words the EC consider that legacy voice services should not necessarily be subject to price controls during transition to alternatives including mobile, over the top services and managed IP voice services. However, where operators have significant market power in broadband access (which may underpin voice services), regulation would apply..

3.2 Transitions without price controls

Commercial transitions including the end of support for legacy systems, services and software are commonplace. Whilst these transitions may involve some cost and inconvenience for consumers (though the replacement often offers benefits) they are typically left at the discretion of industry.

Service providers have an incentive to manage such transitions in a reasonable way, and may provide notice of termination of support for existing services or agree special arrangements on commercial terms. Support is nevertheless ultimately removed.

There are a wide range of technology and service transitions including purely commercial transitions. The following examples include the transition away from Microsoft's Windows XP operating system and transitions in the mobile industry.

[24] Ofcom. June 2014. "Review of the Wholesale Broadband Access Markets - Statement" 7.148

[25] Consultation 7.75

[26] http://ec.europa.eu/digital-agenda/en/news/commission-recommendation-relevant-product-and-service-markets-within-electronic-communications

[27] http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=7056 Page 26.

3.2.1 Mobile technology transitions

A number of mobile operators globally managed the transition from the AMPS analogue mobile system to digital GSM or CDMA technology. Some transitions were left to the market whilst others had some regulatory oversight.[28]

In 2002, the FCC decided to no longer require carriers to support AMPS service as of February 18, 2008; whilst in Canada there was no requirement to maintain AMPS service and Rogers Wireless ceased the service in 2007. Telecom New Zealand announced in 2000 that they would discontinue the AMPS network within 5 years, later extended to March 2007.[29]

Telstra gave notice around 2½ year notice of a transition to its NextG network and closure of its CDMA network by January 2008. Telstra gave assurances that the NextG network would provide the same or better coverage and service than the CDMA network before switch off. After a report by the Australian Communications and Media Authority found insufficient equivalence between the CDMA and NextG network the Communications Minister delayed the CDMA network closure from January to April 2008.[30] There were perhaps several hundred thousand customers still using the CDMA network when it was switched off.[31]

In August 2012 AT&T announced an end date of approximately January 2017 for 2G service.[32] 2G supports many existing M2M applications which have longer replacement cycles and/or higher replacement costs and handsets. AT&T note that the transition will allow more advanced M2M services over 3G/4G networks. Nevertheless this represents a significant transition for the M2M industry.[33]

In July 2014 Telstra announced an end date of 2016, a significantly shorter notice period than that given by AT&T.[34] Although the 2G network is fully covered by the 3G network, this nevertheless involves a significant transition in relation to embedded M2M devices in particular. Telstra state that they will notify customers explaining the changes and providing them with options. However, transition costs are the responsibility of customers.

3.2.2 Microsoft Windows Support

In addition to the telecoms services considered above there are many examples of transitions outside of the telecommunications sector. One example is software versions and support.

In April 2009, Windows XP entered 'Extended Support' – Microsoft would continue to provide security updates, but it would no longer provide support or new features. This signalled that the Windows XP operating system was nearing the end of its lifecycle.

[28] Note, in relation to price controls, that our focus is on access price controls. Regulation of voice termination is a separate matter.

[29] http://en.wikipedia.org/wiki/Advanced_Mobile_Phone_System

[30] http://www.itnews.com.au/News/109422,telstra-says-goodbye-to-cdma-tonight.aspx

[31] Page 16. http://www.telstra.com.au/uberprod/groups/webcontent/@corporate/@about/documents/document/tls633-2008annualreport.pdf

[32] http://www.business.att.com/enterprise/Family/mobility-services/machine-to-machine/m2m-applications/cd2migration/page=addl-info/

https://learn.adafruit.com/system/assets/assets/000/017/834/original/Aeris_1113_whitepaper.pdf?1404356134

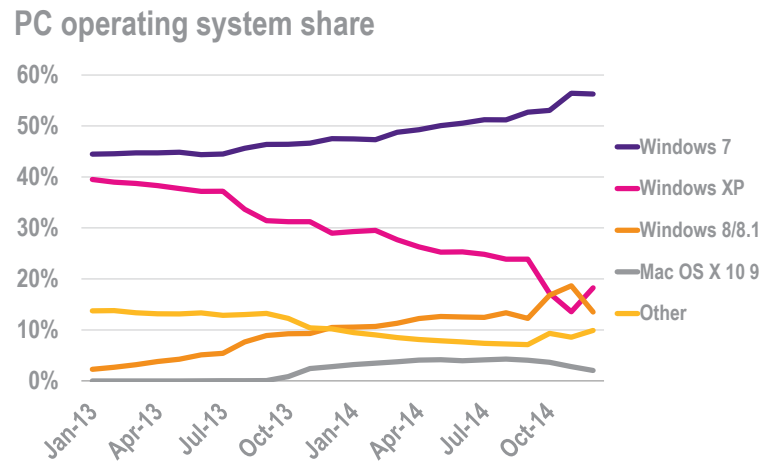
[33] https://learn.adafruit.com/system/assets/assets/000/017/834/original/Aeris_1113_whitepaper.pdf?1404356134

[34] http://exchange.telstra.com.au/2014/07/23/its-time-to-say-goodbye-old-friend/

In April 2014, Microsoft ended its support for the Windows XP operating system altogether. It warned that PCs running Windows XP after this date would become increasingly vulnerable to security threats. These PCs were likely to suffer compatibility issues with software designed for newer operating systems, such as Windows 7.

Responsibility rested with customers to upgrade or find an alternative. Windows XP's operating system share declined steadily as the end of extended support neared (although it was still running on 18% of PCs as of December 2014).[35] In January 2014, it was estimated that more than 95% of the 3 million automated teller machines in the world were still running Windows XP (an embedded version with support to 2016), but that plans were being made by ATM vendors and their customers to migrate.

Figure 3-4:



Source: Plum Consulting, NetMarketShare.com

However, in April 2014 it was revealed that the Dutch and UK governments had agreed to pay for extended support for Windows XP. The UK extension cost £5.5m and is valid for a year, or around £200 per user.[36] The extension was on commercial terms.

[35] www.netmarketshare.com

[36] http://www.telegraph.co.uk/technology/microsoft/10741243/Government-pays-Microsoft-5.5m-to-extend-Windows-XP-support.html

4 Evaluation of options

Drawing on our analysis of our assessment of what constitutes an efficient transition, experience of regulated and market transitions and the characteristics of the market for business connectivity services we evaluate the options for legacy to new Ethernet service transition.

4.1 Options

We focus in particular on price regulation, but also consider other non-price aspects of regulation. Figure 4-1 set out the options.

Figure 4-1: Options in relation to price controls

		New service: Price control	New service: No price control
Old service	Price control	Status quo where price controls apply	
Old service	No price control		Status quo where competitive

Our focus is on evaluating the status quo versus the diagonal options of no price control on legacy or no price control on new.

4.2 Status quo price controls for legacy and new services

As discussed in Section 2 we consider that the status quo involving price controls on both old and new services is unlikely to be consistent with efficient transition for the following reasons:

- It requires the determination of both price caps and therefore the margin between old and new services.
- Future volumes for legacy services are uncertain, yet price caps are determined for fixed period.
- There may be an upward bias in the margin due to the disparity between old and new in terms of asset depreciation.
- The challenge of reflecting an element of service risk in the legacy service price given information asymmetries and the challenge of basing such a premium on objective and verifiable information.

The above considerations imply that price regulation of both new and old services may discourage efficient transition. Customers may not make the socially efficient input choice, and there is a risk of moral hazard if the risks of the legacy service failing are not adequately signalled. Furthermore, innovation and investment in alternative services may suffer.

4.3 Price control for either legacy or new service only

The alternatives of no price control for new or legacy services would allow the service provider to determine the margin and to factor in the above considerations. Greater flexibility would also see the service provider taking greater responsibility for managing transition weighing up the risks involved in continued dependence on legacy services, the efficient pace of transition, and the appropriate balance between price and non-price signals. In particular, the relative price between legacy and new services could be managed by the service provider to encourage efficient transition.

However, the above advantages in favour of flexibility need to be considered alongside any increased scope to abuse market power. In practice we consider that this risk is constrained:

- The service provider has an incentive to manage the transition in a way that is viewed as reasonable by customers. Otherwise they will be encouraged to search for alternatives.
- Either the legacy or new service will still be subject to price controls, constraining the scope to increase the price of the other service.

In relation to the second point above, whilst Ofcom have concluded that the two markets are separate it is nevertheless acknowledged that an ongoing transition between legacy and new services is underway. Further, substitutability between the two services has also been increasing with the growing capability of Ethernet services, which now can emulate many qualities of TI services:

> *"Since the last review, Ethernet technologies have continued to evolve such that a number of differences between Ethernet and TDM-based services have reduced. One major development has been the emergence of 'carrier-class' Ethernet. The availability of carrier-class Ethernet means that AI services are now closer to TDM services in that they can now fulfil many of the functions needed to support the efficient provision of leased lines services across national and international networks" Paragraph 4.41, June 2012 BCMR consultation.*
>
> *"Ethernet technologies have also evolved to support synchronisation functions (which for some customers is one of the drivers for the demand for TDM circuits). Therefore, the convergence of Ethernet and TDM may have eroded many of the technical differences that would matter to most end-users." Paragraph 4.42, June 2012 BCMR consultation.*
>
> *"We observed that the responses to this question indicated that notwithstanding respondents' views about the increasing importance of latency and jitter over the next two years, only a small minority consider these characteristics to be a barrier to switching from TI to AI leased lines." Paragraph 3.52, March 2013 BCMR statement.*

The price of one service will act as a constraint on the price of the other service (with alternative fixed and wireless services also acting as a constraint).

4.4 Choice between legacy or new service price control

Finally we consider whether the legacy or alternatively the new service should be subject to a price control. In the case of legacy and next generation broadband access legacy copper loops are subject to a price control whilst fibre services are not.

In part this decision was pragmatic, reflecting the fact that a price control for copper loops was already established. However, it also reflected information asymmetries and uncertainty regarding fibre demand and the optimal pricing strategy for fibre, and a desire to incentivise fibre investment. A long period of parallel running was also envisaged, so the question of how to regulate once copper loops are retired is, at this stage, somewhat hypothetical.

In the business market, price controls already exist for new Ethernet services and the prospect of retirement of legacy services is real. Pragmatism therefore points to price regulation of new but not old services. Further, as volumes for legacy services decline price controls for legacy services would become increasingly sensitive to volume forecasts and forecast errors. On balance we consider that removal of price controls for legacy services is the preferred option.

4.5 Timing of transition

We propose that as much commercial freedom as possible is offered in relation to legacy TI services in the business connectivity market on grounds that BT would have appropriate incentives to ensure that the transition is neither too fast nor too slow. Transparency and a reasonable degree of notice are necessary for all market participants to make informed decisions regarding investment in alternatives and transition.

BT will have strong commercial incentives to manage the transition in an efficient and timely manner, and to maintain a good relationship with customers. BT thus has an incentive to charge a reasonable price to users of its legacy services to facilitate efficient transition, and to help them find alternatives. This is occurring in the WBA market as BT helps its customers migrate from its IPstream and DataStream products in exchanges where WBC products have been deployed.

However, BT should not be obliged to find alternative for each and every customer and should not remain responsible for those who have failed to adapt and transition. As access network technology transitions in the mobile market demonstrate, after a period of notice legacy networks are switched off even though some (potentially many) customers are still using them.

We note that the major commercial transitions we considered had periods of notice ranging from around two to five years, extensions were in some instances announced voluntarily and, in one instance, the cessation of Windows XP support and updates, the governments in the UK and the Netherlands agreed to pay on commercial terms to prolong the service. Shorter notice of termination might be appropriate if the migration has already been underway for some time, and if termination applied to a single service rather than a network.

In addition, a ‘reasonable endeavours’ interpretation of the obligation to supply should be applied in relation to legacy services, in recognition of the fact that reinstatement might not be feasible in some

circumstances and as a signal of this risk to customers. This is BT's position in relation to PPC sub-2Mbits products: [37]

> *"…should a major incident, such as a fire at switching centre occur, which directly impacts PPC sub-2Mbits products; there is a strong possibility that [BT] will be unable to restore full service due to the limited availability of equipment."*

4.6 Preferred option

We propose, irrespective of the approach adopted in relation to wholesale price controls for legacy services, that retail price controls be removed. In relation to legacy wholesale services also conclude that the price controls should be removed from legacy services (which would continue to be subject to existing non-discrimination requirements). We also conclude that BT should have flexibility over the mix of price and non-price signals to manage transition and over the timing of legacy service closure.

During transition Ofcom may prefer an approach which offers greater flexibility, but with the maintenance of additional safeguards. We consider options in relation to safeguards in the next section.

[37] https://www.btwholesale.com/shared/document/News_and_Insights/Briefings/PPCs/Sub_2Mb_Review_Briefing_Revision_Issue.pdf

5 Possible safeguards

During transition Ofcom may prefer an approach which offers greater flexibility, but with the maintenance of additional safeguards, at least initially. We explore possible options in terms of safeguard controls below.

We anticipate that BT would engage with customers over transition and negotiating over support for and pricing of legacy services. However, ensuring that the approach is fully transparent would help shape expectations and promote efficient transition. Transparency should therefore be part of the package alongside greater flexibility.

In relation to legacy wholesale services, non-discrimination requirements would continue to apply. In addition, the following possible safeguards are put forward for consideration, should Ofcom prefer an approach with additional safeguards:

- A volume threshold for removal of price controls. A volume threshold for deregulation could allow a relaxation of regulation between reviews if the threshold were met. However, consideration would need to be given to the possibility that the approach would promote inefficient behaviour in order to reach the threshold.
- A safeguard cap. This could take the form of a revenue cap for legacy services or more relaxed price caps with greater scope for overall price increases and rebalancing of prices.
  - Capping legacy service revenues at their current level does not require cost information or a volume forecast, and would leave BT with flexibility subject to a requirement that revenues for legacy services are maintained at or below existing levels during transition. This approach would offer progressively greater flexibility over time as volumes declined.
  - A more flexible price control allowing more rapid price increases and greater flexibility for rebalancing than the current caps. Safeguard caps are applied, for example, in relation to second class stamps (a safeguard cap of 55 pence is imposed on second class stamps which also, via potential substitution, constrains unregulated first class stamp prices).[38]

We consider that the preferred option, should Ofcom wish to adopt additional safeguards, would be a requirement that revenues for legacy services are capped at their existing level. This, in our view, comes closest to meeting the requirements for efficient transition whilst providing a measure of protection and assurance to the market.

[38] http://stakeholders.ofcom.org.uk/binaries/consultations/review-of-regulatory-conditions/statement/statement.pdf